



Endocardial Solutions to Save \$35,000 by Reducing the Use of Supply Materials

Minnesota Technical Assistance Program ■ INTERN SUMMARY

Reducing the cost of solvent, booties, wipes and Teflon rod

Company	Endocardial Solutions, Inc. St. Paul, Minnesota
Results	Reduced solid waste disposal nearly 4,000 pounds a year. Will reduce fluorinated solvent losses by 65 gallons a year. Identified alternate products and procedures for clean room wipes. Changed a purchasing contract.

Endocardial Solutions, Inc. (ESI) produces diagnostic technologies for tachycardia arrhythmia, a heart abnormality. One component of the technology is a catheter that is inserted into the patient's heart, via the leg, to detect abnormal cell reactions when the heart is stimulated.

The catheter is made by braiding stainless steel wire around a Teflon rod that protects the braid through the first few assembly steps, after which the rod is discarded. Several steps during the manufacturing process require the catheter to be cleaned either by wiping or immersion in a solvent bath.

For each catheter produced, the company spent more than \$36 on consumable supplies used directly in catheter production but not incorporated into the product. Although a minor fraction of total production cost, these non value-added supplies had potential for significant waste reduction and cost savings.

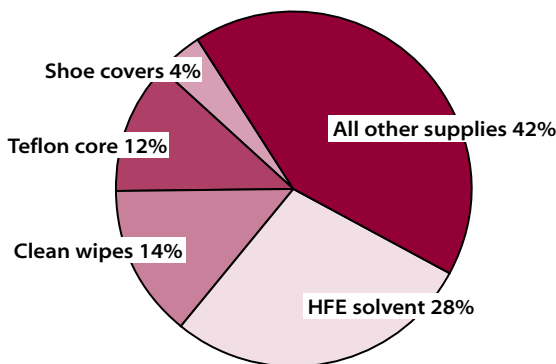
The company requested a **MnTAP intern** to help investigate ways to reduce the four most-costly supply items, which made up nearly 60 percent of supply costs.

Clean Room Wipes

ESI has a class 1000 clean room for assembling its catheters. The intern evaluated the use of wipes in the clean room. The company used class 10 and class 1000 wipes. A wipe's class number refers to how many particles could be shed during use. Class 10 wipes shed the fewest particles and are used for critical, late production steps on the catheter itself. The less shedding, the more expensive the wipe.

Roughly 42,000 nine-inch square class 10 wipes and 98,000 12-inch square class 1000 wipes were used in 2004. The intern identified 12 operations using wipes, from wiping catheters and counter tops in late production stages using class 10 wipes to removing excess adhesive from catheters and providing a disposable work surface for applying adhesive, using class 1000 wipes.

Catheter Supply Costs



Size

The intern observed that most employees did not use the full surface area of the wipes. For example, nine-inch square wipes were generally folded several times to wipe the 3/4-inch circumference of the catheter tubes. When 12-inch square wipes were used to clean counter tops, cleaning pressure was only applied to the area under the hand.

The intern instituted smaller wipes at several of the work stations. Two final-stage operations in which

the catheter is wiped down now use a four-inch square class 10 wipe, reducing solid waste volumes by 180 pounds per year and cost by \$1,650 per year. Class 1000 wipes are now all purchased as nine-inch squares, reducing solid waste by 1,050 pounds per year and costs by \$9,250 per year.

Laundering

The intern observed that clean room wipes are well constructed and that many of their uses left them relatively clean. He learned that wipes could be laundered, like clean room lab coats, at less than half the cost of purchasing new wipes. Most of the stations before the post-clean steps—which require class 10 wipes—could safely use laundered wipes.

The main concern about reuse was potential catheter contamination from residual adhesive on the wipes. The intern set up six work stations with collection tubs for wipes to be laundered and wrote procedure changes to designate stations that could reuse wipes. Used wipes from work stations that could result in contamination were disposed of in the trash.

To ensure that the wipes would not shed excessive particles due to laundering, the intern estimated how many times the wipes could be used. Over half of the laundered wipes would be disposed of after two launderings because of the work stations that use adhesive.

Laundered Wipe Reuse

Number of uses	Percent of wipes
1	12
2	48
3	22
4 or more	18

Laundering wipes reduced solid waste by 1,200 pounds per year and saved a net \$5,200 per year, after accounting for laundering cost of \$3,500 per year.

Fluorinated Solvent Losses

HFE-7100 is a fluorinated, hydro-ether solvent that ESI uses to dry and clean catheter parts and assemblies at various points in production. In 2003, ESI used 240 gallons at \$211 per gallon, costing \$10 per catheter in solvent costs. HFE is used because it dries quickly, is nonflammable, leaves no residue and has very low human toxicity. The draw backs are its high cost and significant global warming potential.

The intern investigated the sources of solvent use and loss. He accounted for 90 percent of the solvent.

Solvent Baths

Final cleaning bath. ESI had previously redesigned its final cleaning bath for the catheter braid, which is very flexible in the final product stage after the rod is removed. The bath was converted from a horizontal tray into a U-shaped vertical dip. Reducing the surface area of the solvent exposed to air when the bath was open cut evaporation by about 45 gallons per year (gpy).

Post-clean bath. At the “post-clean” bath, the catheter still contains a Teflon rod in its core, used to support the catheter during production. Because the rods made the catheters less flexible, the U-shaped bath design used for the final cleaning bath would not work.

The intern found that ESI’s post-clean bath accounted for 25 percent of solvent use. Catheters were immersed in a horizontal HFE-filled tray to remove water residue from cleaning. Water was removed from the surface of the solvent in the bath with a syringe or the edge of a clean wipe. Transferring and filtering lost a significant amount of solvent through splashes, spills and absorption.

Post-Clean Bath Solvent Losses

Solvent loss	Gallons per year
Catheter surface evaporation	4.5
Bath surface evaporation	19
Solvent transfer	38

The intern redesigned the post-clean bath into a column-like structure to reduce the solvent’s exposed surface area and decrease the chance of spills. Decanting water off the surface of the solvent and filtering will be done continuously, reducing the potential for contaminating catheters with water or particulate matter. This eliminates the need to transfer solvent eight times a week for filtering. The new bath will also make weekly solvent changeout easier.

Because the bath’s main parameters are staying the same—like the size of the bath and the time the catheters reside in the bath—ESI does not need to revise the basic validation for the procedure.

ESI plans to implement the vertical bath once a technician has time to test the new system. The cost

of the new bath was \$4,000. Reduced solvent losses should save \$7,000 annually. The company also plans to apply continuous filtering to its U-shaped, final cleaning bath.

Solvent Soaked Wipes

Three production steps involve hand cleaning catheter surfaces using a solvent soaked wipe. The technicians used a squirt bottle to soak clean room wipes with solvent. Five stations used a total of 42 gpy of solvent, costing \$8,800.

The intern observed that technicians typically folded the wipes several times to make them manageable for wiping down the catheter surface. A folded wipe absorbed considerable solvent. Switching to smaller wipes helped reduce the volume of solvent used.

Also, plunger cans that pump a small, uniform volume of solvent to the wipe were purchased. Identifying a plunger can suitable for clean room use was a challenge. Domestically-made plunger cans have a brass pump mechanism that could potentially shed particles during use. The intern found a foreign manufacturer of plunger cans with a stainless steel pump, but testing showed that these pumps had an inferior design. After thorough deburring and cleaning, the brass pumps were acceptable.

The volume of solvent added to wipes was cut from 16 grams per use to four grams. This reduced solvent use by about 32 gpy, reducing cost by \$7,000 per year. Plunger cans for the three stations cost \$600, including the cost for the stainless steel cans.

Reusable Shoe Covers

ESI spent \$9,000 per year on disposable shoe covers that helped keep biological and particulate contamination out of the clean room, resulting in 1,300 pounds of solid waste per year. A gummy residue that accumulated on the floor was attributed to the anti-slip coating on the soles of the disposable booties.

Disposable booties were replaced by launderable, over-the-calf shoe covers. Each production employee was given three pairs of the reusable shoe covers, with a stock of shoe covers held in reserve for guests and to replace any damaged ones. The shoe covers cost \$6,200 and laundering costs about \$1,600 per year. ESI saved \$1,100 by purchasing a close-out model for some of the shoes. Using full-price purchase figures, the change breaks even if the shoes

last a minimum of 13 months. Over the expected three year life of the reusable shoe covers, ESI expects to save \$5,100 per year.

In tests to validate the conditions in the clean room, changes in particulate and biological contamination were statistically insignificant.

Teflon Purchasing and Recycling

Teflon rod is used as an internal support for the stainless steel wire braiding, a key component of the catheter. The nearly 1/8-inch diameter rod is fed from a 500-foot spool. After an eight-foot section of braid is made, the Teflon rod is cut and stays inside the braid to protect it through the first few assembly steps, then the rod is discarded.

Reuse of the eight-foot Teflon sections was not pursued because it would involve significant changes to the braid manufacturing equipment and extensive, expensive validation for sterility and efficacy.

The intern investigated hollow, Teflon tubing as a substitute for the solid stock. This change was estimated to reduce Teflon purchase costs by \$6,800 per year. But, significant testing would be needed to validate the process change and an increase in production labor was likely.

In the process of investigating Teflon purchasing costs and procedures, the intern learned that ESI could get a 20 percent price break by purchasing Teflon rod with an annual contract instead of purchasing as needed. ESI entered into an annual contract to purchase 40,000 feet per year to be delivered in quarterly installments. The new procedure saves \$4,200 per year. Hollow tubing was not considered further after the bulk purchasing option was discovered.

At 350 pounds per year, Teflon rod is a small fraction of ESI's solid waste and its disposal costs are not quantifiable. The waste Teflon is a clean, high value material. The intern found a local Teflon recycler who now supplies a box to collect the Teflon sections, picks it up when full and pays ESI about \$90 per year for the scrap. The economic benefit for recycling this waste is trivial. However, the environmental benefit is significant because the consumption and release of toxic chemicals used to manufacture an equivalent volume of virgin Teflon is avoided.

Cost and Savings

ESI made an initial investment of \$10,800 for the new solvent bath, plunger cans and reusable booties. Laundering will run \$5,100 annually and new booties will need to be purchased every three years for \$6,200. Accounting for all savings, ESI will save almost \$40,000 net annually.

Application to Other Companies

Operations that have class 1000 clean rooms can safely use launderable supply items, like booties and clean wipes, instead of disposables.

Crucial to the success of this project was identifying, quantifying and understanding the individual uses of solvent and wipes in the facility. When evaluating sources of waste, be sure to:

- Account for the volume of materials used
- Accurately assess the cost of the material, including purchase, maintenance and disposal costs
- Evaluate the procedures to see if they meet, without far exceeding, production, quality and safety requirements
- Assess how alternative methods and materials can meet requirements

For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs. Our information resources are available online at <mntap.umn.edu>. Or, call MnTAP at 612/624-1300 or 800/247-0015 from greater Minnesota for personal assistance.

See the MnTAP intern project summary *Endocardial Solutions Saves \$15,000 through Waste Reduction* to read how the company reduced 1.4 tons of solid waste per year after implementing intern suggestions from a project in 1998.

This intern project was conducted in 2004 by MnTAP intern Kevin McGuire, a chemical engineering senior at the University of Minnesota, Duluth.