Waste Minimization Progress Report

Improving Environmental Quality with Economic Benefits

Environmental Quality Management Center

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Environmental Health & Safety Division
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The Past—

During the 1970s, the seriousness of the hazardous waste problem became apparent and resulted in Congress passing the Resource Conservation and Recovery Act (RCRA). In response to the law, the U.S. Environmental Protection Agency (EPA) established a regulatory program requiring "cradle-to-grave" management of hazardous waste. It soon became clear, however, that even well-regulated land disposal could cause environmental damage. Thus, RCRA was amended in 1984:

> *The Congress hereby declares it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible.*

As a result, EPA rules now require all generators of hazardous waste to have a waste minimization program in place.

The University of Kentucky, being a public institution and one of the largest generators of hazardous waste in Fayette County, should have a model waste minimization program. Prior to 1998, UK had difficulty implementing an effective program due to severe space restrictions. In 1993, the Hazardous Materials Management (HMM) Department was conducting its waste operations in two rooms totaling 939 square feet. In May of that year, UK applied to the State for a permit to build an 11,000 square-foot, state-of-the-art waste storage facility. The major objectives of the new building were (1) to improve the safety and reduce the environmental risks of UK's waste operations, (2) to improve compliance with environmental laws and regulations, and (3) to fully implement a waste minimization program.

What We Are Doing—

The $2.4 million Environmental Quality Management Center (EQMC) opened in March of 1998. This convenient, centralized facility houses UK's hazardous waste operations. It has approximately 1,000 square feet of office space and 10,000 square feet of waste storage area.

Numerous engineering controls were incorporated into the design of the facility, enabling it to operate safely with no impact on the surrounding environment. Floors and walls are twelve-inch thick reinforced concrete. Floors are sealed and sloped toward the center of the facility to keep liquids from migrating to the exterior. The facility has sophisticated fire and vapor monitoring systems and several fire suppression systems, all designed to quickly mitigate any releases. The waste area is kept locked at all times to prevent unauthorized entry, and there are motion detectors and intrusion alarms throughout. All systems are continuously monitored, and HMM is on call to respond to emergencies twenty-four hours a day, seven days a week. Exhaust from the waste storage section and the chemical fume hoods is routed through an elaborate ventilation system to induced-draft fans on top of the adjacent, nine-story Garrigus Building. The waste area receives an average of six air changes per hour, and the exhaust can be increased to fourteen changes per hour if necessary.

HMM handles all of the hazardous waste generated by the campus, associated farms, and research centers in strict compliance with federal, state and local environmental regulations. The department provides full waste pick up service and transports waste to the EQMC for storage and processing prior to shipping. In 2000, HMM staff handled nearly 6,000 waste containers and processed approximately 150,000 pounds of regulated waste at the EQMC. HMM is also

responsible for UK's waste minimization program. The EQMC allows the department to take advantage of a full range of waste minimization opportunities:

Reuse—Reuse is the process of diverting chemicals and other products from the waste stream by finding new uses for these materials. HMM operates an extensive distribution program for the beneficial reuse of good laboratory chemicals. Available stock can be viewed and ordered on HMM's web page. These chemicals are available at no charge to the UK community. The program not only cuts down on the amount and cost of waste disposal, but also avoids the purchase cost of new chemicals. ***Last year HMM distributed over 600 containers of good chemicals for reuse. (Zero prior to 1998.)***

Recycling—Recycling is the process of extracting raw materials from waste products and reusing them in a beneficial manner. UK collects a variety of recyclable products and sends them to off-site facilities for recycling. HMM operates two major recycling efforts, one for spent fluorescent bulbs removed by the physical plants and one for used batteries generated across campus. EPA regulations treat fluorescent bulbs and all types of batteries as hazardous waste. In order to reduce hazardous waste generation, HMM collects and stores these items until shipment to a recycling contractor. ***Last year HMM recycled approximately 54,000 bulbs and 32,000 batteries. (Zero prior to 1998.)***

HMM also initiates waste reduction activities that occur outside the EQMC facility. The department has been able to eliminate all of the parts washers on campus that use mineral spirits, a flammable liquid. (The spent solvent is hazardous waste.) These units were replaced with parts washers that use a non-flammable solvent, which is recycled. Other significant initiatives include recycling lead from radioactive materials labs and the firing range and silver recovery from photo labs.

Treatment—Treatment is the act of altering a material through a chemical process to make it less toxic, nontoxic or unregulated. The EQMC has a 228 square-foot treatment room that enables HMM to perform small-scale chemical reactions to render chemicals non-hazardous so they can be removed from the hazardous waste stream. Examples are the neutralization of acids and bases (corrosive liquids) and the chemical reduction of oxidizing agents. ***Last year HMM neutralized nearly 6,000 pounds of corrosive liquids and reduced over 200 pounds of oxidizing agents. (Both were zero prior to 1998.)***

Bulking and other physical processes—Bulking is the process of transferring compatible chemicals and other toxic materials from many small containers, which may or may not be full, into 55-gallon drums that are stored until completely filled. Prior to the opening of the EQMC, only three waste streams could be bulked, and then only infrequently, when space permitted. These included flammable liquids, toxic liquids and waste oil. Since moving into the EQMC, HMM not only bulks those wastes, but also has added six more waste streams: non-organic liquids, chemotherapy agents, pesticides, fertilizers, mercury compounds and antifreeze. In the past, these nine wastes would have been shipped in "lab packs," multiple containers in drums filled with a material such as vermiculite to keep the containers from breaking. This costly mode of disposal has been cut dramatically. ***HMM has reduced the number of "lab packs" shipped by 95 percent, resulting in hazardous waste reduction by more than a third and annual cost savings of $165,000 from these operations.***

The quantities of two other waste streams were reduced by improved separation and bulking. Lead-based paint waste, which results from renovation projects and sidewalk curb

repair, is collected and consolidated in a manner to exclude soil and other non-lead debris that formerly added to the amount of lead waste. PCB waste, which results from transformers and light ballasts removed or replaced by the Physical Plant Division, is also handled at the EQMC. HMM works closely with the physical plant to collect, store and properly dispose of these items without extraneous non-PCB debris. ***The effectiveness of HMM's bulking and segregating lead paint and PCB waste may be judged by the fact that the quantity of toxic solids generated has been reduced by more than 85 percent.***

EQMC has a 240-square foot analytical lab, which allows HMM to perform approximately 150 chemical determination per year of unknowns that previously had to be presumed hazardous waste, but which often turn out to be non-hazardous.

Intact compressed gas cylinders are considered hazardous waste, even when they are empty. HMM dismantles gas cylinders to remove them from the hazardous waste stream. HMM no longer ships any intact, empty cylinders.

The Results—

The EQMC has played an integral role in UK's waste minimization efforts, including the reuse, recycling, treatment, and bulking of hazardous materials. The facility provided new equipment and additional storage area, enabling HMM to significantly expand its waste minimization activities. The results have been striking. ***Since the EQMC opened, the amount of hazardous waste generated at UK has been reduced by nearly half, and the cost of hazardous waste disposal has been reduced by more than two-thirds.***

The impact of waste minimization at UK may be determined by examining the historical trend of cost and quantity (see Tables 1 and 2). Waste quantities and disposal costs both increased on a steeply rising curve following enactment of RCRA and its amendments. Total regulated waste generation increased by nearly 4-fold between 1984 and the peak year of 1991. Hazardous waste generation peaked at nearly 200,000 pounds in 1992. Disposal cost over the same period increased 27-fold. Due to space limitations, HMM's initial waste minimization efforts achieved only modest results. ***In 1997, the quantity of hazardous waste generated by UK was 174,000 pounds. Since the EQMC opened in 1998, hazardous waste quantities have been reduced sharply—to 124,000 pounds in 1998; 87,000 pounds in 1999; and 109,000 pounds in 2000. Cost reductions have been even more impressive—down from a peak of $329,000 in 1992 to $100,000 in 2000.***

Without HMM's aggressive pursuit of UK's waste minimization goals, waste quantities and disposal costs would still be increasing. These results were achieved in spite of the fact that

- UK's research activities—the major source of hazardous waste—have increased significantly. Sponsored-research funding rose from $61 million in 1991 to $150 million in 2000.
- The price vendors charge for disposal of certain waste streams has soared. UK has to pay higher prices today to dispose of toxic metals (e.g., mercury), chlorinated hydrocarbons (e.g., pentachlorophenol) and compressed gas cylinders.
- Recycling to reduce hazardous waste has resulted in new costs. Last year HMM spent over $15,000 just to recycle batteries and fluorescent bulbs.

Looking to the Future—

HMM plays a vital role in helping the University meet its objectives for environmental stewardship. The department will continue to pursue new waste minimization opportunities in the future. Some of these will be accomplished at the EQMC in the areas identified above. For example, distillation and reuse of spent solvents is being examined as an option to solvent disposal.

Other opportunities exist, but many of the activities will have to take place outside the EQMC. HMM will work with other UK units to implement strategies that include

- Substitution of non-hazardous materials for hazardous materials in all UK operations.
- Greater use of micro-chemistry to reduce the quantity of wastes generated in research and teaching labs.
- Better segregation of waste to keep non-hazardous materials out of hazardous waste streams and to keep costly hazardous waste from contaminating less costly non-hazardous waste streams.
- Institutional purchasing policies to encourage source reduction by buying smaller quantities of hazardous materials.

The waste minimization program has enabled UK to deal more efficiently and effectively with materials that may be harmful to human health and the environment. The payoff is a cleaner, healthier environment for the University, the local community and citizens of the Commonwealth.

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Hazardous Waste Cost and Quantity Trend Report

Table 1

Total Regulated Waste Disposal

Fiscal Year	Gross weight* (pounds)	Disposal Cost** ($)
1984-85	70,314	12,000
1985-86	57,968	12,000
1986-87	45,053	32,000
1987-88	83,726	141,000
1988-89	110,876	112,000
1989-90	116,808	124,000
1990-91	143,470	221,000
1991-92	272,244	275,000
1992-93	232,882	329,000
1993-94	126,271	298,949
1994-95	150,400	317,803
1995-96	240,336	294,644
1996-97	188,476	317,591
1997-98	181,062	254,932
1998-99	149,054	226,506
1999-00	146,950	95,668
2000-01	168,859	99,226

* Includes hazardous waste (Subtitle C, RCRA), mixed radioactive-hazardous waste , TSCA waste, medical and other regulated waste; excludes other radioactive and Hospital biohazard waste and non-campus waste.

** Includes vendor cost plus other expenses associated with all UK waste disposal.

Table 2

Hazardous Waste Disposal

Year	Gross weight* (pounds)
1984	56,560
1985	63,350
1986	57,933
1987	91,459
1988	88,739
1989	82,221
1990	106,616
1991	148,732
1992	197,640
1993	111,531
1994	114,483
1995	175,426
1996	178,105
1997	174,282
1998	124,503
1999	86,724
2000	108,661

* All UK waste regulated under Subtitle C, Resource Conservation and Recovery Act. Data taken from the UK Hazardous Waste Annual Reports.