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GREEN PRACTICES FOR SURGICAL UNITS

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GREEN PRACTICES FOR SURGICAL UNITS

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Abstract

The study aimed to identify leading practices to promote environmentally friendly and efficient efforts in surgical healthcare. Despite widespread enthusiasm for going green in the U.S. economy, little information is available to inform the medical community on the effort. We explore safe and efficient strategies for hospitals and healthcare providers to protect the environment while delivering high-quality care. As part of the study design, we performed a systematic review of the literature using relevant Pubmed search terms and surveyed a panel of hospital managers and CEOs of healthcare organizations pursuing green initiatives. Recommendations were itemized and reviewed with each panelist for a consensus agreement. At the end, we identified forty-three published articles and obtained interview data from the 7-member expert panel. Five green recommendations for surgical practices were identified: (1) OR Waste Reduction and Segregation; (2) Environmentally Preferable Purchasing; (3) Energy Consumption Management; (4) Pharmaceutical Waste Management; (5) Reprocessing of Single Use Medical Devices. We concluded that the medical community has a large opportunity to

implement green practices in surgical units. These practices can have significant benefits to both the healthcare community and the environment.

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INTRODUCTION

Healthcare facilities are the number two contributors of waste in the U.S., producing more than 6,600 tons of waste per day or 4 billion pounds of waste annually.[1, 2] Operating room and labor-delivery waste alone account for approximately 70% of hospital waste.[3] Traditionally, hospitals have disposed of waste using costly autoclaves, microwave disinfection systems, and chemical disinfection. In addition, many hospitals use incineration and dumping of the resultant ashes into landfills.[4] However, these disposal methods are associated with several environmental and public health concerns.

In response, many hospitals have adopted newer, more eco-friendly means of handling waste. The old dictum of "reduce, reuse and recycle", also known as the 3Rs, continues to offer a simple strategy for achieving green goals. Recycling, serving sustainable foods, reprocessing of medical devices, addressing energy efficiency, mercury elimination, pharmaceutical waste management and instituting green building designs have been some of the ways the 3Rs have evolved over the years. These strategies have been associated with significant cost-savings. The difficulty, though, in surgical specialties is how to creatively find ways to incorporate the 3Rs within an environment responsible for handling large amounts of hazardous or infectious medical waste while ensuring patient safety.

The purpose of this study is to review the published literature on green initiatives in the surgical community and draw on the wisdom of experts to generate a list of practical

green solutions surgical units can implement. The panel was selected based on their leadership in green efforts in hospitals, waste management and physician groups.

It is our hypothesis that surgical personnel engage less in green efforts because of huge concerns surrounding patient safety and lack of knowledge of existing suitable green measures that can be easily implemented in their practices. This paper aims to:

a) shed light on the impact of surgical waste on the environment and public health
b) identify several green practices that can be safely utilized in surgical environments
c) explore the debate surrounding controversial practices such as Reprocessing of Single Use Devices and
d) highlight other potential benefits surgical practices can reap by going green

METHODS

We conducted a literature search of PubMed and bibliographies of other relevant journals from 1980 through December 31, 2008. We used the following MeSH search terms classified into 3 main categories:

1. Problem: waste management; medical waste disposal; public health concerns; environmental; incineration; landfill
2. Interventions: surgery green initiatives; green in surgery; operating room green practices; recycling in operating room; recycling in surgery; reducing waste in surgery; surgical waste disposal; hospital waste management

3. Results: cost-savings; staff response; environmental impact; public impact; protests

Combinations of the above terms from each category were performed and initial selection of articles was done based on abstracts. To obtain varying perspectives, articles reviewed were not limited to studies with primary data. This was decided because of very little existing primary research conducted on the topic of interest. Review was limited to English language publications and data reported from US hospitals only.

The panel was selected from experts in the field of medical green practices and was interviewed from June to December 2008. Interviews were conducted and recorded either in person or over the phone for at least 30 minutes each. Ten questions were asked of each expert and additional time was reserved for other comments. Experts were asked questions regarding current medical waste production, options for reducing or eliminating waste, and potential benefits to public and medical organizations from going green (see Table 1). At the end of each interview, experts were also asked to identify one area of greatest concern to them and to list 5 main things they thought surgical practices in particular could do to contribute to green initiatives. No other qualifications were provided such as size of surgical unit, location, or resources (both financial and human). Where possible, they were asked to reference figures or literature to support their arguments. Hospital and participant data were de-identified. Expert's agreement on surgical green initiatives was determined by tallying number of similar responses and picking the top five priorities out of the resultant list. Results from the literature review were then used to support or closely examine information obtained from the panel.

Answers to the questions were reviewed by the authors and a consensus list of recommendations was sent to the panelists for their approval. The panel approved the consensus recommendations without changes.

RESULTS

Literature Review

We found a total of 113 peer-reviewed U.S based articles on environmentally friendly practices. There were 98 fulltext articles but only 43 fulfilled inclusion criteria and were included in this study. These articles were used by the authors to validate and expand on consensus recommendations by the panel.

Expert panel

Seven experts participated in this study. The panel was comprised of both the Clinical Products Specialist and the Director of Environmental Sciences of a tertiary medical institution in the Northeast, the research director for the medical organization HealthCare Without Harm, the CEO of Ascent Health Care Solutions, two certified general surgeons from 500+ bed hospitals, and one public health expert with 15 years experience in the field.

All 7 experts independently identified waste reduction and segregation as the most effective and practical method for initiating green practices on surgical floors. Three of the 7 experts recommended the same 5 green initiatives with varying order of preference. Only one expert listed 3 items that varied significantly from all the others obtained.

After tallying the results obtained from the survey and reviewing the data with published literature, five strategies were agreed upon as a group to be the highest priority solutions for the surgical community. They are: (1) OR Waste Reduction and Segregation; (2) Environmentally Preferable Purchasing; (3) Energy Consumption Management; (4) Pharmaceutical Waste Management; (5) Reprocessing of Single Use Medical Devices. We explore briefly each of the first four strategies using the systematic literature review and take a more detailed look at "Reprocessing" giving its relative newness in the field and controversies surrounding it.

DISCUSSION

OR Waste Reduction and Segregation

Medical waste can be separated into 5 main categories that require different treatment and disposal procedures based on federal guidelines. These are infectious, sharps, pathological (e.g. tissues, body fluids), pharmaceuticals, radioactive and general (e.g. paper, unsoiled linens) waste.[5] Two kinds of disposal bags are used to separate waste--red for specific infectious and pathologic waste and clear for all non-infectious waste. Radioactive and sharp wastes are disposed off in pre-assigned containers depending on their level of contamination with infectious waste. The problem, however, is that most waste in surgical units is misallocated at an individual level into red bags. This is believed to be because of a misunderstanding of what criteria needs to be used for waste segregation. For instance, although usually disposed of in red bags, items in table 2

should be placed in clear bags unless visibly soiled, dripping or caked with blood or bodily fluids.[5]

The importance of careful, diligent waste segregation becomes clear when the cost associated with disposal of each type is taken into consideration. Figure 1 compares the relative waste per volume of each category of waste to its cost. From the figure, it is seen that although hazardous and regulated medical waste (equivalent to infectious waste), make up only 24% of medical waste, they account for almost 85% of costs.[6] It is estimated that approximately 40% of regulated medical waste from operating rooms is actually just packaging material while another 40% is suction canister waste.[2, 7] If the quantities of these two items were reduced, the volume of regulated medical waste could be cut down by more then 30%. For instance, a sanitary sewer system could be used to dispose of certain suction fluids and the empty canister disposed of as solid waste.[7] It is also possible to completely eliminate the need for a canister by connecting the vacuum directly to the sanitary sewer.[7]

To make waste segregation even easier for its staff, a medical center in Maryland initiated a simple system of having only clear bags available during surgical preparation and replacing these with red bags just before the patient is wheeled into the operating room.[3] They also began washing and reusing all surgical scrubs and jackets.[3] These two changes, in addition to several others, have amounted to a 50% reduction in their medical waste volume over the course of 7 years.[3] Another hospital in California reduced its

waste by 50,000 pounds and saved $60,000 annually by switching to reusable surgical gowns.[8]

Environmentally Preferable Purchasing (EPP)

Hospitals for Healthy Environment (H2E), a collaboration between US Environmental Protection Agency and the American Hospital Association, advocates strongly for use of EPP in all departments of hospitals. They define EPP as the "act of purchasing products/services whose environmental impacts have been considered and found to be less damaging to the environment and human health when compared to competing products/services".[9] Apart from cost-savings, EPP creates a healthier hospital environment for patients and staff which further reduce long term expenditure. Material managers of surgical units can support EPP by purchasing supplies from vendors who use environmentally friendly raw materials or products. Hospitals should also aim to eliminate all mercury products and replace these with approved alternatives that are easily recycled or require no specialized disposal.

Other general practices that have been shown to improve overall impact on the environment could also be adopted by surgical units. For instance, surgical facilities can commit to using only unbleached, recycled paper instead of chlorine-bleached white paper given that manufacturing of the latter releases dioxins into our waterways as a by-product.[10] By using 100% recycled paper, hospitals can reduce manufacturing energy use by 44%, decrease greenhouse gas emissions by 37% and cut both solid waste emissions and water use by 50%.[11] Other suggestions include purchasing products that are free of

latex, polyvinyl chloride and diethylhexylphthalate, reducing product packaging and switching to safer cleaning products.[9] This could reduce the incidence of allergic reactions, asthma, eye damage, burns and indirect contamination of hospital food and water supply.[11]

Cost savings, although significant, vary depending on types and amount of EPP utilized by various hospitals. It is estimated, however, that a 1,000-bed hospital could save, for example, $175,000 per year and reduce waste by 34,000 pounds if they just use reusable sharps containers instead of disposable ones.[8] In addition, the direct environmental and public health impact of EPP are important given several studies that have highlighted the effects of current waste disposal strategies. For instance, testing of leachate from landfills has revealed heavy metals, salts, chlorinated hydrocarbons and pathogenic microorganisms which poison soils, waterways and cause DNA damage in life forms that inhabit these environment.[12] Studies have shown lower birth weights and adverse birth outcomes in groups of people residing near landfills leading to demand by local groups for Congress to close them down.[13, 14] Alarms have also been raised about methane (CH_4), a greenhouse gas released from landfills, and both dioxin and mercury contamination caused by incineration of medical waste.[15] EPP helps to address these issues in part, by eliminating sources of these toxic by-products and replacing them with items that are easily biodegradable and recyclable.

Energy Consumption Management

The healthcare industry accounts for 9% of America's commercial energy usage, driven by its dependence on energy intensive medical equipment, special lighting and a 24-hour operating schedule.[16] It is estimated that 25% of a hospital's operating cost goes towards meeting its energy needs with distribution varying from one department to another.[16] Understandably, surgical units consume a large proportion of this energy not only in the operating rooms and Post Anesthesia Care Units but also in the clinics, waiting rooms, and nursing and physician stations where it is used to power monitors, computers and coffee machines. By managing energy usage, surgical practices could save between 25-45% in energy costs.[16] Monthly savings could be increased further by implementing energy efficiency programs (EEP) (see table 3).[17]

Given the high rate of energy waste, instituting very simple EEP changes can result in significant savings as experienced by New York Presbyterian Hospitals (NYPH). By replacing older lighting, air conditioning, water chilling and pumping systems with newer more efficient models, NYPH expects annual savings of $1.77million.[18] As an additional incentive, hospitals can also qualify for federal tax deductions under the Energy Policy Act of 2005 for new or renovated buildings that save 50% or more of their projected annual energy costs for heating, cooling and lighting.[19, 20] An investment tax credit can also be claimed if practices use combined heat and power systems or specific solar lighting and photovoltaic systems.[19, 20]

Pharmaceutical Waste Management

The environmental impact of pharmaceuticals is a relatively new and still controversial issue. Recent studies, confirmed by the US Geological Services (USGS), show evidence of contamination of surface, ground and drinking water by pharmaceutical compounds including antibiotics, steroids, hormones, and other drugs.[21,22] USGS sampled 139 streams across the country and reported at least one pharmaceutical contaminant in 80% of the samples.[22] The real impact of these drugs on humans is not yet known although effects of endocrine disruptors on reproduction have been shown in aquatic organisms.[23] While much is yet to be discovered, many within the public health community have advocated for use of the precautionary principle which states that: " when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."[24]

It is a subject worth the attention of the surgical community, given we use and prescribe several of the more common drugs that end up as pharmaceutical waste contaminants in public waterways. These chemicals get into public water streams usually after being dumped down hospital drains or as part of discarded general waste that ends up in landfills and leaches out. Sources include IV preparations, partially used vials of anesthetics, discontinued or unused preparations or unit dose repacks, patients' personal medication, outdated drugs or from simple spills and breakages.[25]

The Federal Resource Conservation and Recovery Act (RCRA) classifies these drugs as either P- listed waste (acutely hazardous) or U-listed waste (toxic) as shown in Table 4. The RCRA and the Clean Water Act's General Pretreatment Regulations have specific statements regarding disposal of both P- and U-listed waste, which are summarized in H2E's document entitled *Managing Pharmaceutical Waste: A 10-Step Blueprint for Health Care Facilities in the United States.*[25] Pharmacies and waste management services in hospitals can also be good resources for guidelines on correct disposal of pharmaceutical waste and provide needed education to surgical staff.

Reprocessing of Single Use Medical Devices

The American Society for Healthcare Central Service Professionals (ASHCSP) describes reprocessing as any process which renders a used, reusable or singe-use device (SUD) to be patient ready or allows an unused product that has been opened to be made patient ready.[26] According to the FDA, a SUD is any device intended for one use or on a single patient while a reprocessed SUD is an original device that has previously been used on a patient and has been subjected to additional processing and manufacturing for the purpose of additional use on a patient.[27]

As in all activities, incentives, both economic and non-economic, drive behavior. Prior to the introduction of SUDs, most medical devices were manufactured for multiple uses and were reused after cleaning and sterilization by locally trained hospital staff. With increasing concerns regarding safety and rising costs of sterilizing multiple use devices, healthcare migrated to SUDs. But as these also became increasingly sophisticated, their

costs drove healthcare organizations to explore other options such as reprocessing which was conducted and monitored by hospitals. However, due to staffing shortages and stricter FDA regulations, there has been a major shift from in-house reprocessing to use of third party reprocessing companies. In 2007, the FDA identified 11 such establishments, including one hospital that was actively engaged in reprocessing over 100 types of SUDs.[28] Three of these companies now account for 90% of all SUD reprocessing. Currently, they serve many of the nation's major hospitals.

Classes of Reprocessed Devices

There are three categories of devices that lend themselves to reprocessing. Class I devices have a relatively low associated risk to patients and include elastic bandages, pressure infuser bags, tourniquet cuffs and general use surgical scissors.[29] These are exempt from premarket submission requirements.[30] Approximately 65-75% of reprocessed SUDs fall into Class II (medium risk) which requires submission of a premarket notification report providing evidence of equivalence, in relation to safety, effectiveness and intended use, to devices already on the market.[30] Class II devices include pulse oximeter sensors, ultrasound catheters, drills, compression sleeves and most laparoscopic equipment.[29] The last group, Class III (high risk) devices, require valid scientific data proving safety and effectiveness, in addition to a satisfactory inspection of the reprocessing facility in order to obtain FDA premarket approval.[30] Devices that fall into this category are balloon angioplasty catheters, percutaneous tissue ablation electrodes and implanted infusion pumps.[29] Given the high patient risk associated with Class III devices and the strenuous approval process, most healthcare organizations refrain from reprocessing these items.

FDA's post-market activities involve inspection of reprocessing establishments and reviewing device safety reports including adverse events. (A complete listing of reprocessed devices as at time of publication is available in Table 5. For a more current listing, refer to FDA's website for cleared reprocessed SUDs. http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/ucm121197.htm)

Global and Local Savings Associated with Reprocessing

In 2002, approximately 25% of US hospitals used at least one type of reprocessed SUD.[31] Larger hospitals have been more likely to reprocess equipment, with 45% of large hospitals (>250 beds) participating, compared to only 13.3% of small hospitals (<50 beds).[31] This disparity, which has been increasing over the past five years, is likely due to a parallel trend towards heightened awareness at universities regarding the harmful effects of medical waste disposal in landfills. The resource constraints of these small hospitals may be an additional factor. Overall, however, the number of hospitals engaging in reprocessing activities has been noted to be steadily increasing as previous waste disposal practices such as incineration loose popularity given health concerns associated with contamination of air by dioxin and mercury compounds.[32, 33]

In addition to the environmental concerns, many hospitals have been struck hard by the current economic crises with 2008 profit margins at an all-time low. Given these financial concerns, hospitals are increasingly attracted to reprocessing because of its associated 50% cost reduction of medical devices compared to purchasing new

equipment (see figure 2).[29] In 2008 alone, there was a 20% increase in hospital utilization of reprocessing services offered by one leading reprocessing service, and associated cost savings of $138,142,000 nationwide.[34] This represented 4,300,000 pounds (2,150 tons) of medical waste diverted from local landfills.[34] Over the last 20 years operation, this reprocessor has enabled $1 billion in savings in supply costs and eliminated 24 million pounds of waste for its 1700 member healthcare facilities.[34]

Cost savings differ from one institution to the next depending on types and quantity of devices reprocessed. Across the board, however, hospitals are observing significant savings which are being channeled into badly needed medical infrastructure or services. For instance, a 300-bed hospital in the Southeast realized savings of approximately $400 per bed within just 11-months of implementing a reprocessing program consisting of 10 devices.[35] The hospital's annual savings are currently projected to be more than $125,000.[35] Banner Health in Phoenix also reported a total savings of $1,494,050 over 12 months from reprocessing operating room devices, compression sleeves, catheters, open but unused devices and pulse oximeters.[36]

Patient Safety Debates

One barrier to the widespread adoption of reprocessing is its potential impact on patient safety. Concerns include the potential dysfunction of devices and the risk of infectious diseases.[37] Some have cited an ethical dilemma reprocessing presents given the absence of patient consent to usage of reprocessed devices as a part of treatment.[38] PatientGUARD (Patient Groups United Against Reprocessing Dangers), a coalition of New Jersey health-care and patient advocacy groups, has lobbied for legislation requiring

written patient consent, documentation of all reprocessed SUDs used during treatment and stricter systems of tracking SUD failures and injuries, while holding reprocessors fully liable for any adverse events.[38]

The government has responded to these concerns by conducting several investigations and hearings into reprocessing of SUDs and introduced stricter regulations at all levels of production. Most notably, The Medical Device User Fee and Modernization Act of 2002 (MDUFMA) was enacted, requiring that all reprocessed SUDs be labeled and have the identification of the reprocessor.[39] MDUMFA also created more stringent FDA oversight of reprocessed SUDs than had been present in the past.[39]

In January 2008, the US Government Accountability Office (GAO), released a report entitled *Reprocessed Single-Use Medical Devices: FDA Oversight Has Increased, and Available Information Does Not Indicate That Use Presents an Elevated Health Risk.*[28] In this report, the GAO outlined steps taken by the FDA since 2000 to improve its supervision and regulation of reprocessing including additional requirements for pre and post market approval and easier and more detailed adverse effect reporting mechanisms.[28] More importantly, GAO concluded that although available FDA data fail to allow for rigorous in-depth comparisons, reprocessed SUDs do not present an increased health risk when compared with new non-reprocessed devices.[28] Of the 434 adverse events reported to the FDA between 2003 and 2006 in which reprocessed SUDs were identified, only 65 actually did involve a reprocessed device and all adverse events were similar to those reported for new devices.[28]

Another GAO report released in September 2008 on HealthCare Associated Infections also found no evidence of reprocessed SUDs contributing to infections.[40] All devices have risks, including SUDs. Yet the available evidence, though limited, suggests that reprocessed devices pose no greater risks for failure or infections than non-reprocessed SUDs. Though no regulatory oversight is perfect, the use of reprocessed SUDs has strong oversight to help ensure patient safety. We have found that U.S. reprocessors have a strong environmental mission and are very transparent. They offer random factory site visits, conduct exhaustive testing of reprocessed devices, are registered with the FDA, and have adequate liability insurance coverage. It is important that similar high standards of service and production are upheld by any potential reprocessing organization that a hospital is interested in using.

Suggestions for Academic Medical Centers

U.S. medical schools and teaching hospitals have become the center for cutting edge research, technology development and highly-skilled health professional training. They have spearheaded patient advocacy and safety issues leading to significant changes in healthcare delivery today. These efforts have also been channeled into promoting green healthcare practices such as recycling, mercury elimination and energy conservation in an attempt not only to protect our environment but also to join public health efforts in preventative care. Today, due to these initiatives, almost all academic medical centers have extensive recycling projects which have trickled down into the communities they serve. Reprocessing not only provides another arena for promoting green practices, but

also offers academic medical centers a chance to proactively reduce the volume of waste stream by safely reusing sterilized, repackaged devices that previously would have been discarded after a single use.

We have discussed both the environmental and cost savings associated with this practice above and how savings could be channeled into other avenues. In addition to this, the relatively new status of reprocessing as a green healthcare practice makes it an interesting and needed subject for research. Faculty could create research projects for medical students and resident staff that revolve around issues of acceptance, usage, medical device errors, cost-effectiveness and medical-legal issues that extend over a period of time. Such research will be helpful in augmenting the existing limited literature and will help shape future healthcare practices especially in the fields of surgery, obstetrics/gynecology, emergency medicine, intensive care and internal medicine, which rely significantly on SUDs.

Centers interested in reprocessing should consider internal education of employees and students prior to initiation in order to maximize usage and benefits. We have found that U.S. reprocessors have a strong environmental mission and are very transparent. They offer random factory site visits, conduct exhaustive testing of reprocessed devices, are registered with the FDA, and have adequate liability insurance coverage. It is important that similar high standards of service and production are upheld by any potential reprocessing organization that a hospital is interested in using. Though no regulatory

oversight is perfect, our experience is that reprocessing of SUDs currently has strong oversight to help ensure high quality standards and patient safety.

CONCLUSION

Information obtained from both the literature review and the expert panel reveals a strong need for better, widespread environmentally friendly initiatives in the surgical community. As doctors, we are bound by a common desire to protect the health of our patients both directly and indirectly. This should be paramount as we seek ways to contribute to preventative health through green initiatives. As an added bonus, these efforts can also provide significant cost-savings and public recognition.

References

1) Diconsiglio, J. Reprocessing SUDs Reduces Waste, Costs. Materials Management in Health Care. 2008; 17 (9): 40-42

2) Gaskill, M. Going Green — RNs Tackle Hospital Waste. NurseWeek. Published April 24, 2006. Available at http://www.h2e-online.org/docs/nurseweek42406.pdf. Accessed January 14, 2009

3) United States Air Force IERA. Medical Waste Incinerator Waste Management Plan. Malcolm Grow Medical Center. Released June 2001. Available at http://airforcemedicine.afms.mil/idc/groups/public/documents/afms/ctb_033957.pdf. Accessed January 14, 2009

4) Lee BK, Ellenbecker MJ, and Rafael ME. Alternatives for the Treatment and Disposal of Healthcare Wastes in Developing Countries, Waste Management 2004; 24: 143–151.

5) Yeshnowski M. Minimizing Medical Waste. Tetra Tech Em Inc. Presentation. Available at http://www.wrppn.org/hospital/pdf/11-Minimizing%20Red%20Bag%20Waste%20(Hawaii).pdf. Accessed January 13, 2009

6) Wong KV, Narasimhan R, Kashyap R, Fu J. Medical Waste Characterization. Journal of Environment and Health 1994; 57 (1):19-24.

7) Suction Canister Waste Reduction. Minnesota Technical Assistance Program Reference List. Available at http://mntap.umn.edu/health/91-Canister.pdf. Accessed January 15th, 2009

8) Waste Reduction Activities for Hospitals. California Integrated Waste Management Board. Available at http://www.ciwmb.ca.gov/bizWaste/FactSheets/Hospital.htm. Accessed January 13, 2009

9) Environmentally Preferable Purchasing How-To Guide. Health Care Without Harm Publication. Available at http://www.noharm.org/library/docs/Going_Green_5-1_Environmentally_Preferable_Pur.pdf. Accessed January 14, 2009.

10) Muna Ali and T. R. Sreekrishnan Aquatic toxicity from pulp and paper mill effluents: a review. Advances in Environmental Research.2001; 5 (2): 175-196

11) The Supply Chain/ Green Purchasing Overview. Rutgers, The State University of New Jersey. Available at http://purchasing.rutgers.edu/green/supply_chain_green_purchasing.html. Accessed January 13, 2009.

12) Sang N and Li GK. Chromosomal Aberrations Induced in Mouse Bone Marrow Cells by Municipal Landfill Leachate. Environ Toxicol Pharmacol 2005; 20(1):219–24.

13) Berry M, Bove F. Birth weight reduction associated with residence near hazardous landfills. Environ Health Perspect 1997; 105(8):856–61.

14) Elliott P, Briggs D, Morris S, de Hoogh C, Hurt C, Jensen TK, et al. Adverse birth outcomes in populations living near landfill sites. Br Med J 2001; 323:363–8.

15) Thornton J, McCally M, Orris P, and Weinberg J. Hospitals and Plastics: Dioxin Prevention and Medical Waste. Public Health Rep. 1996 Jul–Aug; 111(4): 298–313

16) Healthcare Facilities Account for 9% of Energy Consumption. Managed Healthcare Executive. Published December 1st, 2008.

17) Ruparel M. Energy Efficiency Program for Hospitals. Healthcare Management Express. 2003: 2-3

18) ENERGY STAR Success Story: New York-Presbyterian Hospital. Report. Available at http://www.energystar.gov/index.cfm?c=healthcare.bus_healthcare_ny_presb_hospital Accessed January 15, 2009.

19) Energy Policy Act Of 2005. Public Law 109–58—August 8, 2005. pages 594 -1142. Available at ehttp://www.epa.gov/oust/fedlaws/publ_109-058.pdf. Accessed January 15, 2009

20) The Tax Incentives Assistance Program (TIAP). IRS Regulations. Available at http://www.energytaxincentives.org/general/irs_regs.php. Accessed January 15, 2009.

21) Jones OAH, Voulvoulis N, Lester JN. Human Pharmaceuticals in the Aquatic Environment a Review. Environmental Technology, 2001; 22 (12): 1383-1394

22) Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams: A National Reconnaissance. Environmental Science & Technology. 1999-2000; 36 (6):1202-1211.

23) Nash et al. Long-Term Exposure to Environmental Concentrations of the Pharmaceutical Ethynylestradiol Causes Reproductive Failure in Fish. Environ Health Perspect. 2004; 112(17): 1725–1733

24) Raffensperger C, Tickner J, eds. Protecting Public Health and the Environment: Implementing the Precautionary Principle. Washington, DC: Island Press, 1999.

25) Managing Pharmaceutical Waste: A 10-Step Blueprint for Health Care Facilities in the United States. Hospitals for a Healthy Environment. Published April 15, 2006. Available at http://www.h2e-online.org/docs/h2epharmablueprint41506.pdf. Accessed January 15, 2009.

26) Selvey D. Medical Device Reprocessing: Is It Good for Your Organization? Infection Control Today Magazine. Published January 01, 2001. http://www.infectioncontroltoday.com/articles/111feat1.html. Accessed January 12, 2009

27) United States Department Of Health and Human Services. Food and Drug Administration. Center for Devices and Radiological Health. Reprocessing of Single Used Devices: Definitions. http://www.fda.gov/Cdrh/reprocessing/definitions.html. Accessed January 13, 2009.

28) United States Government Accountability Office. Report to the Committee on Oversight and Government Reform, House of Representatives. Reprocessed Single-Use Medical Devices: FDA Oversight Has Increased, and Available Information Does Not Indicate That Use Presents an Elevated Health Risk. Document released January 31, 2008.

29) Association of Medical Device Reprocessors (AMDR) Members' Product Listings, January 2007. http://www.amdr.org/documents/00038728.pdf. Accessed January 13, 2009.

30) United States Department Of Health and Human Services. Food and Drug Administration. Center for Devices and Radiological Health. Enforcement Priorities for

Single-Use Devices Reprocessed by Third Parties and Hospitals. Document issued August 14, 2000

31) United States Department Of Health and Human Services. Food and Drug Administration. Center for Devices and Radiological Health. Executive Summary: Survey on the Reuse and Reprocessing of Single-Use Devices (SUDs) in U.S. Hospitals. Document updated October 16, 2002. http://www.fda.gov/cdrh/reprocessing/survey-execsum.html. Accessed January 14, 2009.

32) Thornton J, McCally M, Orris P and Weinberg J. Hospitals and Plastics: Dioxin Prevention and Medical Waste Incinerators. Public Health Rep. 1996 Jul–Aug; 111(4): 298–313

33) Lee CC and Huffman GL. Medical Waste Management/Incineration. Journal of Hazardous Materials.1996; 48 (1-3): 1-30

34) Ascent Health Solution Report: Hospitals Benefit from Sustainability Initiatives with more than $138 Million in Savings in 2008. Press Release Jan 12, 2009. http://www.ascenths.com/docs/press/2008_year-end_011209.pdf. Accessed January 14, 2009.

35) SterilMed Staff Acceptance Case Study: By facilitating high user acceptance, hospital exceeds savings goal by 100% in less than one year. SM133 Rev A 06/07.

36) Diconsiglio, J. Reprocessing SUDs Reduces Waste, Costs. Materials Management in Health Care. 2008;17 (9): 40-42

37) Heeg P, Roth K, Reichl R, Cogdill CP and Bond WW. Decontaminated Single-Use Devices: An Oxymoron That May Be Placing Patients at Risk for Cross-contamination. Infect Control Hosp Epidemiol 2001; 22:542–549

38) Honorable Bob Franks. Greater Transparency Needed In Reprocessing Of Medical Devices. Legal Opinion Letter. Washington Legal Foundation. 2007; 17: 7

39) Medical Device User Fee And Modernization Act Of 2002. Public Law 107–250. 116 STAT. 1588- 1620. October 26, 2002. http://www.fda.gov/cdrh/mdufma/MDUFMA2002.pdf. Accessed January 13, 2009.

40) United States Government Accountability Office. Health-Care-Associated Infections in Hospitals: Number Associated with Medical Devices Unknown, but Experts Report Provider Practices as a Significant Factor. Document Released September 26, 2008

Figure 1. Comparing relative cost of waste to volume.

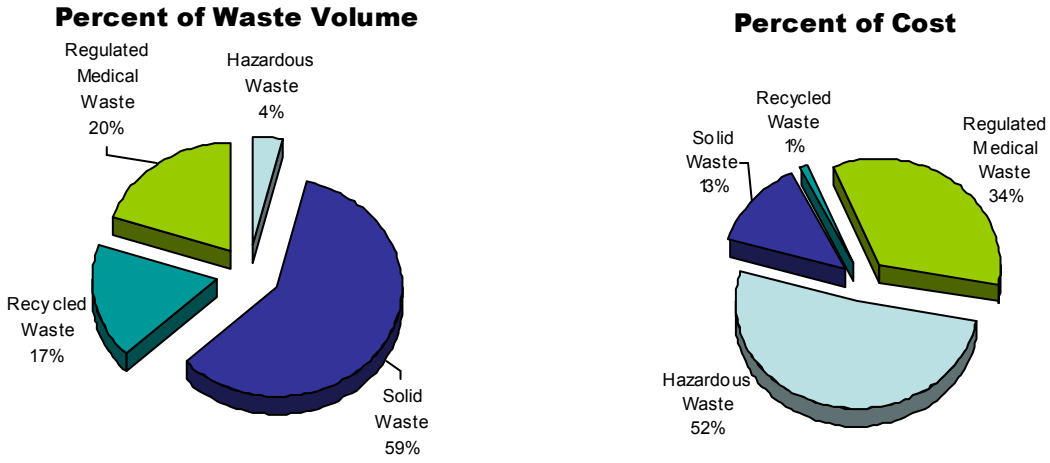
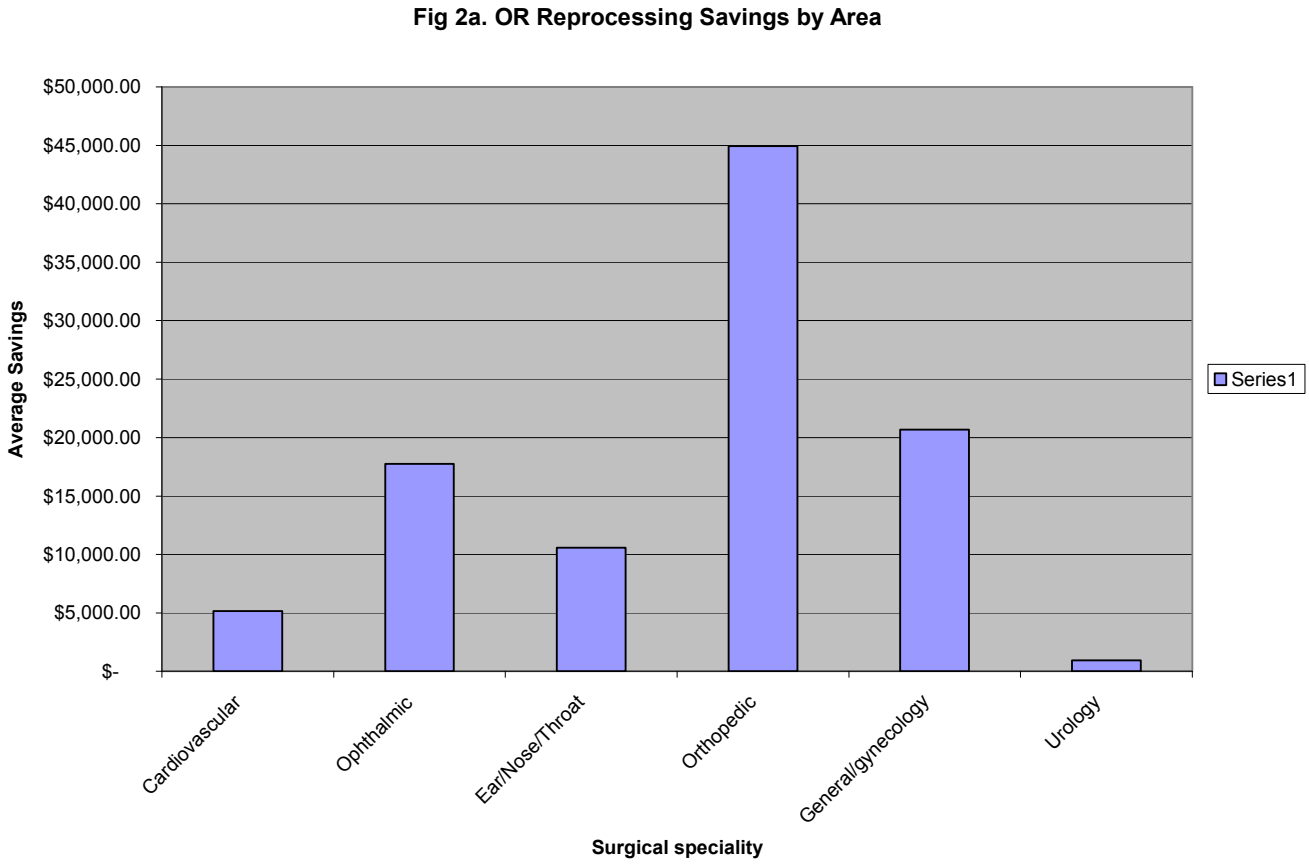


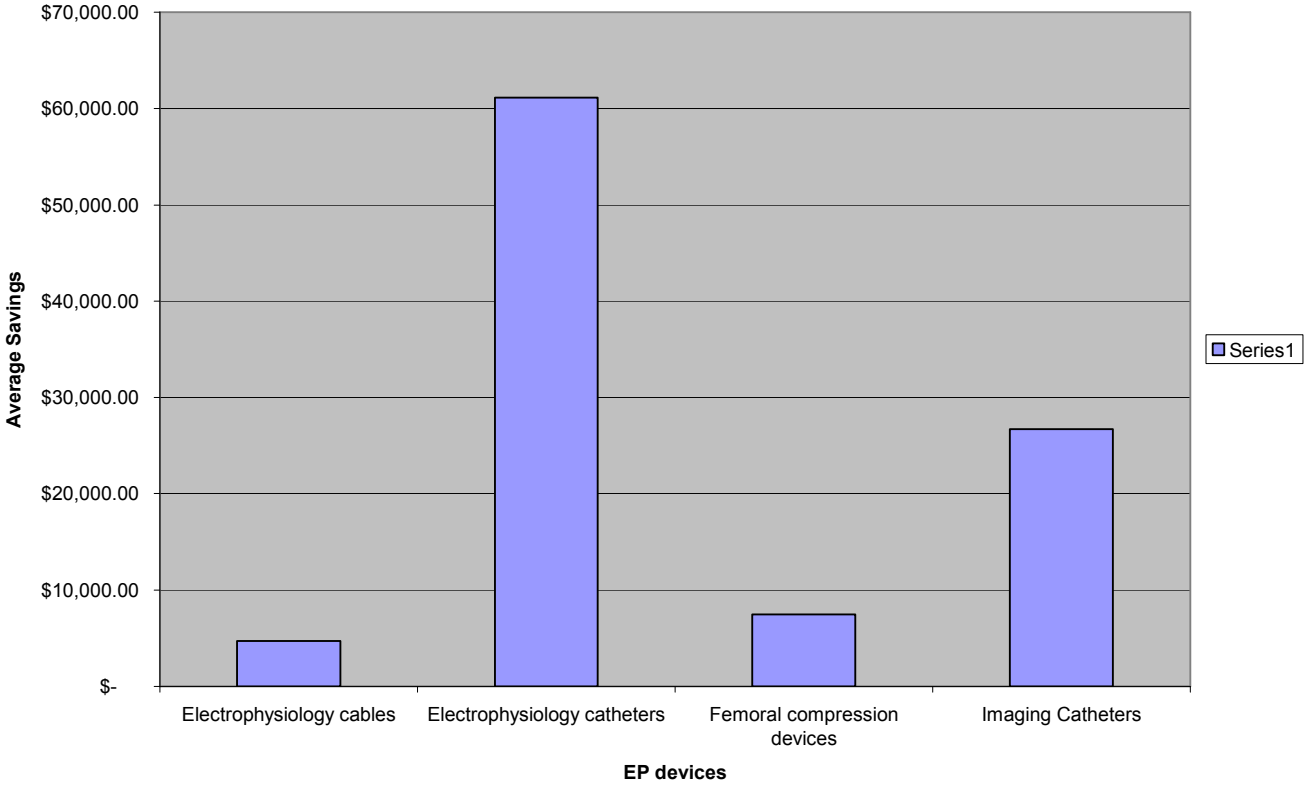
Figure courtesy of Colleen Cusick, from The Johns Hopkins Go Green Initiative Presentation.

Figure 2: Comparison of average savings associated with reprocessing in various surgical specialties and of specific devices.



Data from Flynn AB and Knishinsky R. A Matter of Reprocessing. Materials. 2005; 14(10):32-35

Fig 2b. Average Distribuition of $100K in EP Reprocessing Savings Across 20 Facilities



Data from Flynn AB and Knishinsky R. A Matter of Reprocessing. Materials. 2005; 14(10):32-35

Table 1: Questionnaire completed by each member of our panel

We are interested in studying the impact, if any, of surgical medical waste on health and the environment. Please answer all the questions below and where suitable, provide data to support your statements. All data will be de-identified to protect patient and institutional rights. Thank you.

1) How much medical waste is produced annually in the US? Of this, surgical waste constitutes what percentage or fraction?

2) Waste streams are usually classified into specific categories. Into which categories will you place surgical waste and what is the associated cost for disposing each identified stream?

3) There have been several reports on the impact of medical waste disposal techniques on the environment. Are you aware of any such effects? If yes, please provide examples and data to support or disprove these reports.

4) Please list and explain several surgical waste disposal techniques used by your institution or one that you are familiar with.

5) Are there any benefits or risks –to people, environment, and medical institutions-- associated with these techniques?

6) There has been much hype in the media and even in medical centers on 'going green'. What are your thoughts on this?

7) Has the organization you work in adopted any such green practices? If yes, what steps did management take to implement them and how has employee acceptance been?

8) Have you noted any benefits or risks associated with these new green practices at your center? Please comment, if possible, on financial costs, safety, environmental cleanliness, waste volume and employee/patient health. Any data to support points is appreciated.

9) Considering the subject of surgical waste production and disposal, what is one area of greatest concern to you and why?

10) Based on your experience, what are the five (5) main things surgical practices in particular can do to become more green? Please rank in order of greatest impact.

Table 2. Common materials used in surgical practices that should not be placed in red bag waste		
Paper towels Vent tubing Suction tubes IV bags Foley bags Foley Catheters Batteries	Masks Gowns Drapes Linens Cast and splints Packaging materials Alcohol preps and wipes	Dressings and gauze Cotton Tapes Diapers and Incontinence pads Bed pans Urinals Emesis basins

Table 3: Energy Efficiency Programs
• Energy efficient HVAC system designs • Energy efficient lighting system designs • Energy efficient sterilization, gas & water plants • Energy efficient waste disposal systems • Energy efficient housekeeping methods • Energy efficient medical & non- medical equipment • Thermal storage analysis systems & cooling analysis systems • Energy efficient building infrastructure designs • Effective cogeneration feasibility analysis and design • Highly motivated and trained staff including the senior management for initiating and implementing energy saving protocols

Data from Ruparel M. Energy efficiency program for hospitals. Healthcare Management Express.2003: 2-3

Table 4. RCRA list of hazardous and toxic pharmaceuticals

P-listed waste	**U-listed waste**
Arsenic trioxide	Chloral hydrate (CIV)
Epinephrine (most common hazardous waste)	Chlorambucil
Nicotine	Cyclophosphamide
Nitroglycerin	Daunomycin
Phentermine (CIV)	Dichlorodifluoromethane
Physostigmine	Diethylstilbestrol
Physostigmine salicylate	Hexachlorophene
Warfarin >0.3%	Lindane
	Melphalan
	Mercury
	Mitomycin
	Paraldehyde (CIV)
	Phenol
	Reserpine
	Resorcinol
	Saccharin
	Selenium sulfide
	Streptozotocin
	Trichloromonofluromethane
	Uracil mustard
	Warfarin <0.3%

Table 5: List of Single-Use Devices Known To Be Reprocessed or Considered for Reprocessing

	Medical Specialty	Device Type	Class	Risk \A\	Critical/ Semicritical/ Noncritical	Premarket Exempt
1	Cardio	Cardiopulmonary Bypass Marker		1	C	N
2	Cardio	Percutaneous & Operative Transluminal Coronary Angioplasty Catheter (PTCA)	3	3	C	N
3	Cardio	Percutaneous Ablation Electrode	3	3	C	N
4	Cardio	Peripheral Transluminal Angioplasty (PTA) Catheter	2	3	C	N
5	Cardio	Blood-Pressure Cuff	2	1	N	N
6	Cardio	Angiography Catheter	2	3	C	N
7	Cardio	Electrode Recording Catheter	2	3	C	N
8	Cardio	High Density Array Catheter	2	3	C	N
9	Cardio	Fiber-optic Oximeter Catheter	2	3	C	N
10	Cardio	Steerable Catheter	2	3	C	N
11	Cardio	Steerable Catheter Control System	2	3	C	N
12	Cardio	Guide Wire	2	3	C	N
13	Cardio	Angiographic Needle	2	3	C	N
14	Cardio	Trocar	2	3	C	N
15	Cardio	Syringes	2	3	C	N
16	Cardio	Injector Type Syringe Actuator	2	3	C	N
17	Cardio	Oximeter	2	3	N	N
18	Cardio	Tissue Saturation Oximeter	2	3	C	N
19	Cardio	Intra-Aortic Balloon System	3	3	C	N
20	Cardio	Vascular Clamp	2	3	C	N
21	Cardio	Heart Stabilizer	1	2	C	Y
22	Cardio	Non-compression Heart Stabilizer	1	3	C	Y
23	Cardio	External Vein Stripper	2	3	C	N
24	Cardio	Compressible Limb Sleeve	2	1	N	N
25	Dental	Bur	1	1	C	Y
26	Dental	Diamond Coated Bur	1	3	C	Y
27	Dental	Diamond Instrument	1	3	C	Y
28	Dental	AC-Powered Bone Saw	2	2	C	N
29	Dental	Manual Bone Drill and Wire	2	2	C	N

		Driver				
30	Dental	Powered Bone Drill	2	2	C	N
31	Dental	Intraoral Drill	1	1	C	Y
32	Dental	Injection Needle	1	3	C	Y
33	Dental	Metal Orthodontic Bracket	1	3	S	Y
34	Dental	Plastic Orthodontic Bracket	2	3	S	N
35	ENT	Bur	1	1	C	Y
36	ENT	Diamond Coated Bur	1	3	C	Y
37	ENT	Micro-debrider	1	3	C	Y
38	ENT	Microsurgical Argon Fiber Optic Laser Cable, For Uses Other Than Otology, Including Laryngology & General Use In Otolaryngology	2	1	S	N
39	ENT	Microsurgical Argon Fiber Optic Laser Cable, For Use In Otology	2	1	S	N
40	ENT	Microsurgical Carbon-Dioxide Fiber Optic Laser Cable	2	1	S	N
41	ENT	Bronchoscope Biopsy Forceps (Nonrigid)	2	3	C	N
42	ENT	Bronchoscope Biopsy Forceps (Rigid)	2	1	C	N
43	Gastro/Urology	Biopsy Forceps Cover	1	1	C	Y
44	Gastro/Urology	Biopsy Instrument	2	3	C	N
45	Gastro/Urology	Biopsy Needle Set	2	3	C	N
46	Gastro/Urology	Biopsy Punch	2	2	C	N
47	Gastro/Urology	Mechanical Biopsy Instrument	2	2	C	N
48	Gastro/Urology	Nonelectric Biopsy Forceps	1	3	C	Y
49	Gastro/Urology	Cytology Brush For Endoscope	2	2	S	N
50	Gastro/Urology	Endoscope Accessories	2	2	S	N
51	Gastro/Urology	Extraction Balloons/Baskets	2	2	S	N
52	Gastro/Urolo	Endoscopic Needle	2	3	C	N

	gy					
53	Gasro/Urology	Simple Pneumoperitoneum Needle	2	3	C	N
54	Gastro/Urology	Spring Loaded Pneumoperitoneum Needle	2	3	C	N
55	Gastro/Urology	Active Electrosurgical Electrode	2	3	S	N
56	Gastro/Urology	Biliary Sphincterotomes	2	3	C	N
57	Gastro/Urology	Electric Biopsy Forceps	2	3	C	N
58	Gastro/Urology	Electrosurgical Endoscopic Unit (with or without accessories)	2	3	S	N
59	Gastro/Urology	Flexible Snare	2	3	S	N
60	Gastro/Urology	Flexible Suction Coagulator Electrode	2	3	S	N
61	Gastro/Urology	Flexible Stone Dislodger	2	3	S	Y
62	Gastro/Urology	Metal Stone Dislodger	2	3	S	Y
63	Gastro/Urology	Needle Holder	1	1	C	Y
64	Gastro/Urology	Nonelectrical Snare	1	1	S	Y
65	Gastro/Urology	Urological Catheter	2	2	S	N
66	Gastro/Urology	Single Needle Dialysiss Set	2	3	C	N
67	Gastro/Urology	Hemodialysis Blood Circuit Accessories	2	2	S	N
68	Gastro/Urology	Single Needle Dialysis Set	2	3	C	N
69	Gastro/Urology	Hemorrhoidal Ligator	2	2	C	N
70	General Hospital	Implanted Programmable Infusion Pump	3	3	C	N
71	General Hospital	Needle Destruction Device	3	1	N	N
72	General Hospital	Nonpowered Flotation Therapy Mattress	1	2	N	Y
73	General Hospital	NonAC-Powered Patient Lift	1	2	N	Y

74	General Hospital	Alternating Pressure Air Flotation Mattress	2	1	N	Y
75	General Hospital	Temperature Regulated Water Mattress	1	2	N	Y
76	General Hospital	Hypodermic Single Lumen Needle	2	3	C	N
77	General Hospital	Piston Syringe	2	3	C	N
78	General Hospital	Mattress Cover (Medical Purposes)	1	2	N	Y
79	General Hospital	Disposable Medical Scissors	1	1	N	Y
80	General Hospital	Irrigating Syringe	1	1	C	Y
81	Infection Control	Surgical Gowns	2	1	C	N
82	Lab	Blood Lancet	1	1	C	Y
83	Neurology	Clip Forming/Cutting Instrument	1	3*	C	Y
84	Neurology	Drills, Burrs, Trephines & Accessories (Manual)	2	3*	C	N
85	Neurology	Drills, Burrs, Trephines & Accessories (Compound, Powered)	2	3*	C	N
86	Neurology	Drills, Burrs, Trephines & Accessories (Simple, Powered)	2	3*	C	N
87	OB/GYN	Oocyte Aspiration Needle	3	3	C	N
88	OB/GYN	Laparoscope Accessories	1	2	C	Y
89	OB/GYN	Laparoscope Accessories	2	3	C	N
90	OB/GYN	Laparoscopic Dissectors	1	2	C	Y
91	OB/GYN	Laparoscopic Graspers	1	2	C	Y
92	OB/GYN	Laparoscopic Scissors	1	2	C	Y
93	OB/GYN	Insufflator Accessories (Tubing, Verres Needle, Kits)	2	3	C	Y
94	OB/GYN	Laparoscopic Insufflator	2	2	N	N
95	OB/GYN	Endoscopic Electrocautery and Accessories	2	2	N	N
96	OB/GYN	Gynecologic Electrocautery (and Accessories)	2	2	N	N
97	OB/GYN	Endoscopic Bipolar Coagulator-Cutter (and Accessories)	2	2	N	N
98	OB/GYN	Culdoscopic Coagulator (and	2	2	N	N

		Accessories)				
99	OB/GYN	Endoscopic Unipolar Coagulator-Cutter (and Accessories)	2	2	N	N
100	OB/GYN	Hysteroscopic Coagulator (and Accessories)	2	2	N	N
101	OB/GYN	Unipolar Laparoscopic Coagulator (and Accessories)	2	2	N	N
102	OB/GYN	Episiotomy Scissors	1	1	C	Y
103	OB/GYN	Umbilical Scissors	1	1	C	Y
104	OB/GYN	Biopsy Forceps	1	3	C	Y
105	OB/GYN	Assisted Reproduction Needle	2	3	C	N
106	Ophthalmic	Endoilluminator	2	3*	C	N
107	Ophthalmic	Surgical Drapes	2	2	C	N
108	Ophthalmic	Ophthalmic Knife	1	3	C	Y
109	Ophthalmic	Keratome Blade	1	3	C	N
110	Ophthalmic	Phacoemulsification Needle	2	3	C	N
111	Ophthalmic	Phacoemulsification/ Phacofragmentation Fluidic	2	2	C	N
112	Ophthalmic	Phacofragmentation Unit	2	1	N	N
113	Orthopedic	Saw Blades	1	1	C	Y
114	Orthopedic	Surgical Drills	1	1	C	Y
115	Orthopedic	Arthroscope Accessories	2	2	C	Y
116	Orthopedic	Bone Tap	1	1	C	Y
117	Orthopedic	Burr	1	1	C	Y
118	Orthopedic	Carpal Tunnel Blade	1	2	C	Y
119	Orthopedic	Countersink	1	1	C	Y
120	Orthopedic	Drill Bit	1	1	C	Y
121	Orthopedic	Knife	1	1	C	Y
122	Orthopedic	Manual Surgical Instrument	1	1	C	Y
123	Orthopedic	Needle Holder	1	1	C	Y
124	Orthopedic	Reamer	1	1	C	Y
125	Orthopedic	Rongeur	1	1	C	Y
126	Orthopedic	Scissors	1	1	C	Y
127	Orthopedic	Staple Driver	1	1	C	Y
128	Orthopedic	Trephine	1	1	C	Y
129	Orthopedic	Flexible Reamers/Drills	1	1	C	Y
130	Orthopedic	External Fixation Frame	2	2	N	N
131	Physical Medicine	Nonheating Lamp for Adjunctive Use Inpatient Therapy	2	1	N	N
132	Physical Medicine	Electrode Cable	2	1	N	Y

133	Physical Medicine	External Limb Component, Hip Joint	1	2	N	Y
134	Physical Medicine	External Limb Component, Knee Joint	1	2	N	Y
135	Physical Medicine	External Limb Component, Mechanical Wrist	1	2	N	Y
136	Physical Medicine	External Limb Component, Shoulder Joint	1	2	N	Y
137	Plastic Surgery	Stapler	1	2	C	Y
138	Radiology	Isotope Needle	2	3	C	N
139	Respiratory	Endotracheal Tube Changer	3	3	C	N
140	Respiratory	Anesthesia Conduction Needle	2	3	C	N
141	Respiratory	Short Term Spinal Needle	2	3	C	N
142	Respiratory	Respiratory Therapy and Anesthesia Breathing Circuits	1	2	S	Y
143	Respiratory	Oral and Nasal Catheters	1	1	C	Y
144	Respiratory	Gas Masks	1	1	S	Y
145	Respiratory	Breathing Mouthpiece	1	1	N	Y
146	Respiratory	Tracheal Tube	2	3	C	N
147	Respiratory	Airway Connector	1	2	S	Y
148	Respiratory	CPAP Mask	2	3	S	N
149	Respiratory	Emergency Manual Resuscitator	2	2	S	N
150	Respiratory	Tracheobronchial Suction Catheter	1	3	S	Y
151	Surgery	AC-Powered Orthopedic Instrument and Accessories	1	2	C	N
152	Surgery	Breast Implant Mammary Sizer		1	C	N
153	Surgery	Ultrasonic Surgical Instrument		3	C	N
154	Surgery	Trocar	1	3	C	Y
155	Surgery	Endoscopic Blades	2	2	C	N
156	Surgery	Endoscopic Guidewires	2	1	C	N
157	Surgery	Inflatable External Extremity Splint	1	1	N	Y
158	Surgery	Noninflatable External Extremity Splint	1	1	N	Y
159	Surgery	Catheter Needle	1	3	C	Y
160	Surgery	Implantable Clip	2	3	C	N
161	Surgery	Electrosurgical and	2	2	C	N

		Coagulation Unit with Accessories				
162	Surgery	Electrosurgical Apparatus	2	2	C	N
163	Surgery	Electrosurgical Cutting & Coagulation Device & Accessories	2	2 3	C	N
164	Surgery	Electrosurgical Device	2	2	C	N
165	Surgery	Electrosurgical Electrode	2	2	C	N
166	Surgery	Implantable Staple, Clamp, Clip for Suturing Apparatus	2	3	C	N
167	Surgery	Percutaneous Biopsy Device	1	3	C	Y
168	Surgery	Gastro-Urology Needle	1	3	C	Y
169	Surgery	Aspiration and Injection Needle	1	3	C	Y
170	Surgery	Biopsy Brush	1	1	C	Y
171	Surgery	Blood Lancet	1	1	C	Y
172	Surgery	Bone Hook	1	1	C	Y
173	Surgery	Cardiovascular Biopsy Needle	1	3	C	Y
174	Surgery	Clamp	1	1	C	Y
175	Surgery	Clamp	1	1	C	Y
176	Surgery	Curette	1	1	C	Y
177	Surgery	Disposable Surgical Instrument	1	1	C	Y
178	Surgery	Disposable Vein Stripper	1	1	C	Y
179	Surgery	Dissector	1	1	C	Y
180	Surgery	Forceps	1	2	C	Y
181	Surgery	Forceps	1	2	C	Y
182	Surgery	Gouge	1	1	C	Y
183	Surgery	Hemostatic Clip Applier	1	2	C	Y
184	Surgery	Hook	1	1	C	Y
185	Surgery	Manual Instrument	1	1	C	Y
186	Surgery	Manual Retractor	1	1	C	Y
187	Surgery	Manual Saw and Accessories	1	1	C	Y
188	Surgery	Manual Saw and Accessories	1	1	C	Y
189	Surgery	Manual Surgical Chisel	1	1	C	Y
190	Surgery	Mastoid Chisel	1	1	C	Y
191	Surgery	Orthopedic Cutting Instrument	1	1	C	Y
192	Surgery	Orthopedic Spatula	1	1	C	Y
193	Surgery	Osteotome	1	1	C	Y
194	Surgery	Rasp	1	1	C	Y
195	Surgery	Rasp	1	1	C	Y

196	Surgery	Retractor	1	1	C	Y
197	Surgery	Retractor	1	1	C	Y
198	Surgery	Saw	1	1	C	Y
199	Surgery	Scalpel Blade	1	1	C	Y
200	Surgery	Scalpel Handle	1	1	C	Y
201	Surgery	Scissors	1	1	C	Y
202	Surgery	Snare	1	1	C	Y
203	Surgery	Spatula	1	1	C	Y
204	Surgery	Staple Applier	1	2	C	Y
205	Surgery	Stapler	1	2	C	Y
206	Surgery	Stomach and Intestinal Suturing Apparatus	1	2	C	Y
207	Surgery	Surgical Curette	1	1	C	Y
208	Surgery	Surgical Cutter	1	1	C	Y
209	Surgery	Surgical Knife	1	1	S	Y
210	Surgery	Laser Powered Instrument	2	2	C	N
211	Surgery	AC-Powered Motor	1	2	C	Y
212	Surgery	Bit	1	1	C	Y
213	Surgery	Bur	1	1	C	Y
214	Surgery	Cardiovascular Surgical Saw Blade	1	1	C	Y
215	Surgery	Chisel (Osteotome)	1	1	C	Y
216	Surgery	Dermatome	1	1	C	Y
217	Surgery	Electrically Powered Saw	1	2	C	Y
218	Surgery	Pneumatic Powered Motor	1	2	C	Y
219	Surgery	Pneumatically Powered Saw	1	2	C	Y
220	Surgery	Powered Saw & Accessories	1	2	C	Y
221	Surgery	Saw Blade	1	1	C	Y
222	Surgery	Nonpneumatic Tourniquet	1	1	N	Y
223	Surgery	Pneumatic Tourniquet	1	1	N	Y
224	Surgery	Endoscopic Staplers	1	2	C	Y
225	Surgery	Trocar	2	3	C	N
226	Surgery	Surgical Cutting Accessories	1	2	C	Y
227	Surgery	Electrosurgical Electrodes/Handles/ Pencils	2	2	C	N
228	Surgery	Scissor Tips	1	2	C	Y
229	Surgery	Laser Fiber Delivery Systems	2	1	C	N

\A\Risk categorization:
1 = low risk according to RPS
2 = moderate risk according to RPS
3 = high risk according to RPS
3* = high risk due to neurological use

Data from FDA's List of Single Use Medical Devices Known to be Reprocessed or Considered for Reprocessing (Attachment 1). Federal Register Notice, Published September 29, 2005. http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/ucm121218.htm Accessed December 23, 2009.