AIR FORCE MEDICAL SERVICE MODEL COST REDUCTION OPPORTUNITY AND POLLUTION PREVENTION PLAN

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Developed By**:**

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1 INTRODUCTION

1.0 Background of Air Force Pollution Prevention

The Pollution Prevention Act of 1990 established a national policy of Pollution Prevention (P2) as the preferred method for solving the nation's environmental problems. On August 3, 1993, the President issued Executive Order 12856, "Pollution Prevention and Right-to-Know in the Government." The Executive Order mandated that federal agencies prepare P2 management plans for their installations and facilities, reduce hazardous material usage and hazardous waste disposal. The Air Force developed a multifaceted pollution program to comply with the Executive Order and the subsequent DoD policy. As part of the Air Force program, the Air Force developed a method to define tasks where pollution prevention would prove to be a benefit. The major element of the Air Force P2 program is performing a thorough Pollution Prevention Opportunity Assessment (PPOA). A pollution prevention opportunity assessment is an assessment of work center processes to identify opportunities to reduce or eliminate the generation of waste thus saving resources and reducing costs.

Department of Defense (DoD) and corresponding Air Force (AF) policy (AFI 32-7080, Pollution Prevention Program) states that hazardous material shall be selected, used, and managed over its life cycle so the DoD and AF incur the lowest cost required to protect human health and the environment. The preferred method of accomplishing this is to avoid or reduce the use of hazardous material. Where the use of hazardous materials cannot reasonably be avoided, users shall follow DoD and AF instructions and policy governing its use and management. In the absence of instructions, users shall apply sound management practices that reduce the risk to human health and the environment. Emphasis must be placed on decreasing the use of hazardous materials in processes and products (source reduction), rather than the management of hazardous waste (DoD, 1989).

1.1 What is Pollution Prevention

The pollution prevention concept is designed to prevent pollution by reducing or eliminating harmful discharges to the air, land, and water at the source. Pollution prevention provides every installation with the opportunity to become good stewards of the environment and to act on the 13 Mar 95 SECAF/CSAF Environment, Safety and Occupational Health Initiatives memorandum:

- **Sustain Readiness:** Pollution prevention is essential to maintaining and improving environmental quality. This strongly supports the initiative of "preserving the long-term environmental vitality of our training ranges and airspace."

- **Be a Good Neighbor:** Although the SECAF/CSAF memo emphasizes cooperation with local communities on restoration issues, the Emergency Planning and Community Right-to-Know Act (EPCRA) also offers pollution prevention program managers the opportunity to cooperate with local agencies. All communities that have AF installations as neighbors will certainly welcome waste reductions and pollutant discharges.

2 HOW TO USE THIS REPORT

2.0 Introduction

The information presented in this report was developed to provide a generic view of medical service healthcare operations at a typical Air Force base. The cost reduction opportunities identified are those potentially achievable at a medical group consisting of four squadrons. Application of this report to medical groups with less than four squadrons can be accomplished by selecting those work centers specific to their organizational structure and adding any work center not already defined in this report. Application of this report to large hospitals and medical centers can be accomplished by using this report as a starting point and developing templates for work centers not specifically identified in this report. The techniques used to develop the new templates would be the same as those used for the existing work center templates. Most AF medical facilities can use the information in this model report to develop their own pollution prevention management action plan (P2 MAP) without considerable expenditures of fiscal and human resources. By using the electronic version, the medical facility can use the templates by refining the sections to meet the requirements of their work centers. This model report describes work center processes evaluated and provides a tabular format that can be easily modified. The medical facility can than develop their P2 MAP (Section 3). The report also provides applicable cost reduction opportunities (CROs) and pollution prevention opportunities (PPOs) (Section 4), management initiatives and good ideas (Section 5), affirmative procurement (Section 6), and a PPO assessment (PPOA) guide (Section 7). The Appendices provide information on various medical waste treatment options, vendor information for a variety of affirmative procurement options and references for further research.

2.1 Who Should Use This Model Report?

The Air Force Medical Service Facility Model Cost Reduction Opportunity and Pollution Prevention report can be used by the group, squadron and flight commanders and by the supervisor of each individual work center to conduct CROs, PPOs and help develop the facility P2 MAP. The medical facility executive committee can use their P2 MAP to find methods and procedural modifications to meet their financial targets by finding ways to stretch their shrinking budget. The medical facility Quality Assurance and Risk Management (QA/RM) committee and the facility safety committee can also use the work center PPOs to evaluate the effectiveness of the facility’s RM and safety programs. Finally, contractors working in Air Force medical facilities can use this report to contribute to the medical P2 efforts and to develop procedures to help reduce the hazards to their workers.

2.2 Integration with the Installation Pollution Prevention Program

This report provides a selection of PPOs. Medical facility PPOs can be compared with those of other installation work centers practices for a crossover of cost reduction ideas and savings. For

3 AIR FORCE MEDICAL SERVICE FACILITY WORK PROCESSES

3.0 Introduction

Air Force Medical Service facilities provide a wide range of medical support to their assigned installation. This support can range from outpatient care at small clinics through comprehensive inpatient services at medium size hospitals to extensive specialty/trauma care at large medical centers. Currently, the typical Air Force medical group is composed of from two to four squadrons focusing on integrating their operations to meet the demands of their beneficiary population. In the future the number of medical groups and associated squadrons may be reduced as a projected realignment of medical services occurs and this will have an impact on the amount and type of waste generated. These work centers consume resources and generate differing waste products/waste streams daily. The consumed resources can range from medical supplies/equipment to utilities. Each resource consumed is potentially capable of generating atmospheric, liquid and/or solid waste. Some of the work practices and associated materials used pose an increased risk to the health of the patient, the employee and/or personnel in adjacent areas. Local, state and/or federal statutes regulate the medical practices and the materials used and may also regulate the waste generated by the facility. Preventing these materials and waste streams from posing a health risk is the basis for the Air Force's occupational health and safety, medical cost reduction and pollution prevention programs.

This section is arranged by work centers typically assigned to one of the medical squadrons. The work processes associated with the work centers are generically described with input and output product streams defined. From those generic descriptions, process flow diagrams (PFDs) depicting input-output relationships for the work center processes were developed. In order to eliminate redundancy, only one PFD was generated for processes, such as administrative functions, that are common to multiple work centers. All of the cost reduction/pollution prevention opportunities, management practices, and good ideas applicable to each are also described once with a reference to the common process included within each applicable work center. One item noted during the visits was that within a facility, and even within a work center, there were differences in the method of disposal of the same or similar materials and resources. From the work center evaluations, summaries of cost reduction opportunities (CROs), good ideas and pollution prevention opportunities (PPOs), where applicable, were noted. ***The generic work centers and associated processes presented are representative of the work center operations performed at the five DoD medical treatment facilities visited.*** This section is not inclusive of all the waste handing practices and associated best or recommended procedures. The process waste stream description may not be representative of conditions existing today or in the future at your facility. The processes described may not necessarily represent the best/recommended practice because of the differences between the visited facilities and the facility using this plan. This chapter is written to provide the medical commanders with ideas on implementing cost reduction and pollution prevention initiatives. The electronic form of this chapter can be used as a template to develop the unit's medical environmental CRO/PPO management action plan (MAP). The CROs/PPOs that define resource needs and associated return on investment should be incorporated into the unit's Medical Strategic Plan (MSP) for future year budget requests. **Table 3.1** summarizes the work centers and processes described in this report.

Table 3.1
Summary of Work Centers and Associated Processes

Work Center	Process Category	Section #
Group Commander		3.1
Administration	Administrative	3.1.1
Aerospace Medicine Squadron		3.2
Flight Medicine	Prevention/Patient Care	3.2.1
Bioenvironmental Engineering	Prevention	3.2.2
Immunization	Prevention	3.2.3
Inoculation	Prevention/Patient Care	3.2.3.1
Allergy Testing	Prevention/Patient Care	3.2.3.2
Optometry	Patient Care	3.2.4
Medical Readiness	Support	3.2.5
Health Promotions	Prevention/Administrative	3.1.2
Occupational Medicine	Administrative	3.1.2
Public Health	Prevention/Administrative	3.1.2
Dental Squadron		3.3
Dental Administration	Administrative	3.3.1
Dental Screening	Prevention	3.3.2
Preventive Dentistry	Prevention	3.3.3
Restoration	Patient Care	3.3.4
Endontics	Patient Care	3.3.5
Oral Surgery	Patient Care	3.3.6
Prosthodontics	Patient Care	3.3.7
Dental Laboratory	Support	3.3.8
Dental Radiology	Support	3.3.9
Dental Sterilization	Support	3.3.10
Medical Operations Squadron		3.4
Emergency Services	Patient Care	3.4.1
Family Practice/ Primary Care	Patient Care	3.4.2
Cardiopulmonary	Patient Care	3.4.2.1
Dermatology	Patient Care	3.4.2.2
Family Practice	Patient Care	3.4.2.3
Gastroenterology	Patient Care	3.4.2.4
Neurology	Patient Care	3.4.2.5
Otorhinolarngology (ENT)	Patient Care	3.4.2.6
In-Patient Services (Wards)	Patient Care	3.4.3
Medical Records	Administrative	3.1.2
Mental Health	Administrative	3.1.2
OB/GYN Services	Patient Care	3.4.4
Patient Examination & Treatment	Patient Care	3.4.4.1
Labor and Delivery	Patient Care	3.4.4.2
Pediatrics	Patient Care	3.4.5

Work Center	Process Category	Section #
Physical Therapy	Patient Care	3.4.6
Surgical Services	Patient Care	3.4.7
Central Sterile Supply	Support	3.4.7.1
Surgery	Patient Care	3.4.7.2
Orthopedics	Patient Care	3.4.7.3
Urology	Patient Care	3.4.7.4
Medical Support Squadron		3.5
Clinical Laboratory	Support	3.5.1
Anatomic Pathology	Support	3.5.1.1
Blood Bank	Support	3.5.1.2
Blood Chemistry/ Toxicology	Support	3.5.1.3
Hematology	Support	3.5.1.4
Microbiology	Support	3.5.1.5
Serology/ Immunology	Support	3.5.1.6
Urinalysis	Support	3.5.1.7
Medical Information	Administrative	3.1.2
Medical Logistics	Support	3.5.2
Supply Procurement	Support	3.5.2.1
Medical Equipment Repair	Support	3.5.2.2
General Housekeeping	Support	3.5.2.3
Cleaning/ Disinfecting	Support	3.5.2.4
Autoclave/ Incinerator	Support	3.5.2.5
Utilities	Support	3.5.2.6
Electricity	Support	3.5.2.6.1
Steam Usage	Support	3.5.2.6.2
Water Usage	Support	3.5.2.6.3
Sanitary Sewer	Support	3.5.2.6.4
Waste Management Program	Support	3.5.2.6.5
Air Emissions	Support	3.5.2.6.6
Recycling	Support	3.5.2.6.7
Nutritional Medicine	Patient Care/Support	3.5.3
Personnel and Administration	Administrative	3.1.2
Pharmacy	Support	3.5.4
In-Patient	Support	3.5.4.1
Out-Patient	Support	3.5.4.2
Satellite	Support	3.5.4.3
Radiology	Patient Care	3.5.5
Radiology	Patient Care	3.5.5.1
Nuclear Medicine	Patient Care	3.5.5.2
Resource Management	Administrative	3.1.2
TRICARE	Administrative	3.1.2

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3.1 Group Commander

3.1.1 Work Center Description:

The medical group commander manages the overall operation of the facility. Administrative functions are primarily performed in this work center.

3.1.2 Administrative Process Description

Administrative functions performed in this work center are similar to those performed in most of the administrative work centers throughout the medical facility. Information generation, processing and storage are typically performed in administrative areas. The use of electronic processes, such as the Composite Health Care System (CHCS) computer system and other computer-based systems is rapidly becoming the primary method of accomplishing specific administrative functions. This computerization is reducing the paper waste stream by storing information on computer disk instead of paper. However, data worksheets, forms, reports and official correspondence requiring signatures, hardcopy requests of computerized records, reports, and copies of official correspondence are examples of paperwork that is still processed and eventually results in the generation of waste paper, a municipal solid waste (MSW). Cardboard, printer cartridges, foam and plastic items such as toner bottles, and packaging materials are other typical wastes generated in administrative areas. The total of the solid waste from all administrative areas, especially in smaller medical facilities, can account for the major quantity of MSW generated. **Table 3.2** summarizes the input materials and waste streams related to Administrative Tasks.

Table 3.2
Input Materials and Waste Streams for Administrative Tasks

Input Material	Waste Stream	Disposal Method(s)
Cleaning supplies	Wastewater	Used in Process/ Sanitary Sewer
Office paper	Paper	MSW/ Recycle
Packaging	Cardboard	MSW/ Recycle
	Plastic	MSW/ Recycle
	Foam	MSW/ Recycle
Printer/copier inks and toners	Cartridges	MSW/ Recycle

3.1.2.1 Process Flow Diagram (PFD). See Figure C-1 in Appendix C for Administrative Tasks PFD.

3.1.2.2 CROs, PPOs, Management Practices and Good Ideas Applicable to Administrative Tasks

Table 3.3 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Administrative Tasks including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice or Good Ideas.

Table 3.3
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Administrative Tasks

CRO/PPO/Management Practice/Good Idea	Section #
Increase Municipal Solid Waste Recycling	4.6
Reduce Quantity of Office Paper Used	5.2.2.2
Turn off Lights and Equipment When Not In Use	5.2.4.2

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3.2 Aerospace Medicine Squadron

The Aerospace Medicine Squadron provides:

- Primary care to flying and special operational duty personnel, their dependents and other authorized beneficiaries.
- Anticipation, recognition, evaluation and control of chemical and physical stresses upon the human being and its environment.
- Preventive population-based public health and immunization programs and programs encouraging healthy life styles.
- Aerospace physiology and human performance enhancement training and support.
- Preventive care and consultation on occupational illnesses and injuries.
- Comprehensive eye care for DoD health care beneficiaries.
- Planning the organizing, training and equipping of medical elements to respond to contingencies.

Health Promotions, Occupational Medicine, and Public Health perform mainly administrative functions and should use the process description with slight modifications, the tables, and the flow diagram (see **Figure C-1**) applicable to administrative tasks. Aerospace Physiology is only located at a select few installations and is not included in this report.

3.2.1 Flight Medicine

3.2.1.1 Process Description

Military personnel and their dependents are seen in Flight Medicine either by appointment or referral. The patient's paperwork is processed at the front desk with the patient being examined by a healthcare provider. The provider either treats the patient or refers them to a specialty clinic. Exam rooms typically contain sharps containers, biohazardous waste receptacles, and solid waste receptacles although the generation of biohazardous waste is generally uncommon. Electronic temperature and blood pressure devices are used in lieu of mercury containing ones. Providers may perform minor surgical procedures, such as wart removals and vasectomies, in a minor treatment room that is shared with another clinic. At some locations, flight medicine will maintain an emergency vehicle for responding to flight emergencies. A discussion on this process can be found in the process description for Emergency Room activities. Flight Medicine activities typically generate the following wastes: gloves, tongue depressors, cotton swabs, tissue (paper), small amounts of exam table paper, intravenous (IV) bags and tubing, gauze, sterile strips, and alcohol pads. In addition, the alkaline batteries used to power flashlights generate waste when the battery power is depleted. The batteries are returned to Medical Logistics for disposal. **Table 3.4** summarizes the input materials and waste streams related to Flight Medicine.

Table 3.4
Input Materials and Waste Streams for Flight Medicine

Input Material	Waste Stream	Disposal Method
Alcohol pads	Non-hazardous	Municipal Solid Waste (MSW)
Batteries	Hazardous	Hazardous Waste/Recycle
Culture swabs	Infectious	Biohazard Waste
Exam table paper	Paper	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Cardboard/ Foam/ Plastic	MSW/ Recycle
Plastic syringes and needles	Infectious	Biohazard Waste
Sterile strips	Paper	Municipal Solid Waste
Thermometers/ some with mercury	Non-hazardous/ hazardous	MSW/ Hazardous Waste

3.2.1.2 Process Flow Diagram: See Figure C-2 in Appendix C for Flight Medicine PFD.

3.2.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Flight Medicine.

Table 3.6 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Flight Medicine including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.6
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Flight Medicine

CRO/PPO/Management Practice/Good Idea	Section #
Increase Municipal Solid Waste Recycling	4.6
Recycle Waste Batteries	5.2.3.1
Use Non-Mercury Thermometers	5.2.6.4
Use Non-mercury Containing Blood Pressure Monitoring Devices	5.2.6.5
Recycle Unused Items from Surgical Procedures	5.2.9

3.2.2 Bioenvironmental Engineering

3.2.2.1 Process Description

Bioenvironmental Engineering (BE) performs occupational and radiological health evaluations of base work areas; select portions of the installation's environmental compliance sampling, analysis and monitoring program; contingency skill development through proficiency training; and health risk assessments as required. BE may produce small amounts of municipal solid waste consisting of gloves, gauze pads, and alcohol pads. Packaging for environmental samples is typically recycled. Reagent bottles are rinsed and discarded as municipal solid waste or recycled, and culture dishes (if BE maintains a water laboratory) are discarded as municipal solid waste. Alkaline and spent rechargeable batteries used in the equipment maintained by BE are recycled through Medical Logistics. Some BE units also maintain a supply of different calibration gases and test gas cylinders. The empty cylinders are turned into the hazard material facility for puncturing and disposal or return to the gas supplier. Mercury thermometers may also be used to calibrate certain pieces of equipment and for temperature measurements. **Table 3.7** summarizes the input materials and waste streams related to Bioenvironmental Engineering.

Table 3.7
Input Materials and Waste Streams for Bioenvironmental Engineering

Input Material	Waste Stream	Disposal Method
Alcohol pads	Non-hazardous	Municipal Solid Waste (MSW)
Batteries	Hazardous	Hazardous Waste/Recycle
Calibration gases	Metal containers	Recycle
Chemical reagents	None	Used in Process
	Bottles: Non-hazardous	Municipal Solid Waste
	Hazardous	Hazardous Waste
Culture dishes	Non-infectious plastic	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packing material	Paper	MSW/ Recycle
Paper	Paper	MSW/ Recycle
Plastic containers and wrapping	Plastic	Municipal Solid Waste

3.2.2.2 Process Flow Diagram. See Figure C-3 in Appendix C for the Bioenvironmental Engineering PFD.

3.2.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Bioenvironmental Engineering.

Table 3.8 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Bioenvironmental Engineering including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.8
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Bioenvironmental Engineering

CRO/PPO/Management Practice/Good Idea	Section #
Recycle Waste Batteries	5.2.3.1
Use Non-Mercury Thermometers	5.2.6.4

3.2.3 Immunization

3.2.3.1 Inoculations Work Center

3.2.3.1.1 Process Description

Immunization provides all preventive inoculations against diseases to military personnel, their dependents and other authorized beneficiaries. In conducting these duties, they generate waste consisting of examination table paper, latex and other types of gloves, alcohol pads, syringes, sterile strips, and glass immunization vials. The discarded glass immunization vials are placed into either the sharps container or the municipal solid waste container that is picked up by housekeeping. The small amount of exam table paper is disposed as municipal solid waste. Administrative paper and cardboard boxes are recycled or are discarded as municipal solid waste. Syringes and needles are placed in sharps containers for disposal. There is typically very little biohazardous waste generated. Expired pharmaceuticals, unused and partially filled immunization vials are taken to Medical Logistics for disposal either by a disposal contract or by a returns contractor who credits the medical account. **Table 3.9** summarizes the input materials and waste streams related to inoculations.

Table 3.9
Input Materials and Waste Streams for Inoculations

Input Material	Waste Stream	Disposal Method
Alcohol pads	Non-hazardous	Municipal Solid Waste (MSW)
Glass immunization vials	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Packaging	Cardboard/ Paper/ Plastic	MSW/ Recycle
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sterile strips	Paper	Municipal Solid Waste

3.2.3.1.2 Process Flow Diagram. See Figure C-4 in Appendix C for Immunizations PFD.

3.2.3.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Inoculations.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Inoculations.

3.2.3.2 Immunization, Allergy Testing Work Center

3.2.3.2.1 Process Description

Allergy Clinic personnel use various types of antigens to test for allergic reactions. The procedures followed by this work center generate waste consisting of exam table paper, gloves, alcohol pads, syringes, sterile strips, and glass immunization vials. Some reusable instruments may also be used and are maintained by Central Sterile Supply. The glass immunization vials and syringes/needles are disposed in the sharps container. Small amounts of exam table paper are discarded as municipal solid waste and administrative paper and cardboard boxes are either recycled or discarded as municipal solid waste. Expired vaccines may be disposed through placing the vial in the sharps container, or they may be returned to Medical Logistics for a disposal contractor or to a returns contractor for a credit to the Medical Facility. **Table 3.10** summarizes the input materials and waste streams related to Allergy Testing.

Table 3.10
Input Materials and Waste Streams for Allergy Testing

Input Material	Waste Stream	Disposal Method
Alcohol pads	Alcohol pads	Municipal Solid Waste (MSW)
Exam table paper	Paper	Municipal Solid Waste
Glass immunization vials	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Plastic syringes/ needles	Infectious	Biohazard Waste
Packaging	Cardboard	Recycle/ MSW
	Plastic wrap	Municipal Solid Waste

3.2.3.2.2 Process Flow Diagram. See Figure C-4 in Appendix C for Immunizations PFD.

3.2.3.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Allergy Testing.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Allergy Testing.

3.2.4 Optometry

3.2.4.1 Process Description

Military personnel, their dependents and other beneficiaries are seen in Optometry by appointment or referral. The patient's paperwork is processed at the front desk, and then he/she is examined by a provider. Optometry waste streams include: gloves, gauze, glass vials, plastic, alcohol pads, hydrogen peroxide, and packaging materials. Prescription glasses are ordered and fitted upon receipt. Glasses that no longer meet the patients needs are routinely collected and given to a local charity for their use. Biohazardous waste and sharps (syringes and needles) are not typically generated by this work center. **Table 3.11** summarizes the input materials and waste streams related to Optometry.

Table 3.11
Input Materials and Waste Streams for Optometry

Input Material	Waste Stream	Disposal Method
Alcohol pads	Non-hazardous	Municipal Solid Waste (MSW)
Excess/used eyeglasses	Non-hazardous	Given to Local Charity
Eye speculum	Plastic	Municipal Solid Waste
Eyedroppers	Plastic	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass vials	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Hydrogen peroxide	None	Used in Process
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Packaging	Cardboard/ Paper/ Plastic	MSW/ Recycle
Suture packs	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste

3.2.4.2 Process Flow Diagram. See Figure C-5 in Appendix C for Optometry PFD.

3.2.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Eye Examination and Treatment.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Optometry.

3.2.5 Medical Readiness

3.2.5.1 Process Description

Medical Readiness is responsible for the medical contingency planning and, in some cases, the War Reserve Materiel (WRM) as it relates to medical supplies and deployments. A pharmaceutical supply in the WRM is maintained ready for deployment. Most drugs are those needed only in specific contingency operations, not for everyday application. Most installations have an on-going effort to rotate pharmaceuticals with the Medical Logistics medical supply warehouse in order to prevent them from surpassing their expiration date. Aside from some expired pharmaceuticals that cannot be rotated, other waste streams typically generated by Medical Readiness include paper, plastic, batteries, and packaging materials. **Table 3.12** summarizes the input materials and waste streams related to Medical Readiness.

Table 3.12
Input Materials and Waste Streams for Medical Readiness

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Cardboard	Cardboard	Municipal Solid Waste (MSW)/ Recycle
Paper	Paper	MSW/Recycle
Pharmaceuticals	Expired pharmaceuticals	Return (contractor)/MSW
Plastic containers/ wrapping	Plastic	MSW/Recycle

3.2.5.2 Process Flow Diagram. See Figure C-6 in Appendix C for Medical Readiness PFD.

3.2.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Medical Readiness.

Table 3.13 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Medical Readiness including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.13
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Medical Readiness

CRO/PPO/Management Practice/Good Idea	Section #
Recycle Cardboard/ Paper	4.4
Recycle Waste Batteries	5.2.3.1
Return Excess Pharmaceuticals to Returns Contractor	4.2.2

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3.3 Dental Squadron

The Dental Squadron provides dental care, ranging from prevention to specialized restoration, to military personnel and dependents, in overseas areas. The Dental Squadron may be combined with another squadron such as the Aerospace Medicine Squadron. The following dental care centers can be included in this squadron: endontics, screening examination, oral surgery, preventive dentistry/oral hygiene, prosthodontics and restorations. Work centers such as administrative support, laboratory, radiography, and dental sterilization provide support to the dental care centers. After an initial dental screening examination, the patient's dental needs are evaluated and he/she is referred to the appropriate follow-on dental work center. Examination and treatment rooms are cleaned and disinfected as needed after each patient. The barrier, patient protection and room clean-up/ disinfection procedures are standard for all dental work centers and will not be repeated in each center. There are common cost reduction and pollution prevention opportunities, management practices and good ideas that are applicable to most work centers in the squadron. **Table 3.14** presents the CROs, PPOs, Management Practices and Good Ideas applicable to these works centers.

Table 3.14
CROs, PPOs, Management Practices, and Good Ideas Universally Applicable to most Dental Squadron Work Centers

CRO/PPO/Management Practice/Good Idea	Section #
Increase MSW Recycling	4.6
Cost Reduction Associated with Faucets with Sensors	4.7
Increase Participation in Hazardous Material Pharmacy Program	5.1.1
Provide On-Going Employee P2 Training	5.1.2
Use Translucent Red Bags	5.2.1.1
Use Cadmium Free Red Bags	5.2.1.2
Improve Medical Waste Segregation	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Turn off Lights and Equipment	5.2.4.1
Use Products Made from Materials Other than PVC	5.2.7
Recycle Unused Items from Surgical Procedures	5.2.9

3.3.1 Dental Administration Work Center Process Description

Dental administrative tasks performed in this work center are similar to those performed in other administrative work centers of the medical group. They process paperwork relating to the dental health of the patients seen and treated by the Dental Squadron. Patient dental records are maintained by this work center. For general information on pollution prevention for administrative work centers refer to: **Table 3.2**, Input Materials and Waste Streams for Administrative Tasks;

Figure C-1 for Administrative PFD; and **Table 3.3** for CROs, PPOs, Management Practices, and Good Ideas Applicable to Administrative Tasks.

3.3.2 Dental Screening Examination Work Center

3.3.2.1 Process Description

The dental screening examination process involves a visual, and possibly a radiographic examination, of the teeth, gum, and other maxillofacial structures. During the examination process, dental personnel wear cloth smocks that are laundered and reused, paper surgical masks and latex gloves. Patients and their clothing are protected from bodily fluids by using paper coverings such as bibs. Examination rooms are equipped with "sterile barriers" which includes clear plastic wrap placed over light handles and tray brackets; plastic bags placed over chair head rests; and equipment trays covered with a paper cover. These items are usually disposed of as municipal solid waste. The dental instruments and cloth coverings are cleaned and sterilized for reuse. Sharps and biohazardous wastes are not typically generated by this work center. **Table 3.15** summarizes the input material and waste streams relating to the General Dental Exams Process.

Table 3.15
Input Materials and Waste Streams for Dental Screening Examinations

Input Material	Waste Stream	Disposal Method
Disinfectant	None	Used in Process
Foam trays	Plastic	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper towels	Paper	Municipal Solid Waste
Plastic covers/plastic wrap	Plastic	Municipal Solid Waste
Plastic suction tips	Plastic	Municipal Solid Waste

3.3.2.2 Process Flow Diagram: See Figure C-7 in Appendix C for Dental Screening Examination PFD.

3.3.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dental Screening Examination.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Dental Screening Examination.

3.3.3 Preventive Dentistry/ Oral Hygiene Work Center

3.3.3.1 Process Description

The preventive dentistry/oral hygiene process uses an ultrasonic cleaner; dental picks and other hand pieces; floss; and polishing pastes. During the cleaning process, water is gently sprayed into the patient's mouth to remove any saliva, blood and cleaning residue. A suction hose with disposable tip is used to evacuate liquids and residues from the patient's mouth with the tip being changed after every patient. Waste from the suction unit goes down the sanitary sewer drain. Ultrasonic cleaners use forced water to remove heavy calculus deposits. Reusable dental instruments, such as dental picks, are cleaned and sterilized for reuse (see Section 3.3.10). Sharps and biohazardous wastes are not typically generated by this work center**.** **Table 3.16** summarizes the input material and waste streams relating to Preventive Dentistry/Oral Hygiene.

Table 3.16
Input Materials and Waste Streams for Preventive Dentistry/Oral Hygiene

Input Material	Waste Stream	Disposal Method
Baking soda	Wastewater	Sanitary Sewer
Disinfectant	None	Used in Process
Disposable cups	Plastic	Municipal Solid Waste
Disposable Trays	Foam	Municipal Solid Waste
Fluoride	Wastewater	Sanitary Sewer
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
Paper towels	Paper	Municipal Solid Waste
Plastic covers/plastic wrap	Plastic	Municipal Solid Waste
Plastic tips	Plastic	Municipal Solid Waste
Polishing pastes	Wastewater	Sanitary Sewer

3.3.3.2 Process Flow Diagram: See Figure C-8 in Appendix C for Preventive Dentistry/ Oral Hygiene PFD.

3.3.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Preventive Dentistry/Oral Hygiene.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Preventive Dentistry.

3.3.4 Dental Restorations Work Center

3.3.4.1 Process Description

In performing dental restorations, the patient is draped in disposable protective coverings and prepared for an anesthesia. A topical anesthetic is routinely applied to the gum line using a cotton applicator that is discarded into a biohazard bag. Next the local anesthetic, prepackaged in glass carpules, is injected into the gum. Used carpules and needles are placed in the sharps container. The patient has a rubber dam placed into the mouth covering all or most of the teeth except the ones to be restored. The dentist uses high and low speed drills with different bits, along with other dental instruments to prepare the tooth for the filling. Potable water is used to wash any old amalgam, debris, blood and/or saliva from the patient's mouth. This rinse water is suctioned from the mouth using a vacuum line connected to a filter to capture the amalgam and other debris. Once the tooth has been readied, a varnish is applied to the exposed interior parts of the tooth to act as a bonding agent. The dentist uses either amalgams that contain mercury or resins as filling material; however, amalgam is generally preferred over resin because it lasts longer and has greater protection for the tooth. The mercury containing amalgam becomes a hazardous waste upon disposal. Applicator sticks are used for the amalgam bonding process and a syringe is used for the resin or composite bonding process. Amalgam is packaged in a disposable capsule. A wooden wedge is used to apply the amalgam to fill the tooth. Articulating paper is used to identify any uneven surfaces on the new filling. Once uneven surfaces are smoothed with a drill, the tooth is polished using polishing disks containing a special polishing paste. Unused/waste amalgam is placed into partially water filled glass bottles usually kept in each treatment room. Scrap amalgam is removed from the vacuum line filters and placed into the water containing glass collection bottles. Any scrap resin removed from the filter is placed in a biohazard bag. Excess polishing paste, disposable rubber paste container, and polishing disks are disposed of as municipal solid waste. Drilling burrs and other dental instruments used during this procedure are cleaned and sterilized for reuse (see Section 3.3.10). **Table 3.17** summarizes the input material and waste streams relating to Dental Restorations.

Table 3.17
Input Materials and Waste Streams for Dental Restorations

Input Material	Waste Stream	Disposal Method
Amalgam	Hazardous (contains mercury)	Hazardous Waste
Anesthetics	None	Used in Process
Bonding agents	Non-hazardous	Municipal Solid Waste
Copal varnish containers	Non-hazardous	Municipal Solid Waste
Disinfectant	None	Used in Process
	Non-hazardous	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
Glass Carpules	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
Plastic covers/Plastic wrap	Plastic	Municipal Solid Waste

Input Material	Waste Stream	Disposal Method
Plastic covers/Plastic wrap	Plastic	Municipal Solid Waste
Plastic syringes/metal needles	Infectious	Biohazard Waste
Plastic mixing dish/pad	Plastic	Municipal Solid Waste
Polishing paste	None	Used in Process
	Wastewater	Sanitary Sewer
	Non-hazardous	Municipal Solid Waste
Resins	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Rubber dam	Non-hazardous	Municipal Solid Waste
Rubber paste containers	Non-hazardous	Municipal Solid Waste

3.3.4.2 Process Flow Diagram: See Figure C-9 in Appendix C for Dental Restorations PFD.

3.3.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dental Restorations.

Table 3.18 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Dental Restorations including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.18
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Dental Restorations

CRO/PPO/Management Practice/Good Idea	Section #
Collect and Recycle Waste Dental Amalgam	5.2.6.3
Use Amalgam Alternatives	5.2.6.3.1
Use Pre-capsulated Alloys	5.2.6.3.2
Clean Drain Traps and Drain Trap Screens	5.2.6.3.3
Install Finer Mesh Screens on Drain Traps	5.2.6.3.4
Install Amalgam Separators	5.2.6.3.5

3.3.5 Endontics Work Center

3.3.5.1 Process Description

Patients are referred to endontics for root canal procedures. Patient preparation, anesthetic and tooth enamel removal procedures are similar to those used in the Restorations work center. If the tooth had a previous amalgam or resin filling, the waste is handled as in the restorations work center. Once the pulp of the tooth has been accessed, the tooth is prepared for the gutta percha, a rubber-like material used as the pulp canal filling material. The gutta percha is mixed with a sealer, mostly zinc oxide and eugenol, and is packed into the tooth. Any waste compound is disposed of as municipal solid waste. If the tooth has had some root canal work performed on it in the past, then a solvent (chloroform) is used to help remove the older gutta percha. The chloroform is used in minute quantities (0.5 cc at a time). A small syringe is used to allow precise delivery of the solvent to the gutta percha, one drop at a time. Small amounts of sharps and biohazardous wastes are typically generated in this work center. **Table 3.19** summarizes the input material and waste streams relating to the Endontics Process.

Table 3.19
Input Materials and Waste Streams for Endontics

Input Material	Waste Stream	Disposal Method
Amalgam	Hazardous	Hazardous Waste
Anesthetics	None	Used in Process
Bleach	Chemical	Used in Process
Chloroform	None	Used in Process
Composites/Resins	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Cotton pellet	Non-hazardous	Municipal Solid Waste
Disinfectant	Non-hazardous	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
Paper towels	Paper	Municipal Solid Waste
Plastic covers/plastic wrap	Plastic	Municipal Solid Waste
Plastic spray tips	Plastic	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Rubber dam	Non-hazardous	Municipal Solid Waste

3.3.5.2 Process Flow Diagram: See Figure C-10 in Appendix C for Endontics PFD.

3.3.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Endontics.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Endontics.

3.3.6 Oral Surgery Work Center

3.3.6.1 Process Description

When appropriate, patients are referred for tooth extraction or gum surgery, which may require patient sedation. Patient preparation and draping procedures, as well as the use of different equipment items (e.g., drills, vacuum suction, etc.), are similar to those discussed in previous sections. If necessary, the sedating drugs are administered through an intravenous (IV) solution. In addition to (or instead of) sedation, the dentist may use a topical and/or local anesthetic, similar to the types used during restorations. After the tooth is extracted or gum segment removed, it is placed in a gauze pad (4X4) and placed in a biohazard bag. The IV catheter needle and any syringes used are placed in the sharps container, and excess tubing and IV fluids are placed in the municipal solid waste container. **Table 3.21** summarizes the input material and waste streams relating to the Oral Surgery Process.

Table 3.21
Input Materials and Waste Streams for Oral Surgery

Input Material	Waste Stream	Disposal Method
Anesthetics	None	Used in Process
Blood-clotting material	Infectious	Biohazard Waste
Disinfectant	None	Used In Process
	Non-hazardous	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
Glass carpules	Infectious	Biohazard Waste
IV bags/tubing	Plastic	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
Paper towels	Paper	Municipal Solid Waste
Plastic covers/plastic wrap	Plastic	Municipal Solid Waste
Plastic syringes/ metal needles	Infectious	Biohazard Waste
Plastic tips	Plastic	Municipal Solid Waste
Removed Sutures	Infectious	Biohazard Waste
Scalpel blades	Infectious	Biohazard Waste
Sedation drugs	Non-hazardous	Municipal Solid Waste
Suture material	Non-hazardous	Municipal Solid Waste

3.3.6.2 Process Flow Diagram: See Figure C-11 in Appendix C for Oral Surgery PFD.

3.3.6.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Oral Surgery.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Oral Surgery.

3.3.7 Dental Prosthodontics Work Center

3.3.7.1 Process Description

A patient is referred to prosthodontics when a tooth has been damaged, diseased, or removed and it is determined a need exists to protect the teeth or gum with either a crown or a bridge. There are two types of crowns used in the Air Force, porcelain and gold. Any waste gold generated during this process is collected in a bottle and turned over to Medical Logistics for recycling and reimbursement under the precious metals contract. Patient preparation and draping procedures, as well as the use of different equipment items (e.g., drills, vacuum suction, etc.) and sedation/ anesthetics, are similar to those discussed in previous sections. The dentist uses a drill to shape the tooth/teeth in preparation for receiving the crown. The correct shape is verified (also known as “bite registration”) by using a “blu mousse.” The blu mousse is consumed during the process. An impression is then made using a tray adhesive to bond the impression material to the tooth. The tooth impression is disinfected and sent to the dental laboratory for the preparation of the permanent gold or porcelain crown. The preparation of a permanent crown takes from one to two weeks, so a temporary metal crown is installed over the patient’s tooth and the patient is discharged. The room is cleaned and disinfected as needed. When the patient returns the second time for the fitting of the permanent crown, the same patient preparation and use of anesthetic is employed as during the initial visit. The dentist will remove the temporary crown, fit the permanent crown (stain it if porcelain), glaze, and polish it. After the permanent crown is polished and fitted, the permanent crown is cemented onto the reshaped tooth. The patient is discharged, and the room is cleaned and disinfected. Any excess stain, glaze, and polish are disposed as municipal solid waste as well as the gloves, plastic wraps, trays and protective bibs. The waste cement is disposed of as hazardous waste. Small amounts of biohazardous waste may be generated by this work center. **Table 3.22** summarizes the input material and waste streams relating to the Dental Prosthodontics Process.

Table 3.22
Input Materials and Waste Streams for Dental Prosthodontics

Input Material	Waste Stream	Disposal Method
Acrylic	Non-hazardous	Municipal Solid Waste
Anesthetics	Non-hazardous	Municipal Solid Waste
Articulating paper	Paper	Municipal Solid Waste
Blu Mousse	None	Used in Process
Cement	Hazardous	Hazardous Waste
Disinfectant	Non-hazardous	Sanitary Sewer
Glass bottles	Infectious	Biohazard Waste
Gold	Precious Metals	Recycle
Impression material	Non-hazardous	Municipal Solid Waste
Indicator Spray	None	Used in Process
Latex gloves	Non-hazardous	Municipal Solid Waste
	Infectious	Biohazard Waste
Paper covers/clothing	Paper	Municipal Solid Waste
Paper towels	Paper	Municipal Solid Waste
PIP Paste	Non-hazardous	Municipal Solid Waste

Input Material	Waste Stream	Disposal Method
Plastic covers/plastic wrap	Plastic	Municipal Solid Waste
Plastic tray	Non-hazardous	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Polishing kit	None	Used in Process
Porcelain	None	Used in Process
Tray adhesives	Hazardous	Hazardous Waste
Waxes	Non-hazardous	Municipal Solid Waste

3.3.7.2 Process Flow Diagram: See Figure C-12 in Appendix C for Dental Prosthodontics PFD.

3.3.7.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dental Prosthodontics.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Dental Prosthodontics.

3.3.8 Dental Laboratory Work Center

The Dental Laboratory manufactures prosthodontic appliances including dentures; bridges; crowns (gold and porcelain); night guards; impressions; and custom trays.

3.3.8.1 Dental Crown Preparation Process

3.3.8.1.1 Process Description

There are two types of crowns used in the Air Force, gold and porcelain. When a crown is requested, the die is prepared for waxing using Die Spacer, which is consumed in the process. When the dies are waxed, Die Lube and green inlay wax are used. The Die Lube is consumed in the process and any residual wax is disposed of as municipal solid waste. Additionally, Nosbestos and Beaty Cast Debubblizer are used when waxed crowns are made. Waste Nosbestos is disposed of as municipal solid waste, and the debubblizer is consumed in the process. The invested crowns are placed in a furnace for hardening. Occasionally, personnel have to solder on the crown to build up the surface. This involves mixing rouge and chloroform to keep the solder from flowing outside the perimeter of the crown. Waste solder is disposed as municipal solid waste. Finally, the crown is placed in a sonicator filled with general purpose cleaner to clean the crown. The sonicator is cleaned once per month and the used cleaner is discharged to the sanitary sewer system. Any scrap gold generated is collected and turned in to Medical Logistics for proper disposition. **Table 3.23** summarizes the input material and waste streams relating to the Dental Crown Preparation Process.

Table 3.23
Input Materials and Waste Streams for the Dental Crown Preparation Process

Input Material	Waste Stream	Disposal Method
Chloroform	None	Used in Process
Debubblizer	None	Used in Process
Die Lube	None	Used in Process
Die Spacer	None	Used in Process
Gold	Precious Metals	Recycle
Green inlay wax	Non-hazardous	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Nosbestos	Non-hazardous	Municipal Solid Waste
Solder	Non-hazardous	Municipal Solid Waste

3.3.8.1.2 Process Flow Diagram: See Figure C-13 in Appendix C for Dental Crown Preparation PFD.

3.3.8.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the Dental Crown Preparation.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Dental Crown Preparation.

3.3.8.2 Night Guards, Dentures, Custom Tray Preparation Process

3.3.8.2.1 Process Description

When night guards, dentures or custom trays are ordered, the first step is to make an impression of the patient’s teeth or mouth. A plaster cast is made from the impression. Bubbles are removed from the casts (upper and lower teeth) and the night guards, dentures, and custom trays are designed using red and blue pencil. Petroleum jelly is used to articulate both casts, and hot glue is used to keep the bite open. Excess petroleum jelly and glue are disposed of as municipal solid waste. Two sheets of wax are used to wax the casts using a butane flame. Excess wax is disposed as municipal solid waste. Articulating paper is used to determine occlusal contact, with excess paper being discarded as municipal solid waste. The final cast is broken off the articulator, and the cast is placed in a boil-out flask and filled with three cups of plaster. Excess plaster is disposed of as municipal solid waste. The plaster is allowed to harden, then placed in the boil-out tank. The base plate wax is allowed to melt and the cast is removed from the tank. After the cast is hardened and removed from the tank, the two halves are separated. Tinfoil substitute is brushed on both halves. The entire tinfoil substitute is consumed in the process. Next, the polymer and monomer are added together and mixed. The mixture is then added to one of the two flasks. For dentures, the pre-made teeth are added at this time. The halves of the flasks are pieced together and placed into the flask press. Once pressed, the flasks are set in the curing unit. When the flasks are cured, the night guard is broken out of the flask and trimmed on the bench lathe. Personnel use a drill with a burr bit to sculpt the night guard or denture for a perfect fit. Finally, the night guard or denture is polished using pumice and polishing compound. Residual polymer/monomer, pumice, and polishing compound are disposed of as municipal solid waste. **Table 3.25** summarizes the input material and waste streams relating to the Night Guards, Dentures, and Custom Tray Preparation Process.

Table 3.25
Input Materials and Waste Streams for the Night Guards, Dentures, and Custom Tray Preparation Process

Input Material	Waste Stream	Disposal Method
Articulating paper	Paper	Municipal Solid Waste
Butane	None	Used in Process
Hot glue	Non-hazardous	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Petroleum jelly	Non-hazardous	Municipal Solid Waste
Plaster	Non-hazardous	Municipal Solid Waste
Plastic bags	Plastic	Municipal Solid Waste
Polishing compound	Non-hazardous	Municipal Solid Waste
Polymer/monomer	Non-hazardous	Municipal Solid Waste
Potable Water	Wastewater	Sanitary Sewer
Pumice	Non-hazardous	Municipal Solid Waste
Tin foil substitute	None	Used in Process
Wax	Non-hazardous	Municipal Solid Waste

3.3.8.2.2 Process Flow Diagram: See Figure C-14 in Appendix C for Dental Nightguard, Dentures, and Custom Tray Preparation PFD.

3.3.8.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the Nightguard, Dentures, and Custom Tray Process.

Table 3.26 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Night Guards, Dentures, Custom Tray Preparation including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.26
CROs, PPOs, Management Practices, and Good Ideas Applicable to Night Guards, Dentures, and Custom Tray Preparation

CRO/PPO/Management Practice/Good Idea	Section #
Use Reusable (Washable) Smocks and Gowns	5.2.2.9
Investigate Use of Reusable, Non-latex Gloves	5.2.2.10

3.3.9 Dental Radiography Work Center

Dental Radiography is responsible for performing x-rays of patient's teeth during routine examinations, or when requested by a dentist during non-routine visits. Once the x-rays are taken, the film is developed for an immediate assessment of the patient's dental status. Most Dental Squadron's use automatic "wet" process x-ray film processors; however, some are now using digital x-ray film processing units. Dental technicians drain and clean the film processors monthly.

3.3.9.1 Dental "Wet Process" Radiographic Film Development Process

3.3.9.1.1 Process Description

X-ray tube heads and grips covered with plastic wrap, and technicians wear gloves to position the x-ray film and positioning device (if necessary) in the patient's mouth. After the film is exposed, the technician removes the x-ray film and positioning device (if used), places the film into a plastic cup and takes it to the dark room for developing. After the exam, the latex gloves and sterile barriers are disposed of as municipal solid waste. The x-ray room is cleaned and disinfected as needed after the patient has left the room. The technician dons new latex gloves and opens the film packet, discarding the packet and plastic cup as municipal solid waste. The lead foil x-ray shield located in the x-ray packet is disposed of through Medical Supply. The film is inserted into the automated processor for developing. The technician's gloves are discarded as municipal solid waste. After the film processing is complete, the film is retrieved and the technician views the quality of the exposed film. If the film quality is unacceptable, the radiograph is repeated. The unacceptable quality x-rays are placed in a holding box and turned into Medical Logistics for silver recovery. If the film quality is acceptable, the film is mounted, labeled, and delivered to the dentist. The waste products from film processing (water, developer, and fixer) are disposed of by the following methods. The spent fixer waste is processed through a silver recovery unit, and then disposed as hazardous waste. The silver recovery cartridge is turned into Medical Logistics for recycling. Developer is first tested for silver content, then discharged to the sanitary sewer provided the analytical results indicate the silver content is below acceptable discharge limits. To keep the film processor in good working condition, it is run through a cleaning cycle on a routine basis. After the cycle is complete, the developer and fixer are drained, run through the silver recovery unit and disposed of as hazardous waste. New fixer and developer are then added back to the processor unit. **Table 3.27** summarizes the input material and waste streams relating to Dental "Wet" Process X-Ray Film Development.

Table 3.27
Input Materials and Waste Streams for Dental "Wet" Process X-Ray Film Development

Input Material	Waste Stream	Disposal Method
Developer	Hazardous (silver > 5 ppm)	Hazardous Waste
	Non-hazardous (silver < 5 ppm)	Sanitary Sewer
Fixer	Hazardous	Hazardous Waste
Lead Foil x-ray shield	Hazardous	Recycle
Latex gloves	Non-hazardous	Municipal Solid Waste
Paper towels	Paper	Municipal Solid Waste
Plastic cups	Plastic	Municipal Solid Waste
Plastic wrap	Plastic	Municipal Solid Waste
Potable water	Wastewater	Sanitary Sewer
Process cleaner	Non-hazardous	Sanitary Sewer
X-ray film	Waste film	Recycle

3.3.9.1.2 Process Flow Diagram: See Figure C-15 in Appendix C for Dental "Wet Process" Radiography PFD.

3.3.9.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dental "Wet Process" Radiographic Film Development.

Table 3.28 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Dental "Wet Process" Radiographic Film Development including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.28
CROs, PPOs, Management Practices, and Good Ideas Applicable to Dental "Wet Process" Radiographic Film Development

CRO/PPO/Management Practice/Good Idea	Section #
Optimize Development Process	5.2.10.1
Store Chemicals Properly	5.2.10.2
Test Expired Processing Chemicals	5.2.10.3
Extend Processing Bath Life	5.2.10.4
Use Squeegees to Remove Excess Liquid	5.2.10.5
Use Countercurrent Washing	5.2.10.6
Use Chromium-Free Cleaners	5.2.10.7
Recycle Lead Foil	5.2.10.8

3.3.10 Dental Sterilization Work Center

Used and contaminated instruments generated during dental processes must be cleaned, disinfected and/ or sterilized before they can be used again. Dental Sterilization work centers will typically use steam sterilizers, chemical sterilizers, disinfecting systems, and/or ultrasonic cleaning systems to accomplish this task. Some units also have a washer and dryer available for cleaning used for the laundry, however this is generally atypical.

3.3.10.1 Dental Sterilization Process Description

The contaminated/used instruments (dental picks, drill bits, etc.) and equipment (e.g., hand pieces), from the dental suites are transported to a receiving area for disinfection and sterilization. Personnel working in this section wear heavy rubber, puncture protective gloves and long sleeve, paper gowns during the sorting of the instruments. A typical process for sterilizing instruments is as follows: The instruments arrive in plastic bags, which are subsequently disposed of as municipal solid waste. Handpieces are checked for cleanliness (wiped off if necessary) and placed in the ultrasonic disinfection unit. Handpiece cleaner (mineral oil mist) is then added to the handpieces in order to lubricate them. Once lubricated, the handpieces are operated at normal speed to expel excess lubrication. When lubrication is complete, handpieces are prepared for the disinfection and sterilization units. At the preparation counter the instruments are assembled, inspected, and stocked with cotton supplies before being packaged and placed into sterilizer. Once the sterilization cycle is complete, the kits are wrapped in sterile wrap and taken to the appropriate storage area. Biological indicator testing is performed to check the effectiveness of the sterilization process. Wastewater from the sterilizer is discharged into the sanitary sewer. Most chemical sterilizers are currently using a Harvey's Vapo-Sterile solution (ethanol/formaldehyde) which, when used, must be disposed of as a hazardous waste. Some Dental Sterilization work centers use a steam autoclave system that eliminates the use of the Vapo-Sterile solution. Unusable sharps are disposed of in a container located in the work center. Very little biohazardous waste is generated. **Table 3.29** summarizes the input material and waste streams relating to the Dental Sterilization Work Center.

Table 3.29
Input Materials and Waste Streams for Dental Sterilization Work Center

Input Material	Waste Stream	Disposal Method
Biological indicator test paper	Paper	Municipal Solid Waste
Cleaning solution	Non-hazardous	Sanitary Sewer
Cotton supplies	Non-hazardous	Municipal Solid Waste
Glass vials	Infectious	Biohazard Waste
Handpiece cleaner	None	Used in Process
Heavy rubber gloves	Non-hazardous	Municipal Solid Waste
Kimguard sterile wrap	Non-hazardous	Municipal Solid Waste
Long-sleeved gowns	Paper	Municipal Solid Waste
Lubrication oil	None	Used in Process
Needles	Infectious	Biohazard Waste
Packaging material	Plastic	Municipal Solid Waste

Input Material	Waste Stream	Disposal Method
Paper towels	Paper	Municipal Solid Waste
Plastic bags	Plastic	Municipal Solid Waste
Puncture protective gloves	Non-hazardous	Municipal Solid Waste
Steam	Wastewater	Sanitary Sewer
Sterilizing packages	Non-hazardous	Sanitary Sewer
Vapo-Sterile solution	None	Used in Process

3.3.10.2 Process Flow Diagram: See Figure C-16 in Appendix C for Dental Sterilization PFD.

3.3.10.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dental Sterilization.

Table 3.30 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Dental Sterilization including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.30
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Dental Sterilization

CRO/PPO/Management Practice/Good Idea	Section #
Use Old Towels and Linens as Rags	5.2.2.3
Segregate Unused Surgical and Other Prepackaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns and Smocks	5.2.2.9

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3.4 Medical Operations Squadron

3.4.1 Emergency Services

3.4.1.1 Emergency Services Work Center Process Description

The level of emergency services provided to the installation is a function of the mission of the installation, the size of the medical group, and the response capabilities of the nearby community. The emergency services provided are classified as Level I/II/III/IV depending on these capabilities.

The patients arrive by ambulance or personal vehicle and are seen by a provider for initial assessment of the patient's medical problem. A typical emergency room will have one or more beds/rooms dedicated to the following services: OB/GYN; cardiac/intensive care; trauma (such as broken bones, etc.); and general purpose use. Each room is equipped with sharps containers and receptacles for municipal solid and biohazard wastes. Electronic temperature and blood pressure devices are generally used in lieu of ones containing mercury. Most beds have plastic protective covers, cloth sheets with paper barrier covers that are replaced after each patient. Emergency services personnel make extensive use of pre-wrapped, sterile, single-use items. Metal medical instruments are sterilized at Central Sterile Supply and returned for reuse. Tissue specimens are collected and sent to the lab in small resealable biohazard bags or in vials pre-filled with formalin. Some gram-stain microscope slides are generated and disposed as sharps. After each patient, the room is cleaned and disinfected with most of the disinfectant solution consumed in process; residual solution being discharged to the sanitary sewer.

Emergency services personnel also maintain ambulances that are used for patient transfers and emergency responses. The ambulances are maintained daily, and fluid levels (oil, transmission fluid, etc.) are checked and "topped-off" as needed. The ambulance area floor is mopped with a cleaning solution such as Simple Green, which is flushed to a floor drain connected to the sanitary/storm sewer system. Other waste streams include: cleaning/disinfectant supplies, splint and cast waste, gloves, IV bags and tubes, paper gowns, paper smocks, gauze, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.31** summarizes the input materials and waste streams related to Emergency Services.

Table 3.31
Input Materials and Waste Streams for Emergency Services

Input Material	Waste Stream	Disposal Method
Cleaning solutions	None	Used in process
	Wastewater	Sanitary sewer
Disinfectant	Wastewater	Sanitary Sewer
Fiberglass casting material	Fiberglass	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Glass vials	Infectious	Biohazard Waste

Input Material	Waste Stream	Disposal Method
Hydrogen peroxide	None	Used in Process
IV bags and solutions	Plastic	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic sheets	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process
Suture kit components	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Staple kit components	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste

3.4.1.2 Process Flow Diagram. See Figure C-17 in Appendix C for Emergency Services PFD.

3.4.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Emergency Services.

Table 3.32 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Emergency Room including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.32
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Emergency Services

CRO/PPO/Management Practice/Good Idea	Section #
Install Water Saving Devices	4.7
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient and Surgical Gowns and Items	4.9
Improve Waste Segregation During Clean-up	5.2.1.4
Segregate Unused Surgical and Other Pre-packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns and Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10

3.4.2 Family Practice/ Primary Care

Family Practice/ Primary Care incorporates various work centers (Clinics) including the following (not all inclusive): Cardiopulmonary, Dermatology, Family Practice, Gastroenterology, Internal Medicine, Neurology, Opthalmology, and Otorhinolaryngology (ENT). As with other facility clinics, electronic temperature and blood pressure measuring devices are used in lieu of those containing mercury.

3.4.2.1 Cardiopulmonary Work Center

3.4.2.1.1 Process Description

Military personnel, dependents and other beneficiaries are referred to the Cardiopulmonary Clinic. After the paperwork is processed, a provider examines the patient. The provider either prescribes a treatment regimen or refers the patient to another work center for further evaluation. Cardiologists may perform various invasive procedures in the surgical suites at some facilities (see Section 3.4.7). Typical tests conducted on patients include EKGs, pulmonary function, blood gases analyses, and IV shunts. Paper is usually used as a barrier on exam tables, and patients may also be offered cloth or paper gowns. Other waste streams include: gloves, electrodes, plastic filters, IV bags, cloth gowns, paper smocks, gauze, sharps, batteries (from small flashlights), and packaging materials. **Table 3.33** summarizes the input materials and waste streams related to Cardiopulmonary.

Table 3.33
Input Materials and Waste Streams for Cardiopulmonary

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Cloth gowns	Infectious/ Non-hazardous	Recycle (laundry)
Electrodes	Electrodes	Municipal Solid Waste
Exam table paper	Paper	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
IV bags and solutions	Plastic	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic filters	Plastic	Municipal Solid Waste
Plastic syringes/ metal needles	Infectious	Biohazard Waste

3.4.2.1.2 Process Flow Diagram. See Figure C-18 in Appendix C for the Cardiopulmonary PFD.

3.4.2.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Cardiopulmonary.

There is one CRO, PPO, Management Practice, and Good Idea that could be employed by Cardiopulmonary and it is recycle waste batteries as described in 5.2.3.1.

3.4.2.2 Dermatology Work Center

3.4.2.2.1 Process Description

Dermatology Clinics typically have a number of patient examination/treatment rooms, one of which may also be used for minor surgical procedures. These rooms all contain sharps containers, biohazardous waste receptacles, and solid waste receptacles. Paper is typically used on all exam tables as an infection control barrier, and the patient may don a paper or cloth gown. One of the treatment rooms will typically contain a standup tanning bed for cirrhosis treatment. The tanning bed uses 44 fluorescent bulbs that are changed after every 40 hours of use. These bulbs are collected by Medical Logistics and disposed of in accordance with appropriate State regulations. The minor surgery room is used for biopsies, wart removal (typically using liquid nitrogen), small skin cancer removals, and other dermatological treatment procedures. The provider routinely administers a local anesthesia for these procedures. Biopsy tissue specimens are placed in vials containing a pre-measured amount of formalin and taken to the Medical Laboratory for analysis, or are evaluated "in-house" by the Dermatologist. All reusable instruments are taken to Central Sterile Supply for cleaning and sterilization. Other waste streams include: gloves, plastic, paper gowns, paper smocks, gauze, needles, glass microscope slides, fluorescent light bulbs, and packaging materials. **Table 3.34** summarizes the input materials and waste streams related to Dermatology.

Table 3.34
Input Materials and Waste Streams for Dermatology

Input Material	Waste Stream	Disposal Method
Anesthetic agents	None	Used in process
Exam table paper	Paper	Municipal Solid Waste
Gauze	Non-hazardous	Municipal Solid Waste,
	Infectious	Biohazard Waste
Glass microscope slides	Infectious	Biohazard Waste
Liquid nitrogen	None	Used in Process
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process
Suture kits	Infectious	Biohazard Waste
Tanning fluorescent bulbs	Fluorescent crusher filter	Hazardous Waste
	Fluorescent bulb glass	Municipal Solid Waste

3.4.2.2.2 Process Flow Diagram. See Figure C-19 in Appendix C for Dermatology PFD.

3.4.2.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Dermatology.

Table 3.35 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Dermatology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.35
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Dermatology

CRO/PPO/Management Practice/Good Idea	Section #
Improve Waste Segregation During Clean-up	5.2.1.4
Segregate Unused Surgical and Other Pre-packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns and Smocks	5.2.2.9

3.4.2.3 Family Practice Work Center

3.4.2.3.1 Process Description

Military personnel, their dependents and other authorized beneficiaries are seen in the Family Practice Clinic through an appointment. As with other Clinics, the patient's paperwork is processed at the front desk, and the patient is then examined by a provider. Initially the provider examines the patient and determines a course of action to address the patient's ailment. The provider may refer the patient for diagnostic procedures such as laboratory tests or radiographic examination; prescribe medication and releases the patient; or refer the patient to a specialist. The Family Practice Clinic is similar to other clinics in that the exam rooms all contain sharps containers, biohazardous waste receptacles, and solid waste receptacles, and electronic temperature and blood pressure devices are used in lieu of those containing mercury. Paper barriers are typically used on exam tables. One of the treatment rooms may be used as a minor surgery room (perhaps shared by Flight Medicine) where procedures such as vasectomies, wart removal, in-grown toenail correction, etc. are performed. Tissue specimens are collected, placed into pre-measured formalin containing vials, and sent to the Medical Laboratory for analysis. Waste streams generated include: gloves, IV bags and tubes, excess sedation agents, paper gowns, paper smocks, gauze, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.36** summarizes the input materials and waste streams related to Family Practice.

Table 3.36
Input Materials and Waste Streams for Family Practice

Input Material	Waste Stream	Disposal Method
Exam table paper	Paper	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
IV bags and solutions	Plastic	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process
Sedatives	Drug	Biohazard Waste

3.4.2.3.2 Process Flow Diagram. See Figure C-20 in Appendix C for Family Practice PFD.

3.4.2.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Family Practice.

Table 3.37 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Family Practice including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.37
CROs, PPOs, Management Practices, and Good Ideas Applicable to Family Practice

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient and Surgical Gowns and Items	4.9
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Segregate Unused Surgical and Other Pre-packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns & Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10

3.4.2.4 Gastroenterology Work Center

3.4.2.4.1 Process Description

Military personnel, their dependents and other beneficiaries are referred to Gastroenterology. Providers frequently use a gastrointestinal (GI) scope to examine the patient's gastrointestinal tract. A mercury-filled sphygmomanometer may also be used. These Clinics typically consist of several examination rooms and a GI procedures lab. Cloth gowns are provided to patients which, along with cloth bed sheets and pillowcases, are laundered after each use. Rooms contain sharps containers, biohazardous waste receptacles, solid waste receptacles, and soiled laundry collection bags. Providers and technicians typically use disposable smocks, gloves, shoe covers and hats during procedures. IV sedation may be administered to a patient prior to some procedures. Tissue specimens are collected, placed into pre-measured formalin containing vials, and sent to the medical laboratory for analysis. A GI Scope disinfectant procedure is conducted daily and after every procedure, with the disinfectant wastewater being discharged to the sanitary sewer. Other waste streams include: gloves, paper, excess sedation agents, paper gowns, plastic smocks, gauze, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.38** summarizes the input materials and waste streams related to Gastroenterology.

Table 3.38
Input Materials and Waste Streams for Gastroenterology

Input Material	Waste Stream	Disposal Method
Cloth gowns and sheets	Infectious/ Non-hazardous	Recycle (laundry)
Disinfectant	Non-hazardous	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process

3.4.2.4.2 Process Flow Diagram. See Figure C-21 in Appendix C for Gastroenterology PFD.

3.4.2.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Gastroenterology.

Table 3.39 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Gastroenterology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.39
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Gastroenterology

CRO/PPO/Management Practice/Good Idea	Section #
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Use Non-Mercury Esophageal Devices	5.2.6.6

3.4.2.5 Neurology Work Center

3.4.2.5.1 Process Description

Military personnel, their dependents and other beneficiaries are referred to Neurology Clinics for neurological examinations, electromyagrams, lumbar punctures, and biotox injections. Exam rooms contain sharps containers, biohazardous waste receptacles, and solid waste receptacles. Paper is used as the barrier on examination tables, and batteries used in scopes are turned in to Medical Logistics for proper disposal. Waste streams include: gloves, electrodes, paper, gauze, sharps, and packaging materials. **Table 3.40** summarizes the input materials and waste streams related to Neurology.

Table 3.40
Input Materials and Waste Streams for Neurology

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Electrodes	Electrodes	Municipal Solid Waste
Exam table paper	Paper	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste

3.4.2.5.2 Process Flow Diagram. See Figure C-22 in Appendix C for Neurology PFD.

3.4.2.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Neurology.

There is one CRO, PPO, Management Practice, and Good Idea that could be employed by Neurology and it is recycle waste batteries as described in 5.2.3.1.

3.4.2.6 Otorhinolaryngology (ENT) Work Center

3.4.2.6.1 Process Description

Otorhinolaryngology (ENT) Clinics are typically comprised of several examination rooms and a procedure room. The examination tables use paper barriers, and all the rooms contain sharps containers, biohazardous waste receptacles, and solid waste receptacles. Cloth bed linens, and cloth or paper patient gowns may also be used. Patients are assessed, followed-up post-operatively, and treated for a variety of aliments/conditions within the clinic. Reusable medical instruments, maintained by Central Sterile Supply, may be used for some procedures, as may disposable suture kits are used. Biopsy tissue specimens are collected, placed in pre-measured formalin containing vials, and either sent to the Medical Laboratory for analysis or analyzed by the physician. Other waste streams include: gloves, paper gowns, paper smocks, gauze, plastic, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.41** summarizes the input materials and waste streams related to Otorhinolaryngology**.**

Table 3.41
Input Materials and Waste Streams for Otorhinolaryngology

Input Material	Waste Stream	Disposal Method
Exam table paper	Paper	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste

3.4.2.6.2 Process Flow Diagram: See Figure C-23 in Appendix C for the Otorhinolaryngology PFD

3.4.2.6.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Otorhinolaryngology

Table 3.42 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Otorhinolaryngology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.42
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Otorhinolaryngology

CRO/PPO/Management Practice/Good Idea	Section #
Degradable Patient and Surgical Gowns and Items	4.9
Improve Waste Segregation During Clean-up	5.2.1.4
Segregate Unused Surgical and Other Pre-packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns & Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10

3.4.3 In-Patient Service Work Centers (Wards)

3.4.3.1 Process Description

Most medical facilities provide at least a limited number of in-patient services for one or more of the following work centers (wards): family practice, mental health, OB/GYN, pediatrics, and surgical. In-patient services provides a wide range of nursing care including drug administration (oral, IV, and injection), vital signs measurements, bathing, changing dressings, suture removal, initial emergency patient stabilization and other tasks that meet the needs of the patient. An "admission kit" consisting of slippers, robe, and toiletries is typically provided to each patient. A solid waste receptacle is located in each room. A biohazardous waste receptacle may also be present depending on the patient's status. Sharps containers may or may not be located in each patient room.

The following items are used in the ward areas and are considered disposable items: plastic pitchers and cups, slippers, plastic pillow cases, plastic wash basins, wash cloths, suture removal kits, pen lights, and flashlight batteries. Cloth sheets and towels are laundered. Other waste streams include: gloves, IV bags and tubes, paper gowns, paper smocks, gauze, needles, glass vials, glass microscope slides, disinfectant, and packaging materials. **Table 3.43** summarizes the input materials and waste streams related to in-patient services.

Table 3.43
Input Materials and Waste Streams for In-Patient Services

Input Material	Waste Stream	Disposal Method
Admission kits	Paper	Municipal Solid Waste
Batteries	Hazardous	Hazardous Waste/Recycle
Cloth	Infectious/ Non-hazardous	Recycle (laundry)
Disinfectant	Wastewater	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
IV bags and solutions	Plastic	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Suture kits	Infectious	Biohazard Waste

3.4.3.2 Process Flow Diagram. See Figure C-24 in Appendix C for In-Patient Services PFD.

3.4.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to In-Patient Services.

Table 3.44 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to In-Patient Services including a reference to the location of the section with the complete description of the CROs, PPOs, Management Practices, or Good Ideas.

Table 3.44
CROs, PPOs, Management Practices, and Good Ideas
Applicable to In-Patient Services

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient and Surgical Gowns and Items	4.9
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Save and Reuse In-Patient Supplies	5.2.2.7
Segregate Unused Surgical and Other Pre-Packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns & Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Recycle Waste Batteries	5.2.3.1
Use Non-Mercury Thermometers	5.2.6.4
Use Products Made from Materials Other than PVC	5.2.7

3.4.4 Obstetrics/Gynecology (OB/GYN)

3.4.4.1 Patient Examination and Treatment Work Center

3.4.4.1.1 Process Description

OB/GYN Clinic personnel perform general GYN care, pre-natal care, and GYN post-operative care (see Section 3.4.7 for a description of general surgical procedures). Patients are typically provided with a cloth or paper gown, and the exam tables are covered with paper and/or linen sheets. Each room will also typically have a sharps container, a biohazardous waste receptacle, and municipal solid waste receptacle (a soiled laundry receptacle will also be available if cloth gowns/sheets are used). Tissue samples are obtained (usually is specific containers) and transferred to the Medical Laboratory for analysis or shipment to a referral laboratory for analysis. Waste plastic pipettes, speculums, and gauze are disposed as municipal solid waste. Yeast tissue samples are placed on glass microscope slides and analyzed in OB/GYN. When the microscope slides have been viewed and are no longer needed, they are placed in the sharps container. Used batteries from lights and other equipment are collected and sent to Medical Logistics for proper disposal. Other waste streams include: exam table paper, gloves, paper gowns, sharps containers, biohazardous waste receptacles, and municipal solid waste receptacles, sharps, plastic, paper smocks, and packaging materials. **Table 3.45** summarizes the input materials and waste streams related to Patient Examination and Treatment.

Table 3.45
Input Materials and Waste Streams for Patient Examination and Treatment

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Exam table paper	Paper	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Pap smear speculums	Plastic	Municipal Solid Waste
Paper gown & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic pipettes	Plastic	Municipal Solid Waste
Sample kits	None	Used in Process

3.4.4.1.2 Process Flow Diagram. See Figure C-25 in Appendix C for the OB/GYN Patient Examination and Treatment PFD.

3.4.4.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Patient Examination and Treatment.

Table 3.46 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Patient Examination and Treatment including a reference to the location of the section with the complete description of the CROs, PPOs, Management Practices, or Good Ideas.

Table 3.46
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Patient Examination and Treatment

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient and Surgical Gowns and Items	4.9
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Save and Reuse In-Patient Supplies	5.2.2.7
Segregate Unused Surgical and Other Pre-Packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns & Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Recycle Waste Batteries	5.2.3.1
Use Products Made from Materials Other than PVC	5.2.7

3.4.4.2 Obstetrics/Gynecology, Labor and Delivery Work Center

3.4.4.2.1 Process Description

When a patient is in the early stages of labor, she is admitted to In-Patient Services until it is time to be taken to the Delivery Room or an operating suite for the birth. After the birth, the mother is taken back to the In-Patient Services and the baby is taken to the Nursery. In most facilities, beds are covered with cloth sheets and patients are given cloth gowns to wear, both of which are laundered for reuse. Delivery rooms are equipped with sharps containers, biohazardous waste receptacles, and municipal solid waste receptacles. OB/GYN makes extensive use of pre-wrapped, sterile, reusable items, although a number of single-use items (e.g., tissue staplers) are also often used. Reusable medical instruments are sterilized by Central Sterile Supply. Various tissue specimens may also be obtained after delivery, which are either placed in vials containing premeasured amounts of formalin or into resealable biohazard bags for transport to the medical laboratory. Physicians may also place tissue or cell specimens on microscope slides for immediate analysis. These slides are disposed of as sharps when they are no longer needed for medical purposes. Other waste streams include: gloves, IV bags and tubes, paper gowns, paper smocks, disposable instruments, gauze, diapers, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.47** summarizes the input materials and waste streams related to Labor and Delivery.

Table 3.47
Input Materials and Waste Streams for Labor and Delivery

Input Material	Waste Stream	Disposal Method
Diapers	Non-hazardous	Municipal Solid Waste
Disposable instruments	Infectious	Biohazard Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Glass vials	Infectious	Biohazard Waste
IV bags and solutions	Plastic	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Pharmaceuticals	Pharmaceuticals	Recycle (Return contractor)
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process

3.4.4.2.2 Process Flow Diagram. See Figure C-26 in Appendix C for Labor and Delivery PFD.

3.4.4.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Labor and Delivery.

Table 3.48 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Labor and Delivery including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.48
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Labor and Delivery

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient and Surgical Gowns and Items	4.9
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Save and Reuse In-Patient Supplies	5.2.2.7
Segregate Unused Surgical and Other Pre-Packaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns & Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Use Products Made from Materials Other than PVC	5.2.7

3.4.5 Pediatrics Work Center

3.4.5.1 Process Description

Most pediatric appointments are for well baby checks, physicals, and acute minor illnesses. Typically, the patient's paperwork is processed at the front desk, and the patient examined by a provider in one of the exam rooms or in a minor treatment room. The provider can monitor the patient's progress such as in the well baby clinic, treat the patient for an illness; or refer the patient to another specialty clinic. Paper sheets are often used on the exam tables for barrier protection. The exam and treatment rooms are typically equipped with a sharps container, biohazardous waste receptacle, and a solid waste receptacle. Most facilities also use electronic temperature and blood pressure measuring devices in lieu of those containing mercury. Occasionally cloth gowns and linens are used and laundered. In the treatment room(s), minor surgery, inhalation therapy, biopsies and blood draws are typically performed. Tissue biopsy specimens are placed into pre-measured formalin containing vials and sent to the medical laboratory. Other waste streams include: gloves, paper smocks, plastic, gauze, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.49** summarizes the input materials and waste streams related to Pediatrics.

Table 3.49
Input Materials and Waste Streams for Pediatrics

Input Material	Waste Stream	Disposal Method
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Paper sheets	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process

3.4.5.2 Process Flow Diagram. See Figure C-27 in Appendix C for Pediatrics PFD.

3.4.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Pediatrics.

Table 3.50 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Pediatrics including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.50
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Pediatrics

CRO/PPO/Management Practice/Good Idea	Section #
Improve Waste Segregation During Clean-up	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.2.4
Segregate Unused Surgical and Other Pre-Packaged Equipment and Supplies	5.2.2.8

3.4.6 Physical Therapy

3.4.6.1 Physical Therapy Work Center

3.4.6.1.1 Process Description

Physical Therapy performs outpatient and, at some facilities, inpatient services consisting of manual manipulation of muscles and extremities, various non-invasive treatments such as electrical stimulation, hydrotherapy, and oil/paraffin immersions. Typically, the patient's paperwork is processed at the front desk, and the patient is examined by a provider. No medications are used or prescribed, and there is very little generation of sharps or biohazard waste. Physical Therapy generates soiled pillowcases, sheets and towels, which are laundered, and the exam tables are usually covered with paper. Following patient treatment the tables are disinfected with any waste disinfectant being discarded to the sanitary sewer. The used oil or paraffin generated from treating patients is allowed to cool and is discarded as municipal solid waste when it can no longer be used. Other waste streams include: paper, gauze, plastic containers, and packaging materials. **Table 3.51** summarizes the input materials and waste streams related to Physical Therapy.

Table 3.51
Input Materials and Waste Streams for Physical Therapy

Input Materials	Waste Stream	Disposal Method
Disinfectants	None	Used in Process
Exam table paper	Paper	Municipal Solid Waste
Gauze	Non-hazardous	Municipal Solid Waste
Oils/paraffins	Non-hazardous	Municipal Solid Waste
Pillow cases and sheets	Cloth	Recycled (laundry)
Plastic wrapping	Plastic	Municipal Solid Waste
Potable water	Wastewater	Sanitary Sewer
Towels	Cloth	Recycled (laundry)

3.4.6.1.2 Process Flow Diagram. See Figure C-28 in Appendix C for Physical Therapy PFD.

3.4.6.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Physical Therapy.

Table 3.52 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Physical Therapy including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.52
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Physical Therapy

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Use Old Towels and Linens as Rags	5.2.2.3

3.4.7 Surgical Services

3.4.7.1 Central Sterile Supply Work Center

Metal medical instruments, and other pieces of equipment used by the various work centers throughout the medical group, routinely require cleaning and sterilization. This work center accomplishes these tasks and returns the sterile instruments to the work centers for their reuse.

3.4.7.1.1 Process Description

When contaminated and soiled medical instruments arrive in Central Sterile Supply, technicians will typically perform a wash and rinse procedure using a rust free soap, such as – Klenzyme, which is generally consumed in process. The wastewater from this initial cleaning step is discharged to the sanitary sewer system. The instruments are then placed in a "hot wash" dishwasher unit using an agent such as NpH-Klenz. Once the hot wash is completed, all instruments are sent through a washer/sterilizing unit. Wastewater from both of these units is discharged into the sanitary sewer. The next step is to soak the instruments in a "surgical milk" solution. This solution provides a metal protective, anti-corrosive coating to the instruments. Reusable containers are often used as soaking basins for the surgical milk. The waste from the surgical milk process is discharged into the sanitary sewer. After soaking, the instruments are then transferred to the sterile side of the room where they are wrapped in reusable cloth towels and packed onto trays and placed in a steam autoclave. After the autoclave process is completed, the items are stored or repackaged for use. Wastewater from the sterilizer is discharged to the sanitary sewer. A biological indicator test (spore test) is performed routinely to determine the effectiveness of the sterilizer. The waste paper used for this test is discarded as municipal solid waste. Technicians routinely wear latex gloves, except when handling hot trays, in which case they wear heavy rubber gloves.

For some instruments, ethylene oxide (ETO) sterilization is used. The process follows the same initial procedure as the steam sterilization process except that the instruments are packed in towels are place into the ETO sterilizer. During the autoclave process, the waste and purge gases are discharged to the outside through ductwork that is typically connected to an emissions control device. When the sterilized packs come out of the sterilizer, they are placed in an aerating cabinet where ETO off-gases into the cabinet and eventually into the work room or to a ventilation system which carries the gases to the outside. The spent ETO cartridges are discarded as municipal solid waste.

Heat sensitive equipment (cameras, light cords, etc.) are often sterilized using a hydrogen peroxide plasma process, such as the STERRAD™ brand sterilizer. The equipment tray is placed into the sterilizer chamber where hydrogen peroxide ampoules are mechanically opened under a vacuum. Energy is then applied to the chamber creating a low-temperature plasma which destroys the microorganisms. When the ampoule contents are consumed, the machine automatically ejects it into a box, which is subsequently discarded as municipal solid waste. The waste gas plasma is vented to the outside. **Table 3.53** summarizes the input material and waste streams relating to the Central Sterile Supply process.

Table 3.53
Input Materials and Waste Streams for Central Sterile Supply

Input Material	Waste Stream	Disposal Method
Biological indicator test paper	Paper	Municipal Solid Waste
Ethylene oxide cartridges	Plastic	Municipal Solid Waste
Heavy rubber gloves	Non-hazardous	Reuse
Hydrogen peroxide	None	Used in Process
Klenzyme soap	Wastewater	Sanitary Sewer
Latex gloves	Non-hazardous	Municipal Solid Waste
NpH – Klenz soap	Wastewater	Sanitary Sewer
Plastic plate & ampoules	Plastic	Municipal Solid Waste
Reusable cloth towels	Cloth	Recycle(laundry)
Surgical milk	Wastewater	Sanitary Sewer

3.4.7.1.2 Process Flow Diagram: See Figure C-29 in Appendix C for Central Sterile Supply PFD.

3.4.7.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Central Sterile Supply.

Table 3.54 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Central Sterile Supply including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.54
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Central Sterile Supply

CRO/PPO/Management Practice/Good Idea	Section #
Replace Ethylene Oxide Sterilizer (if still in use)	4.3
Cost Reduction Associated with Faucets with Sensors	4.7
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Use Old Towels and Linens as Rags	5.2.2.4

3.4.7.2 Surgery Work Center

3.4.7.2.1 Surgery Work Center Process Description

Surgical personnel perform a variety of procedures in the medical facility's surgical suites including general surgery, dental, ENT, orthopedics, OB/GYN, pediatric, and vascular. Anesthetic gases, nitrous oxide and halogenated hydrocarbons such enflurane and holothane, may be used in lieu of general I.V. administered anesthesia or epidural anesthesia. Most surgical suites at Air Force installations have a dedicated anesthetic waste gas removal system. Red biohazard bags for blood or fluid soaked items are contained in each surgical suite, as are linen bags (for used towels, sheets, and blankets), sharps containers (for syringes, needles, and scalpel blades), solid waste disposal containers. Reusable surgical instruments are routinely used; however, a number of single use items such as tissue staplers are also used and disposed of as either medical or municipal solid waste. All reusable instruments are sterilized in Central Sterile Supply. Drapes, caps, masks, shoe covers, and gowns are disposable and, if not contaminated, are discarded as municipal solid waste. After each surgical procedure, the entire suite is cleaned and disinfected. All surfaces are wiped with an antiseptic/disinfectant, such as Virex II 128, and the floor is mopped. Waste streams include: gloves, IV bags and tubes, sedative containers, paper gowns, plastic, paper smocks, gauze, needles, suture kits, glass vials, glass microscope slides, packaging materials, and wastewater. **Table 3.55** summarizes the input materials and waste streams related to Surgery.

Table 3.55
Input Materials and Waste Streams for Surgery

Input Material	Waste Stream	Disposal Method
Anesthetic gases	None	Used in Process
Cloth	Infectious/ Non-hazardous	Recycle (laundry)
Disinfectant	None	Used in Process
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
IV bags and solutions	Plastic	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes / needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process
Sedatives	Sedatives	Biohazard Waste

3.4.7.2.2 Process Flow Diagram. See Figure C-30 in Appendix C for Surgery PFD.

3.4.7.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Surgery

Table 3.56 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Surgery including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.56
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Surgery

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Degradable Patient & Surgical Gowns & Items	4.9
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Use Reusable (Washable) Gowns and Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Install Occupancy Sensors in Infrequently Used Rooms	5.2.4.8
Install Water-Saving Devices on Plumbing Fixtures	5.2.5.2
Use Non-Mercury Blood Pressure Monitoring Devices	5.2.6.5
Use Products Made from Materials Other than PVC	5.2.7
Recycle Unused Items from Surgical Procedures	5.2.9

3.4.7.3 Orthopedics Work Center

3.4.7.3.1 Process Description

Orthopedic personnel evaluate and treat bone and joint disorders in the clinic; perform surgical procedures in the facility's surgical suites; and assist with fracture reduction and casting in the emergency room (activities conducted in the surgical suites and the ER are covered in those sections of this report). The patient's paperwork is processed at the front desk, and then examined by a provider. Orthopedic clinic typically consists of several examination rooms and a multistation cast room, all of which will have a sharps container, a biohazard collection bag, and a solid waste receptacle. Most visits are for follow-up postoperative care (including suture removal). Many clinics use fiberglass casts, and technicians use a metal bucket, rather than disposable plastic wash basins, to prepare the casting material. Cloth gowns and sheets are used and then laundered. The exam rooms use paper covers on the tables. Waste streams include: splints, alcohol pads, gloves, paper gowns, paper smocks, gauze, syringes and needles, staple and suture kits, hydrogen peroxide, and packaging materials.

Table 3.57 summarizes the input materials and waste streams related to Orthopedics.

Table 3.57
Input Materials and Waste Streams for Orthopedics

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Cloth	Infectious/ Non-hazardous	Recycle (laundry)
Disinfectant	None	Used in Process
Fiberglass casting material	Fiberglass	Municipal Solid Waste
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Hydrogen peroxide	None	Used in Process
Latex gloves	Latex gloves	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Splints	Splints	Municipal Solid Waste
Suture kits	Infectious	Biohazard Waste,
	Non-hazardous	Municipal Solid Waste
Staple kits	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste

3.4.7.3.2 Process Flow Diagram. See Figure C-31 in Appendix C for Orthopedics PFD.

3.4.7.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Orthopedics

There is one CRO, PPO, Management Practices, and Good Ideas that could be employed by Orthopedics and it is recycle waste batteries as described in 5.2.3.1. Also, review the CROs, PPOs, Management Practices and Good Ideas for the Surgery Services and Emergency Services.

3.4.7.4 Urology Work Center

3.4.7.4.1 Process Description

Urology clinic personnel perform surgical procedures in the medical facility's surgical suites (described in the surgery section of this report), and provide postoperative care and perform minor surgical procedures within their clinic. The patient's paperwork is processed at the front desk, and a provider examines the patient. A typical Urology clinic consists of examination and treatment rooms, each having a sharps container, a biohazard collection bag, and a solid waste receptacle. The examination tables are covered with paper barriers and paper or launderable gowns are provided to the patients. The main urological procedures performed are cystoscopies and biopsies. Biopsy tissue specimens are collected and placed in pre-measured formalin containing vials and sent to the medical laboratory. Dialysis procedures may be performed at some installations. The medical equipment used in the procedures of this clinic is sent to central sterile supply for sterilization. Urology Clinic waste streams may include: gloves, plastic, paper gowns, paper/ launderable smocks, gauze, needles, glass vials, glass microscope slides, and packaging materials. **Table 3.58** summarizes the input materials and waste streams related to Urology.

Table 3.58
Input Materials and Waste Streams for Urology

Input Material	Waste Stream	Disposal Method
Medical Equipment	Contaminated Equipment	Sterilization and Recycle
Exam table paper	Paper	Municipal Solid Waste (MSW)
Gauze	Infectious	Biohazard Waste
	Non-hazardous	MSW
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Infectious	Biohazard Waste
	Non-hazardous	MSW
Packaging	Plastic	MSW
Paper gowns & smocks	Infectious	Biohazard Waste
	Paper	MSW
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample kits	None	Used in Process

3.4.7.4.2 Process Flow Diagram. See Figure C-32 in Appendix C for Urology PFD.

3.4.7.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Urology

Table 3.59 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Urology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.59
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Urology

CRO/PPO/Management Practice/Good Idea	Section #
Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Waste Segregation During Clean-up	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Segregate Unused Surgical and Other Prepackaged Equipment and Supplies	5.2.2.8
Use Reusable (Washable) Gowns and Smocks	5.2.2.9
Install Water-Saving Devices on Toilets & Other Plumbing Fixtures	5.2.5.2
Recycle Unused Items from Surgical Procedures	5.2.9

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3.5 Medical Support Squadron

3.5.1 Medical Laboratory

Patients are referred to the Medical Laboratory for the collection of specimens that assist in their diagnosis and treatment. The majority of routine laboratory requests are entered into the Composite Health Care System (CHCS) computer system, with some tests being requested using locally generated forms or a DoD Standard Form (SF). The laboratory can be divided into specialty work centers to expedite the handling of patient specimens. The work centers may include: Anatomic Pathology, Blood Bank, Chemistry, Hematology, Microbiology, Serology/Immunology, and Urinalysis. The Laboratory has to maintain the quality standards established by various accreditation organizations such as the College of American Pathologists, and the DoD Clinical Laboratory Improvement Program. These accreditation organizations establish standards that govern the collection, analysis and handling of the specimens. There are pollution prevention opportunities, management practices and good ideas common to all work centers of the medical laboratory. **Table 3.60** presents those opportunities, practices and ideas applicable to all medical laboratory work centers.

Table 3.60
CROs, PPOs, Management Practices, and Good Ideas
Applicable to All Medical Laboratory Work Centers

CRO/PPO/Management Practice/Good Idea	Section #
Recycle Spent Solvents by Distillation - Ethanol	4.1.2
Recycle Spent Solvents by Distillation - Xylene	4.1.3
Formalin Options	4.1.4.2
Cost Reduction Associated with Faucets with Sensors	4.7
Improve Waste Segregation During Clean-up	5.2.1.4
Use Reusable Equipment and Instruments	5.2.2.6
Use Reusable (Washable) Gowns and Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Monitor Reagent Expiration Dates	5.2.3.2
Turn off Lights and Equipment	5.2.4.2
Install Occupancy Sensors in Infrequently Used Rooms	5.2.4.8
Install Water-Saving Devices on Plumbing Fixtures	5.2.5.2
Use Non-Mercury Thermometers	5.2.6.4
Use Non-Mercury Batteries	5.2.6.7
Use Non-Mercury Preservatives, Stains, and Reagents	5.2.6.10
Laboratory Waste Reduction Strategies	5.2.8

3.5.1.1 Medical Laboratory, Anatomic Pathology Work Center

3.5.1.1.1 Process Description

Anatomic Pathology laboratories conduct pathological examinations of tissues including biopsies, routine surgical specimens, frozen sections, cytology specimens, histological studies (microscope slide preparation) and postmortem examinations. Typically, biopsy tissue specimens are taken from the patient and placed in a small vial with a premeasured amount of preserving solution (usually formalin). Specimens, regardless of how they are derived, are analyzed using a variety of stains and solvents, such as xylene and alcohols. Automatic analyzers are sometimes used, and their solutions are normally consumed in process. The laboratory technicians usually wear paper or cloth smocks, gloves, and sometimes masks. If paper smocks become soiled with blood and/or other bodily fluids, are placed into a biohazard bag. Unsoiled smocks are disposed of as municipal solid waste. Syringes, needles, and scalpel blades are disposed of in sharps containers. Other waste streams include: sharps, gloves, gauze, sample kits, formalin, paraffin, alcohols (such as ethanol, and packaging materials). Some laboratories have distilling equipment for recycling alcohols and xylene. **Table 3.61** summarizes the input materials and waste streams related to anatomic pathology.

Table 3.61
Input Materials and Waste Streams for Anatomic Pathology

Input Material	Waste Stream	Disposal Method
Ethanol	Hazardous	Recycle
Formalin	Unused/excess	Hazardous Waste
	Used	Sanitary Sewer
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paraffin	Non-hazardous	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample vials	Infectious	Biohazard Waste
Stains	None	Used in Process
Tissue	Pathological	Biohazard Waste
Xylene	Hazardous	Recycle

3.5.1.1.2 Process Flow Diagram. See Figure C-33 for in Appendix C Anatomic Pathology PFD.

3.5.1.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Anatomic Pathology.

Table 3.62 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Anatomic Pathology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.62
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Anatomic Pathology

CRO/PPO/Management Practice/Good Idea	Section #
Recycle Spent Solvents by Distillation - Ethanol	4.1.2
Recycle Spent Solvents by Distillation - Xylene	4.1.3
Formalin Options	4.1.4.2
Cost Reduction Associated with Faucets with Sensors	4.7
Improve Waste Segregation During Clean-up	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Monitor Reagent Expiration Dates	5.2.3.2
Use Non-Mercury Preservatives, Stains, and Reagents	5.2.6.10
Laboratory Waste Reduction Strategies	5.2.8

3.5.1.2 Medical Laboratory, Blood Bank Work Center

3.5.1.2.1 Process Description

Blood Banks collects and partially maintains a supply of whole blood, platelets, red blood cells and fresh frozen plasma. They receive blood donations, conduct screening and cross-matching, maintain proper storage conditions, and issues the proper blood products as requested. The waste streams generated from this process are gloves, paper gowns and smocks, gauze, plastic containers, packaging materials, and expired shelf-life blood products. **Table 3.63** summarizes the input materials and waste streams related to the Blood Bank.

Table 3.63
Input Materials and Waste Streams for the Blood Bank

Input Material	Waste Stream	Disposal Method
Blood products	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Cardboard	Recycle
Paper gowns & smock	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/ metal needles	Infectious	Biohazard Waste
Sample vials	Infectious	Biohazard Waste
	Plastic	Municipal Solid Waste

3.5.1.2.2 Process Flow Diagram. See Figure C-34 in Appendix C for Blood Bank PFD.

3.5.1.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the Blood Bank.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to the Blood Bank.

3.5.1.3 Medical Laboratory, Blood Chemistry/Toxicology Work Center

3.5.1.3.1 Process Description

Blood Chemistry/Toxicology laboratories conduct analyses of the blood serum/plasma. After the sample is collected from the patient, the blood sample tubes are analyzed using an analyzer, such as the Coulter Onyx analyzer, or shipped to an external laboratory for those analytical parameters not available in the medical group laboratory. The blood serum sample tubes are loaded directly into the analyzer, and the analyzer automatically draws the serum from the tubes for the specific analysis needed. The tubes with unused blood serum are placed in a biohazard bag. Other waste streams include: sharps, gloves, paper smocks, gauze, reagents, plastic, and packaging materials. **Table 3.64** summarizes the input materials and waste streams related to Blood Chemistry/Toxicology.

Table 3.64
Input Materials and Waste Streams for Blood Chemistry/Toxicology

Input Material	Waste Stream	Disposal Method
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/metal needles	Infectious	Biohazard Waste
Reagents	Pathological	Biohazard Waste
Sample vials	Pathological	Biohazard Waste

3.5.1.3.2 Process Flow Diagram. See Figure C-35 in Appendix C for Blood Chemistry/Toxicology PFD.

3.5.1.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Blood Chemistry/Toxicology.

Table 3.65 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Blood Chemistry/Toxicology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.65
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Blood Chemistry/Toxicology

CRO/PPO/Management Practice/Good Idea	Section #
Dispose of Sharps Containers Only When Needed	5.2.1.5
Use Reusable (Washable) Gowns and Smocks	5.2.2.9
Monitor Reagent Expiration Dates	5.2.3.3

3.5.1.4 Medical Laboratory, Hematology Work Center

3.5.1.4.1 Process Description

Hematology work centers analyze whole blood samples. The patient's blood sample tube is tested using an analyzer such as the Coulter Onyx analyzer. The blood sample tubes are loaded directly into the analyzer, and the analyzer automatically draws the blood from the tubes for the different tests. The tubes with unused blood are placed in a biohazard bag. Other waste streams include: sharps, gloves, paper smocks, gauze, reagents (added to the analyzer), plastic, and packaging materials. **Table 3.66** summarizes the input materials and waste streams related to Hematology.

Table 3.66
Input Materials and Waste Streams for Hematology

Input Material	Waste Stream	Disposal Method
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/metal needles	Infectious	Biohazard Waste
Reagents	Pathological	Biohazard Waste
Sample kits	None	Used in Process

3.5.1.4.2 Process Flow Diagram. See Figure C-36 in Appendix C for Hematology PFD

3.5.1.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Hematology

Table 3.67 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Hematology including a reference to the location of the section with the complete description of the PPO, Management Practice, or Good Idea.

Table 3.67
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Hematology

CRO/PPO/Management Practice/Good Idea	Section #
Dispose of Sharps Containers Only When Needed	5.2.1.5
Monitor Reagent Expiration Dates	5.2.3.2

3.5.1.5 Medical Laboratory, Microbiology Work Center

3.5.1.5.1 Process Description

Microbiology workcenters culture and analyze patient specimens as requested by providers. The specimens are either incubated in-house for the prescribed time or shipped to a reference laboratory for analysis. A Gram stain may be added to the culture depending upon the specimen. No Gram stain waste is generated because it is consumed in the culturing process. Waste culture plates are placed into the biohazard bag. Other waste streams include: swabs, gloves, paper smocks, and packaging materials. **Table 3.68** summarizes the input materials and waste streams related to Microbiology.

Table 3.68
Input Materials and Waste Streams for Microbiology

Input Material	Waste Stream	Disposal Method
Cardboard boxes	Cardboard	Recycle
Culture container	Plastic	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Swabs	Swabs	Biohazard Waste

3.5.1.5.2 Process Flow Diagram. See Figure C-37 in Appendix C for Microbiology PFD.

3.5.1.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Microbiology

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Microbiology.

3.5.1.6 Medical Laboratory, Serology/Immunology Work Center

3.5.1.6.1 Process Description

Serology/Immunology sections specialize in the collection, processing, and analysis of blood samples. Blood is drawn into collection tubes, which are then spun in a centrifuge to separate the blood serum from the cells. Serology analyses use only the blood serum. The serum is decanted into a serum vial and the blood cell residue is placed into a biohazard bag. At some facilities, the Serology section is incorporated with the Blood Bank. Depending on the test requested, the serum is either shipped to a reference laboratory for analysis or is processed in-house using an analyzer. Analyzers consume a certain amount of serum in process, while the tubes with unused specimen are discarded as medical waste. A variety of cell analyses can also be performed. Paper smocks and gloves are used by technicians. Smocks soiled with blood are placed in biohazard bags, while unsoiled smocks and gloves are discarded as Municipal Solid Waste. Other waste streams include syringes and needles, which are placed in sharps containers for disposal, gauze, and packaging materials. **Table 3.69** summarizes the input materials and waste streams related to Serology/Immunology.

Table 3.69
Input Materials and Waste Streams for Serology/Immunology

Input Material	Waste Stream	Disposal Method
Gauze	Infectious	Biohazard Waste
	Non-hazardous	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic syringes w/metal needles	Infectious	Biohazard Waste
Sample vials	Infectious	Biohazard Waste

3.5.1.6.2 Process Flow Diagram. See Figure C-38 in Appendix C for Serology/Immunology PFD.

3.5.1.6.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Serology/ Immunology

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Serology/Immunology.

3.5.1.7 Medical Laboratory, Urinalysis Work Center

3.5.1.7.1 Process Description

In the urinalysis process, the physical and chemical analyses are accomplished using visual observation, specific gravity measurements, a urine dipstick, a microscopic examination when indicated or requested, and a urine culture, when requested. In this process, a urine sample is obtained from the patient in a plastic sample container. The physical appearance of the sample is noted. A urine dipstick is dipped into the sample and then placed into an analyzer, such as a Bayer Climtek 50. The dipstick is subsequently disposed of as ordinary trash. Microscope slides are made from urine sediment, examined, and then disposed as sharps. A swab is used to inoculate a culture as required. Leftover urine is poured down a sanitary sewer drain, and the plastic container is disposed as ordinary trash. Other waste streams include: gloves, paper smocks, and packaging materials. **Table 3.70** summarizes the input materials and waste streams related to Urinalysis.

Table 3.70
Input Materials and Waste Streams for Urinalysis

Input Material	Waste Stream	Disposal Method
Glass microscope slides	Infectious	Biohazard Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper smocks	Infectious	Biohazard Waste
	Paper	Municipal Solid Waste
Plastic sample container	Plastic	Municipal Solid Waste
Urine	Sanitary	Sanitary Sewer

3.5.1.7.2 Process Flow Diagram. See Figure C-39 in Appendix C for Urinalysis PFD.

3.5.1.7.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Urinalysis.

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Urinalysis.

3.5.2 Medical Logistics

Medical Logistics provides the following support to the medical group (Note: Support may differ from installation to installation, and other work centers may provide one or more of the following services.):

- Procuring supplies, materiel, chemicals, and pharmaceuticals.
- Storing and issuing of supplies to authorized users.
- Collecting, storing and disposing of medical/infectious wastes.
- Coordinating recycling efforts with the installation's recycling manager, normally in Civil Engineering's Environmental Flight or in the installation's hazardous materials office.
- Executing and managing the laundry and housekeeping contracts.
- Collecting hazardous waste and coordinating it's disposal.
- Disposing of expired/returned pharmaceuticals.
- Repairing medical equipment.
- Monitoring general facility repair, maintenance, and utility usage.

3.5.2.1 Medical Logistics Supply Procurement Work Center

3.5.2.1.1 Process Description

Supply personnel order the supplies, equipment, materiel, chemicals, and pharmaceuticals used by the medical group. Administrative and warehousing tasks are performed, which generate waste paper, cardboard, and packaging materials. **Table 3.71** summarizes the input materials and waste streams related to Supply Procurement.

Table 3.71
Input Materials and Waste Streams for Supply Procurement

Input Material	Waste Stream	Disposal Method
Office paper	Paper	Recycle
Packaging	Cardboard	Recycle
	Plastic	Recycle
	Foam	Municipal Solid Waste

3.5.2.1.2 Process Flow Diagram. See Figure C-40 in Appendix C for Supply Procurement PFD.

3.5.2.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Supply Procurement

Table 3.72 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Supply Procurement including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.72
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Supply Procurement

CRO/PPO/Management Practice/Good Idea	Section #
Optimize Pharmaceutical Inventory & Use Returns Contractor	4.2
Initiate Cardboard Recycling to Reduce MSW Cost	4.4
Municipal Solid Waste Recycling	4.6
Work with Suppliers to Reduce Product Packaging	5.2.2.1
Purchase Concentrated Cleaning Supplies	5.2.2.5
Recycle Waste Batteries	5.2.3.1
Purchase Equipment with an Energy-Saving Mode	5.2.4.13
Recycle Waste Mercury and Mercury-Containing Equipment	5.2.6.1
Recycle Mercury-Containing Lamps	5.2.6.2
Recycle Lead Foil	5.2.10.8
Store Radiographic Chemicals Properly	5.2.10.2

3.5.2.2 Medical Logistics Medical Equipment Repair Work Center

The Medical Equipment Repair Center (MERC) manages the maintenance on all medical equipment used in the medical group. Minor maintenance operations are performed, while vendors service equipment requiring large-scale maintenance. Chemicals such as isopropyl alcohol, solder, hydraulic fluid, greases, acetone, paint thinner, and solid film lubricants are used in maintaining the equipment.

3.5.2.2.1 Process Description

Medical equipment repair performs minor maintenance on medical equipment. This typically consists of limited soldering operations; cleaning electrical circuit boards with isopropyl alcohol; maintaining dental chairs with hydraulic fluid and greases; degreasing various components with acetone; and applying corrosion preventive compounds of solid film lubricants to specified medical equipment. These work centers will often maintain several mercury-containing thermometers for calibration purposes. Solder and fluxes are consumed in process, and generate minimal fumes. Lead-acid and alkaline batteries contained in various pieces of equipment, and replaced by MERC personnel, are turned into the installation's hazardous material office for proper disposal. Used rags and gloves generated by these work centers are disposed of as ordinary trash. **Table 3.73** summarizes the input materials and waste streams related to Medical Equipment Repair.

Table 3.73
Input Materials and Waste Streams for
Medical Equipment Repair

Input Material	Waste Stream	Disposal Method
Acetone	None	Used in Process
Aerosol cans	Metal	Municipal Solid Waste/Recycle
Antifreeze	Hazardous	Recycle
Batteries	Hazardous	Hazardous Waste/Recycle
Greases/ Lubricants	None	Used in Process
Hydraulic Fluid	Hazardous	Hazardous Waste
Isopropyl alcohol	None	Used in Process
Motor oil	Petroleum	Recycle
Packing material	Plastic	Municipal Solid Waste
Paper	Paper	Municipal Solid Waste
Plastic containers	Plastic	Municipal Solid Waste
Solder	None	Used in Process

3.5.2.2.2 Process Flow Diagram. See Figure C-41 in Appendix C for Medical Equipment Repair PFD.

3.5.2.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Medical Equipment Repair

Table 3.74 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Medical Equipment Repair including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.74
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Medical Equipment Repair

CRO/PPO/Management Practice/Good Idea	Section #
Increase Participation in Hazardous Material Pharmacy	5.1.1
Use Old Towels and Linens as Rags	5.2.2.3
Purchase Concentrated Cleaning Supplies	5.2.2.5
Recycle Waste Batteries	5.2.3.1
Turn Off Lights and Equipment	5.2.4.2
Replace Magnetic Ballast with Electronic Ballast's	5.2.4.4
Install Timers on Thermostats	5.2.4.7
Install Occupancy Sensors in Infrequently Used Rooms	5.2.4.8
Recycle Waste Mercury and Mercury-Containing Equipment	5.2.6.1
Use Non-Mercury Thermometers	5.2.6.4
Use Non-Mercury Batteries	5.2.6.7
Use Non-Mercury Lamps and Lighting Devices	5.2.6.8
Use Non-Mercury Electrical Switches	5.2.6.9

3.5.2.3 Medical Logistics General Housekeeping Work Center

Housekeeping conducts the general sanitary maintenance and collection/disposal of biohazard waste for the medical group. These services are normally contracted under the Hospital Aseptic Management System (HAMS). Representative processes performed by Housekeeping Services include: vacuuming, carpet cleaning, waxing, sweeping, mopping or scrubbing floors; removing trash; cleaning glass; dusting; cleaning restrooms; disinfecting surfaces; collecting recyclable material; collecting/disposing of biohazard waste; and replacing light bulbs.

3.5.2.3.1 Process Description

General Housekeeping Services normally perform tasks that do not require the use or disposal of hazardous materials:

- Vacuuming carpets involves personnel using a vacuum to clean dirt and debris from carpets throughout the medical facility with the vacuum bag being discarded as a solid municipal waste.
- Sweeping floors involves workers using a broom or dry mop to remove dust, dirt, or debris from floors in order to maintain a level of cleanliness. This material is also discarded as a solid municipal waste.
- Removing trash involves workers removing all refuse (non-medical waste) from public and administrative areas and discarding it as a solid municipal waste.
- Dusting involves workers dusting surfaces of office furniture, equipment, walls, ceilings, and artwork to remove dirt, dust and cobwebs.
- Cleaning exterior ducts involves workers cleaning dust and dirt from diffusers, grills, and registers.
- Cleaning mats involves workers vacuuming carpet entrance mats, and sweeping or rinsing with potable water. No chemicals are added during the cleaning process.
- Removing trash from entrances and entrance platforms involves workers removing debris or accumulated trash from public and administrative entrances or entrance platforms and 15 feet in each direction from the bulk refuse container, including the smoking area. This material is also discarded as a solid municipal waste.
- Cleaning exterior/interior lights involves workers dusting interior lights in order to remove dust and lint, while exterior lights may be washed in order to remove dirt, bugs, or other matter.
- Housekeeping Services collects all Nickel-Cadmium and alkaline batteries in places them in the appropriate disposal containers.
- Housekeeping replaces incandescent/fluorescent light bulbs by removing the burned out bulb and replacing it with a functioning bulb. This task is performed on as needed basis. Incandescent light bulbs are disposed of as regular waste and fluorescent light bulbs are sent to the installation’s hazardous material office for disposal.

Table 3.75 summarizes the input materials and waste streams related to General Housekeeping Activities.

Table 3.75
Input Materials and Waste Streams for
General Housekeeping Activities

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Fluorescent light bulbs	Fluorescent bulbs	Municipal Solid Waste
	Fluorescent crusher filter	Hazardous Waste
Incandescent light bulbs	Incandescent bulbs	Municipal Solid Waste
Office trash	Trash	Municipal Solid Waste
Packaging	Cardboard	Recycle
	Plastic	Municipal Solid Waste
Plastic trash bags	Plastic	Municipal Solid Waste
Potable water	Wastewater	Stormwater Sewer
Rags/cloths	Cloth	Municipal Solid Waste
Vacuum bags	Paper	Municipal Solid Waste

3.5.2.3.2 Process Flow Diagram. See Figure C-42 in Appendix C for General Housekeeping Activities PFD.

3.5.2.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to General Housekeeping Activities.

Table 3.76 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to General Housekeeping Activities including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.76
CROs, PPOs, Management Practices, and Good Ideas
Applicable to General Housekeeping Activities

CRO/PPO/Management Practice/Good Idea	Section #
Use Translucent Red Bags	5.2.1.1
Use Cadmium Free Red Bags	5.2.1.2
Use Old Towels and Linens as Rags	5.2.2.3
Purchase Concentrated Cleaning Supplies	5.2.2.5
Turn Off Lights and Equipment	5.2.4.2
Recycle Mercury-Containing Lamps	5.2.6.2
Use Non-Mercury Containing Batteries	5.2.6.7

3.5.2.4 Housekeeping, Cleaning and Disinfecting Work Center

3.5.2.4.1 Process Description

Housekeeping Services typically performs six tasks that require the use of materials containing chemicals or hazardous materials:

- Cleaning windows using general-purpose glass cleaners. The cleaners are applied to windows, and rags and cloths are used to wipe the window surfaces. The rags are discarded as municipal solid waste or, in some instances, washed and reused several times prior to disposal.
- Cleaning floors using general-purpose cleaners and detergents to remove dirt, old wax, and stains from hard-surface floors. After use and floor clean up, the residual wastewater is discharged to the sanitary sewer.
- Maintaining floors involves workers applying uniform coatings of non-skid floor finish in order to maintain the glossy appearance of hard surfaced floors, and to remove scuffs and other discolorations. Containers are disposed of as municipal solid waste.
- Cleaning/disinfecting restrooms using general-purpose cleaners and disinfectants on restroom surfaces to remove dirt, and odors. These materials are consumed in the process or the residual wash water is drained to the sanitary sewer. Containers are disposed of as municipal solid waste.
- Cleaning interior ducts using a phenolic disinfectant to wash the duct after vacuuming. This material is consumed in the process. Containers are disposed of as municipal solid waste.
- Cleaning patient exam and surgical treatment areas using disinfectants to wipe down tables, walls, tables, etc. Floors are cleaned as above. Rags and containers are disposed of as municipal solid waste.

Table 3.77 summarizes the input materials and waste streams related to Cleaning and Disinfecting.

Table 3.77
Input Materials and Waste Streams for Cleaning and Disinfecting

Input Material	Waste Stream	Disposal Method
Cleaner/disinfectant containers	Plastic	Municipal Solid Waste
Cleaners/disinfectants	Wastewater	Sanitary Sewer
Packaging	Plastic	Municipal Solid Waste
Potable water	Wastewater	Sanitary Sewer
Rags/cloths	Cloth	Municipal Solid Waste

3.5.2.4.2 Process Flow Diagram. See Figure C-43 in Appendix C for Cleaning and Disinfecting PFD.

3.5.2.4.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Cleaning and Disinfecting

Table 3.78 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Cleaning and Disinfecting including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.78
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Cleaning and Disinfecting

CRO/PPO/Management Practice/Good Idea	Section #
Use Old Towels and Linens as Rags	5.2.2.3
Purchase Concentrated Cleaning Supplies	5.2.2.5
Turn Off Lights and Equipment	5.2.4.2

3.5.2.5 Housekeeping, Autoclave and Incinerator Work Center

3.5.2.5.1 Process Description

Typically, Housekeeping Services collects all biohazard waste throughout the medical facility on a daily basis regardless of how full the container is. Many facilities have a contractor who collects the biohazard bags from a central location for disposal. In those facilities where this service has not been contracted out, the biohazard bags are typically autoclaved, compacted, and transferred to a waste container for disposal in an appropriate landfill. All Infectious waste and sharps containers require incineration, either in the medical facilities waste incinerator or in one owned by a contractor. After incineration is completed, the ash is stored for 72 hours in a metal trash can, bagged, and placed in the municipal solid waste dumpster for disposal in a landfill. **Table 3.79** summarizes the input materials and waste streams related to Autoclave and Incinerator Usage.

Table 3.79
Input Materials and Waste Streams for
Autoclave and Incinerator Usage

Input Material	Waste Stream	Disposal Method
Pathological waste	Pathological	Incinerator to Municipal Solid Waste
Red bag material	Medical waste	Autoclave to Municipal Solid Waste
Sharps containers	Infectious	Incinerator to Municipal Solid Waste

3.5.2.5.2 Process Flow Diagram. See Figure C-44 in Appendix C for Autoclave and Incinerator PFD.

3.5.2.5.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Autoclave and Incinerator Usage

Table 3.80 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to Autoclave and Incinerator Usage including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.80
CROs, PPOs, Management Practices, and Good Ideas Applicable to
Autoclave and Incinerator Usage

CRO/CRO/PPO/Management Practice/Good Idea	Section #
Sterilize, Pulverize and Dispose as MSW	4.8
Degradable Patient & Surgical Gowns & Items	4.9

3.5.2.6 Utilities

The medical facility commander is ultimately responsible for the management of the utilities consumed within the facilities associated with medical facilities. This responsibility is normally delegated to the Medical Logistics Office to manage. The critical element of a utilities management program is the establishment of baselines for each of the different utilities. Having an established baseline allows periodic comparisons of use and cost. This enables the commanders to monitor their progress toward reducing use, waste generation and/or costs. If cost reductions are not possible, at least cost increases can be minimized because utility consumption and waste generation have been reduced. Metering electrical, gas, steam and water consumption is critical to documenting and validating cost opportunity reductions. Coupled with the metering, by tracking the amounts by weight of waste (hazardous, medical, municipal solid, radiological) generated will provide cost reduction savings that can be used for other medical programs.

3.5.2.6.1 Electricity Usage

Electrical consumption by medical facilities is typically not metered but is either prorated or apportioned based upon a factor determined by the installation. At some installations, the installation charges a set amount each month regardless of the amount of energy consumed. If a metering device would be installed, it would allow the facility to determine how much electrical energy in kilowatt-hours per month it consumed. Once this is known, the facility could accurately track its electrical costs, and could document any savings associated with a medical cost reduction opportunity. Without an accurate means of measuring the energy consumption, there is no effective method of evaluating cost reduction opportunities and validating the savings determined from the analysis. Thus, no economic reason exists to implement energy savings measures. The only reason to implement an energy savings opportunity is because it theoretically could reduce energy consumption and it the “right thing to do”.

A significant amount of the electricity used in a medical facility comes from electrical equipment and light fixtures remaining on for most if not all the day. In some rooms and hallways the lights remain on 24 hours a day, seven days a week. Some newer facilities use energy efficient lighting and fixtures, natural sunlight, and/or motion sensors in work areas and rooms that are infrequently occupied in order to reduce electrical usage. **Table 3.81** presents the CROs, PPOs, Management Practices, and Good Ideas that could be implemented to reduce electrical consumption, including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.81
CROs, PPOs, Management Practices, and Good Ideas Applicable to Reducing Electrical Consumption

CRO/PPO/Management Practice/Good Idea	Section #
Install Electric Meter	5.2.4.1
Replace Incandescent Lighting with Fluorescent Lighting	5.2.4.3
Replace Magnetic Ballast with Electronic Ballast's	5.2.4.4
Retrofit or Replace Exit Signs	5.2.44.5
Install Weather Stripping, Caulking and Insulation	5.2.4.6
Install Timers on Thermostats	5.2.4.7
Install Occupancy Sensors In Infrequently Used Rooms	5.2.4.8
Paint Ceilings Light Colors/Clean Light Fixtures	5.2.4.9
Insulate Hot Water Holding Tanks and Hot/Chilled Water Pipes	5.2.4.10
Install Motion Sensors for Exterior Lighting	5.2.4.11
Install Solar Timers for Exterior Lighting	5.2.4.12
Purchase Equipment with an Energy Saving Mode	5.2.4.13

CAUTION: Replacing electrically powered exit and other warning signs in the medical facility with radioluminescent signs requires permission from the USAF Radioisotope Committee prior to purchase. Normally, the use of radioluminescent signs is prohibited according to Air Force Instruction 40-201, Chapter 3**.**

3.5.2.6.2 Steam Usage

Most Air Force bases use self-generated steam to heat buildings during cold months. As with electricity, a majority of medical facilities do not meter their steam usage. Installation of a meter is essential for determining baseline steam usage costs, as well as validating savings resulting from an effective steam conservation program.

Due to patient comfort concerns, lowering the temperature in the facility is generally not considered to be a viable option. However, there are other heat conservation options available such as maintaining weather stripping and caulking, and using solar (radiant) heating during daylight hours. **Table 3.82** presents the CROs, PPOs, Management Practices, and Good Ideas that could be implemented to reduce steam usage, including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.82
CROs, PPOs, Management Practices, and Good Ideas Applicable to Reducing Steam Usage

CRO/PPO/Management Practice/Good Idea	Section #
Install Weather Stripping, Caulking and Insulation	5.2.4.6
Install Timers on Thermostats	5.2.4.7
Insulate Hot Water Holding Tanks and Hot/Chilled Water Pipes	5.2.4.10

3.5.2.6.3 Water Usage

Potable water is used throughout a medical facility for a wide variety of tasks from cleaning floors to cooking and washing laundry. Medical facilities typically use large amounts of water; however, like electricity, water consumption is not metered. Installing a water meter and validating the amount of water consumed per month is the critical first step in establishing an effective water conservation program. In addition to water reduction, additional benefits in energy consumption can be accrued. This occurs when hot water use is reduced. **Table 3.83** presents the CROs, PPOs, Management Practices, and Good Ideas that could be implemented to reduce water consumption including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.83
CROs, PPOs, Management Practices, and Good Ideas Applicable to Reduce Water Consumption

CRO/PPO/Management Practice/Good Idea	Section #
Cost Reduction Associated with Faucets with Sensors	4.7
Install Water Meter	5.2.5.1
Install Water-Saving Devices on Toilets & Other Plumbing Fixtures	5.2.5.2
Monitor Sprinkler Use in the Warmer Months	5.2.5.3

3.5.2.6.4 Sanitary Sewer

Wastewater from medical facilities enters the sanitary sewer system and flows to either an on or off-base wastewater treatment plant. Wastewater volumes are not typically monitored for individual facilities on an installation. The amount of wastewater generated is typically estimated from the amount of potable water used by a facility during the winter months. During the summer months lawn sprinklers are used and that water does not go to the wastewater treatment plant. Any fruitful effort to reduce water consumption correspondingly reduces the wastewater needing treatment along with the cost to treat it.

3.5.2.6.5 Waste Management Program

3.5.2.6.5.1 Municipal Solid Waste

The housekeeping/janitorial staff is typically responsible for collecting the municipal solid waste from throughout the medical facility and depositing it in dumpsters for removal to a municipal or installation-owned landfill. Medical facilities on Air Force installations use a housekeeping contractor service that is centrally administered through the Hospital Aseptic Management System (HAMS) contract from Brooks AFB, TX. The municipal solid waste stream at most medical facilities consists primarily of paper towels, gloves, paper/cardboard packaging, paper, food waste, non-recycled aluminum cans and plastic bottles, non-contaminated patient and equipment coverings, lights bulbs and plastic/rubber patient supplies and material. A discussion of how solid waste is divided into different categories was presented in Chapter 2. **Table 3.84** presents the CROs, PPOs, Management Practices, and Good Ideas that apply to reducing the quantity of municipal solid waste requiring disposal including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.84
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Municipal Solid Waste Reduction

CRO/PPO/Management Practice/Good Idea	Section #
Initiate Cardboard Recycling to Reduce MSW Cost	4.4
Evaluate MSW Dumpster Cost	4.5
Municipal Solid Waste Recycling	4.6
Degradable Patient & Surgical Gowns & Items	4.9
Provide On-Going Employee Waste Segregation Training	5.1.2
Work with Suppliers to Reduce Product Packaging	5.2.2.1
Reduce Quantity of Office Paper Used	5.2.2.2
Use Old Towels and Linens as Rags	5.2.2.3
Replace Paper Towels with Air Dryers	5.2.2.4
Purchase Concentrated Cleaning Supplies	5.2.2.5
Use Reusable Equipment and Instruments	5.2.2.6
Save and Reuse In-Patient Supplies	5.2.2.8
Use Reusable(Washable) Gowns and Smocks	5.2.2.9
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10

3.5.2.6.5.2 Hazardous Waste

In comparison to industrial facilities, medical facilities typically generate very little hazardous waste. Most hazardous waste arises from the medical laboratory (used alcohols and solvents), radiology (used developer), the dental laboratory (used amalgam), and the pharmacy (certain expired pharmaceuticals). Medical Logistics may also accumulate used fluorescent light bulbs and used batteries, both of which may be considered hazardous wastes depending on state-specific regulations. **Table 3.85** lists the major hazardous waste stream components identified during the study. The table should be used by the medical facility as a starting point in identifying their hazardous waste. The facility should then determine the quantities of each waste generated per month. The list requires the medical facility track the amount of each hazardous waste.

Table 3.85
Major Hazardous Waste Stream Components
from the Medical Facility

Waste Stream Component
Excess Formalin
Spent Ethanol
Spent Xylene
Radiographic Developer/Fixer
Excess/Spent Acids
Spent Vapo-Sterile Solution (ethanol/formaldehyde)
Expired Pharmaceuticals
Expired Chemical Reagents
Waste Radiographic Film
Waste Dental Amalgam
Burned-out Fluorescent Light Tubes
Used Alkaline and Nickel-Cadmium Batteries

Table 3.86 presents the CROs, PPOs, Management Practices, and Good Ideas that could be implemented to reduce the quantity of hazardous waste generated including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.86
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Hazardous Waste Reduction

CRO/PPO/Management Practice/Good Idea	Section #
Recycle Spent Solvents by Distillation	4.1
Ethanol Distillation	4.1.2
Xylene Distillation	4.1.3
Formalin Options	4.1.4.2
Return Excess Pharmaceuticals to a Returns Contractor Prior to Expiration Date	4.2.2
Optimize Pharmaceutical Inventory Control	4.2.4
Replace Ethylene Oxide Sterilizer	4.3
Recycle Waste Batteries	5.2.3.1
Monitor Reagent Expiration Dates	5.2.3.2
Recycle Waste Mercury and Mercury-Containing Equipment	5.2.6.1
Recycle Mercury-Containing Lamps	5.2.6.2
Collect and Recycle Waste Dental Amalgam	5.2.6.3
Use Amalgam Alternatives	5.2.6.3.1
Use Pre-Capsulated Alloys	5.2.6.3.2
Use Non-Mercury Thermometers	5.2.6.4
Use Non-Mercury Blood Pressure Monitoring Devices	5.2.6.5
Use Non-Mercury Esophageal Devices	5.2.6.6
Use Non-Mercury Batteries	5.2.6.7
Use Non-Mercury Lamps and Lighting Devices	5.2.6.8
Use Non-Mercury Electrical Switches	5.2.6.9
Use Non-Mercury Preservatives, Stains, and Reagents	5.2.6.10
Additional Mercury Information	5.2.6.11
Laboratory Waste Reduction Strategies	5.2.8
Store Radiographic Chemicals Properly	5.2.10.2
Test Expired Radiographic Processing Chemicals	5.2.10.3
Extend Processing Bath Life	5.2.10.4
Use Chromium Free System Cleaners	5.2.10.7
Recycle Lead Foil	5.2.10.8

3.5.2.6.5.3 Medical Waste

The housekeeping/janitorial contractor is responsible for the pickup; sterilization, if available, and transfer to the dumpster of the medical (red bag/biohazard) waste. Instead of placing the waste in the medical waste dumpster, the biohazard waste bags may be transferred to a special treatment unit for sterilization. When the sterilization cycle is complete, the unit transfers the treated waste into a grinder/compactor and then to a dumpster for collection and removal to an off-site location. The treated waste becomes classified as a municipal solid waste (MSW) because the sterilization/grinding process eliminates the potential health hazard and makes the waste no longer recognizable as a medical waste. The disposal cost becomes the same cost per unit as the MSW. If sterilization is not accomplished, the medical waste is collected, held in specially marked storage areas/containers/dumpsters and disposed through a licensed medical waste contractor. The medical facility should record the weight of waste collected by contractor. The facility can then calculate/ validate the total monthly medical waste cost charged by the contractor.

Pathological, infectious waste and sharps are either treated on site in a sterilizer/grinder unit or picked up by a contractor who takes the waste to a permitted facility for incineration or other approved disposal method. The medical facility normally monitors the amount and cost of waste disposed each month. The medical facilities should verify that the waste collected is taken to an approved facility thus, limiting their future environmental liability. **Table 3.87** presents the CROs, PPOs, Management Practices, and Good Ideas that could be implemented to reduce the quantity of medical waste generated including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.87
CROs, PPOs, Management Practices, and Good Ideas
Applicable to Medical Waste Reduction

CRO/PPO/Management Practice/Good Idea	Section #
Sterilize, Pulverize and Dispose MSW	4.8
Degradable Patient & Surgical Gowns & Items	4.9
Provide On-Going Employee Waste Segregation	5.1.2
Use Translucent Red Bags	5.2.1.1
Use of Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
Improve Medical Waste Segregation	5.2.1.4
Dispose of Sharps Containers Only When Needed	5.2.1.5
Use Reusable (Washable) Gowns and Smocks	5.2.2.9

3.5.2.6.6 Air Emissions

If the medical facility has a permitted pathological incinerator regulated by an Air Quality Control Permit, a copy of the permit is normally maintained by Medical Logistics, who is responsible for the operation of the incinerator. Medical Logistics monitors compliance with the conditions listed in the permit. The permit may contain the following: date of issue, restrictions on what can be incinerated, expiration date, allowable burn (maximum load) rate, monitoring requirements and documenting the amount and the type of material incinerated. If the specifications of the incinerator and/or the permit restrictions are exceeded, additional cost could be borne by the medical facility in fines from a regulatory agency and through increased maintenance cost.

Limiting access to a select number of personnel is critical in achieving the optimum use of the incinerator. These selected individuals must be provided instruction on the correct loading rate and operation of the unit. Through overloading and improper burn techniques, the expected life of the incinerator will be negatively impacted and may cause the permit limits to be exceeded. A reduction in the useful life of the incinerator can increase the repair cost and eventually cause the incinerator to be replaced earlier than projected. As the incinerator nears the end of it's useful life the medical facility will have to evaluate the cost of replacing their incinerator with a unit that complies with new air emission requirements to the cost of disposing of the medical and pathological waste by contract. Those facilities that monitor the amount of medical/pathological waste generated by work center or area have an effective method of keeping their cost under control. By identifying work centers or areas that may not be properly segregating their waste and then training those personnel to better segregate their waste, the medical facility may be able to extend the useful life of the incinerator or reduce the cost of the medical waste disposal contract.

3.5.2.6.7 Recycling

The Civil Engineering Squadron normally operates the installation recycling program. The installation establishes the program to recover/collect recyclable materials. The following items are candidates for recycling:

- White paper/mixed paper
- Cardboard
- Numbers 1 and 2 plastic bottles/jugs and other plastic material
- Glass (all types and colors)
- Aluminum/tin cans
- Batteries
- Office paper
- Other items recycled include nickel-cadmium and alkaline batteries, toner cartridges, compact disks (CDs), xylene and alcohol (by distillation)

The medical facility may or may not be participating in a recycling program. If a program exists, the medical facility should participate and encourage all medical personnel to actively participate by properly segregating the waste. When recyclable/ recoverable items are not placed into a MSW or medical waste container, MSW/MW cost savings could accrue because less MSW/MW is being disposed. See Section 4.4, 4.5 and 4.6 for discussion of the cost reduction opportunities for using recycling instead of other disposal methods.

3.5.3 Nutritional Medicine

Nutritional Medicine provides for the nutritional needs of the patients and hospital staff. The work center provides nutritional counseling to beneficiaries to help them in maintaining a healthy life style and adapting to special dietary requirements based upon an existing medical condition. This work center may also operate the food service area (cafeteria), and serve meals to In-Patients.

3.5.3.1 Process Description

As the food service supplies are delivered, unloaded, and unpacked, the packing material (mainly cardboard) is typically collected for recycling. When the supplies are used, the containers (glass and metal) are rinsed and separated for recycling. Meals prepared for patients on the wards are served on reusable dinnerware that is washed in an industrial dishwasher. Cafeteria patrons may have the option of using disposable dinnerware but this should be discouraged. Many cafeterias track how many patrons typically eat each meal and adjust the amount of food prepared. Other facilities feature services for preparing food on an "as needed" basis to prevent preparation of unneeded foods. Some cafeterias provide bulk condiments (salt, pepper, catsup, etc.), while others prefer to provide individual condiment packets. A recycling vendor typically collects the grease generated during cooking. Food waste not used for other purposes is either ground up by the garbage disposal or put into plastic bags and placed in the MSW dumpster. Other materials used are oven cleaners, bleach/disinfectants and soaps/cleaners. **Table 3.88** summarizes the input materials and waste streams for Nutritional Medicine.

Table 3.88
Input Materials and Waste Streams for
Nutritional Medicine/Food Service

Input Material	Waste Stream	Disposal Method
Cleaning products	Wastewater	Sanitary Sewer
Dinning supplies	Paper	Municipal Solid Waste
	Plastic	Municipal Solid Waste
Foodstuffs	Garbage	Municipal Solid Waste
	Garbage (ground up)	Sanitary Sewer
	Glass	Recycle
	Metal	Recycle
	Plastic	Municipal Solid Waste
Grease and fat	Tallow	Contracted Disposal/ Recycle
Packaging material	Cardboard	Recycle
	Plastic	Municipal Solid Waste
Potable water	Wastewater	Sanitary Sewer

3.5.3.2 Process Flow Diagram. See Figure C-45 in Appendix C for Nutritional Medicine's Food Service PFD.

3.5.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Nutritional Medicine

Table 3.89 presents the CROs, PPOs, Management Practices, and Good Ideas that apply Nutritional Medicine including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.89
CROs, PPOs, Management Practices, and Good Ideas Applicable to Nutritional Medicine

CRO/PPO/Management Practice/Good Idea	Section #
Sell Reusable Beverage Cups in the Cafeteria	5.2.11.1
Compost Food Waste	5.2.11.2
Use Reusable Dishware and Utensils	5.2.11.3
Additional Good Ideas	5.2.11.4

3.5.4 Pharmacy

The Pharmacy dispenses pharmaceutical medication to military personnel, their dependents and other authorized beneficiaries. The Pharmacy may be separated into three individual work centers: (1) In-Patient Pharmacy, (2) OutPatient Pharmacy, and (3) Satellite Pharmacy.

The Medical Logistics warehouse receives delivery of pharmaceuticals from distributors and dispenses them to those different pharmacies. Medical groups typically contract for the disposal of expired pharmaceuticals and receive credit towards future purchases. Expired pharmaceuticals not returned are typically disposed by incineration.

3.5.4.1 Pharmacy: In-Patient Pharmacy Work Center

3.5.4.1.1 Process Description

The In-Patient Pharmacy dispenses pharmaceutical prescriptions to patients residing on the wards. In addition to measuring doses of solid pharmaceuticals (pills and capsules), the pharmacy prepares intravenous solutions, oral liquid pharmaceutical suspensions, and, in some facilities, chemotherapy drugs. Chemotherapy drug waste generated is collected and disposed as hazardous waste. The exhaust hood where the drugs are prepared is cleaned with disinfectants and the cleaning materials disposed as municipal solid waste. Reusable plastic items are used in preparing and dispensing most pharmaceuticals. These items are washed in a sink and dried before being used again. Some plastic and glass waste is generated from pharmaceutical containers in addition to cardboard boxes and plastic wrapping. Syringes and needles used are disposed in sharps containers. **Table 3.90** summarizes the input materials and waste streams related to the In-Patient Pharmacy.

Table 3.90
Input Materials and Waste Streams for the In-Patient Pharmacy

Input Material	Waste Stream	Disposal Method
Cardboard	Cardboard	Recycle
Chemotherapy drugs	Hazardous	Hazardous Waste
Controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
	Hazardous	Hazardous Waste
Glass containers	Glass	Municipal Solid Waste
Latex gloves	Infectious	Biohazard Waste
Non-controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
Packaging	Plastic	Municipal Solid Waste
Paper	Paper	Municipal Solid Waste
Plastic syringe w/metal needles	Infectious	Biohazard Waste

3.5.4.1.2 Process Flow Diagram. See Figure C-46 in Appendix C for In-Patient Pharmacy PFD.

3.5.4.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the In-Patient Pharmacy.

Table 3.91 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to the In-Patient Pharmacy including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.91
CROs, PPOs,, Management Practices, and Good Ideas Applicable to the In-Patient Pharmacy

CRO/PPO/Management Practice/Good Idea	Section #
Return Excess Pharmaceuticals to Returns Contractor	4.2.2
Optimize Pharmaceutical Inventory	4.2.4
Work with Suppliers to Reduce Product Packaging	5.2.2.1

3.5.4.2 Pharmacy: Out-Patient Pharmacy Work Center

3.5.4.2.1 Process Description

Out-Patient Pharmacies dispense prescriptions to patients seen in one of the medical facility's clinics. These pharmacies may mix orally administered pharmaceuticals and typically maintain limited supplies. Expired pharmaceuticals are boxed and returned to Medical Logistics for proper disposition. Plastic, paper and glass are generated from pharmaceutical containers in addition to cardboard boxes and plastic wrapping. No biohazard or sharps wastes are typically generated by Out-Patient pharmacies. **Table 3.92** summarizes the input materials and waste streams related to the Out-Patient Pharmacy.

Table 3.92
Input Materials and Waste Streams for the OutPatient Pharmacy

Input Material	Waste Stream	Disposal Method
Cardboard	Cardboard	Recycle
Controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
	Hazardous	Hazardous Waste
Glass containers	Glass	Municipal Solid Waste
Latex gloves	Non-hazardous	Municipal Solid Waste
Non-controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
Packaging	Plastic	Municipal Solid Waste
Paper	Paper	Municipal Solid Waste
Plastic pharmaceutical containers	Plastic	Municipal Solid Waste
Plastic syringe w/metal needles	Infectious	Biohazard Waste

3.5.4.2.2 Process Flow Diagram. See Figure C-47 in Appendix C for Out-Patient Pharmacy PFD.

3.5.4.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the Out-Patient Pharmacy

Table 3.93 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to the Out-Patient Pharmacy including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.93
CROs, PPOs, Management Practices, and Good Ideas Applicable to the Out-Patient Pharmacy

CRO/PPO/Management Practice/Good Idea	Section #
Return Excess Pharmaceuticals to Returns Contractor	4.2.2
Optimize Pharmaceutical Inventory	4.2.4
Work with Suppliers to Reduce Product Packaging	5.2.2.1
Install Occupancy Sensors in Infrequently Used Rooms	5.2.4.8
Use Products Made from Materials Other than PVC	5.2.7

3.5.4.3 Pharmacy, Satellite Pharmacy Work Center

3.5.4.3.1 Process Description

Satellite Pharmacies dispense original and refill prescriptions at remote sites within the medical facility or elsewhere on the installation. These pharmacies do not mix pharmaceuticals and typically maintain limited supplies. Expired pharmaceuticals are boxed and returned to Medical Logistics for proper disposition. Plastic, paper and glass are generated from pharmaceutical containers in addition to cardboard boxes and plastic wrapping. No biohazard or sharps wastes are typically generated by Satellite Pharmacies. **Table 3.94** summarizes the input materials and waste streams related to the Satellite Pharmacy.

Table 3.94
Input Materials and Waste Streams for the Satellite Pharmacy

Input Material	Waste Stream	Disposal Method
Cardboard	Cardboard	Recycle
Controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
	Hazardous	Hazardous Waste
Glass containers	Glass	Municipal Solid Waste (MSW)
Latex gloves	Non-hazardous	Municipal Solid Waste
Non-controlled pharmaceuticals	Expired pharmaceuticals	Contract Return
Packaging	Plastic	Municipal Solid Waste
Paper	Paper	Recycle
Plastic containers	Plastic	Municipal Solid Waste

3.5.4.3.2 Process Flow Diagram. See Figure C-48 in Appendix C for Satellite Pharmacy PFD.

3.5.4.3.3 CROs, PPOs, Management Practices and Good Ideas Applicable to the Satellite Pharmacy.

Table 3.95 presents the CROs, PPOs,, Management Practices, and Good Ideas that apply to the Satellite Pharmacy including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.95
CROs, PPOs, Management Practices, and Good Ideas
Applicable to the Satellite Pharmacy

CRO/PPO/Management Practice/Good Idea	Section #
Return Excess Pharmaceuticals to Returns Contractor	4.2.2
Optimize Pharmaceutical Inventory Control	4.2.4
Work with Suppliers to Reduce Product Packaging	5.2.2.1
Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Turn off Lights and Equipment	5.2.4.2
Use Products Made from Materials Other than PVC	5.2.7

3.5.5 Radiology/Nuclear Medicine

3.5.5.1 Radiology

3.5.5.1.1 Process Description

Patients are referred to Radiology for diagnostic imaging of body components or systems. A typical radiographic procedure involves a technician accomplishing the paperwork and readying the appropriate radiographic unit while the patient changes into either a reusable or disposable gown. Depending upon the radiographic procedure, lead shielding is worn by the technician and/or placed on the patient to reduce their exposure from non-diagnostically significant ionizing radiation. After the unexposed film cartridge and the patient are appropriately positioned, the technician takes the radiograph. The exposed radiographic film cartridge is returned to the exposed film storage unit, the patient changes back into their personal clothing, placing the used gown into the appropriate receptacle; paper gowns are discarded as municipal solid waste and the reusable cloth gowns are collected and sent to a laundry. Radiology units at larger medical facilities may perform magnetic resonant imaging (MRI), computed tomography (CT) scans, and angiography studies. The wastes generated from these procedures are similar to general radiographic imaging with the addition of disposable plastic items (tubing, IVs, etc.) and their associated packaging, gowns, gloves, masks, patient drapes, etc. Sharps containers collect the syringes/needles.

There are two different methods of processing the exposed radiographic film, “wet” and digital. In the “wet” film processing method, the exposed film cartridge is placed into an automatic film processor, such as a Kodak M35A X-OMAT film processor. The film is processed through developer and fixer solutions, and a wash system. The developed film emerges from the processor ready for reading by a radiologist. Most “wet” process film developers have a silver recovery unit or units attached in line with the processor’s effluent to reduce the silver content to below acceptable discharge limits. Effluent below these levels can be discharged to the sanitary sewer system. The silver recovery cartridges are replaced periodically and usually turned in to the DRMO for precious metals recovery and recycling. Processors not connected to a silver unit must have their effluent collected and tested. Effluent that exceeds applicable discharge limits must be disposed as a hazardous waste. Film processors are emptied and cleaned on a periodic basis determined by the unit’s throughput. Used developer solution is typically disposed as hazardous waste while used fixer solution is typically disposed of in the sanitary sewer. Rubber gloves are used during the film developer cleaning process. (Note: Film developer cleaning and maintenance is often performed under contract.) Other waste streams include packaging materials and wastewater. Once the radiograph is read, it is filed and maintained for a specific time period. Patients may take their radiographic file when they transfer to another installation. There is an annual selective reduction of radiographic files. When the files are no longer needed for diagnostic, treatment or legal purposes, they are sent to a recycler for silver recovery. The film jackets, made from paper, are also typically recycled.

In the digital film development process, the exposed digital cassette is slid into a digital processor, such as a Fuji Film FCR AC-3C5, and an electronic file of the patient's x-ray is stored in the CHCS computer system. The electronic file can be read by the radiologist on a CRT screen or a hardcopy of the radiographic file can be printed on a laser imager, such as a 3M Dry View 8700, if necessary. The laser imager uses recyclable vinyl acetate sheets. The radiographic electronic files can be stored indefinitely or deleted after a specified time period when no longer needed for diagnostic, treatment or legal purposes. No hazardous chemicals are used in the digital film development process. Waste streams include packaging materials, waste vinyl acetate, and waste toner cartridges. **Table 3.96** summarize the input materials and waste streams related to the "Wet Process" Radiographic Film Development.

Table 3.96
Input Materials and Waste Streams for
"Wet Process" X-Ray Film Development

Input Material	Waste Stream	Disposal Method
Developer solution	Non-hazardous	Sanitary Sewer
Fixer solution	Non-hazardous	Sanitary Sewer
Packaging materials	Cardboard	Recycle
	Plastic	Municipal Solid Waste
Potable water	Wastewater	Sanitary Sewer
Processor cleaner	Non-hazardous	Sanitary Sewer
Radiographic film	Plastic	Recycle
Silver recovery unit	Silver recovery cartridges	Recycle

3.5.5.1.2 Process Flow Diagram. See Figure C-49 in Appendix C for the "Wet Process" Film Development PFD.

3.5.5.1.3 CROs, PPOs, Management Practices and Good Ideas Applicable to "Wet Process" X-Ray Film Development.

Table 3.97 presents the CROs, PPOs, Management Practices, and Good Ideas that apply to "Wet Process" X-Ray Film Development including a reference to the location of the section with the complete description of the CRO, PPO, Management Practice, or Good Idea.

Table 3.97
CROs, PPOs, Management Practices, and Good Ideas Applicable to "Wet Process" X-Ray Film Development

CRO/PPO/Management Practice/Good Idea	Section #
Optimize Development Process	5.2.10.1
Store Chemicals Properly	5.2.10.2
Test Expired Processing Chemicals	5.2.10.3
Extend Processing Bath Life	5.2.10.4
Use Squeegees to Remove Excess Liquid	5.2.10.5
Use Countercurrent Washing	5.2.10.6
Use Chromium-Free Cleaners	5.2.10.7
Recycle Lead Foil	5.2.10.8

Table 3.98 summarizes the input materials and waste streams related to Digital X-Ray Film Development.

Table 3.98
Input Materials and Waste Streams for Digital X-Ray Development

Input Material	Waste Stream	Disposal Method
Cloth Gowns	Infectious/ Non-hazardous	Recycle
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Toner Cartridge	Toner cartridge	Recycle
Vinyl Acetate Sheets	Plastic	Recycle

3.5.5.1.4 Process Flow Diagram. See Figure C-50 in Appendix C for Radiography, Digital X-Ray Film Development PFD.

3.5.5.1.5 CROs, PPOs, Management Practices and Good Ideas Applicable to Digital X-Ray Film Development

There are no CROs, PPOs, Management Practices, and Good Ideas that specifically apply to Digital X-Ray Development.

3.5.5.2 Nuclear Medicine

3.5.5.2.1 Process Description

Patients are referred to Nuclear Medicine for diagnostic imaging studies and treatment. All radioisotopes are licensed by the Air Force. At some installations the radioisotopes are supplied from local nuclear pharmaceutical companies in prescribed doses, while at other installations doses are drawn from small stocks of radioisotopes maintained by the unit. Patients may or may not don cloth/paper gowns depending on the procedure, and cloth linens may also be used. After the dose has been administered, used syringes and empty isotope vials/containers are either placed in a storage area for radioisotope decay or returned to the supplier in lead-lined containers. Following the previously defined disposition procedures, no radioactive waste is generated. Inhalation studies are done with a disposable plastic vent and an aerosol. Batteries are used in radiological monitoring equipment. Biohazard waste may be generated depending upon the procedure and isotope used. Radiographic images produced can be developed by the “wet” process or by using a digital processor (see the x-ray development process descriptions in section 3.5.5.1.1). No radioactive or mixed (radioactive and hazardous) wastes are typically generated. Sharps containers are used to dispose of non-radioactive syringes/needles. Other waste streams include: gloves, paper or cloth gowns, paper or cloth smocks, gauze, plastics and packaging materials. **Table 3.99** summarizes the input materials and waste streams related to Nuclear Medicine Patient Examination and Treatment.

Table 3.99
Input Materials and Waste Streams for Nuclear Medicine Patient Examination and Treatment

Input Material	Waste Stream	Disposal Method
Batteries	Hazardous	Hazardous Waste/Recycle
Cloth gowns/smocks/linens	Infectious/ Non-hazardous	Recycle (laundry)
Disinfectants/soaps	Wastewater	Sanitary Sewer
Latex gloves	Non-hazardous	Municipal Solid Waste
Packaging	Plastic	Municipal Solid Waste
Paper gowns & smocks	Paper	Municipal Solid Waste
Plastic syringes and needles	Infectious	Biohazard Waste
Plastic ultravent kit	Plastic	Municipal Solid Waste
Radioactive vials/containers	Radiological	Decay in storage/ return to supplier

3.5.5.2.2 Process Flow Diagram. See Figure C-51 in Appendix C for Nuclear Medicine Patient Examination and Treatment PFD

3.5.5.2.3 CROs, PPOs, Management Practices and Good Ideas Applicable to Nuclear Medicine Patient Examination and Treatment.

The one CRO, PPO, Management Practice, and Good Idea to employ by the Nuclear Medicine Patient Examination & Treatment is to recycle the batteries per paragraph 5.2.3.1.

4 MEDICAL ENVIRONMENTAL COST REDUCTION AND POLLUTION PREVENTION OPPORTUNITIES

4.0 Introduction

This section presents the medical environmental cost reduction opportunities (CROs) and pollution prevention opportunities (PPOs) that can be implemented at Air Force Medical Treatment Facilities. Medical personnel must be vigilant for potential CROs that can be implemented in their workcenter(s). These can be incorporated into the Medical Strategic Plan identifying resource needs along with the benefits and payback period for the CRO. These CRO's can also be merged with the installation's pollution prevention program and can contribute to the installation meeting its pollution prevention goals. The medical facility can achieve measurable cost reduction and pollution prevention success by:

- Recycling spent solvents.
- Returning expired pharmaceuticals to the manufacturer or through a pharmaceutical return contractor for credit instead of incurring disposal costs.
- Medical Equipment Sterilization.
- Participating in the Installation Program or Developing a Separate Medical Cardboard Recycling Program.
- Monitoring the weight/ volume of municipal solid waste generated and evaluating the size of and frequency of pick-up of the disposal containers (dumpsters).
- Sensored Water Faucet Use.
- Medical Waste Segregation and Disposal.
- Evaluating the practice of using disposable patient gowns, surgery sponges, and patient drapes, especially those in the medical waste stream, and comparing the cost with using similar degradable/ dissolvable items.

Economic analyses are included for the CROs and PPOs, when data were available. The 59th MDW, Lackland AFB has taken several measures to reduce their cost by reducing their waste generation, thus, contributing to the installation's pollution prevention efforts. The 59th MDW provided the bulk of the data used in performing the analyses for the CROs. In some instances, detailed economic analysis could not be preformed because sufficient data were not available. The spreadsheets used in the different analyses can be modified in the event additional information becomes available and/or another cost analysis is needed.

Relative cost savings and additional vendor information are provided when applicable.

Please note that the identification of specific products within this document does not constitute endorsement or approval of these products by the Air Force. The product names used are for discussion purposes only. Many manufacturers produce similar products. A product's merits and capabilities must be gauged in relation to the specific tasks addressed. The user is advised to contact PRO-ACT and/or medical suppliers for additional product information.

The CROs/ PPOs provided are recommendations to reduce reliance on specific disposal options, to improve the medical facilities cost reduction program and to aid the installation's overall pollution prevention program. The majority of the CROs and PPOs are applicable to numerous work areas throughout the medical facility. Group, squadron and work center personnel should review the alternatives within each CRO/ PPO to determine the most effective recommendations for their work center(s). To achieve the maximum benefit possible, the CROs/ PPOs should be implemented in all applicable work centers. The CROs/ PPOs described in this section are summarized in **Table 4.1**.

Table 4.1
Summary of CROs and PPOs

Cost Reduction and Pollution Prevention Area	Cost Reduction Opportunity and Pollution Prevention Opportunity	Section #
Medical Laboratory Hazardous Waste Reduction	Recycle Spent Solvents by Distillation	4.1
	Ethanol Distillation	4.1.2
	Xylene Distillation	4.1.3
	Formalin Options	4.1.4.2
Pharmaceutical Waste Reduction	Return Excess Pharmaceuticals to Returns Contractor Prior to Expiration Date	4.2.2
	Optimize Pharmaceutical Inventory Control	4.2.4
Medical Equipment Sterilization	Replace Ethylene Oxide Sterilizer	4.3
Municipal Solid Waste (MSW) Cost Reduction	Initiate Cardboard Recycling to Reduce MSW Cost	4.4
	Evaluate MSW Dumpster Cost	4.5
	Municipal Solid Waste Recycling	4.6
Utility Cost Reduction	Cost Reduction Associated with Faucets with Sensors	4.7
Medical Waste Reduction	Sterilize, Pulverize and Dispose as MSW	4.8
	Degradable Patient & Surgical Gowns & Items	4.9

Internet sites are provided for the user to obtain more information regarding many of the subjects. These lists are far from all-inclusive; a vast array of information is available on the Internet. For additional CRO/ P2 information beyond that provided in this document, the following Internet web sites are good starting points. These sites contain links to numerous other sites.

- Health Care Without Harm; http://www.sustain.org/hcwh
- Pro-Act; www.afcee.brooks.af.mil/proact

- Pollution Prevention Roundtable; www.p2.org
- The Sustainable Hospitals Library; http://www.uml/edu/centers/LCSP/ hospitals
- PA; http://www.epa.gov

4.1 Cost Reduction Opportunity 1: Recycle Spent Solvents in Medical Laboratory

4.1.1 Description

Ethanol, formalin, and xylene (one of the EPA Industrial Toxics, see Table 1-3) are used primarily in the medical facility laboratory. Once these chemicals have been used, they are put into a hazardous waste container to be disposed of as a hazardous waste. Water and body fluid/tissue are some of the contaminants of these solvents during their use. Distillation units are commercially available that purify spent solvents to between 90 and 98 % of the input solution making the reclaimed solution viable for reuse. The 59th MDW, Lackland AFB TX determined the cost per pound to be $.95 to dispose of the spent solvents using a hazardous waste contractor. Because of this cost, they converted from the one time use of the solvent to solvent recycling using the B/R Instruments 9700 Procycler™ Plus series solvent recycler. With B/R solvent recycling, the solvent is recycled four times before disposal. Using existing data for recycled and disposed quantities; the following information was used for this analysis.

Table 4-2
Quantity and Associated Cost of Ethanol and Xylene Solvent

Chemicals and Cost	Ethanol	Xylene
Quantity used without recycling (lbs.)	17975	18510
Cost	$19593	$17955
Quantity used with recycling (lbs.)	4005	4160
Cost	$3415	$3517
Quantity disposed as a HW without recycling (lbs.)	17975	18510
Cost	$17076	$17,585
Quantity disposed as a HW with recycling (lbs.)	3595	3702
Cost	$3415	$3517

- Cost of virgin xylene = $8.50/ gallon ($0.97/lb) and ethanol = $8.60/ gallon ($1.09/lb).
- Procycler Recycler cost = $10,184 includes installation and training cost.
- Annual maintenance contract cost per year = $1200.
- No occupational health costs using the use/ dispose method and no occupational health costs using the recycling method.
- The Environmental Compliance Sampling, Analysis and Monitoring (ECSAM) costs were assumed to be the same for waste characterization.

- Installation costs and utility costs were not available.

4.1.2 Ethanol Recycling Alternative

Instead of using the ethanol one time and then discarding, reusing the ethanol after recycling is economical and reduces pollution. The Cost Reduction Opportunity Economic Analysis for this option is presented in **Table 4 – 3**.

Table 4 – 3
Ethanol Cost Reduction Opportunity Economic Analysis

Row	Cost Item	Current Method	Alternative I	Alternative II
1	**Capital Cost**			
2	Procycler Ethanol Solvent Recycler		$ 10,184.00	
3	**Additional Requirements Cost**			
4	Permit, e.g., Air Permit ($)			
5	Equipment Installation ($)			
6	Equipment Removal ($)			
7	**Total Additional Requirements Cost ($)**	$ -	$ -	$ -
8	**Total Installed Costs($)**	$ -	$ 10,184.00	$ -
9	**Annual Cost**			
10	**Utility Cost**			
11	Electricity ($)			
12	Potable Water ($)			
13	Sewerage ($)			
14	Steam ($)			
15	Waste Generated			
16	Medical ($)			
17	Hazardous ($)	$ 17,076.00	$ 3,415.00	
18	Radiological ($)			
19	Municipal Solid ($)			
20	**Total Utility Cost ($)**	$ 17,076.00	$ 3,415.00	$ -
21	Work Center Training & Exam Cost ($)	$ -	$ -	$ -
22	Work Center Process Labor Costs ($)	$ -	$ -	$ -
23	**Total Work Center Labor Cost ($)**	$ -	$ -	$ -
24	ECSAM Cost ($)	$ -	$ -	$ -
25	Occupational Health Cost ($)	$ -	$ -	$ -
26	Cost of Materiel Used in Process ($)	$ 19,593.00	$ 4,365.00	
27	Annual Maintenance Contract Cost ($)		$ 1,200.00	
28	**Total Operating Cost ($)**	$ 19,593.00	$ 5,565.00	$ -
29	**Total Annual Cost ($)**	$ 36,669.00	$ 8,980.00	$ -
30	**Payback Period (years)**	N/A	0.368	0.000
31	**First Year Savings ($)**	N/A	$ 17,505.00	$ -
32	**Three Year Savings ($)**	N/A	$ 83,067.00	$ -

A negative payback period means that the alternative annual cost exceeds the status quo annual cost.
N/A = not applicable.
Double Click in Spreadsheet to Open

4.1.3 Xylene Recycling Alternative

Instead of using the xylene one time and then discarding, reusing the xylene after recycling is economical and reduces pollution. The Cost Reduction Opportunity Economic Analysis is presented in **Table 4 – 4**.

Table 4 – 4
Xylene Cost Reduction Opportunity Analysis

Row	Cost Item	Current Method	Alternative I	Alternative II
1	**Capital Cost**			
2	Procycler Xylene Solvent Recycler		$ 10,184.00	$ -
3	**Additional Requirements Cost**			
4	Permit, e.g., Air Permit ($)			
5	Equipment Installation ($)			
6	Equipment Removal ($)			
7	**Total Additional Requirements Cost ($)**	$ -	$ -	$ -
8	**Total Installed Costs($)**	$ -	$ 10,184.00	$ -
9	**Annual Cost**			
10	**Utility Cost**			
11	Electricity ($)			
12	Potable Water ($)			
13	Sewerage ($)			
14	Steam ($)			
15	Waste Generated			
16	Medical ($)			
17	Hazardous ($)	$ 17,585.00	$ 3,517.00	
18	Radiological ($)			
19	Municipal Solid ($)			
20	**Total Utility Cost ($)**	$ 17,585.00	$ 3,517.00	$ -
21	Work Center Training & Exam Cost ($)	$ -	$ -	$ -
22	Work Center Process Labor Costs ($)	$ -	$ -	$ -
23	**Total Work Center Labor Cost ($)**	$ -	$ -	$ -
24	ECSAM Cost ($)	$ -	$ -	$ -
25	Occupational Health Cost ($)	$ -	$ -	$ -
26	Cost of Materiel Used in Process ($)	$ 17,955.00	$ 4,035.00	
27	Annual Maintenance Contract Cost ($)		$ 1,200.00	
28	**Total Operating Cost ($)**	$ 17,955.00	$ 5,235.00	$ -
29	**Total Annual Cost ($)**	$ 35,540.00	$ 8,752.00	$ -
30	**Payback Period (years)**	N/A	0.380	0.000
31	**First Year Savings ($)**	N/A	$ 16,604.00	$ -
32	**Three Year Savings ($)**	N/A	$ 80,364.00	$ -

A negative payback period means that the alternative annual cost exceeds the status quo annual cost.
N/A = not applicable.
Double Click in Spreadsheet to Open

4.1.4 Discussion of Solvent Recycling Benefits

4.1.4.1. Ethanol and Xylene Solvent Recovery

By installing ethanol and xylene solvent recovery, the 59th MDW was able to achieve a three-year cost reduction savings of $83,067 for the ethanol recycling and a three year cost reduction savings of $80,364 for the xylene recycling. The quality of the recycled product met the laboratory standards for the procedures performed. Similar savings can be achieved at smaller medical facilities but the payback period may be longer and the amount of the saving less because of smaller quantities being recycled. By recycling, the amount of hazardous waste generated was reduced contributing to the installations hazardous waste reduction program.

4.1.4.2 Formalin Options

The Medical Laboratory work centers use various amounts of formalin, a 37% formaldehyde solution used as a tissue preservative. The amount of formalin waste generated depends upon the size of the medical laboratory and the number of procedures performed. The work centers prepare vials containing the formalin solution and issue the vials to other workcenters that need to collect the tissue specimens.

Formalin solution recycling was evaluated but the quality of the product produced did not meet required laboratory standards and it was determined it was not feasible for recycling at this time. However, an alternative to recycling would be look at and evaluate the feasibility of using some of the formaldehyde free fixatives that are available. Vendor information on formaldehyde free fixatives is also included in Appendix D-4. The following vendors offer formaldehyde free fixatives:

- Anatech Ltd; 1202 Harts lake Road; Battle Creek, MI 49015; 1-800-262-8324
- Shandon Lipshaw USA; 1-800-547-7429: http://www.shandon.com.

4.2 Cost Reduction Opportunity 2: Expired Pharmaceuticals

4.2.1 Description

Pharmaceuticals, especially controlled substances that require extensive Drug Enforcement Agency record keeping when destroyed, should be issued/ consumed and not allowed to remain on the shelf until the expiration date has been exceeded. Careful pharmaceutical inventory management throughout the medical facility can provide savings by avoiding the expense of disposal, especially if the pharmaceutical becomes a hazardous waste when it is declared a waste. If due to extenuating circumstances the pharmaceutical(s) can not be issued/ consumed prior to their expiration date, a pharmacy returns contractor that accepts expired pharmaceuticals and issues a credit for those pharmaceuticals should be used. Some manufacturers will directly accept expired pharmaceuticals, even Class II-V controlled substances, for a specific time period following expiration. This time period ranges from 30 days to 1 year. Medical logistics should establish contacts with the return contractor and return the short-dated or expired pharmaceuticals. One company is Easy Returns (Easy Returns, Teduke Court, St. Charles, MO 63301 Phone (314) 236-0044: www.easyreturns.com.). By using a return contractor, a monetary credit is given rather than having to pay for the pharmaceutical's disposal/ destruction. When evaluating this cost reduction opportunity, consider the cost avoidance of not having the weight of the expired pharmaceuticals included with the municipal solid waste or hazardous waste quantities. Add to that cost avoidance, the credit for the returned pharmaceuticals. In some instances the returns contractor will accept the expired pharmaceuticals after the manufacturers credit acceptance date, but will charge the medical facility to properly dispose of the pharmaceuticals.

4.2.2 Use a Returning Pharmaceuticals to the Manufacturer or a Returns Contractor

An analysis of the potential cost avoidance savings by using a pharmaceutical return contractor can be shown in the following example. The information over a one-year period was obtained from the 59th MDW:

- Weight of expired pharmaceuticals returned in one year: 59,800 lbs.
- Credit for returned pharmaceuticals: $17,777. The credit is either a cash refund or a credit in kind for a like item. All expired items were reported as having been returned and nothing disposed as municipal solid waste (MSW) or hazardous waste. A break out of the amounts of pharmaceuticals that could have been classified as a hazardous waste was not available. Table 4 – 5 was developed to demonstrate the total savings assuming various percentages of the amount of pharmaceuticals being classified as a hazardous waste and the remaining being classified as municipal solid waste.
- Cost for disposal of hazardous waste per pound: $.95 and cost for municipal solid waste per pound: approximately $.15.

Table 4 – 5
Savings Achieved by Using a Pharmacy Returns Contractor Instead of Disposing of the Pharmaceuticals as Either Municipal Solid Waste or Hazardous Waste

% Hazardous	Haz Waste Weight (lbs)	Costs of HM Disposal*	MSW Disposal Cost**	CA Savings***	Total Savings****
0	0	$ -	$ 8,970	$ 8,970	$ 26,747
5	2990	$ 2,841	$ 8,522	$ 11,362	$ 29,139
10	5980	$ 5,681	$ 8,073	$ 13,754	$ 31,531
15	8970	$ 8,522	$ 7,625	$ 16,146	$ 33,923
20	11960	$ 11,362	$ 7,176	$ 18,538	$ 36,315
25	14950	$ 14,203	$ 6,728	$ 20,930	$ 38,707
30	17940	$ 17,043	$ 6,279	$ 23,322	$ 41,099
35	20930	$ 19,884	$ 5,831	$ 25,714	$ 43,491
40	23920	$ 22,724	$ 5,382	$ 28,106	$ 45,883
45	26910	$ 25,565	$ 4,934	$ 30,498	$ 48,275
50	29900	$ 28,405	$ 4,485	$ 32,890	$ 50,667
55	32890	$ 31,246	$ 4,037	$ 35,282	$ 53,059
60	35880	$ 34,086	$ 3,588	$ 37,674	$ 55,451
65	38870	$ 36,927	$ 3,140	$ 40,066	$ 57,843
70	41860	$ 39,767	$ 2,691	$ 42,458	$ 60,235
75	44850	$ 42,608	$ 2,243	$ 44,850	$ 62,627
80	47840	$ 45,448	$ 1,794	$ 47,242	$ 65,019
85	50830	$ 48,289	$ 1,346	$ 49,634	$ 67,411
90	53820	$ 51,129	$ 897	$ 52,026	$ 69,803
95	56810	$ 53,970	$ 449	$ 54,418	$ 72,195
100	59800	$ 56,810	$ -	$ 56,810	$ 74,587

Basis is 59,800 lbs of returned pharmaceuticals not going to either the municipal solid waste or
hazardous waste streams.
*Used $.95 per pound as the cost.
** Used $.15 per pound as an average.
***Cost avoidance (CA) savings is the sum of the HW disposal and MSW disposal cost.
****Total Savings includes the CA savings and the credit received of $17777.
Double Click in Spreadsheet to Open

4.2.3 Discussion of Returning Expired Pharmaceuticals Benefits

Returning pharmaceuticals to either the original manufacturer or to a pharmaceutical returns company can produce varying cost reductions depending upon the amount of pharmaceuticals returned and the percentage of pharmaceuticals that are classified as hazardous waste. The greater the percentage classified as hazardous waste, the greater the savings. The cost avoidance of not disposing of the expired pharmaceuticals using a hazardous material disposal contractor is the critical factor in the analysis. Finally, by not disposing of pharmaceuticals as a waste, the installation's pollution prevention program benefits through the reduction in waste quantities.

4.2.4 Optimize Pharmaceutical Inventory Control

In addition to returning expired and short dated pharmaceuticals to a returns vendor on a frequent basis, other opportunities are available to reduce the cost and the quantity of returned/ disposed pharmaceuticals.

The existing inventory system, such as the PYXIS system, reportedly tracks the dispensed pharmaceuticals and restocks automatically depleted items based on predetermined stock level requirements. The list of disposed pharmaceuticals should be evaluated to determine if the stock level requirements should be adjusted to reduce the quantity of materials requiring return.

Pharmacy personnel should investigate the feasibility of maintaining a smaller supply of pharmaceuticals. Some medical groups use the prime vendor program thus, allowing them to maintain a small supply of pharmaceuticals on-hand. The vendor delivers the pharmaceuticals “just in time” with delivery times ranging from daily to weekly. This system has been shown to dramatically reduce the quantity of expired materials requiring subsequent return and/or destruction.

4.3 Cost Reduction Opportunity 3: Medical Equipment Sterilization

4.3.1 Description

After use contaminated medical equipment and supplies are taken to a Central Sterile Processing / Decontamination section sometimes referred to as Central Sterile Supply. Reusable medical and dental surgical instruments and equipment are washed in the decontamination area, rinsed, dried and rebuilt into sets or packs. They are then wrapped and placed into a steam, chemical, ethylene oxide (EtO) or plasma sterilizer. EtO sterilizers have been a very effective method for sterilizing delicate medical and dental surgical instruments. EtO, a suspected human carcinogen requiring occupational health compliance measures, can have stringent environmental protection requirements associated with it's use. The carrier gas used in the ethylene oxide sterilizer process was initially Freon 12, a chlorofluorocarbon (CFC) that is highly regulated and heavily taxed adding to the cost of the sterilant. Production of Freon 12 was halted in 1995 in the United States making Freon 12 a diminishing resource. Other carrier gases have been used in place of the Freon 12 but some of them are hydrochloroflurocarbons (HCFCs) that are also to be phased out of production in the future. When using the EtO sterilizer, personnel had medical monitoring requirements, personal protective requirements, occupational health training requirements and industrial hygiene monitoring requirements. Because of increasing cost and regulatory requirements, it was determined that the EtO sterilizers needed to be replaced. The 59th MDW, Lackland AFB replaced their EtO sterilizers with a plasma sterilizer that uses hydrogen peroxide as the sterilant. The following is the cost reduction opportunity associated with that replacement.

4.3.2 Alternatives

4.3.2.1 Status Quo: Continue Using EtO Sterilizer: Not Acceptable Due to Cost Increases and Regulatory Requirements

Basic information on the information on hand in Central Sterile Supply, in the Bioenvironmental Engineering Flight, Medical Logistics and the Environmental, Safety, & Occupational Health Technical Product Integrated Process Team (ESOH TPIPT) records, the following data were used in the cost reduction analysis for the replacement. The following information is not all-inclusive, meaning that there may be additional cost factors not captured in this analysis.

- Personnel working with EtO: two officers and eight enlisted assigned in the last year the EtO was in operation – 1997.
- Two Survive Air™ self-contained breathing apparatus (SCBA) units were on hand for use during EtO cylinder change-out – Costs for each was approximately $1600. No information was available on the cost of refilling the breathing air used in the SCBA air cylinders.
- A Bioenvironmental Engineering Apprentice accomplished air monitoring of personnel

working in the EtO area for a two day period in the summer of 1997: five samples collected, two for the time weighted average (TWA) and three for the short term exposure limit (STEL). Cost per sample for analysis: $75/ sample.

- Texas Air Control Board standards required the capture of EtO if the total emissions were 1.4 lbs./ cycle with no more than 2000 pounds of EtO/ year emitted. The total operations at the 59th MDW were greater than these requirements thus; air emission controls were in place to meet the environmental requirements.
- Cost of supplies per load for the EtO sterilizers: $208
- Loads per year: 624 in the EtO 26 cubic ft chamber
- Other costs associated with EtO process; self scan indicators, leak tests, emission control systems and abator pellet bed, aerator repairs, unit and associated parts repairs: $48,669

4.3.2.2 Alternative One: Replace the EtO Sterilizer with a Hydrogen Peroxide Plasma Sterilizer

The 59th MDW purchased three Sterrod 1000 Plasma Sterilizers at a cost of $108,000 each to replace the EtO sterilizers. The following information was gathered from available sources but is not all-inclusive:

- Average annual maintenance costs/ sterilizer: $1000
- No occupational health cost associated with this process.
- Initial worker training included as part of the contract and accomplished by the manufacturer.
- Cost of supplies per load: $19
- Number of loads per year: 4056 in the plasma sterilizer’s 4 cubic foot chamber.
- No environmental protection requirements associated with this process.

4.3.2.3 Cost Reduction Opportunity Analysis of the Conversion from EtO to Plasma Sterilization

The savings achieved by reducing the cost associated with medical instruments and equipment sterilization is presented in **Table 4-6.**

Table 4-6
Cost Reduction Opportunity Analysis of the Conversion from EtO to Plasma Sterilizers

Row	Cost Item	Current Method	Alternative I	Alternative II
1	**Capital Cost**			
2	Replacement for ETO Sterilizer		$ 324,000.00	
3	**Additional Requirements Cost**			
4	Permit, e.g., Air Permit ($)			
5	Initial PPE Required ($)	$ 3,200.00		
6	Equipment Installation ($)			
7	Equipment Removal ($)	Not Available		
8	**Total Additional Requirements Cost ($)**	$ 3,200.00	$ -	$ -
9	**Total Installed Costs($)**	$ 3,200.00	$ 324,000.00	$ -
10	**Annual Cost**			
11	**Utility Cost**			
12	Electricity ($)			
13	Potable Water ($)			
14	Sewerage ($)			
15	Steam ($)			
16	Waste Generated			
17	Medical ($)			
18	Hazardous ($)			
19	Radiological ($)			
20	Municipal Solid ($)			
21	**Total Utility Cost ($)**	$ -	$ -	$ -
22	Work Center Training & Exam Cost ($)	$ 821.00	$ -	$ -
23	Work Center Labor & PPE Costs ($)	$ 250.00	$ -	$ -
24	**Total Work Center Labor Cost ($)**	$ 1,071.00	$ -	$ -
25	ECSAM Cost ($)	$ -	$ -	$ -
26	Occupational Health Cost ($)	$ 1,188.60	$ -	$ -
27	Cost of Materiel Used in Process ($)	$ 129,792.00	$ 77,064.00	
28	Annual Maintenance & Other Cost ($)	$ 48,669.00	$ 3,000.00	
29	**Total Operating Cost ($)**	$ 179,649.60	$ 80,064.00	$ -
30	**Total Annual Cost ($)**	$ 180,720.60	$ 80,064.00	$ -
31	**Payback Period (years)**	N/A	3.218864933	$ -
32	**First Year Savings ($)**	N/A	$ (223,343.40)	$ -
33	**Three Year Savings ($)**	N/A	$ 301,969.80	$ -

A negative payback period means that the alternative annual cost exceeds the status quo annual cost.
N/A = not applicable.
Double Click in Spreadsheet to Open

4.3.2.4 Discussion of the Results of the CRO for the EtO Sterilizer Replacement.

Table 4-7 depicts that after the first year, a deficit resulted which meant that there were no savings. However, over the three-year period, the savings accrue to approximately $302,000. Not all cost figures, such at the removal cost for the EtO sterilizers, were available to perform a total cost analysis. No cost increases for the EtO were factored into the analysis. Assuming the price remains constant may not be realistic. Use of the entire Cost Reduction Opportunity Excel® based workbook captured the medical and training related cost associated with EtO sterilization. This cost would not have been captured by just addressing the capital cost of equipment and supplies.

There are some delicate medical instruments that can not be sterilized using the hydrogen peroxide method. Sterilization of these instruments is outsourced to another military facility that uses EtO to sterilize them. Currently no cost accrues for this EtO sterilization service. Besides the achieved monetary savings, the environment benefits by not releasing the EtO gas and its carrier gas. The workers receive an occupational health benefit because they are no longer exposed to a suspected carcinogen. This produces non-quantifiable savings through the prevention of a potential occupationally related illness.

4.4 Cost Reduction Opportunity 4. Cardboard Recycling

4.4.1 Description

Medical facilities frequently incur municipal solid waste disposal costs calculated upon a per tip basis, i.e., each time the dumpster is emptied, and not on the pounds of municipal solid waste (MSW) or the dumpster fullness. An evaluation of the municipal solid waste cost methodology along with an analysis of the quantity and type of MSW discarded could lead to medical cost savings. Participation in the installation paper/ cardboard/ aluminum recycling program(s) can have a positive impact on the medical MSW disposal cost. If the installation has a limited or no recycling program, the medical facility commander should work with installation personnel to establish a limited recycling program for cardboard, office paper and/ or aluminum. Having a recycling program can reduce the frequency of MSW dumpster pick-ups, thus producing savings to the medical facility. During the evaluation, public health sanitation requirements must be considered in determining the frequency of dumpster collection.

A market analysis of the municipal solid waste costs in the San Antonio Texas area showed the following cost per month for a front load, 8 cubic yard dumpster with a once per week pickup for a year ranged from $70 to $95 per month. This yields a range of per cubic yard cost of $2.20 to $2.97. The same analysis of the cardboard disposal costs in San Antonio produced a cost of approximately $40 per month per 8 cubic yard dumpster per month, which yields a $1.25 per cubic yard, cost. Thus, for every MSW cardboard containing 8 cubic yard dumpster load that is diverted to a cardboard recycling dumpster, the cost avoidance ranges from $7.60 to $13.76.

4.4.2 Alternatives

4.4.2.1 Status Quo: Continue the Per Tip MSW Cost Program

The existing charge rate remains in effect and as the MSW cost increase, this “must pay bill” continues to be paid consuming resources that could be used for other medical programs. Medical personnel will continue creating and disposing of their solid waste as “always”. This could impact their ability to minimize their waste generation during contingency deployments because they were not accustomed to utilizing good solid MSW management practices during non-contingency operations.

4.4.2.2 Alternative One: Initiate Recycling of Cardboard

Observe of the volume of cardboard waste placed into each dumpster. Determine the quantity and form, i.e., crushed, broken down, or as originally received, of cardboard waste. Perform a market analysis of the cardboard recyclers in the area and determine the per dumpster or per pound costs for MSW and cardboard waste.

The following is a cardboard recycling cost reduction benefits example. Assume one dumpster load of waste per week can be diverted from the MSW stream to the Recycled Cardboard waste stream. This is not an unrealistic assumption if the cardboard is not currently being flattened prior to being loaded into the MSW dumpster. Using the market analysis in the San Antonio TX area, the following is the yearly cost avoidance for one front load, eight cubic yard dumpster with a one time per week pickup:

- MSW collection range of cost: $70 to $95 per month. This yields a range of per cubic yard cost of $2.20 to $2.97 month.
- Cardboard collection cost of approximately $40 per month. This yields a $1.25 per cubic yard cost per month.
- Difference: $.95 to $1.72 per cubic yard per month. See **Table 4 – 7**.

Table 4 - 7
Cardboard Recycling Cost Reduction Savings

Waste Type	Cost/ Cu Yd	Cu Yds/ Month	Cost/ month	Monthly Savings	Cost / Yr	Yearly Savings
Cardboard Recycle	$ 1.25	32	$ 40	N/A	$ 480.00	N/A
MSW 1	$ 2.20	32	$ 70	$ 30	$ 845	$ 365
MSW 2	$ 2.97	32	$ 95	$ 55	$ 1,140	$ 660

Double Click in Spreadsheet to Open

4.4.2.3 Discussion of the Alternative of Cardboard Recycling

Table 4 – 7 provides a visual yearly savings per dumpster. The yearly savings can range from $365 to $660. These figures are examples of the cost reduction that can occur by diverting cardboard from the MSW to the recycling waste stream. In the analysis, no consideration was given to the cardboard being flat or remaining in it original shape. Even though there is a cost associated with the disposal of the cardboard, the cost is less than if disposed as MSW. The recycling also produces pollution prevention benefits by diverting material bound for a landfill or other disposal method back into the recovered material category. If the cardboard was flattened prior to being put into the recycled cardboard dumpster, the potential exists for the greater savings. This occurs from a reduction in the frequency of dumpster tips or by a reduction in the size of the dumpster. Both of these reductions change the price basis per cubic yard to a lower value.

4.4.2.4 Additional Recycling Benefits

The previous cardboard recycling analysis exemplifies similar cost avoidance/ reduction savings that accrue by recycling white paper, glassware and/ or aluminum. Participation in the installation's recycling program diverts recoverable materials from the MSW stream. It provides the medical facility with cost avoidance savings that can add up over the period of a year or years.

Encouraging personnel to seek out methods of diverting items from the MSW stream will produce cost avoidance savings and could produce additional savings from reductions in purchasing replacement supplies or equipment.

4.5 Cost Reduction Opportunity Five: Evaluate Municipal Solid Waste (MSW) Dumpster Cost

Medical facilities frequently incur MSW disposal costs that are calculated on a dumpster tip basis and not on a per pound of waste basis. With this method of pricing, medical facilities can be paying for unnecessary waste. Evaluating the MSW costing methodology, quantifying the amount of MSW discarded and determining the weight to volume ratio of discarded waste can lead to definable cost reductions/ cost avoidance savings. These savings can come from a reduction in the frequency of dumpster pick-ups or in the size of the dumpsters.

4.5.1 Description

Medical facility personnel should monitor the volume of waste in the dumpster at the time of pickup. Observe if the dumpster contained empty boxes, bulky materials, recyclable materials or was just partially full of routine MSW. Each dumpster that is basically not full, i.e., filled “to the top”, with dense MSW is a dumpster that contains a load that is not achieving it’s maximum economic benefit to the medical facility. Identifying those dumpsters that are not maximizing medical resources and then modifying the dumpster size or collection frequency will contribute to the medical facility’s cost reduction program. During the evaluation, public health sanitation requirements must be considered and met in determining the frequency of dumpster collection.

4.5.2 Status Quo: Continue the per Tip MSW Cost Program

The existing charge rate remains in effect and as MSW disposal cost increase, this “must pay bill” will continue to be paid consuming resources that could be used for other medical programs. Medical personnel will continue creating and disposing of their solid waste as “always”. This could impact their ability to minimize their waste generation during contingency deployments because they had not practiced good solid MSW management practices during non-contingency operations.

4.5.3 MSW Volume Reduction Alternative

4.5.3.1 Determine the Weight to Volume Ratio

Review the loading patterns for each of the medical facilities MSW dumpsters and determine if each is being used effectively. Measure or estimate the weight and volume of the waste being placed into each dumpster to determine a weight to volume ratio. Actual initial and periodic weight checks for weighing the MSW as it is collected is preferable because baseline data can be established for each workcenter, section, department, or other breakout of medical facility area. The higher the weight to volume ratio for each dumpster, the more the dumpster is being optimally utilized, i.e., very little unfilled dumpster volume. A low weight to volume ratio indicates that there may be “dead air” space in the dumpster from such as empty, uncrushed boxes and that the volume of the dumpster is not being effectively utilized. Reducing the volume of the disposed items allows more MSW to be placed into the dumpster.

4.5.3.2 Cost Analysis of Increasing the Weight to Volume Ratio

The following is a cost reduction benefit analysis example. Assume that after observing the MSW disposed into the facilities dumpsters, a decision is made that the volume of waste can be reduced by breaking down boxes, and other bulky material, and/ or by recycling waste paper, cardboard, glass, and aluminum. The volume reduction amounts to one load of MSW per week and the frequency of dumpster collection is one dumpster load per week. This is not an unrealistic assumption and could be low for larger medical facilities. Using the market analysis in the San Antonio TX area, the following is the cost per month for a year for one front load, eight cubic yard dumpster with a one time per week pickup. A MSW collection cost ranges from $70 to $95 per month. This yields a range of per cubic yard cost of $2.20 to $2.97 month. Thus, if one dumpster pickup per week can be eliminated the savings per month range from $70 to $95. This translates into a yearly cost reduction of $840 to $1140. For each dumpster pickup that can be eliminated the cost reduction increases. This analysis was based upon an eight cubic foot dumpster. Smaller dumpsters have a tip fee schedule that is less than the range of $70 to $95 for the eight cubic foot dumpsters. Thus, if the size of the dumpsters and the number of pickups can be reduced, the cost reduction benefits can be several thousand dollars per year depending on the current MSW disposal fee schedule.

4.5.3.3 Discussion of the Alternative of MSW Volume Reduction

Any reduction in the volume of MSW can produce both cost reduction and pollution prevention benefits. The greater the weight to volume ratio of MSW per dumpster, the greater the benefit to the medical facility. If smaller size dumpsters can be used and/ or a reduction in pickup frequency can be arranged without creating a public health problem, the greater the MSW cost reduction. Pollution prevention benefits come from any diversion of bulky, recyclable materials from the MSW to the recycle/recoverable waste stream. See the cardboard recycling cost reduction opportunity for additional information on MSW reduction. Finally, by developing a MSW volume reduction program, individuals will be gaining experience in waste management reduction practices that will be critical during contingency deployments.

4.6 Increase Municipal Solid Waste Recycling

Medical facility waste is sometimes thought of as being mainly comprised of infectious waste requiring special treatment. Recent studies have demonstrated that this is not the case[1]. The bulk of the waste (approximately 75-80 %) generated by a medical treatment facility is similar to that of a hotel, restaurant, or retail store. This waste is noninfectious and non-hazardous and does not require any special treatment. Recycling, reduction or elimination of this waste can result in significant cost reductions.

Recycling waste white paper, other mixed paper, plastic containers, glass, and aluminum cans can reduce the amount of recoverable materials going into the municipal solid waste containers. Education is key to having an effective recovered material program. Continuing efforts should be made to remind medical facility personnel of all the recoverable items that can be recycled. By working with personnel from the installation recycling office, the medical facility will be able to use their experience to expand the medical facility's recycling efforts. As the waste gets diverted from the MSW stream, cost reductions are available because recycling collection cost are offset by the open market value of the recovered material. Thus, the medical facility should make every effort to encourage recycling as a cost reduction measure. Finally, increased recycling efforts may allow the medical facility to reduce the frequency of dumpster tips that could reduce the cost of municipal solid waste disposal.

[1] Source: Fenwick, R.C., American Hospital Association Conference on Hospitals and the Environment, May 1991

4.7 Cost Reduction Opportunity Six: Install Water-Saving Devices on Faucets and Toilets: Water Savings Associated with Faucets with Sensors

4.7.1 Description

Several initiatives can be taken to reduce the quantity of water used at the medical facility. Water conservation efforts can generate installation cost savings by:

- reducing the volume of water used and it's purchase cost,
- reducing wastewater treatment cost, and
- reducing the energy required to heat water.

Water-saving diaphragms, toilet dams, or low-flow model toilets could be installed to reduce water usage. Leaky faucets should be repaired as soon as possible. Low flow aerators should be installed on faucets and showerheads. These items are commonly available through the Standard Base Supply System or through local purchase. Additional information regarding water conservation can be obtained from the U.S. EPA's Water Alliances for Voluntary Efficiency (WAVE) web site at http://www.epa.gov/rgytgrnj/specinit/p2/volprog/wave/htm.

Almost all water faucets in a medical facility rely on the individual user to turn on and off a faucet. The faucet has a standard knob or lever type handle. Faucets in high use areas such as rest rooms, kitchens, laboratories, and surgery suites/ operating rooms, allow the user to regulate the amount of water used. The hot and cold faucets may have separate handles on the faucet instead of a mixing faucet, thus requiring the user to turn two handles to regulate water flow. Personnel needing to wash and sanitize their hands for infection control purposes find lever type handles available. This minimizes the potential for cross-contamination of the hands from the faucet handle.

With the use of handles to regulate the flow, the potential is always present for the individual user to fail to completely shut off the water before leaving the area. Thus, various quantities of water can continue to flow for an unspecified period of time until the next user eventually turns off the water. This can lead to undeterminable amounts of water being wasted. If the hot water is not turned off, besides water wastage, energy wastage occurs in the form of the type of energy, i.e. natural gas, fuel oil, and electricity, used.

Air Force Medical Facilities that do not have water meters are normally charged a set amount per month. For example, the amount can be a percentage of the overall use of water by the entire installation. A variation in charges could be a set fee for water use in the "winter" and another for the "summer". Thus, the cost remains the same for X number of months and then changes to another set cost for the remainder of the year (12 – X months). With this cost model, water conservation and its associated cost reduction efforts can not be determined. Thus, there is no economic advantage to pursue water conservation measures because no tangible benefits are realized and the actual conservation efforts cannot be documented.

4.7.2 Alternatives

4.7.2.1 Status Quo: Keep the Existing Faucet Handles

Using the existing handles on the faucets requires no capital or installation cost. The amount of water wasted and any energy used to heat the wasted water is not easily quantifiable. If the faucets were always shut off, there would be no wastage and no unnecessary cost. For those areas were cross-contamination is a risk potential, the use of the lever handles minimizes the cross-contamination potential but still affords the opportunity for incomplete shut-off of water. With lever handled faucets, a slight risk still exists for cross-contamination to occur thus, increasing the risk of a nosocomial infection occurring.

4.7.2.2 Alternative One: Water Faucets with Sensors

Several companies make automatic, hands-free style faucets that detect the presence of a user's hands and arms. The faucets automatically turn on and off and provide a set stream of water at a preset temperature. This allows the user to be solely concerned with washing/ sanitizing their hands. The user is not required to touch the faucet to turn it on/ off. This eliminates a potential source of cross-contamination/ recontamination from contact with a potentially contaminated faucet handle. The faucet automatically shuts off limiting the amount of water that is used. Automatic shutoff faucets comply with the American Disabilities Act compliant.

Automatic faucets can be either electrically powered or powered through the use of batteries that need to be replaced about every year or every other year. The design of and the finish on the fixture affect the cost. The replacement of the old faucet with the new faucet adds to the initial cost of this alternative. Some of the faucets have a temporary shut-off design so the wash basin can be cleaned without the faucet being activated. Some manufacturers specifically make surgical bend style sensor type faucets. The wash basin and surgical bend faucets have a price range from $305 to $514 for one unit in the commercial market place. Government prices (GSA) are less depending upon the style, purpose and associated accessories desired.

4.7.2.3 Alternative One Cost Reduction Analysis

Known water use data were not available to make a thorough cost reduction analysis. In doing this analysis, we used a market analysis determined from the San Antonio Water System. The rate used was $.004313 per gallon of water used (April 2000 rates). The following information and assumptions were used to perform this cost reduction analysis:

- Average cost of a sensored faucet: $400.
- Cost of replacing the existing faucet with the new sensored faucet: $100. We used the models that were connected to the medical facilities electrical power distribution system.

Battery powered models were not used in this analysis because of the long-term cost associated with the labor required to replace the batteries.

- One manufacturer[2] stated that with one handwashing, the conventional faucet uses an average of 2.2 gallons for the one-minute required to wash the hands. With their electronic faucet, only 1.1 gallons of water are used in the same time period because the hands are not under the water and thus, the faucet is not on as the hands are being lathered and scrubbed. This yields a 1.1 gallons per minute savings. (~ = approximately)

- Cost Analysis:

  - Water reduction/ faucet: 1.1 gallons * $0.004313/ gallon = <u>$0.0047443</u>.

  - Number of uses to capture the initial cost and the installation cost: $500/ $0.0047443 = ~ <u>105,390</u>.

  - Assume cost amortized over a three-year period. The number of uses per year are ~ <u>35,130</u> (105,390/ 3).

  - Assume the faucet is used 365 per year, the per day use = 17565/ 365 = ~ <u>96 times</u> or only about four times per hour. For high traffic public areas such as a public restroom, this can easily be achieved on an average basis.

  - This also produces water savings of 115,929 gallons (1.1 gallons/ use * 105,390 uses) over the three years it takes to capture the initial cost of the faucet.

4.7.2.4 Discussion of Cost Reduction Analysis for Alternative One

The cost reduction opportunities associated with the replacement of traditional faucets with sensored faucets can produce savings of $166.67 per faucet per year for this example and using the three-year payback period. It also produces a reduction of 115,929 gallons of potable water. Finally, it also produces a savings of 115,929 gallons of wastewater not having to be treated because basically all the water from the faucet goes into the sanitary sewer and then to the wastewater treatment plant. This analysis was based upon a reduction quoted in a manufacturer’s literature for hand washing. It did not take into account any water wastage because the faucet was not completely turned off. Finally, no calculation of the cost reduction in energy used for the water wasted from the hot water system. If more than one faucet is replaced, then the cost reduction savings will increase approximately by the number faucets replaced.

The cost reduction analysis above addressed the potential financial savings and pollution reduction afforded by one faucet conversion. If the replaced faucet was in an area where sanitized conditions need to be maintained by health care providers, then an additional benefit can be achieved

[2] KWC Faucet, Inc., 1555 Oakbrook Drive #110, Norcross Georgia 30093 in their KWC Tronic Faucet booklet, page 3.

through minimizing the sources of cross-contamination from faucet handles after the provider washes their hands. This benefit is not quantifiable but can be incorporated into the medical facility risk management program.

If water use in the facility is not metered, there is not a way to document the water savings from the sensored faucets. The medical facility will continue to pay "its fair share" of the water and wastewater bill and no economic benefit will accrue to the medical budget. Thus, the medical facility will only have a documented capital expenditure and this cost reduction opportunity is not economically viable.

The following are some of the vendors who can provide information, specifications and prices for sensored faucets and other water saving devices:

- Chicago Faucet Company. They produce the Eagle Eye Series of faucets that use an infrared detection system with prices ranging from $360 to $500 apiece. They can be reached at The Chicago Faucet Company, 2100 Clearwater Drive, Des Plaines, IL 60018-5999; (847) 803-5000 or www.chicagofaucets.com.

- Delta Faucet Company. They produce a series of sensored faucets ranging in price from $355 to $400. They can be reached at Delta Faucet Company, 55 East 11th Street, Indianapolis IN 46280; 1-800-345-3358; www.deltafaucet.com.

- KWC Faucets Inc. They produce a series of infrared faucets that use a 6-volt lithium battery and range in price from $590 to $730. They can be reached at KWC Faucets Inc., 1555 Oakbrook Drive, #110, Norcross GA 30093; (770) 248-1600; www.kwcfaucets.com.

- Geberit Manufacturing Inc. They can be reached at: Geberit Manufacturing Inc., 1100 Boone Drive, Michigan City IN 46360; 1-800-225-7217.

- Sloan Valve Company. They offer a wide range of faucets, accessories and other sensored plumbing appliances. The range in prices of their faucets is from $360 to $515. They can be reached at Sloan Valve Company, 10500 Seymour Avenue, Franklin Park IL 60131; 1-800-982-5839; www.sloanvalve.com.

4.8 Cost Reduction Opportunity Seven: Medical Waste Segregation.

4.8.1 Description

Medical waste (MW) is a classification of MSW that is normally regulated by state statutes. Each state has its own definition as to what is included in this category. Typically MW may include, but is not limited to:

- Discarded cultures and stocks of infectious agents and associated microbiologicals.
- Pathological wastes consisting of tissues, organs, and body parts derived from medical procedures such as obstetrics, surgery, and minor acute care.
- Disposable materials from patients in selected types of isolation with highly communicable diseases such as those listed in Classification 4 by the Centers for Disease Control in Classification of Etiologic Agents on the Basis of Hazard, September 1976.
- Used and unused discarded sharps, including hypodermic needles, syringes, pipettes, scalpel blades, blood vials, needles with attached tubing, and broken or unbroken glassware in contact with infectious agents, including slides and cover slips.
- Bulk human blood and blood products.
- Other "regulated waste" as defined in Title 29 CFR 1910.1030(b) and as amended through December 6, 1995.
- Animal waste such as discarded material originating from animals intentionally exposed to pathogens or inoculated with infectious agents during research.

For the definition of what is classified as a medical waste at a specific medical facility, the state's department of health or department of environmental protection regulations should be checked.

A market survey of the San Antonio TX area revealed that the range of costs to dispose of a pound of MSW was $.11 /pound to $.20 /pound. A cost of $.15 / pound was used for this analysis. A cost for MW disposal was quoted at $.32 / pound by a representative of American 3CI on April 27, 2000. Some smaller medical waste disposal companies charge per box regardless of its weight. This charge ranged from $15 to $25 per box collected. This per box cost is mainly marketed toward the small operations such as an individual doctor's office. A box with appropriate markings is left with the health care provider and then when the provider calls, the company collects the box and leaves another. Sharps containers best fit this style of waste disposal.

4.8.2 Medical Waste Treatment and Disposal Alternatives

Currently medical waste, with the exception of pathological waste, is either disposed by contractor or by various treatment technologies. The following are currently used treatment methodologies:

- Autoclaving using steam or microwave sterilization (all microorganisms are destroyed).
- Chlorine disinfection (some, but not all, of the microorganisms are destroyed)/ maceration.
- Chemical disinfection.
- Moist heat disinfection.
- Thermal inactivation.
- Incineration.

One of the preferred method of medical waste treatment is by sterilization using an industrial size autoclave, such as a San-I-Pak sterilizer, with the waste then being pulverized/ macerated to make it indistinguishable and finally disposed as MSW. This method works well for most items except for sharps. For sharps, the grinder attachment does not adequately transfer the sharps to the waste container. Waste is sometimes left behind in the grinder and on the floor posing a potential health risk to personnel.

A research report on alternative methods of medical waste treatment prepared by the Midwest Research Institute is included as Appendix D. It should be noted that at the time the report was prepared, incineration was the primary method of destruction for pathological waste. Since then, additional hazards associated with incinerating medical waste have been identified, air emission regulations have become more stringent, existing technologies have been improved and readily accepted, and new technologies developed. The report is provided for background reading purposes. Additional vendor information for medical waste treatment alternatives discussed below can be found in Appendix D; vendor information for sharps treatment can also be found in Appendix D.

4.8.2.1 Sterilize, Pulverize and Dispose as Municipal Solid Waste

Most states do not define the specific requirements for medical waste disposal. They allow incineration, decontamination/ sterilization followed by packaging to prevent a health hazard and disposal in an authorized landfill. However, not all landfills accept sterilized MW and pathological waste. Various vendors provide alternative treatment technologies that reportedly can effectively treat the medical waste to make it disposable as MSW, provided the landfill accepts the waste. One technology is using a medical waste sterilizer with grinder attachment and then disposing of the waste as MSW. The following describes one medical facilities experience with this technology.

The 59th MDW, Lackland AFB TX determined that through the use of the San-I-Pak™ Inc. medical waste sterilization unit with grinder attachment, they were able to render their sterilized medical waste unrecognizable and acceptable for disposing as MSW. Comparing the cost of $.35 per pound for MW disposal by a contractor and the cost of approximately $.15 per pound (average cost) for MSW, the cost differential of $.20 per pound contributed to their cost reduction efforts for every pound of MW sanitized in the San-I-Pak™ Inc. units. Not only were they able to convert their MW to MSW, they also created a high weight to volume MSW ratio because the San-I-Pak™ process pulverized the material. The 59th MDW did not have data on the quantity of medical waste collected and processed daily or weekly. Without the quantity, a current cost analysis of the entire process could not be performed. At some point in time, an analysis was performed and the determination made that it was cost effective to make the conversion. The 59th MDW was also achieving a pollution prevention benefit from this process because they were reducing the volume of MSW generated.

In a discussion with personnel from Brooke Army Medical Center, Fort Sam Houston TX, they stated that they have developed a system of weighing the medical waste being generated by various workcenters and have established a baseline for each. When the quantity of medical waste generated by an individual workcenter exceeds the baseline by a predetermined amount, an investigation into the cause of the increase is initiated. By monitoring the amount of MW generated, corrective actions to determine the cause are initiated to bring any unnecessary cost back into line with projected cost. One of the major causes of increases in MW generation by a workcenter is that personnel begin to get lax on their waste segregation practices and routine MSW begins to be disposed as MW. Thus, cost containment measures are instituted immediately in the workcenter instead of waiting until someone notices the total MW disposal cost has risen and no one can identify the cause or workcenter causing the increase. This technique has become institutionalized and has focused medical personnel's attention on the need to regulate what they dispose of as medical waste.

4.8.2.2 Additional Information on the Medical Waste Sterilization, Pulverization and Disposal as Municipal Solid Waste (MSW)

Various vendors provide alternative treatment technologies that can effectively treat medical and pathological wastes making it disposable as MSW, provided the landfill will accept the waste. The following is a brief summary and vendor contract information for some of these technologies. Additional vendor information is included in Appendix D. Additional technologies such as ozone treatment, are being developed and/or evaluated at this time.

- **Sanitec Microwave Disinfection Systems** – These systems render infectious medical waste, including sharps, safe for disposal as municipal solid waste by combining advanced shredding technology with conventional microwaves. Several models are available to treat various quantities. Sanitec claims that waste treatment costs using their system average $0.05 - $0.11 per pound depending upon usage. Sanitec can be reached at 26 Fairfield Place; West Caldwell, NJ 07006; (973) 227-8855 or www.sanitec-inc.com.
- **San-I-Pak Steam Sterilization Systems –** These systems render infectious medical waste, including sharps, safe for disposal as municipal solid waste by steam sterilization. They offer pulverizers, shredders, etc. that can be attached to their sanitizing units to render treated pathological waste unrecognizable. San-I-Pak, Inc. can work with landfill

operators to educate them on the San-I-Pak process and to achieve compliance prior to installation of their pathological waste handling equipment. The exact cost depends upon several variables including capacity, volume of waste generated, motor size (horsepower), etc. A detailed waste analysis is required to determine the exact specifications for their units. The vendor claims that waste treatment costs using their system can average as low as $0.05 per pound. San-I-Pak can be reached at P.O. Box 1183, Tracy, CA 95378-1183; (209) 836-2310; or www.Sanipak.com for additional information.

- **Sintion Microwave Disinfection and Sterilization Devices** – This technology uses a combination of microwave and steam to treat infectious medical waste, including sharps, needles, and liquids. The system can treat up to 1,200 pounds per day. Shredding is optional after treatment. Sintion claims that waste treatment costs using their system average $0.06 per pound.

- **Antaeus Group Steam Sterilization and Maceration** – This technology uses steam simultaneously with maceration by a patented cutting system to treat infectious waste including sharps and sharps containers. An attachment can be purchased to dewater the treated solids. The units are small, easy to install or can be moved throughout the facility. The vendor claims that treatment costs using their system average less than $0.15 per pound. Antaeus Group can be reached at P.O. Box 432, Hunt Valley, MD 21030 or www.redbag.com.

- **TEMPICO Rotoclave**Ò - This technology uses high-pressure steam with an internal rotating drum to treat all types of medical waste, including sharps, bulk liquids, pathological waste. After sterilization is complete, a vacuum/condensing system is engaged to dry the waste, which is then unrecognizable. The vendor claims that treatment costs using their system average less than $0.03 per pound. Tempico can be reached at P.O. Box 428, 251 HWY. 21 North; Madisonville, LA 70447-0428; (504) 845-0800 or www.tempico.com.

- **Bio-Oxidizer**Ò - The Bio-Oxidizer® system uses pyrolysis and oxidation of medical wastes, including pathological, chemotherapeutic, and sharps. The treated material is a sterile, unrecognizable, inorganic, solid residue. The vendor will perform a cost analysis to determine treatment cost on a per pound basis. Bio-Oxidizer® can be reached at 1745 N. Cameron Street, Harrisburg, PA 17103, (717) 230-9068.

- **Biosiris**Ò **Electron-Beam Waste Sterilization System** – The Biosiris® system uses electron beam technology that provides the acceleration of high-energy electrons, which effectively destroy pathogens and sterilize material. The system can be used to treat all infectious medical waste, including sharps and liquids. Volume reduction attachments are also available. The vendor claims that treatment costs using their system are approximately $0.06 to $ 0.08 per pound. The Biosiris® system can be obtained from

BioSterile Technologies, Inc. 4104 Merchant Road, Fort Wayne, IN 46818; (219) 489-2962. BioSterile can also be reached at BioSterile@aol.com.

The effectiveness of these products in treating medical wastes should be evaluated by the medical facility using information from customers of these companies. Also, each vendor calculated treatment costs using different variables; however, the use of local variables would not be expected to result in widely differing treatment costs.

4.8.2.3 Incineration as a Method to Dispose of Medical Waste

Incineration was a very typical treatment method a few years ago and is still used today for the disposal of medical waste, especially the pathological waste portion. Hazards associated with incinerating medical waste have been identified and are prompting stricter environmental regulations. The EPA promulgated new rules for the Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Hospital/Medical/Infectious Waste Incinerators, effective 16 Mar 1998. These new rules currently exclude incinerators that burn only pathological wastes (in addition to chemotherapeutic and low-level radioactive waste incinerators and crematories) from permit requirements. Even though a pathological incinerator would not require permitting today, the EPA has announced that regulations for other municipal solid waste incinerators will be developed by the year 2000. Exclusion from permitting requirements is only a temporary deferment.[3] Initial performance evaluation costs alone for a new incinerator are anticipated to be $20,000 to $40,000, with annual evaluation costs of $5,000 to $10,000 per year. These expected costs do not include the costs associated with required operator training, management plans, monitoring, reporting, and record keeping. The estimated initial start-up costs for a new incinerator will be approximately $500,000 (anticipated cost calculated by the EPA).

4.8.2.4 Sterilize Waste Using Alternate Technologies and Dispose of the Waste as Municipal Solid Waste

Not all states regulations require medical and pathological waste to be incinerated. Some states just require the wastes to be decontaminated or sterilized, and then packaged to prevent a health hazard with disposal in a landfill authorized. However, not all landfills accept sterilized pathological waste. The first option is to contact the landfill and verify that they will/ will not accept the medical and/ or pathological waste with or without treatment. It may be possible that if the pathological waste is rendered unrecognizable and not co-mingled with the municipal solid waste, that the landfill may accept the waste after treatment.

4.8.2.5 Dispose of Pathological Waste by Contract Incineration

If the medical and/or pathological waste cannot be sterilized on the installation and sent to a

[3] Federal Register; Vol. 62; Monday, September 15, 1997; Air pollution; standards of performance for new stationary sources: Medical waste incinerators.

landfill, disposal by contract is another option. Contracted off-site incineration offers an alternative that is acceptable to regulatory agencies. This disposal option requires aggressive segregation of waste be performed to limit the amount of waste that cannot be sterilized/ landfilled and that must be sent to the incinerator. This disposal method also requires the medical group periodically verify that the contractor is actually incinerating the waste in an approved incinerator.

4.8.3 Dispose of Red Bags Only When Needed or Use Smaller Red Bags

The red bag disposal procedures should be reviewed to validate the need for daily pick-up regardless of the quantity of waste in the bag. If possible, the frequency of disposal should be reduced. This would result in reduced bag purchase cost and possibly reduce housekeeping costs. If this strategy is not possible due to infection control or other requirements, smaller red bags should be used or consolidating of disposal locations should be investigated.

4.9 Cost Reduction Opportunity Eight: Degradable Patient and Surgical Gowns/ Items

4.9.1 Description

Medical facilities generate varying amounts of disposable waste that are discarded as either medical waste or municipal solid waste (MSW). If the item(s) are discarded as medical waste then the cost per pound can range from two to four times the cost to dispose of the same item as MSW. Examples of these discarded items include surgical drapes, lap sponges, operating room towels, patient gowns, and fanfold sheets. During contingency operations, the use of disposable gowns and other items can create both logistical support and solid waste management problems for the site commander. Replacing these disposable items in the initial stages of the contingency operation could pose logistical problems because these replacement items compete for the limited materiel transport capacity. Some facilities have chosen to use reusable patient gowns and launder them instead of discarding them after a one use. This reduces the amount of waste being discarded as either medical waste or MSW and during contingency operations can save on limited materiel transportation space. Using laundered gowns can reduce the supply cost since replacement patient gowns do not have to be purchased as often. However, there is a cost associated with laundering the items and in managing the contract. Finally, when using one time use disposable gowns and other medical/ surgical items, a waste stream is created that contributes to the medical facilities cost. These one time use items do not help the Air Force attain its Pollution Prevention goal of reduction in solid waste generation.

4.9.2 Degradable Patient and Surgical Item Alternative

A technology has been developed that allows certain disposable surgical and patient care items to be made of a non-toxic, biodegradable, water soluble polyvinyl alcohol (PVA) material that dissolve in agitated water heated to 205° F. The PVA breaks down into complex carbohydrates allowing the wastewater to be discharged to the sanitary wastewater treatment system. At the wastewater treatment plant, microbial action further degrades the carbohydrates into carbon dioxide and water. This decrease the amount of medical and solid waste that is disposed. In contingency operations, use of dissolvable product technology definitely reduces the site commander's solid waste management problems. The logistical replacement concerns still remain.

Allegiance Healthcare Corporation (www.allegiance.net) has developed a line of degradable surgical and patient products and has teamed with the Isolyser Company who makes the OREX® Processor that dissolves the degradable items. Isolyzer produces different processors that handle various size and types of loads. One unit can also sterilize and render unrecognizable the non-dissolvable medical waste as the degradable products are dissolved. This affords the medical facility the capability of reducing their medical waste stream by either dissolving the items or by converting them to MSW and being disposed at a reduced cost.

The degradable gowns and drapes are made from spunlaced (nonwoven) material while the other products are made of either woven or film type materials. The benefits of using the degradable technology products are:

- Decreases the quantity of medical waste that must be disposed by incineration or landfill.
- Reduces the disposal cost over the long term.
- Cost competitive with disposable patient gowns and other disposable medical items.
- Company claims the cost per pound to range from $.07 to $.27 per pound of waste processed; includes service agreements.
- Reduces legal liability associated with the transportation and disposal of medical waste.
- Meets the intent of Presidential Executive Order 13101 for waste reduction.
- Provides products that meet the needs of the health care provider.

Requirements and concerns associated with this alternative are as follows:

- Processor cost range: $12,000 for just small degradable loads to $23,000 for the units that can handle larger degradable loads only.
- Steam generators are required to achieve the 205° F water temperature to dissolve the items. Their cost ranges from $5,500 to $7,400.
- For processors that can handle all red bag waste, the cost per unit can be up to $100,000.
- Utility connections such as steam or hot water lines, electrical connections, and wastewater connections. PVC sewer pipes may be degraded over the long term because of the prolonged exposure to the hot effluent.
- State and local environmental regulatory agencies and the local wastewater treatment plant should be consulted regarding the discharge of the processor effluent. The unit uses chemicals to adjust the pH of the water in the processor to be acidic.
- Personnel will need to be trained in handling products and operating the processor.

4.9.3 Cost Analysis Discussion

The medical waste quantity data (in pounds) of disposable patient/ provider gowns and other disposable medical/ surgical garments, drapes and towels were not available. The 59th MDW uses reusable laundered gowns in place of disposable items. By using laundered gowns basically eliminates the medical waste and reduces the MSW disposal problems associated with disposable gowns. Other disposable items such as surgical sponges, drapes, etc. are handled as medical waste and processed in the 59th MDW San-I-Pak™ Inc., sterilization and pulverization units. These items are sterilized, made unrecognizable and discarded as MSW. Thus, this alternative could not be effectively cost analyzed using the data available. Also, Allegiance Healthcare Corporation has recently acquired the product distribution rights for the degradable products and has been in the process of price adjusting their product line. Based upon the literature available, this technology affords the potential of a cost-effective alternative in disposing of medical waste at larger medical facilities. The use of dissolvable patient and surgical supplies could be useful in contingency operations affording a deployed unit the capability to reduce waste management problems. The dissolvable material technology has the potential for use in the existing medical sterilization/pulverizing units. If the temperature of the solution could achieve the required 205° F and the pH adjustment made without having detrimental effects on the existing equipment, the capital cost of using degradable patient and surgical supplies would be minimal and this cost reduction opportunity would have a rapid payback. Finally, this technology offers the potential for waste management benefits during contingency operations. It would afford the site commander a method of reducing the solid and medical waste quantities needing disposal by burial or incineration.

5 MANAGEMENT INITIATIVES AND GOOD IDEAS

5.0 Introduction

In addition to the Cost Reduction/Pollution Prevention Opportunities identified earlier, there are several management initiatives and good ideas that can be implemented that can reduce cost, reduce pollution and minimize environmental compliance burdens and risks. These initiatives and good ideas do not warrant a detailed description or cost analysis and usually can be implemented quickly with minimal to no capital investment. The Management Initiatives and Good Ideas described in this section are summarized in **Table 5.1**.

Table 5.1
Summary of Management Initiatives and Good Ideas

Pollution Prevention Area	Management Initiative/Good Idea	Section #
Medical Facility Management Initiatives	Increase Participation in Hazardous Material Pharmacy	5.1.1
	Provide On-Going Employee Waste Segregation Training	5.1.2
Medical Waste Reduction	Use Translucent Red Bags	5.2.1.1
	Use Cadmium-Free Red Bags	5.2.1.2
	Use Reusable Syringes Rather Than Disposable Plastic Syringes	5.2.1.3
	Improve Waste Segregation During Clean-up	5.2.1.4
	Dispose of Sharps Containers Only When Needed	5.2.1.5
Municipal Solid Waste Reduction	Work with Suppliers to Reduce Product Packaging	5.2.2.1
	Reduce Quantity of Office Paper Used	5.2.2.2
	Use Old Towels and Linens as Rags	5.2.2.3
	Replace Paper Towels with Air Dryers	5.2.2.4
	Purchase Concentrated Cleaning Supplies	5.2.2.5
	Use Reusable Equipment and Instruments	5.2.2.6
	Save and Reuse In-Patient Supplies	5.2.2.7
	Segregate Unused Surgical and Other Prepackaged Equipment and Supplies	5.2.2.8
	Use Reusable (Washable) Gowns and Smocks	5.2.2.9
	Investigate Use of Reusable, Non-Latex Gloves	5.2.2.10
Hazardous Waste Reduction	Recycle Waste Batteries	5.2.3.1
	Monitor Reagent Expiration Dates	5.2.3.2
Energy Conservation	Install Electric Meter	5.2.4.1
	Turn off Lights and Equipment	5.2.4.2
	Replace Incandescent Lighting with Fluorescent Lighting	5.2.4.3
	Replace Magnetic Ballasts with Electronic Ballasts	5.2.4.4
	Retrofit or Replace Exit Signs	5.2.4.5

Pollution Prevention Area	Management Initiative/Good Idea	Section #
Energy Conservation	Install Weather-Stripping, Caulking, and Insulation	5.2.4.6
	Install Timers on Thermostats	5.2.4.7
	Install Occupancy Sensors in Infrequently Used Rooms	5.2.4.8
	Paint Ceilings Light Colors/ Clean Light Fixtures	5.2.4.9
	Insulate Hot Water Holding Tanks and Hot and Chilled Water Pipes	5.2.4.10
	Install Motion Sensors for Exterior Lighting	5.2.4.11
	Install Solar Timers for Exterior Lighting	5.2.4.12
	Purchase Equipment with an Energy-Saving Mode	5.2.4.13
Water Conservation	Install Water Meter	5.2.5.1
	Install Water-Saving Devices on Toilets & Other Plumbing Fixtures	5.2.5.2
	Monitor Sprinkler Use in the Warmer Months	5.2.5.3
Institute Mercury Free Program	Recycle Waste Mercury and Mercury-Containing Equipment	5.2.6.1
	Recycle Mercury-Containing Lamps	5.2.6.2
	Collect and Recycle Waste Dental Amalgam	5.2.6.3
	Use Amalgam Alternatives	5.2.6.3.1
	Use Pre-Capsulated Alloys	5.2.6.3.2
	Clean Drain Traps and Drain Trap Screens	5.2.6.3.3
	Install Finer Mesh Screens on Drain Traps	5.2.6.3.4
	Install Amalgam Separators	5.2.6.3.5
	Use Non-Mercury Thermometers	5.2.6.4
	Use Non-Mercury Blood Pressure Monitoring Devices	5.2.6.5
	Use Non-Mercury Esophageal Devices	5.2.6.6
	Use Non-Mercury Batteries	5.2.6.7
	Use Non-Mercury Lamps and Lighting Devices	5.2.6.8
	Use Non-Mercury Electrical Switches	5.2.6.9
	Use Non-Mercury Preservatives, Stains, and Reagents	5.2.6.10
	Additional Mercury Information	5.2.6.11
PVC Reduction	Use Products Made from Materials Other than PVC	5.2.7
Laboratory Waste Reduction	Laboratory Waste Reduction Strategies	5.2.8
Surgical Waste Reduction	Recycle Unused Items from Surgical Procedures	5.2.9
Radiology (X-Ray) Reductions	Optimize Radiographic Image Developing Process	5.2.10.1
	Store Radiographic Chemicals Properly	5.2.10.2
	Test Expired Radiographic Processing Chemicals	5.2.10.3
	Extend Processing Bath Life	5.2.10.4
	Use Squeegees to Remove Excess Liquid from Film and Paper	5.2.10.5
Radiology (X-Ray) Reductions	Use Countercurrent Washing	5.2.10.6
	Use Chromium Free System Cleaners	5.2.10.7
	Recycle Lead Foil	5.2.10.8

Pollution Prevention Area	Management Initiative/Good Idea	Section #
Nutritional Medicine Dining Waste Reduction	Sell Reusable Beverage Cups in the Dining Area	5.2.11.1
	Compost Food Wastes	5.2.11.2
	Use Reusable Dishware and Utensils	5.2.11.3
	Additional Good Ideas	5.2.11.4

5.1 Management Initiatives with Universal Applicability

Management attention and the relationship among medical squadron/flight commanders, department chiefs, work center supervisors and medical group personnel can have a significant impact on the implementation of CROs/PPOs and on the overall medical strategic plan, cost reduction and pollution prevention strategy. Frequently, successful implementation of a CRO/PPO depends upon cooperation of several work centers to make the CRO/PPO economically viable. Commander involvement demonstrates the importance placed on the CRO/PPO programs and the cooperative efforts needed from all to develop and implement cost effective initiatives and ideas.

5.1.1 Increase Participation in the Hazardous Material Pharmacy Program

The installation hazardous material office, which oversees the Hazard Material Pharmacy, controls the issue of hazardous materials and thereby reduces the quantities, toxicity, and types of hazardous materials used on the installation. It can reduce the quantities of unused materials being disposed as hazardous waste. The hazardous material office can assist in identifying material and product substitutions for both medical and non-medical supplies. Currently, all hazardous materials procured by the medical group/squadron, with the exception of hazardous materials in the 6500 stock class, are purchased through the Hazardous Material Pharmacy Program. There are many hazardous materials are in the 6500 stock class, and as such, these items should be reviewed and included in the Hazardous Material Pharmacy Program.

5.1.2 Provide On-Going Employee Waste Segregation Training

Employee awareness is paramount to the success of any program. When in doubt employees will typically place used items in the biohazard bags – an expensive disposal method. On-going training must be provided to educate personnel on the importance of waste segration, requirements for medical waste disposal and identifying those items that are recyclable. Sometimes personnel will place “trash” in the nearest “trash container/bag” regardless of its waste classification. This can have the impact of needlessly increasing waste disposal cost from about $0.10-$.20/pound to $0.25-$0.35/pound or higher. It also reduces the amount of material that is recycled.

5.2 Good Ideas

Civilian medical facilities, as well as other Air Force medical facilities that contribute to pollution prevention have implemented many good ideas. These “Good Ideas” ideas can be implemented without sacrificing patient care and employee safety and are presented to share the successes and provide the basis for implementation. The ideas presented in this section are organized according to the pollution prevention topic, i.e., Medical Waste Reduction, Municipal Solid Waste Reduction, Mercury Reduction, etc., followed by additional “Good Ideas” specific to an individual work center.

5.2.1 Medical Waste Reduction

5.2.1.1 Use Translucent Red Bags

Translucent red bags should be used rather than opaque bags. This will enable personnel to easily identify work centers where waste segregation is not aggressively being performed.

5.2.1.2 Use Cadmium-Free Red Bags

Medical Logistics should purchase red bags that are cadmium-free to to reduce cadmium on the waste streams.

5.2.1.3 Use Reusable Syringes Rather Than Disposable Plastic Syringes

The use of reusable syringes rather than disposable plastic syringes would decrease the quantity of medical wastes generated and the number of sharps containers purchased. The labor and equipment costs associated with Central Sterile Supply would increase. This option has limited applicability because of the stringent requirements for cross-contamination between patients.

5.2.1.4 Improve Waste Segregation During Clean-up

At the end of a diagnostic, emergency, surgical or other treatment procedure, and at the end of the day, workers must make a concerted effort to segregate the waste products generated to minimize inappropriate waste being placed in the incorrect waste container. Separate receptacles for the different waste streams, i.e. infectious, pathological, hazardous, municipal solid waste, recycle etc., should be available for use during the clean-up process. Work center personnel must discard waste items into the proper receptacle to help control cost.

5.2.1.5 Dispose of Sharps Containers Only When Needed

Establish a policy on when sharps containers will be disposed. This will help contain medical waste costs. For example, a policy statement would be that sharps containers must be over 75 or 80 % full before they are disposed.

5.2.2 Municipal Solid Waste Reduction

5.2.2.1 Work with Suppliers to Reduce Product Packaging

Medical Logistics should evaluate incoming products to identify excess packaging. Then, Medical Logistics should work with vendors to minimize the quantity of packaging delivered to the medical facility; particularly packaging that cannot be recycled. Packaging that is necessary should be made from materials that can be recycled or pelletized. The ultimate goals are to reduce packaging and to recycle the packaging that is required. The following ideas should be considered when working with the vendors to reduce packaging:

- Require vendors to supply products with no or minimal packaging.
- Require vendors to pick up and reuse packaging, containers, and pallets after delivery.
- Require vendors to use consumable, returnable, refillable, and/or reusable packaging.
- Repair pallets for reuse.
- Grind pallets for mulch.
- Require packaging to be both recycled and usable in the pelletizer.
- Reuse packaging. Excess packaging materials that cannot be pelletized, such as foam and peanuts, could be made available to base personnel for personal use.

Use of the Prime Vendor Contract ordering system has shown positive benefits in reducing excess packaging and amount of waste generated. The Prime Vendor Contractor System reduces SMW and help hold down out of date inventory cost.

5.2.2.2 Reduce Quantity of Office Paper Used

Implementation of the CHCS has reduced the necessity for much of the paperwork generated in the medical facility; however, additional efforts should be made to further reduce paper use. Specific opportunities to minimize paper use are:

Emergency Room – The SF Form 558 is a triple form; however, only two copies are used, and the other is always shredded. The feasibility of using a two-part form should be investigated.

Emergency Room – An Ambulatory Encounter Summary is filled out for each patient; the form is scanned into a computer system and then shredded. The feasibility of entering the information directly into a hand-held computer should be investigated. Also, since the software is not compatible with CHCS, the feasibility of modifying the software should be investigated.

Even though waste paper generated during administrative tasks can be recycled, reduction in the use of paper will result in a direct savings associated with the purchase cost of affirmative procurement paper. Additional opportunities to reduce paper usage are listed below:

- Order supplies electronically.
- Computerize documents and filing systems.

- Store information on CD/ROM and other interactive tools.
- Assess need for photocopies and print only what is needed.
- Customize distribution of reports.
- Increase use of double-sided copies.
- Keep records on microfiche or double-side copies.
- Consolidate multiple forms and reduce extra copies.
- Use plain paper faxes.
- Minimize memo distribution.
- Reuse paper only used on one side.
- Purchased recycled paper.
- Implement paperless forms processing.
- Post announcements in central locations.
- Omit fax cover sheets or use small adhesive notes.
- Ask staff to remove their names from unwanted mailing lists. Check for duplicates.

5.2.2.3 Use Old Towels and Linens as Rags

Torn towels and other laundered items, such as linens and scrubs, should be cut up for use as rags by housekeeping before being disposed as municipal solid waste.

5.2.2.4 Replace Paper Towels with Air Dryers

Paper towels should be replaced with air dryers, where feasible, such as in rest rooms. This will slightly increase electric cost but will reduce the time to clean the restroom because no “trash” will have to be removed and transported.

5.2.2.5 Purchase Concentrated Cleaning Supplies

Cleaning supplies should be purchased as concentrates and mixed as needed. This will reduce the number of containers requiring disposal. Also, efforts should be made to purchase materials that are supplied in containers that can be recycled.

5.2.2.6 Use Reusable Equipment and Instruments Rather than Disposable Items

The use of reusable equipment and instruments rather than their disposable counterparts would decrease the quantity of municipal solid waste and possibly medical waste generated and would reduce the labor and material cost to Medical Logistics and the work centers by eliminating the disposable items. However, labor and equipment costs associated with Central Sterile Supply would increase. The use of reusable equipment and instruments has the beneficial effect of changing the mind-set of personnel who would be deplayed under contingency operations.

5.2.2.7 Use Reusable In-Patient Supplies Rather Than Disposable Supplies

For medical facilities that use prepackaged patient kits, such as patient admission kits, the unused portions of these kits should be saved for recycling/use in another kit instead of discarding as MSW. Each kit should include only those components the patient will need and use. Periodic review of the kits for unused components should be accomplished. An analysis of this review could yield cost reduction opportunities through elimination of infrequently used components. Also, for those components that can not be used internally, consolidating them and then donating them to local charitable organizations can reduce MSW quantities.

5.2.2.8 Segregate Unused Surgical and Other Prepackaged Equipment and Supplies

Segregate unused surgical and patient treatment prepackaged equipment and supplies. Return the equipment and supplies to either medical logistics for redistribution or to central sterile supply for sterilization and repackaging. This is a viable alternative to just discarding the unused components as MSW.

5.2.2.9 Use Reusable (Washable) Smocks and Gowns

The use of reusable and washable smocks and gowns instead of disposable gowns and smocks decreases the cost of patient and staff gowns and also decreases the quantity of MSW and possibly medical waste generated. The initial costs for the washable smocks and gowns are greater than for the comparable disposable smocks and gowns but is recovered after a few washings. Overall, costs for the smocks and gowns would decrease. Laundry expenses would increase.

5.2.2.10 Investigate Use of Reusable Non-Latex Gloves

A few workers may develop an allergic dermatological reaction to the latex in some protective gloves. By investigating alternative skin protection, consideration should be given to the use of reusable gloves made from butyl rubber or other type of material. Some medical work centers that use the latex gloves do not have a need for them. There are suitable substitutes that will provide the desired level of protection, flexibility and durability. Bioenvironmental Engineering personnel should be contacted to review work center operations to determine the most appropriate from of skin protection. The selection of reusable gloves will reduce the medical and municipal solid waste streams. By finding a substitute for the latex containing gloves, future potential occupational health problems can be avoided. Additional time for work center personnel to clean the gloves will be required.

5.2.3 Hazardous Waste Reduction

5.2.3.1 Recycle Waste Batteries

All waste batteries including alkaline, nickel, cadmium, magnesium, silver oxide, lithium, mercury oxide and lead acid should be collected and recycled. Medical Logistics should collect the waste batteries for recycling. For this recycling effort to be effective, all medical facility personnel must be kept aware of the policy for battery turn in. Battery turn-in requirements could be provided to personnel upon receipt of new batteries and the requirements should be included in the facility's on-going P2 training.

Additional information can be obtained from the following:

- Recycler's World; http://www.recycle.net.

The following are some of the vendors that recycle most types of batteries:

- Battery Solutions Inc., 38680 Michigan Avenue, Wayne, IN 48184 telephone: (734) 467-9110.
- Raw Materials Corporation, 28 Invertose Drive, Port Colborne, Ontario, Canada L3K 5V7; telephone (905) 835-1203.

5.2.3.2 Monitor Reagent Expiration Dates

An effective inventory management program must include the periodic check of the expiration dates of the chemicals, medical supplies, pharmaceuticals and other expendable items on hand. Using the items that are the closest to their expiration date will minimize waste creation and will maximize the financial resources used to purchase new supplies. Using computer programs to keep track of the inventory will aid in this control process.

5.2.4 Energy Conservation

Conservation of electrical energy provides both pollution prevention and economical benefits to the medical facility and installation. Reducing electrical use prevents pollution by allowing the electrical power generator to use less raw materials such as coal or fuel oil to produce the electricity. Reducing electrical use saves financial resources that could be applied to provide better patient care.

5.2.4.1 Install Electric Meter

An electric meter is mandatory to document electric utility conservation efforts. Without an electric meter, there is no method to document conservation savings. Also, without the electric meter, the installation is probably prorating electric use and/or charging a set fee each month. This method of billing does not permit payback analysis for cost reduction opportunities or pollution prevention opportunities. When estimates of electric use are used, the charges billed to the medical facility may be overstating or understating the actual cost. Knowing the exact amounts of electricity used per month will help establish a baseline for future comparisons. When medical facilities have an electric meter(s), they have a vested interest in pursuing establishment of an effective electric conservation program. They realize their cost savings through less electrical used. The meter can be installed through assistance from the installation Civil Engineering Squadron at a minimum cost.

5.2.4.2 Turn off Lights and Equipment

Perhaps the easiest method of conserving energy is to turn off lights and equipment when not in use. For example: a 95% reduction in energy costs can be realized by turning off the light in a room that is occupied 30 minutes per day rather than leaving the light on the entire day. If the room has one 100-watt light bulb, the energy savings are approximately $20 per year. These savings, when calculated for the entire medical facility, can be significant. Each work center supervisor should encourage personnel to turn off lights, computers, printers, and other electrical equipment when they are no longer needed.

5.2.4.3 Replace Incandescent Lighting with Fluorescent Lighting

Incandescent lighting (ordinary light bulbs) is 10-30% efficient; energy-efficient lighting can save 55-90% of the electricity used by incandescent lighting. Compact fluorescent lamps (CFLs) are long lasting and are available for most circumstances where incandescent lamps are currently used. For example: Replacing one 100-watt incandescent light bulb with a 15-watt compact fluorescent lamp realizes a savings in electrical cost of approximately $18.00/year or a 75% annual return on investment.

Reflectors should be used in lobbies, hallways and other areas where direct lighting is not required. Custom designed reflectors can be installed to enhance light control and efficiency of the fixture, which may allow some lamps to be removed, thereby further reducing energy costs.

Additional information regarding increasing lighting efficiency can be obtained from the following:

- EPA Green Lights Program; US EPA; 401 M Street, SW (6202J); Washington, DC 20460; Phone: (202) 775-6650; Fax: (202) 775-6680; www.epa.gov/GCDOAR.
- Pro-Act Fact Sheet; Energy Conservation; Phone: DSN 240-4214; www.afcee.brooks.af.mil/proact/fact
- Energy efficient lighting and reflectors are available from the Defense Industrial Supply Center at 1-800-DLA-BULB or www.disc.dla.mil.

5.2.4.4 Replace Magnetic Ballasts with Electronic Ballasts

Electronic ballasts can be used in most fluorescent lighting applications in place of conventional magnetic ballasts. Electronic ballasts improve fluorescent system efficiency by converting the standard 60 Hz input frequency to a higher frequency. Lamps operating at higher frequencies produce about the same amount of light and consume 12 to 25 percent less power.

Additional information regarding ballast replacement can be obtained from the following:

- EPA Green Lights Program; US EPA; 401 M Street, SW (6202J); Washington, DC 20460; Phone: (202) 775-6650; Fax: (202) 775-6680; www.epa.gov/GCDOAR.
- Electronic ballasts available from the Defense Industrial Supply Center at 1-800-DLA-BULB or www.disc.dla.mil.

5.2.4.5 Retrofit or Replace Exit Signs

Exit signs required for operation 24 hours per day and during power failure, can be upgraded or retrofitted with energy efficient lighting. Light-emitting diode (LED) sources are the most cost effective for retrofits (approximately $25 each from DLA). Low-wattage replacement bulbs are available through DLA (approximately $25 each). Compact fluorescent lamp, electroluminescent, self-luminous, and LED fixtures are available for replacement signs.

CAUTION: Replacing electrically powered exit and other warning signs in the medial facility with radioluminescent signs requires permission from the USAF Radioisotope Committee prior to purchase. Normally, the use of radioluminescent signs is prohibited according to Air Force Instruction 40-201, Chapter 3**.**

Additional information regarding exit sign retrofit or replacement can be obtained from the following:

- EPA Green Lights Program; US EPA; 401 M Street, SW (6202J); Washington, DC 20460; Phone: (202) 775-6650; Fax: (202) 775-6680; www.epa.gov/GCDOAR.
- Defense Industrial Supply Center at 1-800-DLA-BULB or www.disc.dla.mil.
- Self-Powered Lighting, Inc.; A Tri-Lite Company; 169 Western Highway; West Nyack, NY 10994; Phone: (914) 592-8230; Fax: (914) 592-8435.

5.2.4.6 Install Weather Stripping, Caulking, and Insulation

Significant heat and air conditioning losses occur around poorly sealed windows and doors, and through attics and crawlspaces. Existing caulking, weather-stripping, and insulation should be examined and replaced if necessary. During winter months, it should be easy to identify areas where the cold air is entering the building around the windows and doors.

Additional information regarding increasing lighting efficiency can be obtained from the following: Pro-Act Fact Sheet, Energy Conservation: www.afcee.brooks.af.mil/proact/fact.

5.2.4.7 Install Timers on Thermostats

Install timers on thermostats to regulate when building areas are heated/cooled to just periods of expected occupancy. The timer can be set so that the system comes on prior to the workday and off during nights and weekends. The thermostat can be programmed, as needed, for special events.

5.2.4.8 Install Occupancy Sensors in Infrequently Used Rooms

Occupancy sensors save energy by automatically turning off lights in areas that are unoccupied. Occupancy sensors are available with a variety of features such as sensitivity, time delay, and daylight switching (will not turn on lighting or when sufficient daylight is available when the area is entered). Occupancy sensors are available from DLA at a cost ranging from $25 - $100 depending upon the application.

5.2.4.9 Keep Light Fixtures Clean and Ceilings Light in Color

Light colors like white and creme reflect light better than darker colors; thus, the ceilings should be painted a light color. The use of textured ceiling surfaces should be minimized. Both of these ideas will help reduce the lighting wattage necessary to illuminate a room. Finally, periodic fixture and ceiling cleaning, if possible, will help keep the room at its efficiently designed illumination.

5.2.4.10 Insulate Hot Water Holding Tanks and Hot and Cold Water Pipes

Hot water tanks and cold water pipes should be insulated to reduce the heat transfer between the tanks/pipes and the room atmosphere, thus reducing energy costs. Insulating wraps are available through federal supply channels or through local purchase.

5.2.4.11 Install Motion Sensors for Exterior Lighting

As with interior occupancy sensors, motion sensors for exterior lighting can save energy by automatically turning off lights in outdoor areas that are unoccupied. Motion sensors are available with a variety of features such as sensitivity, time delay, and daylight switching (will not turn on lighting when sufficient daylight is available). Motion sensors should be installed in outdoor areas that do not require continual lighting.

5.2.4.12 Install Solar Timers for Exterior Lighting

Solar timers can be used in outdoor areas that require continual lighting when insufficient daylight is present.

5.2.4.13 Purchase Equipment With An Energy-Saving Mode

Vendors should be required to provide products with an energy saving mode. Vendors should also be required to provide data that can be used to assess the life cycle costs of energy system components, lighting systems, office equipment, and other energy using equipment. Products selected for use should be in the upper 25% rating for energy efficiency as determined by DoD.

Additional information regarding the requirements for purchasing energy-saving equipment can be obtained from the following: Pro-Act Fact Sheet; Energy Conservation; Phone: DSN 240-4214; www.afcee.brooks.af.mil/proact/fact

5.2.5 Water Conservation

5.2.5.1 Install Water Meter

A water meter is mandatory to document cost reduction opportunity savings and capital payback expenditures. Without a water meter, there is no method to document conservation savings. Also, the installation could be prorating the water use and charging a set fee or a prorated share of the installation cost each month. When using estimates of water use, the charges billed to the medical facility may be overstating or understating the actual cost. Knowing the exact amounts of water used per month will help establish a baseline for future comparisons. When medical facilities have a water meter installed, they have a vested interest in pursuing establishment of an effective water conservation program. They realize their cost savings through less water used. They can also realize cost savings in wastewater charges because wastewater charges are normally determined using a percentage of the potable water use. The savings could even be greater in the warmer months when lawn watering occurs and that potable water does not go to the wastewater treatment plant. The meter can be installed through assistance from the installation Civil Engineering Squadron at a minimum cost.

5.2.5.2 Install Water-Saving Devices on Toilets and Other Water Control Devices

Several initiatives can be taken to reduce the quantity of water used in the medical facility. Water conservation efforts can generate cost savings by:

- reducing the volume of water used and water purchase costs,
- reducing wastewater treatment costs, and
- reducing the energy required to heat water.

Water-saving diaphragms, toilet dams, or low-flow model toilets could be installed to reduce water usage. Leaky faucets should be repaired as soon as possible, and low-flow aerators should be installed on faucets and showerheads. See Paragraph 4.7 for a detailed cost reduction opportunity assessment of using faucets with sensors. Key to evaluating the effectiveness of the water savings devices is having a water meter. With the meter, the facility can document its reduction in water use over time. The larger the change out project, the greater the savings that can be achieved. These items are commonly available through the Standard Base Supply System or through local purchase.

Additional information can be obtained from the U.S. EPA's Water Alliances for Voluntary Efficiency (WAVE) web site: http://www.epa.gov/rgytgrnj/specinit/p2/volprog/wave/htm.

5.2.5.3 Monitor Sprinkler Use in the Warmer Months

Water use in the warmer months generally increases due to the use of sprinklers to maintain the landscaping around medical facilities. Water sprinkler use must follow the guidance from the installation commander's water conservation plan. Over-watering must be avoided to prevent water wastage.

If the installation assesses wastewater charges based upon a percentage of potable water used, the wastewater charges in the warmer months should be based on water use in the cooler months because water used for lawn maintenance does not go to the wastewater treatment system. By comparing actual water use and wastewater charges in months where little or no sprinklers use occurs to months where sprinklers are used, the medical facility can determine if it is being fairly charged for wastewater costs.

5.2.6 Institute "Mercury-Free" Program

Mercury over the years has been used in various medical instruments, pieces of equipment and electrical lamps. At some medical facilities mercury has been found in the traps located under the sinks in the rooms of the facility. Establishing a program with installation civil engineering personnel to check each sink trap in areas where mercury could have been spilled, such as on wards, would reduce the chance of the wastewater exceeding allowable mercury concentration limits. Also, visually inspecting the drain lines past the traps could provide information on previous mercury spills that have occurred. If mercury is noted in the drain lines past the traps, then a program needs to be developed to clean out the drain lines. The drain line debris will need to be handled as mercury containing material for recycling or disposal as a hazardous waste.

The following information is presented for employee awareness during the procurement and disposal processes. Mercury presents significant environmental and occupational health hazards, especially when incinerated. It is present in a myriad of equipment and products used throughout the medical facilities. The U.S. EPA estimates that about 10% of the total mercury air emissions come from medical waste incinerators. Mercury-free equipment and products are available in most instances. The overall goal of all medical facilities should be to completely eliminate or greatly reduce the presence of mercury. The first step in reducing mercury pollution should be to eliminate the purchase of products and equipment containing mercury. Participation in the Hazardous Material Pharmacy Program can help in monitoring the constituents of purchased products so mercury-containing products are not inadvertently purchased. Besides reducing the potential for occupational exposures to mercury, cost benefits can be realized in waste disposal; product, equipment, and spill clean-up material purchases; and employee training.

Table 5.2 provides a list of equipment and products commonly containing mercury. **Table 5.3** provides a list of additional equipment that may contain mercury; these items should be examined for mercury content prior to disposal and during the procurement process. The following sections contain additional information about the products and equipment, along with potential substitutes and/or recycling options.

Table 5.2
Equipment and Products Commonly Containing Mercury

Equipment/Product	Equipment/Product	Equipment/Product
Thermometers	Lamps	Preservatives, Stains, & Reagents
Sphygmomanometers – Blood Pressure Monitors	Dental Amalgam	Barometers
Batteries	Esophageal Devices	Switches
Antibacterial Agents – Mercurochrome Antifungal/Anti-Infection Products – Merthiolate, Mercury Nitrate, Mercury Iodide		

Table 5.3
Additional Equipment and Products Potentially Containing Mercury

Equipment/Product	Equipment/Product	Equipment/Product
Films and Coatings	Laboratory Ovens	Incubators
Room Temperature Controllers	Refrigerators	Degreasers
Solvents	Sequential Multiple Analyzer (SMAC) AU 2000	Paints
Microwave Ovens	Cleaning chemicals	Antifouling agents

5.2.6.1 Recycle Waste Mercury and Mercury-Containing Equipment

All equipment and products, including electrical lamps, containing mercury should be collected and recycled rather than disposed as Municipal Solid waste (MSW) or hazardous waste (HW). In addition to protecting the environment, recycling costs are typically less than hazardous waste disposal costs. The companies listed in the **Table 5.4** below recycle a variety of mercury wastes.

Table 5.4
Mercury Recyclers

Company/Contact/ Address	Items Recycled
Bethlehem Apparatus 890 Front Street Hellertown, PA 18055 (610)838-7034	Mercury waste such as dental amalgams and laboratory solutions
D.F. Goldsmith Chemical & Medical Corp 909 Pitner Avenue Evanston, IL 60202 (708)869-7800	Free-flowing mercury that is free of debris
Mercury Refining Company 1218 Central Avenue Albany, NY 12205 (518)459-0820	Aqueous solutions Dental amalgams Laboratory solutions Pharmaceutical mercury
NSSI Recovery Service, Inc. 5711 Etheridge Houston, TX 77087 (713)641-0391	Mercury-contaminated materials
Raw Materials Corporation 28 Invertose Drive Port Colborne Onario Canada L3K 5V7 (905) 835-1203 (905) 835-6824	Batteries and mercury containing equipment
Recyclights 401 W. 86th Street Minneapolis, MN 55420 (800)831-2852	Dental amalgams Pharmaceutical mercury Disinfectants Diagnostic reagents

5.2.6.2 Recycle Mercury-Containing Lamps

Fluorescent and high-intensity discharge (HID) lamps contain a small quantity of mercury (and lead) and must be disposed properly. The medical facility must work with the installation to determine if lamps containing mercury are classified as hazardous waste. If so, burned out fluorescent and mercury containing bulbs must be accumulated as a hazardous waste.

These bulbs should be taken to the installation’s Treatment, Storage, and Disposal (TSD) facility as soon as possible. If the bulbs are classified as a hazardous waste, they must be transported to the TSD upon generation or to a satellite accumulation point that could be established within in the medical facility. Transfer to the TSD is the recommended option.

Burned out mercury containing lamps can be recycled. **Table 5.5** contains a list of mercury lamp recyclers.

Table 5.5
Mercury Lamp Recyclers

Company Information	Company Information
Advanced Environmental Recycling Corp. 2591 Mitchell Avenue Allentown, PA (800) 554-2372 or (215) 797-7608	Allied Technology Group 47375 Freemont Boulevard Freemont, CA 94538 (510) 490-3008
Alta Resource Management Services 88-B Industry Avenue Springfield, MA 01104-9926 (800) 730-ALTA or (413) 734-3399	Bethlehem Apparatus Hellertown, PA (215) 838-7034
Dynex Environmental, Inc. 6801 Industrial Loop Milwaukee, WI 53129 (800) 249-3310 or (414) 421-4959	Global Recycling Technologies, Inc. PO Box 651 Randolph, MA 02368 (617) 341-6080
Light Cycle, Inc. 1222 University Avenue St. Paul, MN 55104 (612) 641-1309	Lighting Resources, Inc. 386 S. Gordon Street Pomona, CA (800) 57-CYCLE
Luminaire Recyclers Inc. 2161 University Avenue, Suite 206 St. Paul, MN 55114 (612) 649-0079	Mercury Recovery Systems 2021 S. Myrtle Street Monrovia, CA (818) 301-1372
Mercury Refining Co., Inc. Albany, NY (518) 459-0820	Mercury Technologies International, LP Hayward, CA (800) 628-3675 Los Angeles, CA (310) 475-4684 West Melbourne, FL (407) 852-1516
Mercury Technologies of Minnesota Pine City Industrial Park Pine City, MN 55063-0013 (612) 629-7888 (800) 864-3821	Nine West Technologies Nashville, TN (615) 399-1486
NSSI, Inc. 574 Etheridge Street Houston, Texas 77087 (713) 641-0391	Recyclights 401 West 86th Street Bloomington, MN 55420 1-800-831-2852 (This number also serves Recyclights facilities in Tallahasseee, FL and Columbus, OH.)
Salesco Systems USA 5736 West Jefferson Phoenix, AZ 85043 1-800-368-9095	Superior Lamp Recycling, Inc. Mineral Springs Facility 1275 Mineral Springs Drive Port Washington, WI 53074 (800) 556-LAMP (5267)
USA Lights 2007 County Road, C-2 Roseville, MN 55113 (612) 628-9370	USA Lamp and Ballast Recyclers (800)-778-6645 for information on disposal facilities.

5.2.6.3 Collect and Recycle Waste Dental Amalgam

Waste mercury is generated in the Dental Squadron in various work centers during the dental restoration processes. The mercury may be in the form of chunks, small particles, or a mixture of particles and water. Most of this is vacuumed from the patient's mouth and discharged down the drain where some mercury is collected on a screen trap in the vacuum system. The remainder enters the sanitary sewer.

The Dental Squadron should contact the installation's Environmental Management Flight or the installation's Hazardous Material Office to determine if waste dental amalgam is classified as a hazardous waste. Waste amalgam contains mercury, and when disposed, usually requires disposal as hazardous waste. .In addition to minimizing the quantity of waste mercury generated, efforts should be made to collect and recycle the greatest quantity of mercury possible. The following subsections contain additional information regarding mercury collection. **Table 5.6** contains information on amalgam recycling.

5.2.6.3.1 Use Amalgam Alternatives

When possible, mercury free substitutes should be considered for fillings. Alternatives to amalgam include gold, ceramic, porcelain.

5.2.6.3.2 Use Pre-Capsulated Alloys

Pre-capsulated alloys of the smallest appropriate size should be used for each procedure. Any leftover material should be placed in an airtight container and recycled.

Table 5.6
Amalgam Recyclers

Company/Address	Materials Accepted	Product Requirements	Preferred Packaging	Price
Amalgaway 10085 Housenville Road, Suite 203 Fishers, IN 26038 (317) 782-3228 (317) 784-2719	Both contact and non-contact amalgam	Need not be sterilized	Package provided by company	$89 per container, which typically takes 4-6 weeks to fill.
Carolina Environmental Associates PO Box 963 Burlington NC 27216 (910) 229-0058	Both contact and non-contact amalgam	Need not be sterilized	Provided for a fee	No charge; payback percentage depends on amount

Company/Address	Materials Accepted	Product Requirements	Preferred Packaging	Price
Dental Exchange 20 Banta Place, Office 203 Indianapolis, IN 46225 (201) 489-3083	Non-contact only	Need not be sterilized	Plastic container with screw top lid. Material placed under water.	No Charge
Dental Recycling - North America PO Box 1069 Hackensack, NJ 07601-1069 (800) 525-3793	Installation and maintenance of an amalgam separator and collection of waste products.	NA	NA	$122 per month
Maguire and Strickland Refining, Inc. 1290 81st Ave. NE Minneapolis, MN 55432 (612) 786-2858	Both contact and non-contact amalgam	Amalgam need not be sterilized	Plastic bags acceptable, but no glass	Less than 1 pound no charge; more than 1 pound will pay 25 cents per ounce
Mercury Refining Co. Inc. 1218 Central Ave. Albany, NY 12205 (800) 833-3505	Both contact and non-contact amalgam	Amalgam must be sterilized	Placed under liquid bleach, which sterilizes the material	May pay for material depending on silver content
US Technology 21211 Durand Ave. Union Grove, WI 53182 (414) 878-2599	Both contact and non-contact amalgam	Prefer acid wash or sterilization	Can provide package	Negotiable; payback depends on content

5.2.6.3.3 Clean Drain Traps and Drain Trap Screens

Drain traps and drain trap screens should be cleaned on a routine basis. Any waste amalgam should be collected for recycling.

5.2.6.3.4 Install Finer Mesh Screens on Drain Traps

Most drain trap screens are manufactured using 40 mesh. More material may be intercepted if the 40 mesh is replaced with a finer mesh, such as 100 mesh. The finer screens require more frequent cleaning, and the equipment manufacturer should be consulted prior to modifying the equipment. The screened material should be recycled along with other waste amalgam.

5.2.6.3.5 Install Amalgam Separators

Amalgam separating equipment, which removes amalgam from wastewater, is available at costs from $100 to several thousand dollars; the manufacturers claim removal efficiencies of up to 99 percent. Several municipalities and organizations are currently evaluating the efficacy of several units. **Table 5.7** contains amalgam separating equipment vendors.

Table 5.7
Amalgam Separator Vendors

Company	Method of Separation	Unit Location	Unit Cost
Avprox, Inc. 2201 4th St. N, Suite B St. Petersburg FL 33704 (800) 300-1249	Filtration Sedimentation	Central; replaces screen traps	$35; Replacement cartridges $22, which last 1-1/2 months
Health 2000 P.O. Box 1138 La Conner WA 98257 (360) 466-5944	Electrolysis	Unit not in production yet	--
Laqua (Metasys) (also distributed through American Dental Coop) P.O. Box 250 Binbrook Ontario, Canada LOR lCO (905) 528-0078 Fax (905) 528-1813	Centrifuge Sedimentation	Central	$200 Economy sedimentation; $2,799 Centrifuge
R & D Services, Inc. 8120 Greenlake Dr., N. Seattle, WA 98103 (206) 525-4994	Sedimentation	Chairside Central	$350-500
Air Techniques (Durr Dental) 70 Cantiague Rock Rd. Hicksville, NY 11801 (516) 433-7676 Fax (516) 433-7683	Centrifuge	Central	$3,995
DRNA PO Box 1069 Hackensack, NJ 07601-1069 (800) 525-3793 Fax (201) 489-9519	Sedimentation	Central	Lease only: $400 down/$119 month includes recycling
Matrx Medical 145 Mid County Dr. Orchards Pk, NY 14127 (800) 847-1000 Fax (716) 662-7130	Sedimentation Ionization	Rasch 890: Central type: approx. 1 per office serves as many as 10 dentists	Unit $697; Optional scale $1,619; New canister $500

Company	Method of Separation	Unit Location	Unit Cost
Pelton & Crane (Siemens) P.O. Box 7800 Charlotte, NC 28241-7800 (704) 523-3324 Ext. 215 Fax (704) 587-7217	Centrifuge	Central	--
Solmetex 21 Green St. Holliston MA 01746 (508) 668-0890	Chelation	Chairside Central	$3,000 Initial monthly fee based on flow
Westdent International 14252 Culver Dr., No. A-484 Irvine, CA 92714 (714) 586-6177 Fax (714) 587-1589	Two-Stage Water Vortex	Central System	$700

5.2.6.4 Use Non-Mercury Thermometers

Alternatives to mercury thermometers include digital, expansion, or aneroid thermometers. Not all mercury containing thermometers will be able to be replaced; especially if the thermometer is needed for calibrating equipment to maintain it's factory warranty.

5.2.6.5 Use Non-Mercury Blood Pressure Monitoring Devices

Alternatives to mercury-containing blood pressure monitoring devices include electronic vacuum gauge, expansion or aneroid blood pressure monitoring devices.

5.2.6.6 Use Non-Mercury Esophageal Devices

Alternatives to mercury weighted esophageal devices, feeding tubes, cantor tubes, and Miller-Abbot tubes include products with tungsten tubing.

5.2.6.7 Use Non-Mercury Batteries

All used batteries containing mercury should be collected for recycling. Alternatives to mercury batteries include lithium, zinc-air, or alkaline. Additional information on battery recycling is included in Section 5.2.3.1.

5.2.6.8 Use Non-Mercury Lamps and Lighting Devices

Alternatives to mercury lamps and lighting devices include non-mercury based sodium vapor, glow lights, and optical lamps. Additional information regarding lighting is contained in Section 5.2.4.

5.2.6.9 Use Non-Mercury Electrical Switches

Alternatives to mercury electrical switches include fiber optics, solid state devices, and mechanical switches.

5.2.6.10 Use Non-Mercury Laboratory Preservatives, Stains and Reagents

Many laboratory preservatives, stains, and reagents contain trace quantities of mercury. Often the mercury is present in quantities much less than that required to be reported on the Material Safety Data Sheet. **Table 5.8** contains laboratory chemicals that commonly contain mercury, along with potential alternatives.

Table 5.8
Alternatives to Mercury-Containing Laboratory Preservatives, Stains, and Reagents

Chemical	Alternatives
Mercury (II) chloride Zenker's solution Histological fixatives	Zinc formalin Freeze drying
Staining solutions and preservatives: Thimerosal, Immusal, Alum. Acetate Carbolfuchin stain Phenolic mercuric Hematoxylin "Solution A"	Request mercury-free versions of the chemical. A variety of other chemical compounds can also be used.
Mercury (II) oxide	Copper catalyst
Mercury oxide	None identified
Mercury (II) chloride	Magnesium chloride/sulfuric acid
Mercury iodide	Phenate method
Mercury nitrate	Ammonia/copper sulfate
Colorimetric chloride analysis	Ion-selective electrode method

5.2.6.11 Additional Mercury Information

Additional information regarding the occupational and environmental hazards associated with mercury and instituting a mercury-free program can be obtained from the following Internet web sites.

- Mercury in Medical Facilities – http://danpatch.ecn.purdue.edu
- Mercury Information Resources – http://www.re3sco.rog
- Mercury (Hg) Pollution Prevention (P2) – http://www.deq.state.mi.us/ead
- EPA Mercury Study Report to Congress, 1997 – http://www.epa.gov/oar/mercury
- MWRA/MASCO Hospital Mercury work Group Project – http://www.masco.org/mercury

- The Sustainable Hospitals Library - http://www.uml/edu/centers/LCSP/ hospitals.

The following vendors offer mercury free-equipment and products:

- Battery Wholesale Distributors – http://www.mywebplace.com
- Access Battery and Power Systems – http://www.AccessBattery.com
- Unipower Corporation – http://www.unipower.com
- Becton Dickinson and Co. – http://www.bd.com
- Trimline Medical Products - http://www.trimlinemed.com.

5.2.7 Polyvinyl Chloride (PVC) Reduction

The EPA estimates that the incineration of medical waste presents the largest identified source of dioxin in the United States[1]. Dioxin is an extremely potent toxic substance that produces adverse effects on reproduction, development, and immune system functions in humans and animals in extremely low doses. Dioxin bioaccumulates in the fatty tissue of animals consumed by humans. Chlorinated organic substances such as PVC are converted into dioxin, dioxin-like compounds, and other products during incomplete combustion. PVC, which, is 59% chlorine by weight, is the only major plastic that contains chlorine and is the most commonly used polymer for medical products. Many medical products, packaging, gloves, infusion bags, tubing, bedpans, trays, gloves, are made using PVC. Alternatives are available for most products that can greatly reduce dioxin pollution. Efforts should be made to minimize the use of PVC-containing products; thereby, eliminating the potential for dioxin production. **Table 5.9** contains products commonly produced using PVC.

Table 5.9
PVC Medical Products

Product	Product	Product
IV bags	Resuscitation bags	Blood bags
Tubing	ID bands	Suction liners
Sharps containers	PVC gloves	Mattress covers
Radiographic folder holders	Shower curtains	Dialysis bags
Thermal blankets	Basins	Bed pans
Catheters	Laboratory equipment	Inflatable splints
Masks	Packaging	

[1] Environmental Protection Agency [US]. Estimating exposures to dioxin-like compounds. Vols. I-III (review draft). Washington DC: EPA Office of Research and Development; 1994. Report No.: EPA/600/6-88/005.

Non-PVC products are typically manufactured using the following materials.

- Polyproplylene
- Polyethylene (PE)
- Polyaminde (PA)
- Polystyrene (PS)
- Polyurethane (PUR)
- Acrylnitrile dutadiene styrene (ABS)
- Ethylene vinyl acetate (EVA)
- Polyintercyclohexan-dimethylcyclohexan-dicarboxycyclate elastomer (PCCE)
- Glass

Table 5.10 contains vendors that offer non-PVC products.

Table 5.10
Vendors of Non-PVC Products

Product	Vendor of Alternative Products
Basins	Braun/McGaw 824 Twelfth Avenue Bethlehem, PA 18018 (800)227-2862 or (800)854-6851 http://www.bbraunusa.com/
Blood Bags	Braun/McGaw 824 Twelfth Avenue Bethlehem, PA 18018 (800)227-2862 or (800)854-6851 http://www.bbraunusa.cm/
Gloves	Adenna Inc. 9945 S Pioneer Blvd. Santa Fe Springs, CA 90670-3219 U.S.A. (888) 3ADENNA or (562) 948-5838 http://www.adenna.com/ AMMEX Corporation P.O. Box 88047 Tukwila, WA 98138 (800) 274-7354 or (425) 251-4000 http://www.ammex.com/index.html

Product	Vendor of Alternative Products
	DOVER MEDICAL P.O. Box 353 Medfield, MA 02052 (800) 600-3158 or (508) 359-2550 http://binar.bbn.com/gloves.html Environmental Travellers P.O. Box 8308 San Jose, CA 95155 (408) 997-0948 http://www.upyouryields.com/GloveIndex.html
IV Bags	VPI Medical Products 3411 Behrens Parkway Sheboygan, WI 53081 (920)208-5555 http://www.dataplusnet.com/vpi/mpdhome.htm Sealed Air Corporation (formerly Cyrovac) Park 80 East Saddle Brook, NJ 07663 (800)229-4539 or (201)791-7600 http://www.sealedair.com/default.htm
Splints	Medical-Surgical Division 3M Health Care 3M Center, Building 275-4E-01 St. Paul, MN 55144-1000 (800)228-3957 healthcare@mmm.com Kendall Healthcare Products Division of Tyco International Mansfield, MA (800)962-9888 http://www.kendallhq.com/
Tubing	Stevens Urethane (800)595-2330 http://www.jpselastomerics.com/index.html 3M Health Care 3M Center, Building 275-4E-01 St. Paul, MN 55144-1000 (800)228-3957 healthcare@mmm.com

Additional information regarding the occupational and environmental hazards associated with PVC and instituting a PVC-free program can be obtained from the following Internet web sites:

- **Department of Plastics Engineering** - University of Massachusetts/Lowell (http://www.eng.uml.edu/Dept/Plastics/)
- **Thermoplastic Polyurethanes for Medical Applications** - (http://www.jpselastomerics.com/news/urthnws8.html)
- **PVC & Medical Products** - by Health Care Without Harm (http://www.sustain.org/hcwh/hcwhmanual/hthmedpvc.html)
- **Endocrine Disrupters -** (http://www.endocrine.org)
- **EPA Integrated Risk Information System -** http://www.epa.gov/docs/ngispgm3/iris/index.html
- **Medical Waste** - by Healthcare Technology Management http://uvmce.uvm.edu:443/hlthcare/impact/donoharm.html

5.2.8 Laboratory Waste Reduction

Solvent and formalin recycling and/or substitution present the greatest opportunities for pollution prevention and cost savings in medical laboratories. See paragraph 4.1 for specific information on solvent recycling. However, there are "Good Ideas" that can be implemented that will result in cost savings and pollution prevention. These ideas are listed below:[2]

- Centralize purchasing of chemicals through one person in the lab.
- Inventory chemicals at least once a year, two times per year is preferred.
- Indicate in the inventory chemicals location.
- Update inventory when chemicals are purchased or used.
- Purchase chemicals in smallest quantities needed.
- If trying out a new procedure, try to obtain the chemicals needed from another lab or purchase a small amount initially. After you know you will be using this chemical, then purchase in larger quantities.
- Date chemical containers when received so the older ones will be used first.
- Keep information about disposal procedures for chemical waste in your lab on file.

[2] The first 19 items in this list were extracted from a larger list of ideas prepared by Cindy Klein-Banay, Chuck Maier, and Peter Ashbrook of the University of Illinois at Urbana-Champaign as a part of a study of laboratory waste minimization grant funded by the Illinois Hazardous Waste Research and Information Center.

- If possible, establish an area for central storage of chemicals.
- Store chemicals in storage area except when in use.
- Keep recyclable waste/excess chemicals separate from non-recyclables.
- Use the least hazardous cleaning method for glassware. Use detergents such as Alconox, Micro, RBS35 on dirty equipment before using KOH/ethanol bath, acid bath or No Chromix.
- Eliminate the use of chromic acid.
- Evaluate laboratory procedures to determine if less hazardous or non-hazardous reagents can be used.
- Review the use and eliminate, if possible, highly toxic, reactive, carcinogenic or mutagenic materials.
- Avoid the use of reagents containing: barium arsenic, cadmium, chromium, lead, mercury, selenium, and silver.
- Consider the quantity and type of waste produced when purchasing new equipment.
- Purchase equipment that employs the use of procedures that produce less waste.
- Review procedures regularly (e.g. annually) to determine if quantities of chemicals and/or chemical waste can be reduced.
- Treat laboratory rinse water prior to discharge to remove mercury.
- Neutralize acids and bases prior to discharge.
- Collect blood and other clinical specimens in smaller containers.
- Aliquot blood samples instead of obtaining separate sample tubes.
- Substitute micromethods for conventional procedures.
- Increase use of screening tests.
- Consolidate test methodologies.
- Use alternative clearing agents.
- Reduce analyte volume requirement.
- Use pre-mixed kits for tests involving solvent fixation.
- Use calibrated solvent dispensers for routine tests.

5.2.9 Surgical Waste Reduction; Recycle Unused Items from Surgical Procedures

There are several "Good Ideas" applicable to surgical procedures, such as using reusable equipment and linens and installing a waste anesthetic scavenging system, that have already been implemented in some surgery work centers. Additional "Good Ideas" are described below.

Often, numerous unused items are discarded as municipal solid or medical waste following surgical procedures. The following list contains several strategies that can be implemented to minimize unnecessary waste.

- Amend surgical service policies to limit opening materials until they are actually needed.
- Save unused surgical kit components for resterilization and repacking into new surgical kits/packs.
- Reuse disposable products such as hypothermia blankets when possible.
- Eliminate unused items from custom surgical packs.
- Contact the manufacturer when one item in a surgical tray is causing the whole tray to outdate early.
- Use unopened items in subsequent procedures rather than disposing of them.
- Use unopened items as training aids.
- Donate unused items to overseas nonprofit medical organizations.
- Donate unused items to the local Humane Society of other nonprofit animal shelter.

Additional information on minimizing surgical wastes can be found in the following documents:

- An Ounce of Prevention, Waste Reduction Strategies for Health Care Facilities; American Society for Healthcare Environmental Services™ of the American Hospital Association.
- Guidebook for Hospital Waste Reduction Planning and Program Implementation; American Society for Healthcare Environmental Services™ of the American Hospital Association.

Also, the Association of Operating Room Nurses routinely publishes articles on reducing surgical waste.

5.2.10 Radiology (X-Ray) Reduction

5.2.10.1 Optimize Radiographic Image Developing Process

Medical facilities should investigate the use of digital imaging as the primary method of taking radiographic images. Converting the process from a wet system to a digital system can prove quite effective in reducing cost and in the amount of hazardous waste generated. The USAF Dental Service has been investigating the effectiveness of and the most appropriate digital system to purchase.

5.2.10.2 Store Radiographic Chemicals Properly

Photo-processing chemicals are very sensitive to temperature and light. The chemical container labels define the optimum storage conditions. Follow The recommendations to increase shelf life.

5.2.10.3 Test Expired Radiographic Processing Chemicals for Usefulness

Optimally photo-processing chemicals should be ordered and their inventory managed so that the shelf life does not expire. In the event the shelf life is exceeded, the chemicals should be tested for shelf-life extension and not automatically discarded. In some case, testing the chemicals can extend the shelf life and prevent an unnecessary waste from being created.

5.2.10.4 Extend Processing Bath Life

Extending the life of fixing baths can minimize radiographic processing wastes. Techniques include:

- Adding ammonium thiosulfate, which doubles the allowable concentration of silver buildup in the bath;
- Using an acid stop bath prior to the fixing bath;
- Adding acetic acid to the fixing bath as needed to maintain the pH at required levels; and
- Covering the process baths with floating lids or other means, to minimize chemical oxidation.

5.2.10.5 Use Squeegees to Remove Excess Liquid from Film and Paper

Squeegees can be used in non-automated processing systems to remove excess liquid from the film and paper. This technique can reduce chemical transfer from one process bath to the next, extending the life of the process baths and reducing the amount of chemicals requiring replenishment.

5.2.10.6 Use Countercurrent Washing

Countercurrent washing should be used in place of parallel rinsing. Countercurrent rinsing involves using water from previous rinsing in the initial rinse. Fresh water enters the process only at the final stage, at which point much of the contamination has already been rinsed from the film.

5.2.10.7 Use Chromium-Free System Cleaners

Many radiographic developing system cleaners contain chromium. Vendors should be required to provide chromium-free system cleaners.

5.2.10.8 Recycle Lead Foil

Radiographic film is shielded with lead foil, which should be collected and recycled. The foil should not be discarded as municipal solid waste.

5.2.11 Nutritional Medicine Dining Waste Reduction

5.2.11.1 Sell Reusable Beverage Cups for Use in the Dining Area

Cost savings and municipal solid waste reduction can be achieved by selling reusable mugs to medical group personnel. Offering a discount on the price of drink refills will encourage employee participation while reducing the municipal solid waste stream.

5.2.11.2 Compost Food Wastes

The medical facility should work with the installation Civil Engineering Environmental Flight to determine if composting select installation waste is being accomplished or planned in the future. If so, nutritional medicine food service personnel should develop procedures to send as much food waste as possible to this compost facility.

5.2.11.3 Use Reusable Dishware and Utensils

By using reusable dishware and utensils for most meals served, Nutritional Medicine’s food service operations will have implemented the most significant waste reduction strategy available.

5.2.11.4 Additional Good Ideas

The following are additional good ideas for consideration to reduce solid waste generation and to reduce cost:

- Install energy efficient appliances.
- Use the smallest paper napkins possible.
- Install low-flow sink aerators.
- Use grease traps in all waste traps.
- Commercial, conveyor-type dishwashers should have an electric eye, so that water only flows when dishes are on the conveyor.

- Install open-door buzzers on walk-in refrigerator doors.
- Install plastic air curtains and air blowers over walk-in refrigerator doors.
- Install timers on hood fans, exhaust systems and hood lights.
- Replace water-cooled ice machines with air-cooled ice machines.
- Service all gas-cooking equipment at least twice a year.
- Use convection ovens instead of conventional ovens when possible.
- Use paper straws instead of plastic.
- Make chef aprons from retired tablecloths.
- Use melting ice and it's water for plant and landscape watering.
- Use bulk straw dispensers instead of individually wrapped straws.
- Serve milk from self-service machines into reusable cups instead of individual cartons.
- When frequent menu changes occur or daily specials are offered, use a chalkboard or dry erase board.

Additional information, PPOs and Good Ideas for Nutritional Medicine and their Food Service Operations are contained in the Food Services Model Shop Report, which can be accessed at:

www.afcee.brooks.af.mil/eq/p2cd/handplan/handbook/174.htm

6 AFFIRMATIVE PROCUREMENT/ PRODUCT SUBSTITUTION

6.0 Introduction

The federal government, America's largest consumer, was directed by the President in Executive Order (EO) 12873, **Federal Acquisition, Recycling, and Waste Prevention**, October 1993, to work at increasing and expanding markets for recovered materials through greater federal government preference and demand for such products. In addition, EO 12873 directed federal agencies (including the Department of Defense) to implement cost-effective procurement preference programs (Affirmative Procurement Programs) favoring the purchase of "environmentally preferable" products and services. This federal pollution prevention effort is designed to stimulate consumer awareness of environmentally preferable products, increase market availability, and set a pollution prevention example for the public. EO 12873 has since been superseded by EO 13101, which reiterates and expands upon the original requirements of EO 12873 and, among other things, creates a parallel program for purchasing "biobased products". Both the Department of Defense (DoD) and the Air Force are committed to "closing the recycling loop" by buying products made with recycled materials. They have developed policy and guidance documents to implement the requirements of EO 13101 and other Federal affirmative procurement regulations. This section provides an overview of current federal, DoD, and Air Force affirmative procurement policies and practices, and provides additional information on this mandated program[1] Product/ process substitution is replacing one chemical/ process with an environmentally preferable alternative. Affirmative procurement is procuring products containing recycled material, helping to close the recycling loop.

6.1 Terminology

6.1.1 Affirmative Procurement Program

A program established by federal agencies, as required under EO 13101, assuring materials composed of recovered materials (Guideline Items) will be purchased to the maximum extent practicable, consistent with federal law and procurement regulations.

[1]Go to www.afcee.brooks.af.mil/EQ/ap.aphtm site and view the PRO-ACT Fact Sheets "Affirmative Procurement Program, July 1999.

6.1.2 Biobased Product

A commercial or industrial product (other than food or feed) that utilizes biological products or renewable domestic agricultural (plant, animal, and marine) or forestry materials.

6.1.3 Certification

Written documentation provided by offerors/bidders/vendors certifying the percentage of recovered materials contained in products.

6.1.4 Environmentally Preferable

A broad term for products or services having a lesser or reduced effect on human health and the environment when used, maintained, and disposed of in comparison to a competing product or service. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and disposal of the product or service. Generally, environmentally preferable products are those manufactured from recycled and reclaimed materials.

6.1.5 Guideline Items

Items designated in Environmental Protection Agency's (EPA's) Comprehensive Procurement Guideline that are, or can be, made with recovered materials.

6.1.6 Life Cycle Cost

The amortized annual cost of a product, including capital costs, installation costs, operating costs, maintenance costs, and disposal costs discounted over the lifetime of the product.

6.1.7 Minimum Content Standard

The minimum recovered material content specifications set to assure the recovered material content required is the maximum available without jeopardizing the intended item end use, or violating the limitations of the minimum content standards set forth by EPA guidelines.

6.1.8 Postconsumer Material

A material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. "Postconsumer material" is a part of the broader category of "recovered material" (see below). Examples of postconsumer material include paper, paperboard, and fibrous wastes from retail stores, office buildings, and homes.

6.1.9 Postconsumer Waste

A material or product, discarded for disposal after passing through the hands of a final user, having served its intended purpose.

6.1.10 Recovered Material

Waste materials and by-products recovered or diverted from solid waste, excluding those materials and by-products generated from, and commonly reused within, an original manufacturing process. Recovered material is a broad term that covers both pre- and post-consumer materials. Examples of recovered materials include manufacturing and forest residues; obsolete finished paper inventories and fibrous by-products of harvesting and woodcutting processes.

6.1.11 Recyclability

The degree to which a product or material may be recovered or otherwise diverted from the solid waste stream for the purpose of recycling.

6.1.12 Recycled Material

A material utilized in place of raw or virgin material in product manufacturing consisting of materials derived from postconsumer waste, industrial scrap, material derived from agricultural wastes, and other items, all of which can be used in new product manufacture.

6.1.13 Recycling

A series of activities, including collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use as raw materials in the manufacture of new products.

6.2. Regulatory Framework

6.2.1 Introduction

Affirmative Procurement Programs for federal agencies are established and governed by portions of the Resource Conservation and Recovery Act (RCRA), various Executive Orders, including EO 13101, and a host of guidance documents published by the EPA.

6.2.2 RCRA

Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. . 6901, et seq., Section 6002, "Federal Procurement." In this section, the rules are codified for Title 40 Code of Federal Regulations (CFR) 247.6, *Affirmative Procurement Programs*, requires federal agencies to procure designated Guideline Items composed of the highest practicable percentage of recovered materials. In addition, they establish several objectives for protecting human health and the environment, and for conserving valuable resources through improved solid waste management and resource recovery practices. This law requires federal agencies give preference in their purchasing programs to products and practices that are "environmentally preferable." RCRA requires Affirmative Procurement Programs contain four elements:

- A demonstrated preference for procuring recycled products that meet recycled content standards;
- An affirmative procurement promotion and education program for employees and contractors;
- Procedures for vendor certification verifying recycled/recovered material content, and;
- Procedures for monitoring the effectiveness of the Affirmative Procurement Program.

6.2.3 Executive Order (EO) 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, 14 September 1998 (63 FR 49643)

This EO revoked and superseded EO 12873, *Federal Acquisition, Recycling, and Waste Prevention*, October 1993. EO 13101 strengthens federal efforts to protect the environment and promote economic growth through the purchase of recycled and other environmentally preferable products. It directs agencies to establish recycling targets, encourages them to purchase biobased and other "green" products, and creates a White House task force to oversee federal recycling efforts. The EO recognizes that the U.S. government is the single largest consumer of goods and services in the world - spending more than $200 billion annually. This means the U.S. government has tremendous purchasing power, which must be leveraged to acquire products and services leading to the minimization of raw material consumption, waste generation, and ultimately to the betterment of the nation's environmental quality.

EO 13101 requires the head of each executive agency to incorporate waste prevention and recycling in daily operations, and to work to increase and expand markets for recovered materials through greater federal government preference and demand for such products. It is the national policy to prefer pollution prevention options and strategies whenever feasible. Pollution that cannot be prevented should be recycled; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner; and disposal should be employed only as a last resort. EO 13101 requires federal agencies to acquire and use environmentally preferable products and services and implement cost-effective procurement preference programs favoring the purchase of these products and services. In addition, the EO required the creation of the Steering Committee on Greening the Government through Waste Prevention and Recycling to develop policy regarding the implementation of the EO. The actual implementation of EO 13101 within each federal agency is delegated to a Task Force. This Task Force is chaired by an appointed Federal Environmental Executive (FEE) within the EPA and staffed by Agency Environmental Executives (AEE) who are appointed from within each of the federal executive agencies, including the Air Force. The FEE has developed a government-wide Strategic Plan for implementing EO 13101. This plan states: "Requirements of EO 13101 **do not apply to facilities and posts abroad** except for purchases made in the U.S. for shipment overseas." The plan is available at http://www.ofee.gov/html/ strtpln2.htm.

6.2.4 Comprehensive Procurement Guidelines

EO 13101 directs the EPA to establish **Comprehensive Procurement Guidelines (CPG)**, which designate EPA Guideline Items. It also requires the mandatory procurement of Guideline Items by federal agencies. Federal agencies were initially required to procure five Guideline Items. EPA then designated nineteen additional Guideline Items in the CPG published 1 May 1995. The latest amendment to the CPG added 12 additional Guideline Items in November 1997. The current CPG is codified in Title 40 CFR Part 247, *Comprehensive Procurement Guideline for Products Containing Recovered Materials*, and contains detailed descriptions of the 36 currently designated Guideline Items and recommended procedures to comply with affirmative procurement objectives. In the 26 August 1998 Federal Register (63 FR 45557), EPA announced its desire to add another 19 items to the CPG. These items include:

6.2.4.1 Construction Products

- Nylon carpet with backing containing recovered materials
- Carpet cushion
- Flowable fill
- Railroad grade crossing surfaces

6.2.4.2 Park and Recreation Products

- Park benches and picnic tables
- Playground equipment

6.2.4.3 Landscaping Products

- Food waste compost
- Plastic lumber landscaping timbers and posts

6.2.4.4 Non-Paper Office Products

- Solid plastic binders
- Plastic clipboards
- Plastic file and presentation folders
- Plastic clip portfolios

6.2.4.5 Miscellaneous

- Absorbents and adsorbents
- Industrial drums
- Awards and plaques
- Mats
- Non-road signs, including sign supports and posts
- Manual-grade strapping

6.2.5 Recovered Materials Advisory Notices (RMAN)

EPA Recovered Materials Advisory Notices (RMANs) are companion documents to the CPG and contain recommended minimum recovered material content standards, among other specifications, for EPA Guideline Items. The RMANs were published in 60 FR 21386, 1 May 1995, and 62 FR 60975, 13 November 1997, in response to changes to the CPG, and a proposed RMAN was published in 63 FR 45557 to coincide with the proposed addition of the 19 new Guideline Items. The intent of these advisory notices is not to preclude federal agencies from purchasing other types or grades of Guideline Items or from using items containing recovered materials for other applications. On the contrary, if a new type or grade of material becomes available containing recovered materials, or if a federal agency discovers a new application for which recovered materials content is appropriate, EPA encourages the procuring agency to develop specifications to allow for its use.

The EPA minimum recovered material content standards for each Guideline Item are specified in the RMANs. For example, the Paper and Paper Products category describes 24 different types of paper products with minimum recovered material content standards ranging from 5 to 90 percent. For useful information on the minimum percentage of recovered material content for a given Guideline Item, contact PRO-ACT or visit EPA's CPG/RMAN World Wide Web (WWW) site at http://www.epa.gov/cpg/products.htm. The Air Force has adopted EPA's recommended recovered material percentages as requirements. If compliant products are not available locally, installations can use the RMANs to develop and establish minimum recovered material content standards based on EPA's recommendations in combination with their own research. Copies of all RMANs are found at http://www.epa.gov/cpg/backgrnd.htm. See **Table 6.1** for sources for information on products with recovered materials.

Table 6.1
Sources for Information on Products with Recovered Materials

Resource	Description	Contact
U.S. EPA	Fact sheets summarizing information on the CPG program, EPA's Recovered Materials Content Recommendations/Case Studies	http://www.epa.gov/cpg/factshts.htm
General Services Administration (GSA)	Catalogs and guides offering stock-listed products containing recovered materials and other environmentally preferable products of services.	http://fss.gsa./gov/environ/recycled-prod.cfm
Defense Logistics Agency (DLA)	Supplies and services to military forces worldwide. Maintains catalogs that are easily accessed listing alternatives.	http://www.dsce.dla.mil/products/epa/eppcat.htm
HQ AFCEE/EQ	Maintains Affirmative Procurement web site with links to a variety or reference documents.	http://www.afcee.Brooks af. mil/EQ/ap/ap.htm
Office of the Assistant Secretary of the air Force for Acquisition (SAF/AQC)	Maintains a WWW site that serves as a source for AF purchasing requirements, policies, and publications.	http://www.safaq.hq. af. mil/contracting.

6.2.6 Contracting/Contractor Requirements

EO 13101, as well as RCRA, EO 12902 ("Energy Efficiency and Water Conservation at Federal Facilities"), and Office of Federal Policy (OFP) Policy Letter 92-4, require federal agencies to include provisions in contracts that obligate contractors to employ environmentally sound and energy-efficient acquisition policies. On 22 August 1997, final changes were made to the Federal Acquisition Regulation (FAR), codified at 48 CFR Chapter 1, which contains requirements and procedures used by federal agencies in establishing contracts. All federal contracting officers are responsible for incorporating current FAR requirements into solicitations and contracts where EPA Guideline Items will be purchased. The General Services Administration (GSA) maintains a WWW site at http://www.arnet.gov/far/ that presents the entire FAR and related information, including recent changes. The Air Force maintains a comprehensive, up-to-date WWW site linked to all DoD and Air Force supplemental acquisition regulations (e.g., the Defense Federal Acquisition Regulations (DFARs) and the Air Force Federal Acquisition Regulations (AFFARs) on the *Air Force FAR Site*, http://farsite.hill.af.mil/.

Title 48 CFR Part 23 (FAR Part 23), *Environment, Conservation, Occupational Safety, and Drug-Free Workplace*, sets forth acquisition policies and procedures supporting the federal government's program for protecting and improving the quality of the environment through the use of recovered materials. FAR Part 23 references related provisions and clauses (found in FAR Part 52) which detail contractor compliance requirements relative to recovered material content in designated items to be used in the performance of the contract. For example:

- Section 23.405(a) of the FAR prescribes the insertion of provision 52.223-4, *Recovered Material Certification*, into solicitations that specify the use of recovered materials; and
- Section 23.405(b) of the FAR requires the inclusion of clause 52.223-9, *Certification of Percentage of Recovered Material Content for EPA Designated Items used in the Performance of the Contract*, into contracts exceeding $100,000 that specify the use of an EPA designated item.

Additional information about contracting, including environmental provisions/clauses and sources of more information is presented in PRO-ACT's Fact Sheet: ***Environmental Issues in Contracting***, June 1999.

6.2.7 Federal/EPA Guidance

EO 13101 requires EPA to develop guidance for use in determining federal facility compliance with Section 6002 of RCRA and EO 13101. This guidance, titled "*Guidance on Conducting Inspections of Federal Facilities for Compliance with Section 6002 of the Resource Conservation and Recovery Act*," was published by EPA on 12 May 1999. Copies of the guidance are available from PRO-ACT or from the Office of the Federal Environmental Executive's (OFEE) WWW site at http://www.ofee.gov. Air Force members should refer to the Guide on Green Purchasing for Air Force specific applicability with the new EPA guidance.

EO 13101 also requires EPA to develop guidance on the acquisition of environmentally preferable products and services. This guidance, dated 19 January 1999, and titled "*Interim Final Guidance on Environmentally Preferable Purchasing*," contains the following five guiding principles that will help federal agencies incorporate environmental preferable purchasing into their procurement practices:

6.2.7.1 Environment + Price + Product Efficacy = Environmentally Preferable Purchasing

Environmental considerations should become part of normal purchasing practices consistent with traditional factors of product safety, price, efficacy, and availability.

6.2.7.2 Pollution Prevention

Consideration of environmental preferability should begin early in the acquisition process and be rooted in the ethic of pollution prevention, which strives to eliminate or reduce, up front, potential risks to human health and the environment.

6.2.7.3 Life Cycle Perspective/Multiple Attributes

A product or service's environmental preferability is a function of multiple attributes from a life cycle perspective.

6.2.7.4 Comparisons of Environmental Impacts

Determining environmental preference may involve comparing environmental impacts. Comparison factors to consider are: degree of improvement that would result from the product, the reversibility of the environmental impact and its geographic scale and the protection of human health.

6.2.7.5 Environmental Performance Information

Information about environmental performance of products or services is necessary in order to determine environmental preferability.

Copies of the *Interim Final Guidance on Environmentally Preferable Purchasing* can be obtained from PRO-ACT or from the EPA's WWW site at http://www.epa.gov/opptintr/epp.

Department of Defense (DoD) Guidance DoD Directive (DoDD) 5000.1, *Defense Acquisition*, 15 March 1996, provides general policies and principles for all DoD acquisition programs. It updates and replaces a 1991 version of the same document. It also authorizes publication of DoD 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information Systems*, 23 March 1998. DoDD 5000.1 states that it is DoD policy to prevent, mitigate, or remediate environmental damage caused by acquisition programs. It further states that acquisition programs shall be managed to optimize system performance and minimize the cost of ownership, including the system's potential impact on the environment and environmental compliance.

DoD policy regarding the purchase of CPG Guideline Items, as outlined in *The Department of Defense Affirmative Procurement Program*, July 1995, Office of the Under Secretary of Defense (Acquisition and Technology), requires 100% of such purchases to meet or exceed RMAN recommended minimum recovered material content standards. When purchasing any Guideline Items, DoD components are required to buy products containing recycled materials unless a written determination is made that the items:

- Are not available within a reasonable period of time;
- Fail to meet the performance standards set forth in applicable specifications or fail to meet reasonable performance standards of the procuring agency;
- Are not available from a sufficient number of sources to maintain a satisfactory level of competition (i.e., available from two or more sources); or
- Are only available at an unreasonable price. If the recycled content product costs more than a comparable non-recycled content product, the cost is considered unreasonable.

DoD Instruction (DoDI) 4715.4, *Pollution Prevention, Change 1*, 6 July 1998, directs DoD agencies and field activities to implement programs to monitor and achieve progress toward specific pollution prevention goals and to establish an Affirmative Procurement Program in accordance with Section 6002 of RCRA and EO 13101.

This instruction further requires DoD components to annually provide data to the Deputy Under Secretary of Defense (Environmental Security) (DUSD[ES]) that summarizes their purchases of commodities not purchased through other government agencies meeting the EPA guideline requirements, and other actions they are taking to meet the intent of the Executive Order. Air Force purchase estimates are provided to DUSD(ES) by HQ USAF.

6.2.8 Air Force Policy

6.2.8.1 Directives.

Air Force Pollution Prevention Strategy, 24 July 1995, Secretary of the Air Force Memorandum, reaffirmed the USAF position on procurement of environmentally preferable products and services. The objective of this strategy includes the implementation of acquisition policies and practices that incorporate affirmative procurement considerations into all acquisition planning. Emphasis is placed on the purchase of recycled materials to the maximum extent practical, and purchasing activities are encouraged to use the environmental soundness of vendors and products as selection criteria in contract awards. The revised Air Force Instruction (AFI) 32-7080, *Compliance Assurance and Pollution Prevention*, requires CONUS Air Force installations to establish Affirmative Procurement Programs in accordance with Section 6002 of RCRA and EO 13101 in order to designate that purchases of all Guideline Items comply with EPA recycled content requirements unless an exemption applies. The exemptions allowed by the AFI are the same as outlined in *The Department of Defense Affirmative Procurement Program*, July 1995. Recommendations for implementing Affirmative Procurement Programs can be found in the Headquarters Air Force Center for Environmental Excellence, Environmental Quality Directorate's (HQ AFCEE/EQ) *Guide to Buying Recycled*.

6.2.8.2 Air Force Reporting Requirements

Specific monitoring and reporting requirements designed to demonstrate compliance with Section 6002 of RCRA and EO 13101, and applicable to all Air Force activities, have not yet been developed. The only Air Force activities subject to upward reporting are contracts with a total value over $100,000 that includes any amount of Guideline Item purchases. Each installation's Qualified Recycling Program (QRP) Manager is responsible for reporting contract information to their respective MAJCOMs who, along with installations, are charged with developing tracking and monitoring procedures best suited to determining the wellness of their respective Affirmative Procurement Programs.

6.3 Product Substitution

The Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act (RCRA) established, as a national policy, that hazardous waste be reduced or eliminated to the greatest extent possible. As a result of these amendments, environmentally preferable products have been used to replace previously used hazardous materials. Environmentally preferable products include products that have a lesser or reduced adverse effect on human health and the environment when compared with competing products that serve the same purpose. Purchasing reasonably priced items that are environmentally preferred is one way the Air Force demonstrates its commitment to the environment. In addition, product substitution helps the Air Force meet its goals in reducing hazardous waste, protecting employees, and saving money.

Over 600 chemicals are subject to reporting requirements under Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and Section 112(r) of the Clean Air Act (CAA) Amendments of 1990. Submission of EPA Form R, the Toxic Chemical Release Inventory (TRI) Reporting Form, is required by Section 313 of EPCRA. Annual reporting is required to provide the public with information on the releases of listed toxic chemicals in their communities and to provide the Environmental Protection Agency (EPA) with release information to assist the Agency in determining the need for future regulations. Facilities and installations must report the annual quantity of both routine and accidental releases of listed toxic chemicals, as well as the maximum amount of the listed toxic chemical on site during the calendar year and the amount contained in wastes transferred off site/installation. The Title III List of Lists (EPA 740-R-95-001 - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-To-Know Act (EPCRA) and Section 112(r) of the Clean Air Act, As Amended) provides a consolidated list of chemicals subject to EPCRA reporting requirements. This list has been prepared to help facilities handling chemicals determine whether they need to submit reports under Sections 302, 304, or 313 of EPCRA and, for which chemical, what reports may need to be submitted.

6.3.1 Product Substitution for Medical Healthcare Facilities

Environmentally preferable products are being used with success by federal governmental agencies and civilian healthcare facilities nationwide. These products work comparably to their hazardous counterparts, are environmentally friendly, save money in disposal costs over the long term, and provide a safe and healthful environment for the workers who use these chemicals. Numerous environmentally preferable products that can be used in healthcare facilities are available from a variety of manufacturers. This section presents a summary of categories for which alternative products are available. A list of manufacturers and products available for healthcare facilities is provided in Appendix E. This list provides certain products currently available and identifies where additional information can be obtained. Specific manufacturers and products are not recommended. The user of this report must identify the best combination of products that meets their organization's specific needs. Certain substitutes may be better suited for some processes than for others.

6.3.2 Spill Control

Disposable materials are often used for spill control. Disposal of these materials as hazardous waste is usually required. Using a lighter weight absorbent or a reusable pad can often significantly reduce hazardous waste disposal costs. Additionally, absorbents may be manufactured from recycled materials that are environmentally preferable to virgin materials.

6.3.3 Resources for Product Substitution

A variety of resources are available for finding replacement products for medical work centers. These resources are presented in **Table 6.2**.

Table 6.2
Resources for Product Substitution

Resource Name	Description	Contact
General Services Administration	This resource provides useful information about environmental products.	General Services Administration ph: (817) 978-2604 x3002 web site: http://www.gsa.gov
EnviroSense	EPA website that provides a variety of environmental solutions and information.	US EPA web site: http://www.epa.gov/envirosense
1997 and 1998 Tri-Service Pollution Prevention Resource CD	This resource presents a variety of product substitution solutions including pollution prevention opportunity assessments with slides; information on material substitution/process modification/ improvement; sample statements of work; and P2 handbooks.	AFCEE Brooks AFB, TX ph: (210)536-5206 web site: http://www.afcee.brooks.af.mil/eq/p2cd/p2cdform.htm
Defense General Supply Center Hazardous Technical Information Service	This resource provides information on environmentally preferred products.	8000 Jefferson Davis Hwy Richmond, VA 23297-5609 ph: (800) 848-4847 DSN: 695-5168 web site: http://www.dscr.dla.mil
EPA Pollution Prevention Directory/ Home Page	This directory is a pollution prevention resource guide to pollution prevention programs and projects and the Pollution Prevention Information Clearing House (PPICH).	USEPA Office of P2 and Toxics Washington, DC 20460 ph: (202) 260-1023 fax: (202) 260-4659; web site: http://www.epa.gov/opptintr/p2home

Pro-Act	Pro-Act provides information on product substitution and other environmental subjects.	AFCEE DSN: 240-4214 ph: (800) 233-4356 / (210) 536-4214 fax: (210) 212-5432; web site: http://www.afcee.brooks.af.mil/pro_act/pro_actform.htm
DENIX	This resource provides information, communication, and collaboration services.	web:http://denix.cecer.army.mil/denix/denix.html

6.4 Affirmative Procurement

Affirmative procurement refers to concerted efforts to purchase items manufactured from recycled and reclaimed materials as distinguished from items made from virgin feedstock. Purchasing reasonably priced items made from recycled materials is another way the Air Force can demonstrate its commitment to the environment. Several environmental benefits result from affirmative procurement efforts. Purchasing items made from recycled/reclaimed feedstock reduces the demand for virgin feedstock. In addition, the rate at which landfills become filled and the need for additional landfill or other waste management capacity is slowed.

In October 1993, Executive Order 12873 entitled “Federal Acquisition, Recycling, and Waste Prevention” was issued requiring all Federal agencies to “incorporate waste prevention and recycling into daily operations and work to increase and expand markets for recovered materials through greater Federal Government preference and demand for such products.” The Resource Conservation and Recovery Act (RCRA) also addresses affirmative procurement in Section 6002. It requires federal agencies to give preference to products and practices that conserve and protect natural resources and the environment. EO 13101, September 1998, was published updating and superceding EO 12873.

Affirmative procurement is intended to increase the demand for recyclable materials as products. Thus, affirmative procurement “closes the loop” and helps insure the long-term viability of pollution prevention programs by helping to establish markets for recyclable materials. In addition, increased market demand for recycled feedstock will help to stabilize market prices for recyclables. Improved stability with enable recycling managers to make investments in processing equipment through shorter payback periods. Environmentally, many products made using recycled feedstock require less energy to produce than do equivalents made from virgin feedstock. For example, it takes 95 percent less energy to produce an aluminum can from recycled material than from virgin feedstock. Another example, several paper mills have recently made major investments in de-inking equipment due to the increased demand for paper with recycled content. De-inking capabilities expand the types of paper a mill will buy to use as feedstock. Increased demand for a product also encourages development of new products and improvements in existing products. Besides expanding markets, industrial discharges are sometimes improved through the use of recycled feedstock over virgin feedstock but this effect various widely across industries and even within an industry depending on the specific process employed. There are occasions when using recycled feedstock require more energy or water than using virgin materials, especially when the requirements of collecting and transporting the recyclable feedstock are taken into consideration.

6.4.1 Paper and Non-Paper Office Products

Other affirmative procurement products that may be purchased by facilities include paper and non-paper office products. The federal government is a large user of many items that can be made from recycled material such as paper. The increased demand caused by federal government use of paper with recycled content achieves several goals. The demand ensures the long-term availability of recycled paper products, lowers the long-term price of recycled paper products, and enables manufacturers to invest in more cost effective production methods, which in turn enables savings to be passed on to the consumer. For example, if white bond paper with a significant recycled content is outselling bond paper without recycled content, manufacturers may consider making other paper-products from recycled material hoping to capitalize on market demand for recycled content. **Table 6.3** provides a list of affirmative procurement items typically used by medical groups.

Table 6.3
Affirmative Procurement Items Typically Used by Medical Groups

1. Paper and Paper Products:
   a. Use paper with at least 20% post-consumer recycled content for administrative functions, paper sheets, patient protective aprons, patient pharmaceutical bags, etc.
   b. Use napkins, paper towels, toilet tissue, bags, etc. with the recommended post-consumer recycled content
   c. Ask suppliers to use cardboard cartons, fiber boxes and pallets made from recycled materials
2. Office waste receptacles and recycling containers
3. Plastic desktop accessories
4. Printer ribbons and toner cartridges
5. Use trash bags with recycled content
6. Purchase computer, printer and typewriter supplies with recycled content Plastic and wood pallets
7. Plastic covered binders

8. Plastic envelopes
9. Plastic trash bags
10. Purchase plastic protective barriers with recycled content
11. Require contractors to use interior fixtures, such as carpeting, tile, and wall board, that are made from recycled materials when remodeling

EPA's recommended minimum recycled content standards for paper and paper products are provided in **Table 6.4**.

Table 6.4
Minimum Recycled Content Guidelines for Paper Products

Product	Minimum % Recovered Materials	Minimum % Post-Consumer Recovered Materials (1)
Newsprint	20- 100	20-85
High Grade Bleached Printing &Writing Papers (2)		
Offset printing	20	20
Writing (stationary)	20	20
Office paper (e.g., note pads)	20	20
Paper for high-speed copiers	20	20
Woven envelopes	20	20
Form bond including computer	20	20
Book papers	20	20
Cover stock	20	20
File folders	20	20
Card stock	50	20
Tissue Products:		
Toilet tissue	20-100	20-60
Paper towels	40-100	40-60
Paper napkins	30-100	30-60
Facial tissue	10-100	10-15
General - purpose industrial wipers	40-100	40
Unbleached Packaging:		
Corrugated boxes <300 psi	25-50	25-50
Corrugated boxes >300 psi	25-30	25-30
Fiber boxes	40	40
Folding cartons used to package foods	100	40-80
Brown papers (e.g., bags)	5-40	5-20
Recycled Paperboard:		
Paperboard products (tubes, cones, cans, drums)	100	45-100
Pad backing	90-100	75-100
Tray liners for food service trays	100	50-75

(1) As an alternative to meeting the above standards printing and writing papers, the

minimum content standard shall be no less than 50 percent recovered materials. The material must be a waste material byproduct of a finished product other than paper or a textile product that would otherwise be disposed in a landfill, as determined by the State where the facility is located.

(2) Minimum content standard for almost all offices paper type increased to 30% post-consumer recycled material effective 31 Dec 1998.

See " A Guide to Buying Recycled: The Air Force Affirmative Procurement Program," Appendix A, for EPA's recycled content requirements for all other Guideline items.

The CPG applies to all DoD purchases of EPA-designated items. Such purchases must meet or exceed the EPA's recommended recovered content levels, unless a written justification is provided stating that an item either is not available competitively, does not meet performance standards or specifications, or is not available at a reasonable price. The CPG does not preclude agencies from purchasing listed items made from other materials, but requires recycled content when items made from the listed materials are purchased. For example, plastic desktop accessories are one of the proposed items to be added to the CPG. The CPG does not preclude purchasing of wooden desktop accessories, but specifies a recycle content if plastic accessories are purchased.

Each squadron in the medical group offers opportunities for implementing affirmative procurement. Table 6.3 presents affirmative procurement opportunities for medical group facilities. Medical group commanders and managers should consult the Air Force document "A Guide to Buying Recycled: The Air Force Affirmative Procurement Program" for specifics on establishing a preference program for the items listed in **Table 6.5**.

Table 6.5
Affirmative Procurement Opportunities for Medical Group Facilities

1. Use paper with at least 20% post-consumer recycled content for administrative functions, paper sheets, patient protective aprons, patient pharmaceutical bags, etc.
2. Use napkins, paper towels, toilet tissue, bags, etc. with the recommended post-consumer recycled content.
3. Ask suppliers to use cardboard cartons, fiber boxes and pallets made from recycled materials.
4. Use trash bags with recycled content.
5. Purchase plastic protective barriers with recycled content.
6. Purchase waste receptacles and desktop items with recycled content.
7. Purchase computer, printer and typewriter supplies with recycled content.
8. Require contractors to use interior fixtures, such as carpeting, tile, and wallboard made from recycled materials when remodeling.

7 CONDUCTING MEDICAL ENVIRONMENTAL COST REDUCTION & POLLUTION PREVENTION OPPORTUNITY ASSESSMENTS

7.0 Introduction

The Air Force is committed to environmental leadership. Pollution prevention provides Air Force Commanders with a tool to accomplish this commitment. Pollution prevention offers a means of reducing or eliminating harmful discharges to the air, land, and water by acting on them at the source; the point at which these harmful materials are first used. At the same time, efficiencies in work processes can provide a reduction in cost through cost avoidance. The Air Force Medical Service can contribute to this Air Force commitment by conducting internal opportunity assessments to identify and implement environmental cost reduction and pollution prevention initiatives.

Environmental cost reduction and pollution prevention requires solid planning and organization. Support for successful CRO/P2 efforts comes from the top offices: the Major Command, the Wing Commander, the Environmental Protection Committee (EPC), the Medical Group and Squadron Commanders, and the Work Center Supervisor. Most cost reduction and pollution prevention ideas are developed in the work center; but, without support from senior management, they may never be implemented. These ideas often require capital investment (supported by management) for up-front financial resources. These ideas and initiatives can completely change existing procedures and relationships. Senior management must be willing to accept change to have a successful environmental cost reduction/pollution prevention opportunity assessment program.

7.1 How To Conduct An Opportunity Assessment (OA)

The following, while not a step-by-step approach to conducting an opportunity assessment (OA), provides an outline for conducting and implementing an environmental cost reduction and pollution prevention opportunity assessment.

7.1.1 Scope the OA

- Scope the assessment. Keep it within manageable proportions. Examine existing materials use data; medical and/or hazardous waste generation data. These data might suggest “targets of opportunity” which will help you meet the medical group/squadron goals.
- Look at the entire work center, squadron or medical group. Don’t artificially segment the work centers, except within the limits established by the data review.
- Determine supply practices for the potential opportunity.
- Determine command, JCAHO, environmental, occupational health, and other medical governing organization’s requirements and constraints. Check the specifics - don’t accept, “That’s the way we’ve always done it” or “that will never work.”

- Keep in mind the following when performing an assessment:
  - Dilution is not the solution to pollution.
  - It is always easier, in the long run, to reduce or eliminate waste at the beginning of a process than it is to treat or clean contaminated material.
  - Mixing waste streams will render treatment more difficult and expensive.
  - Do not switch pollution from one medium to another. Substituting air pollution for water pollution, or vice versa, is not the answer.
  - Do not trade reducing hazardous or other medical waste disposal cost for an increase in occupational or radiological health monitoring and protection cost.

7.1.2 Selecting the OA Team

- Involve people who work directly with the processes and materials of concern. They are most familiar with practices and probably know where changes can be made.
- Involve members from other work centers that may be affected by changes in procedures or practices.
- Include people with a wide variety of backgrounds to gain different perspectives and approaches to problem identification and problem solving.
- Include, as needed, individuals with knowledge of JCAHO, environmental protection, occupational health, radiological health, CAP, and other medical standard setting agencies requirements and regulations.
- Involve suppliers or potential suppliers, if possible. Seek their advice - they are generally looking for new customers or to expanded sales and can offer sound advice.

7.1.3 Identifying Goals and Barriers

- Set goals for elimination or reduction of medical waste generation rates, hazardous material use, energy use, etc. Goals provide the destination towards which to strive. Establish goals and milestones that can be met and are measurable. Review them as the program progresses.
- Identify potential barriers. There are various obstacles - financial, management, attitudes, etc. - that can impede P2 assessment and implementation. It is best to identify the barriers early in the process to assist in a smoother assessment.
- Assess the changes needed to evaluate a CRO/P2 opportunity. Is space a potential problem? Are utilities available? Will the mission or manpower change? These changes need to be addressed before going too far into the evaluation process.
- Determine what contractual constraints may exist to changing the way of doing business.
- Determine if funding will be available to implement the changes.
- Encourage people to adopt a life cycle thought process. Examine what happens to a product when it is procured; how it is used; what wastes are generated; and where the wastes go. Consider what cost factors are involved in each step of the life cycle.

7.1.4 Gathering Information

- Gather data on utility use and cost. Determine quantities used for the last year (or another timeframe established by the OA team). Investigate the method(s) of billing for the utilities provided. Determine the number of individuals working in the group or in the different buildings assigned to the group that are included in the utility costs.

- Gather information from the work centers and supporting organizations. Gather as much information about the work center or process as possible. Look at the following documents, for a start. Verify the content of the listings with work center personnel.

  - Hazardous materials use data (available from the Medical Logistics, Hazardous Material Pharmacy and/or the Bioenvironmental Engineering Office).

  - Waste (medical, hazardous and non-hazardous) generation data (available from the Medical Logistics, Contract Management Office and/or the Environmental Flight (CEV))

- Determine from the materials listings whether the work center or process uses any EPCRA chemicals, ozone depleting substances or EPA-17 chemicals. Also determine if there are air emissions associated with the work center. Consider if there may be significant energy costs or the potential for energy savings in the work center or processes.

- Determine resources required (input) and specific products produced/ waste streams generated (output) for the work center or process. This information can be obtained through interviews with work center personnel. Discussions with personnel from other work centers with similar processes will also provide information on pollution prevention opportunities. Visualizing this information can be accomplished through the use of a process flow diagram (PFD) showing the inputs and output from the process. Additional information on PFDs can be found in paragraph 7.1.5.

- Review existing disposal records for the quantities disposed of hazardous, infectious, pathological, radiological and municipal solid waste (MSW). Identify the cost for each unit (per pound, per ton, etc.) of waste.

- Based upon the review of the existing records, it may be necessary to further characterize the MSW stream.

  - This characterization of municipal solid waste if often referred to as “dumpster diving.” This characterization establishes the waste’s potential for recycling or reuse. “Dumpster diving” can be conducted for individual dumpsters, incinerators, and steam sterilization units located at the medical group or for waste delivered to the landfill (mixed solid waste from the entire installation). The OA is more accurate if individual dumpsters are evaluated. Because the operations at medical group facilities do not vary significantly during different time periods, the sampling and characterization program can be conducted over a relatively short time period.

  CAUTION: When performing a MSW characterization, care must be taken to protect the health of the surveyors from inappropriately disposed hazardous, infectious, pathological, and radiological waste. Discovering that a work center or two in the medical group is inappropriately discarding their waste should not come at the expense of the health of the MSW characterization team.

  - A sampling and sorting protocol should be developed prior to initiation of the study. The protocol should include procedures for sample collection and the weighing of all the samples to verify they are representative. Record-keeping procedures and formats should also be included. A sorting area should be located next to the dumpster, that includes a sample collection area, a sorting area with bins, a weighing station and a decontamination/wash area. The MSW samples collected from the dumpsters should be sorted into categories. The following is a suggested list of potential categories which should be customized based on the critical market assessment:

- Wood waste
- Cardboard
- Glass bottles
- Aluminum cans
- Bi-metal cans
- Tin cans
- HDPE containers
- PET containers
- Other plastic containers
- Other plastic
- High grade office paper
- Computer paper
- Newspaper
- Slick paper
- Other paper
- Food waste
- Compostable waste
- Miscellaneous waste

7.1.5 Analyzing Information

- Analyze the information collected. Quantify and characterize the chemicals and waste streams. Review each of the listings to determine if there appears to be excessive use of a hazardous material; or if there appears to be a large waste stream, medical, hazardous or non-hazardous. Notice if the cost of any product seems excessive. If so, look further into the reasons for the cost, large usage, or large waste stream. Analyze what was obtained during the interviews. If anyone commented on excessive material going to waste or on the hazard of working with a chemical, pursue the comments further.

- If instances of significant chemical usage, significant energy usage, significant medical or other waste streams, or hazardous material usage are noticed, a cost reduction/pollution prevention target may have been identified. Consult with other medical professionals to determine if reasonable substitute materials or processes are available.

- Consider various methods of waste reduction as the potential pollution prevention opportunity is assessed. Are there ways use of a material can be decreased? Is there a better choice of material? Will something less volatile perform the task as well or adequately? Are personnel properly trained in the handling and proper disposal? Are procedures adequate to detect if spills, waste, or undetected losses are happening?

  - At this point it may be useful to develop a process flow diagram (PFD), see Appendix C for examples, that graphically shows all material flows in and out of the process. Process diagrams can illustrate where possible stream (material or waste flow) re-circulation can occur, where stream separation should occur, or where streams could be combined. The process diagram will show if a product can be recycled, or if treatment is required for the product to be useable again. It can also help determine if and how a product can be used again, with or without additional processing.

  - Is segregation of the waste stream needed to identify a P2 opportunity? Look at the total waste stream to determine if it can be handled more effectively in parts. Perhaps only a small portion of the waste stream is a problem such as being hazardous. Can the hazard be isolated and the remaining product be reused, such as in distillation?

  - Options can now be generated for various techniques of reduction, re-circulation, segregation, disposal, and substitution. A preliminary screening will narrow the alternatives to the most promising ones. Consider whether the options will eliminate or significantly reduce the amount of hazardous material consumed and the quantity of medical or hazardous waste generated.

  - Evaluation of the screened options should be undertaken. The evaluation should address availability and reliability of techniques or equipment; the process or product requirements; technical feasibility; the generation of secondary waste streams; environmental compliance; and cost. Assistance from the installation pollution prevention point of contact should be sought for technical and economic analysis of the potential opportunities to determine the viability of alternative solutions. This point of contact can also assist with information on funding sources for the PPO.

7.1.6 Opportunity Hierarchy Evaluation.

- After gathering the data and analyzing potential cost reduction/pollution prevention opportunities, evaluation of the screened list of opportunities can begin. The Air Force has established a hierarchy for evaluating the various waste streams generated. The hierarchy is source reduction, recycling, reuse, or composting, and disposal. Each waste stream option should be categorized into one of these categories. Opportunities that utilize source reduction are most desirable.

- Utility Use Evaluation. Comparing each of the utilities units used, their per unit cost, the total cost of each and possibly determining the per capita use by month, will provide the commander with a picture of the facilities current utility use. This can become the starting point, baseline metric, from which to measure future cost reduction/pollution prevention initiatives.

- Source reduction and recycling opportunities not eliminated from further consideration should be evaluated. The evaluation should be based on technical and economic feasibility, as well as other factors that could affect waste generation. The following are possible source reduction options that should be considered:

- ♦ Reducing and reusing product and supply packaging.
- ♦ Encouraging manufacturers to make their products with less material, less packaging and increased recycled content.
- ♦ Reducing the use of non-recyclable materials.
- ♦ Replacing disposable materials and products with reusable materials and products.

➢ Waste Reduction Evaluation. The waste reduction evaluation should be conducted to identify the effectiveness of each opportunity to reduce the different medical facility waste streams to meet the waste minimization goals of the Air Force and local requirements. The types and amount of the waste that would be reduced by implementing the opportunity should be estimated from the available base characterization data. In those cases where a range in waste reduction is indicated (i.e., high and low range) for an opportunity, the average of the range should be used. Opportunities reducing higher quantities of waste are more desirable.

➢ Technical Feasibility Evaluation. Each opportunity should be analyzed to identify specific aspects that might render it technically infeasible for the medical facility or might raise issues not otherwise considered. The ability of the opportunity to consistently produce utility or waste reduction with minimal implementation and operational problems and down time will be a key factor to consider when selecting technically feasible opportunities. Opportunities that exhibit the least technical feasibility problems are the most desirable. The following lists some of the technical screening criteria that should be used in this evaluation:

- ♦ Commercial availability of the opportunity.
- ♦ Space and utility requirements.
- ♦ Labor requirements.
- ♦ Implementation costs.
- ♦ Secondary impacts [i.e., potential odor generation, vector (birds, vermin, and other nuisance wildlife) attraction, and other nuisance factors].
- ♦ Compatibility with current waste collection and disposal methods.
- ♦ Health and safety concerns.

➢ Ease of Implementation Evaluation. The ease of implementing an opportunity should be established in light of existing and pending federal, state, local and medical governing body regulations as well as the compatibility of the opportunity with effective medical practice. A discussion about the ease of implementing the option should be included for each option. Opportunities that can be implemented quickly are the most desirable.

➢ Economic Feasibility Evaluation. The economic evaluation estimates the economic consequences of implementing the opportunity. The economic analysis procedure includes identifying applicable cost elements and estimating costs/savings. The implementation costs and potential savings should be listed for each option based on projections for the statistical range of waste diverted from disposal. The revenue or cost savings that would be generated by the sale or reuse of recyclable and compostable components should be established. Collection and disposal savings should be estimated based on the current cost of disposal. Operations and maintenance and capital cost data for each opportunity should be estimated.

Opportunities with payback periods of less than two years are highly desirable.

- Sensitivity Analysis. The analysis of the proposed opportunities is based on the data collected during the waste characterization study. While the collected data are assumed to be statistically sound, the potential for the data to be skewed or tainted by assumptions made does exist. A discussion of the sensitivity of the option to changes in key parameters should be included for each option. Opportunities whose economic analysis results remain stable despite changes to key economic assumptions are desirable.
- Opportunity Scoring. Opportunities can be scored (prioritized) in a number of different ways depending on the medical facilities priorities as established in its medical strategic plan. If cost is the major factor affecting option implementation, the weight given to economic factors may be higher than for other factors. The key is to implement sound, quantifiably cost effective options that will help meet the reduction goals.

7.1.7 Implementing the OA

7.1.7.1 Obtain Approval and Funding

The project will have to compete with other projects for either Defense Healthcare Program or Air Force funding. Having answers readily available for the following will greatly aid in the competitive process:

- Is the process now or will it be in the next year out of compliance with existing environmental, occupational and/ or radiological health regulations, standards or requirements? Will it become out of compliance because a new requirement will become effective within the next two years?
- How complex is the process? Include this information in the analysis.
- Would secondary waste streams require additional processing not now available?
- Does the project improve or impact worker health and safety?
- Will additional training be required for work center personnel?
- How much will the project reduce material usage or waste?
- What are the costs and the payback periods?
- What metric(s) are developed to monitor the effectiveness of the project?

7.1.7.2 Funding Sources For CRO/P2

Environmental cost reduction/pollution prevention projects are divided into recurring and non-recurring requirements. Annual recurring “must do” projects include manpower (authorized positions); updates to management plans; baseline survey updates; recurring operating costs associated with the process; municipal solid waste recycling programs; education/training; travel; and opportunity assessments. Non-recurring requirements are categorized into three levels:

- ODC and legal requirements; projects required to reduce or eliminate ODCs, or comply with the law, Executive Order, or DoD mandate.

- Meet future goals, policies, and legal requirements: programs meet current standards, but require action to meet future requirements, goals, and objectives.
- Beyond goals and legal requirements: augment installation's P2 activities, but go beyond what is required or projected.

The following provides information on possible funding sources available or required for implementation of a PPO.

- Federal Energy Management Program (FEMP). This is a Department of Energy program that covers energy conversion, renewable energy, and water conservation projects at federal installations.
- Pollution Prevention Program (PPP). This program includes all work necessary to eliminate or reduce undesirable impacts on human health and the environment to include use of processes, practices, or management actions. Pollution prevention funds can come from a variety of budget sources.
- Operations and Maintenance Funds. Installation funds from the O&M account may be available to implement a PPO.
- Recurring requirements to "keep the gates open" are funded with Operations and Services (O&S) money. Typical items funded with O&S money include hazardous waste disposal, permit fees, and sampling.
- Implement the pollution prevention solution. Keep records of the new components and amounts of the waste streams and compare them with to the older process to quantify the reduction efforts.
- When positive quantifiable results are documented, share the information with the MAJCOM Surgeons Office for possible implementation to other Air Force or DoD Healthcare Facilities.

7.2 Available Pollution Prevention Training

For information on conducting opportunity assessments, refer to the Air Force Resource Recovery and Recycling Program Guide, May 1995. Training in aspects of pollution prevention is available from a variety of Air Force, other military services, DoD, Federal Agency and commercial sources. For additional information on training and other P2 topics, consult PRO-ACT at:

DSN:	240-4214 240-3688, FAX
Comm:	(800) 233-4356 (210) 536-4214 (210) 536-5432, FAX
Internet E-Mail:	proact@hqafcee.brooks.af.mil
World Wide Web:	http://www.afcee.brooks.af.mil/pro_act http://www.afcee.brooks.af.mil/EQ/p2toolbox/ search using "training"

8 ENVIRONMENTAL COST REDUCTION/POLLUTION PREVENTION TRAINING GUIDE

8.0 Introduction

To have a successful Environmental Cost Reduction/Pollution Prevention (P2) program, all medical personnel must be aware of the program, understand it's significance and support it by following good cost reduction/pollution prevention practices. By educating the medical workforce to address reduction opportunities in the consumption of resources and subsequent waste generation, benefits will occur through cost reduction/savings. These benefits can take the form of current monetary savings and later during contingency operations because personnel have developed a conservation of resources mindset. This chapter provides an outline for medical commanders and supervisors to use to educate their personnel on the environmental cost reduction/pollution prevention program and how it benefits them, their work center, the medical unit and the environment. This guide can be used by a trainer in a classroom environment or by a facilitator in a team discussion group. The key to achieving the desired educational outcome is to make the topic important to the individual.

In the earlier chapters of this model report, emphasis was placed on the importance of complying with the Presidential Executive Order 12856, “Pollution Prevention and Right-to-Know in the Government” and the subsequent DoD and Air Force Policy Directives and Instructions. Environmental cost reduction/ pollution prevention goals were listed along with the reasons why it is the preferred method for solving the nation's environmental problems. Opportunity assessments were provided along with initiatives and good ideas. However, the success of this program hinges on the worker who uses the materials and resources and who generates the waste. The worker is the best resource for developing ideas and techniques on how to reduce cost and prevent pollution. Fostering the ideas of the workers and informing them of how to turn their ideas into workable solutions is the focus of this chapter. Development of an environmental cost reduction/ pollution prevention education program for medical personnel is essential to achieving an effective, cost saving program.

8.1 Educational Program Basics

Developing a pollution prevention education program is not difficult and requires a minimal amount of time and effort. The intent of the program is to “create, in medical personnel, a path of least resistance” toward implementing cost reduction/ pollution prevention ideas and initiatives. The program can help establish a resource conservation mindset that will provide critical benefits during contingency operations. The education should instill in personnel a sense that they can make a difference, are willing to follow existing pollution prevention practices and to seek new methods/ procedures that will contribute to the reduction of waste and subsequent savings in resources. Key components of the education program are:

- initial introduction,

- visual reminders,
- incentives/ rewards,
- reinforcement training.

8.1.1 Initial Introduction

The initial introduction portion can be achieved using different methods. Conducting a briefing in a small or large group setting is the standard approach of "getting the word out". This method is effective when the presenter is knowledgeable and motivated. It can be used to train the majority of medical personnel in a short time period. A variation of this technique is to train a small cadre of squadron/ work center personnel who would go return to their squadron and it's work centers and train the personnel in each work center. This technique is referred to as train-the-trainer.

If the medical unit has its own computer based intranet system, it can use that system to let personnel review the tenets of the pollution prevention program. This computer-based training would allow medical personnel to obtain the initial introduction at their pace in their own work center and at a time that they chose. This type of training can be very effective because it allows the user to review those sections that they may not understand completely. Verification of the effectiveness of the training can be accomplished automatically by having a question section at the end or having questions imbedded throughout the lesson. As the individual progresses through the lesson, the questions are answered and the results recorded by the computer.

For individuals in the medical group whom training beyond the basics of the program, there is a comprehensive AFIT course (AFIT Pollution Prevention Program Operations and Management Course). It is intended for those individuals with primary pollution prevention responsibilities in their organization. The course objective is for each student to comprehend the objectives, principles, and mechanics of an installation pollution prevention program. The student can gain the knowledge to successfully plan, establish, and execute a successful pollution prevention program. The course introduces management techniques that can be used to implement a sound pollution prevention program. These management techniques include ways to establish and run the program, conduct pollution prevention opportunity assessments (class exercises included), implement process changes to incorporate pollution prevention, assess pollution prevention program success, and establish awareness training.

8.1.2 Visual Reminders

Once the initial introduction to the program is accomplished, visual reminders to personnel should be used to reinforce the training. Labels, signs and placards can be placed on bulletin boards, walls, pieces of equipment, waste containers and in areas where disposable supplies, and hazardous materials are used to help remind personnel of the importance of the pollution prevention program. Use of the recycling symbol on colored paper with a short message on recycling can make a difference in having a successful program. Examples of short messages that can be used are:

- Recycling helps affirmative procurement.
- Better patient care can be achieved by saving resources.
- Waste not generated today means funds for patients tomorrow.
- Practicing conservation of medical supplies benefits contingency operations.

In areas where personnel have the opportunity to control utility use, reminders about conserving utilities should be posted to help further the objectives of this cost saving measure and pollution prevention opportunity. When using signs, they should be kept in place for only a set period of time. They should then either be replaced with a different sign, change the color of the background, or the sign removed for a short period of time and then reinstalled. By changing the sign/placard or by keeping it in place for just a set period time, personnel are more likely to notice it and follow it. The longer the same sign/ placard remains in place, the greater the possibility that personnel will become accustomed to seeing it and will no longer recognize it's significance.

8.1.3 Incentives/ Rewards

Successful pollution prevention programs use incentives and rewards to augment the training and visual reminders. When personnel are provided with positive benefits, they will strive to find ways to achieve a desired outcome. Incentives and rewards should be developed for individuals, work centers, flights, squadrons and even the entire group. Establishing the criteria for the award will encourage individuals to meet or exceed those criteria. The following are just a few of the various ideas to consider for incentives/ rewards:

- Awarding an achievement certificate or even medal to the individual(s) responsible,
- Making positive comments in the performance reports for the individual,
- Providing financial rewards through the use of the Air Force Suggestion Program,
- Providing a reserved parking place for a set period of time,
- Recognizing personnel publicly at commanders calls, in newsletters, and in articles in the installation newspaper,
- Reducing the work schedule using time off, passes, allowing individuals to have a flexible work schedule, and down days,
- Providing small gifts such a reusable coffee mug, a pen and pencil set, a free lunch or dinner at one of the installation clubs or at an off-installation restaurant.

8.1.4 Periodic Reinforcement Training

Once the initial training is complete, periodic refresher training should be provided. This can be accomplished through short presentations at commander's call or special meetings. This periodic training should highlight any changes that have occurred and reinforce the key elements of the program especially those relating to identifying any candidates for opportunity assessments. Also, the various funding mechanisms for implementation of pollution prevention opportunities should be discussed.

8.2 Training Guide and Resource Material

A sample lesson plan was developed for use by the medical group to help conduct the initial training of group personnel. Additional information on the subject can be found at the HQ AFCEE/EQ internet web site: www.afcee.brooks.af.mil. Another source of information is the AFCEE Pollution Prevention Compact Disk (CD), Version 3.0, August 1998 which contains the AETC Shop-Level Pollution Prevention Training Manual, with visual aids, that was developed by HQ AETC. The AETC training manual is quite comprehensive and provides a complete picture of the pollution prevention program. The CD also contains other valuable information and visual aids that can be used to conduct the initial and refresher training for medical group personnel.

8.2.1 Lesson Plan for Cost Reduction/Pollution Prevention Opportunity Program and the Medical Community

The accompanying lesson plan can be used as the starting point for the initial training of medical personnel. It provides the essential elements to introduce personnel to the topic. The presenter should develop his or her own visual aids for the lesson plan.

LESSON PLAN FOR
COST REDUCTION/POLLUTION PREVENTION OPPORTUNITY PORGRAM AND THE MEDICAL COMMUNITY

I. INTRODUCTION

NOTE: The presenter can insert his or her own unique opening to the topic here. An example of opening remarks follows:

If I could show you that by developing environmental cost reduction and preventing pollution initiatives today, you would be providing better patient care while saving the medical benefits for you, your dependents and all other beneficiaries, would you be interested? You may be wondering how environmental cost reduction/pollution prevention will provide increased benefits now and in the future. Developing ways today to reduce or eliminate the use of hazardous materials pays dividends. This can be achieved by not having to spend money to dispose of the waste generated and for the care of personnel whose health was adversely impacted due to the use and disposal of the hazardous material. Environmental cost reduction/pollution prevention is more than just another program environmentalist succeeded in getting legislation passed. It can have a very positive impact upon you and your daily activities. For environmental cost reduction/ pollution prevention to succeed, every one must do their part.

- **Potential Training Objectives**

1. Define pollution prevention, what it is and is not.
2. Describe the Medical Service role in environmental cost reduction/pollution prevention.
3. Describe how workers can contribute to environmental cost reduction/pollution prevention.
4. List the steps in developing a cost reduction/pollution prevention initiative.

II. TOPIC OUTLINE AND DISCUSSION

A. Environmental Cost Reduction/Pollution Prevention Definition and Principles

1. **Environmental Cost Reduction/Pollution Prevention: What it is.**

- The terms environmental cost reduction and pollution prevention are basically synonymous; pollution prevention will be used to refer to both for the rest of the presentation.

- Concept designed to prevent pollution be reducing or eliminating harmful discharges to the air, land and water at the source.

- Established by the Pollution Prevention Act (PPA) of 1990 and set up an environmental management system. PPA states that:

    - First, whenever possible, pollution should be prevented or reduced at the source. When successful, source reduction either eliminates or reduces the pollution altogether! That is why it's the first choice.

    - Second, if pollution by source reduction can not be accomplished, then consider recycling. Recycling extends the useful life of a waste material.

    - Next, the third option is treatment after source reduction and recycling. Treatment offers the opportunity to reduce the volume and/or toxicity of the waste. In some cases, treating waste without a permit is illegal. Check with the Environmental Flight before treating a waste.

- Finally, if after trying everything else there is still a waste, disposal is the last choice. The Resource Conservation and Recovery Act (RCRA) states that if you dispose of or release a waste into the environment, it must be done in an environmentally safe manner. RCRA strictly regulates how disposal must be done.

- Definitions:
    - Pollution prevention means "source reduction" and other practices that reduce or eliminate the creation of pollutants through increased efficiency in the use of raw materials, energy, water, or other resources or protection of material resources by conservation.
    - Source reduction is any action that reduces the amount of waste generated from a process or activity.
    - Recycling refers to material that is used, reused, or reclaimed. RCRA provides a definition of recycling in 40 CFR 261.

- Source reduction activities: Occur at the "front of the pipe," before a material enters the process. Source reduction is any activity or practice that:
    - Reduces the amount of a hazardous substance, pollutant, or contaminant entering a waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal, and
    - Reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

- Source reduction may include, but is not limited to, the following:
    - Good operating practices: for example, tight inventory controls of pharmaceutical expiration dates will help reduce the quantity of expired pharmaceuticals.
    - Input material changes: for example, seek non-hazardous substitutes for materials that contain formalin.
    - Process modifications: for example, using digital radiographic procedures in place of the "wet process" method of developing radiographic film.

- Recycling in an environmentally sound manner is the second option. The following activities and practices are defined as recycling:

- A material is used or reused [40 CFR 261.1(b)(5)] if it is employed in a particular function or application as an effective substitute for a commercial product. (For example, waste oil can be reused as fuel for heat recovery.)
- A material is reclaimed [40 CFR 261.1(b)(4)] if it is recovered or processed to recover a usable product or regenerated or processed to remove impurities from the waste to obtain a relatively pure reusable substance. (For example, filtering to remove impurities can reclaim solvent used in laboratory procedures.)

2. Pollution Prevention: What it is not.

- Burning
- Evaporating
- Neutralizing
- Diluting
- Reducing Waste Volume
- All of the actions listed above are treatment; simply stated, RCRA (40 CFR 260.10) defines treatment as any actions taken to change the character or composition of waste. Note: Many types of treatment activities require a permit; you should check with the Environmental Flight before treating a waste.

3. Pollution Prevention Principles.

- Life Cycle: Every material used in a work center creates a waste stream, and those waste streams affect the environment. Each material has a "life cycle" and, at every step in that life cycle, what is done with the material dictates if a waste is generated or not. The following are the major steps in the life cycle of a material.
  - Purchase
  - Storage
  - Used in process
  - Unused material returned to storage
  - Waste accumulation
- A material is ordered, stored as inventory, sent to the work center and used in a process. Unused portions of the material are returned to storage. Any waste that results from the material's use is accumulated for disposal. If the waste is non-hazardous, it adds to the municipal solid waste (MSW) stream. If it is infectious or pathological, it may also add to air pollution if the waste is incinerated. If it is hazardous, it adds to the hazardous waste stream.
- Hazardous wastes are generated from hazardous materials. A hazardous material/waste must be tracked, handled, stored, accumulated, and disposed of in accordance with the laws.
- Every decision made in the life cycle process has an effect on the environment. To successfully apply pollution prevention, focus on the entire process, not just one step.

B. Medical Service Role in Pollution Prevention

1. Flow Through Economy.

- When we want something, we take natural resources, convert them into products, and dispose of everything else. This process is acceptable if you have unlimited resources and an unlimited amount of land in which to bury your waste but, we have neither. The resources on our planet are finite.
- When you have a growing population and a flow-through economy, the result is an enormous amount of waste that is difficult to but must be manage.
- Waste management problems are common in densely populated and highly industrialized areas. When large amounts of waste are not managed properly, they can accumulate in the air, in the water, and on the land, reaching concentrations that degrade the environment and are dangerous to health.
- Some wastes are more dangerous than others are. The use of hazardous materials and the problems associated with hazardous wastes have long-term, far-reaching effects on our lives. When hazardous wastes are not managed properly, we end up with situations like Love Canal, Chernobyl, Bhopal, a burning Cuyahoga River, and air so thick that schoolchildren are not allowed to play outside.

2. Air Force Team.

- Medical Service is a part of the total force concept. Some medical groups are potential major waste generators for their installation, for example, the 59th Medical Wing, Lackland AFB and the 81st Medical Group, Keesler AFB. Other medical groups are small contributors to the installations waste stream, such as the 70th Medical Group, Vance AFB or the 76th Medical Group, Kelly AFB.
- Medical groups can change from a minor to a major factor in the efforts of the installation to meet its pollution prevention goals. As the once major hazardous material uses and waste generation areas on the installation are addressed with solutions developed that reduce their contribution, the smaller contributors increase in significance.
- Utility conservation in the medical groups facilities is extremely important because:
  - The installation has a goal to meet and the medical group must do its part to help meet that goal.
  - The installation charges the medical group for the utilities it uses and the lower the usage, the lower the charges to the medical group. Lower medical group charges translates into more funds available for patient treatment and work center improvements.
- Financial and public relations benefits can accrue to both the medical group and the installation as it demonstrates that it can establish and meet those goals in controlling the use of hazardous materials and in reducing or eliminating waste generation. Being a good neighbor to the surrounding community is one of the Air Force's basic tenets.

C. Individuals Role in Pollution Prevention

1. Terminology.

- Municipal solid waste - non-hazardous waste generated by domestic, administrative and medical work centers. Includes wastes such as durable goods, non-durable goods, containers, packaging, food scraps, paper products and wood pallets.
- Medical waste - waste that may include any and all of the following:
  - Infectious - waste that has the potential of producing infectious diseases.
  - Pathological waste - includes tissues, organs and body parts removed during surgery and autopsy.
  - Microbiologic waste - cultures and stocks of infectious wastes and associated biologicals that can cause disease in humans.
  - Contaminated sharps - includes hypodermic needles, scalpels and broken glass.
- Hazardous waste - waste that can pose a substantial or potential hazard to human health or the environment. The waste possesses at least one of the following: ignitability, corrosivity, reactivity or toxicity. Antineoplastic and some pharmaceuticals are included in this category.
- Radioactive - waste that contains a radioisotope and may be in the form of a solid, liquid or gas.
- Mixed waste - waste that contains more than one of the above waste.

2. Follow Established Waste Segregation Procedures.

- Dispose of waste in the proper disposal container. Avoid the temptation to just drop the waste into the nearest container. Do not mix the waste after segregating them.
- Effect of not segregating waste streams:
  - Medical group has unnecessary expenditure of funds that could have been used for patient care,
  - Medical group is in violation of environmental laws because of improper disposal practice.

3. Options to Reduce Health Hazards and Waste Generation.

- Can you substitute a non-hazardous material for a hazardous material?
- Can you order only the quantity required to complete the job, thus avoiding waste material that must be disposed of properly?
- Can you change the process to increase efficiency, reduce a health risk to the workers and reduce waste stream quantities?
- Can you return, to a central storage location such as the Hazard Material Office’s storage facility, any leftover material for others to use before the product reaches it’s shelf-life expiration date?
- Can you recycle/recover any usable product/waste from the process?

D. Steps in Developing a Pollution Prevention Initiative

1. Process Based Approach.

- Examine activities by looking at work center inputs, work process/procedures and outputs.
  - Process is a series of tasks grouped together for the purpose of evaluating all exposures that influence occupational health, community health and the environment. Sterilizing medical instruments, analyzing a specimen or sample, and taking a radiographic image of a patient are examples of a process.
  - Task is the most basic unit of activity that can be used to identify and communicate potential hazards or impacts on the environment. Tasks are the building blocks for describing a process. Developing radiographic film, preparing amalgam, staining a slide, and loading ethylene oxide cartridges in the sterilizer are examples of tasks.

2. Initiative Evaluation Steps.

- Work with others in the work center and squadron to let them know of your interest in finding a way to reduce the use of hazardous materials or a process that reduces or minimizes waste generation. Consider establishing a team to evaluate the process.
- Look at the process task by task and determine where materials are used and the waste generated.
- Determine the major material or hazardous inputs and waste stream components and focus your efforts on eliminating or reducing those.
- Develop process flow diagrams to help with the identification of material inputs and waste outputs.
- Identify existing resources that could help provide suitable alternatives for use in the work process tasks.
- If existing resources do not prove to be helpful, seek assistance from other work centers on the installation such as Bioenvironmental Engineering in the medical group and the Environmental Flight in civil engineering.
- Develop a list of options that will need a technical and feasibility evaluation.
- For those processes that are beyond the capabilities of the medical group to develop options, develop a technical needs statement for submission to the Air Force Environmental, Safety and Occupational Health (ESOH) Technical Planning and Integrated Product Team (TPIPT) through MAJCOM channels.
- For those processes that can be evaluated locally, evaluate the options by listing the advantages and disadvantages. Develop cost comparisons for the most promising options.
- Chose the best option and initiate the requests for funding.
  - Some options will be able to be implemented with minimal funding while other options may require capital expenditures beyond the financial capabilities of the medical group.
  - For options requiring resources beyond the capabilities of the medical group, work with the installation Environmental Flight to determine if Air Force pollution

prevention funds could be made available. If so, work with them to initiate the A-106 process.

- For those options that do not qualify under the A-106 process, work with the Medical Support Squadron to develop a project submittal to be forwarded to MAJCOM for funding using Defense Health Program funds. The project may need to be included in the medical group's medical strategic plan as part of its resource requirement identification.
- Consider submitting a suggestion through the AF Suggestion Program for possible implementation Air Force wide.

➢ Once funding is available, implement the options and evaluate the effectiveness of the option. Refine the tasks or process as appropriate to achieve the desired outcome.

III. Summary

1. **Questions.** Are there any questions concerning the material presented?

2. **Additional References**. If additional information is desired on the subject of pollution prevention, the following are excellent locations where more information may be obtained.

➢ The medical group pollution prevention management action plan.

➢ HQ Air Force Center for Environmental Excellence (AFCEE) at Brooks AFB TX: www.afcee.brooks.af.mil/eq .

3. **Concluding Remarks.**

The presenter should develop his or her own remarks. The remarks should highlight the importance of the subject with a brief summary of the key points. The following is an example of the concluding remarks:

As I stated in the opening, avoiding and /or preventing pollution today could help you save your medical benefits by saving patient care funds. Knowing what pollution prevention is; what the medical service role is; how individuals contribute to pollution prevention; and knowing the steps to follow in developing pollution prevention initiatives all contribute to increasing the awareness of the importance of this topic. As each of us practice waste minimization procedures, the cost benefits will rapidly accrue. We live on a planet with finite resources and by using them efficiently, we will help maintain the intricate balance that exists between our environment and ourselves.

APPENDIX A

LIST OF ACRONYMS

LIST OF ACRONYMS

ABS	Acrylnitrile Butadiene Styrene
ADA	American Disabilities Act
AEE	Agency Environmental Executive
AETC	Air Education and Training Command
AF	Air Force
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFCESA	Air Force Civil Engineer Support Activity
AFI	Air Force Instruction
AFIT	Air Force Institute of Technology
AFMS	Air Force Medical Service
AFPD	Air Force Policy Directive
AFSA	Air Force Safety Agency
AMDS	Aerospace Medicine Squadron
BCE	Base Civil Engineer
BEF	Bioenvironmental Engineering Flight
CAA	Clean Air Act
CAP	College of American Pathologists
cc	Cubic centimeter
CD	Compact Disk
CDC	Center for Disease Control
CDRL	Contract Data Requirements List
CD/ROM	Compact Disk/ Read Only Memory
CES	Civil Engineering Squadron
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CHCS	Composite Health Care System
CPG	Comprehensive Procurement Guideline
CRO	Cost Reduction Opportunity
CRT	Cathode Ray Tube
CSAF	Chief of Staff of the Air Force
CT	Computed Tomography
CWA	Clean Water Act
DENIX	Defense Environmental Network and Information Exchange
DLA	Defense Logistics Agency
D.O.	Delivery Order
DoD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Redistribution and Marketing Organization
DS	Dental Squadron
ECAMP	Environmental Compliance, Assessment and Management Program
ECSAM	Environmental Compliance, Sampling, Analysis and Monitoring
EKG	Electrocardiogram
ENT	Ears, Nose and Throat
EO	Executive Order
EPA	Environmental Protection Agency
EPC	Environmental Protection Committee

EPCRA	Emergency Planning and Community Right-to-Know Act
ER	Emergency Room
ESL	Environmental Safety Library
ESOH	Environmental, Safety, and Occupational Health
ETO	Ethylene Oxide
EVA	Ethylene Vinyl Acetate
FAR	Federal Acquisition Regulation
FEE	Federal Environmental Executive
FY	Fiscal Year
GSA	General Services Administration
GOCO	Government Owned Contractor Operated
GI	Gastrointestinal
HAMS	Hospital Aseptic Management System
HAZCOM	Hazard Communication
HAZMAT	Hazardous Material
HCFC	Hydrochlorofluorocarbon
Hg	Mercury
HHL	Health Hazard Listing
HID	High Intensity Discharge
HQ	Headquarters
hrs/wk	Hours per week
HW	Hazardous Waste
Hz	Hertz
IEX	Issue Exception Code
IV	Intravenous
JCAHO	Joint Commission for Accreditation of Healthcare Organizations
LED	Light Emitting Diode
MAJCOM	Major Command
MAP	Management Action Plan
MSDS	Material Safety Data Sheet
MDG	Medical Group
MDOS	Medical Operations Squadron
MDSS	Medical Support Squadron
MDW	Medical Wing
MERC	Medical Equipment Repair Center
MHz	Megahertz
MILSPEC	Military Specification
MRI	Magnetic Resonant Imaging
MSP	Medical Strategic Plan
MSW	Municipal Solid Waste
MTF	Medical Treatment Facility
MW	Medical Waste
NA	Not Applicable
NAF	Nonappropriated Fund
NCO	Noncommissioned Officer
NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
OA	Opportunity Assessment
O&M	Operations and Maintenance
OB/GYN	Obstetrics/ Gynecology

ODS	Ozone Depleting Substance
OFP	Office of Federal Policy
OSHA	Occupational Safety and Health Act
P2	Pollution Prevention
P2OA	Pollution Prevention Opportunity Assessment
PA	Polyamide
PACAF	Pacific Air Forces
PCCE	Polyintercyclohexan-dimehylcyclohexan-dicarboxycyclate Elastomer
PE	Polyethylene
PFD	Process Flow Diagram
PIES	Pollution Prevention Information Exchange System
PPA	Pollution Prevention Act
ppm	Parts per million
PPOA	Pollution Prevention Opportunity Assessment
PS	Polystyrene
PUR	Polyurethane
PVA	Polyvinyl Alcohol
PVC	Polyvinyl Chloride
QA/RM	Quality Assurance/ Risk Management
QRPO	Qualified Recycling Program
RCRA	Resource Conservation and Recovery Act
RMAN	Recovered Materials Advisory Notice
ROI	Return on Investment
SARA	Superfund Amendments and Reauthorization Act
SBSS	Standard Base Supply System
SCBA	Self Contained Breathing Apparatus
SECAF	Secretary of the Air Force
SF	Standard Form
SNUD	Stock Number Directory
STEL	Short Term Exposure Limit
TIM	Technical Information Management
TO	Technical Order
TPIPT	Technical Product Integrated Process Team
TRI	Toxic Release Inventory
TSD	Treatment, Storage and Disposal
TWA	Time Weighted Average
USAF	United States Air Force
USDA	United States Department of Agriculture
WAVE	Water Alliances for Voluntary Efficiency
WRM	War Reserve Material
www	World Wide Web

APPENDIX B

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REFERENCES

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APPENDIX C

PROCESS FLOW DIAGRAMS

Figure C-1 Process Flow Diagram - Administrative Tasks

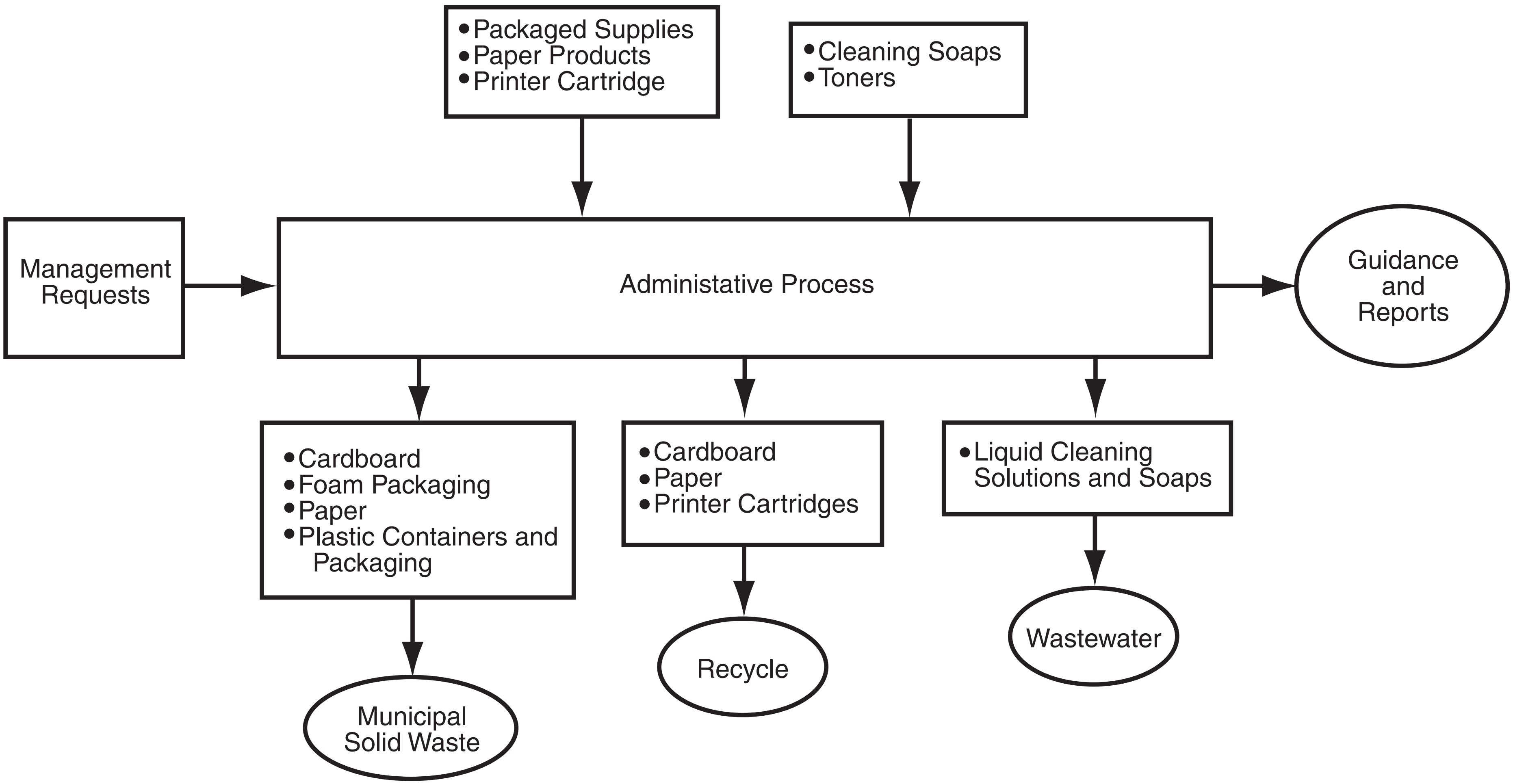


Figure C-2 Process Flow Diagram - Flight Medicine

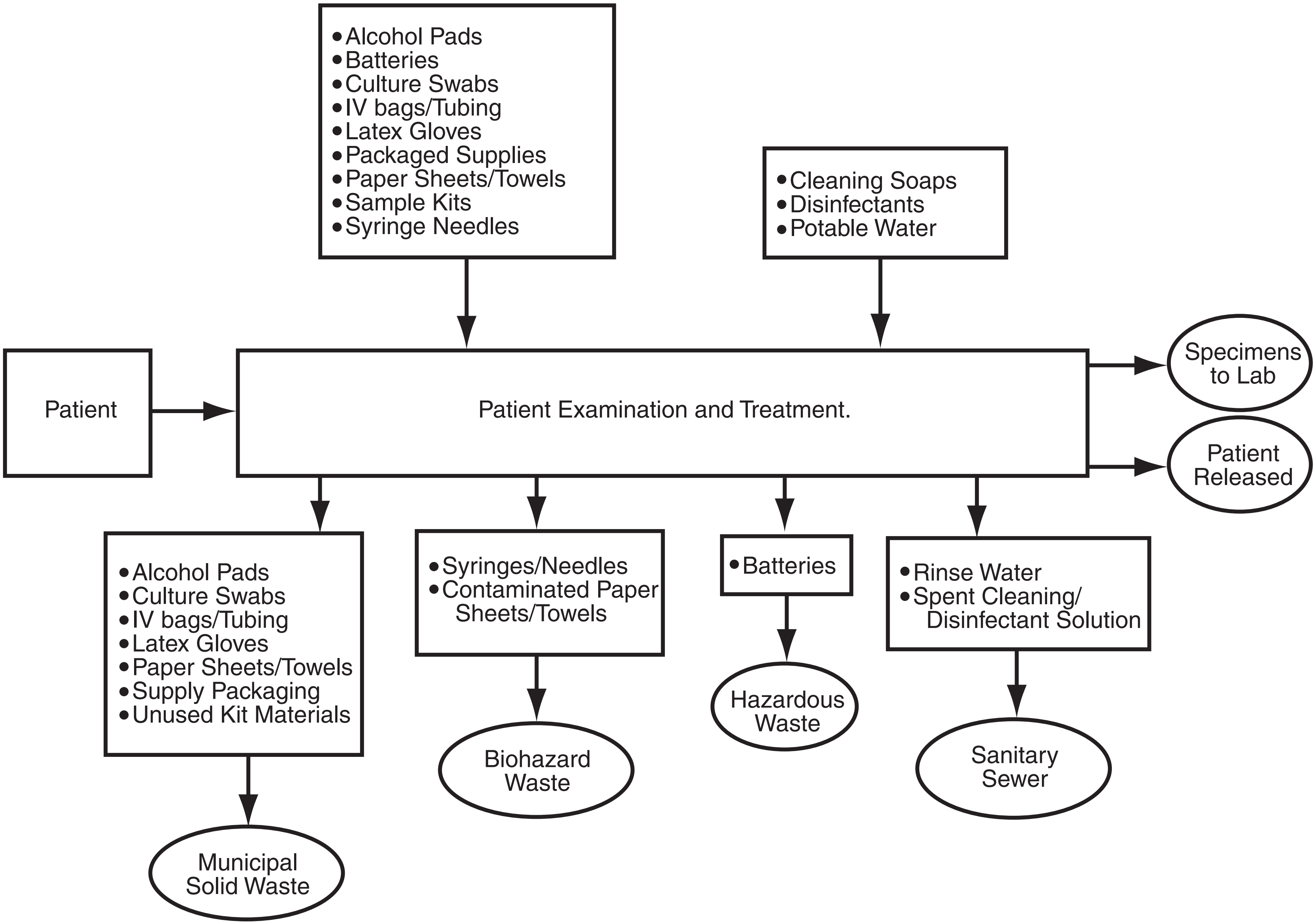


Figure C-3 Process Flow Diagram - Bioenvironmental Engineering

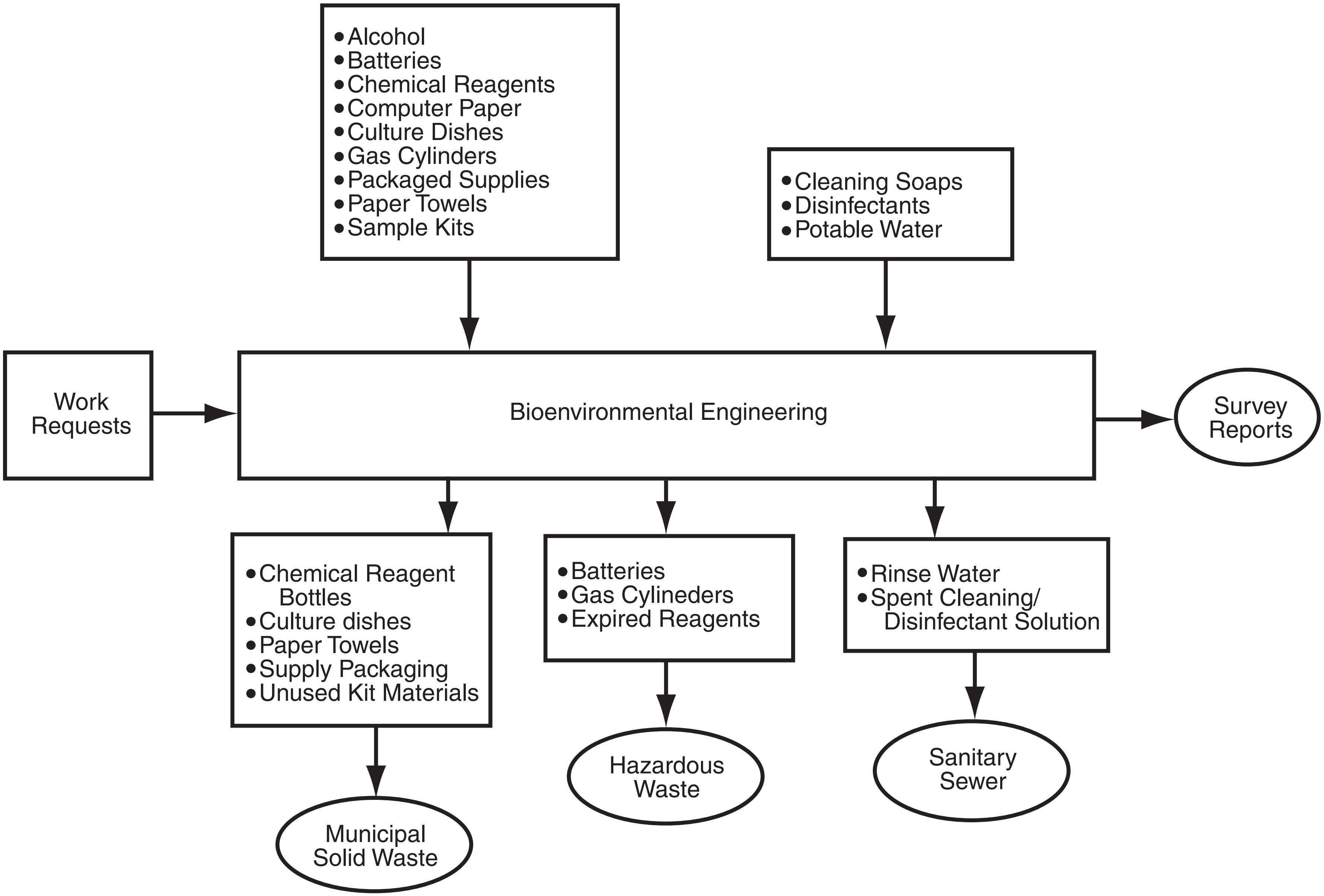


Figure C-4 Process Flow Diagram - Immunizations

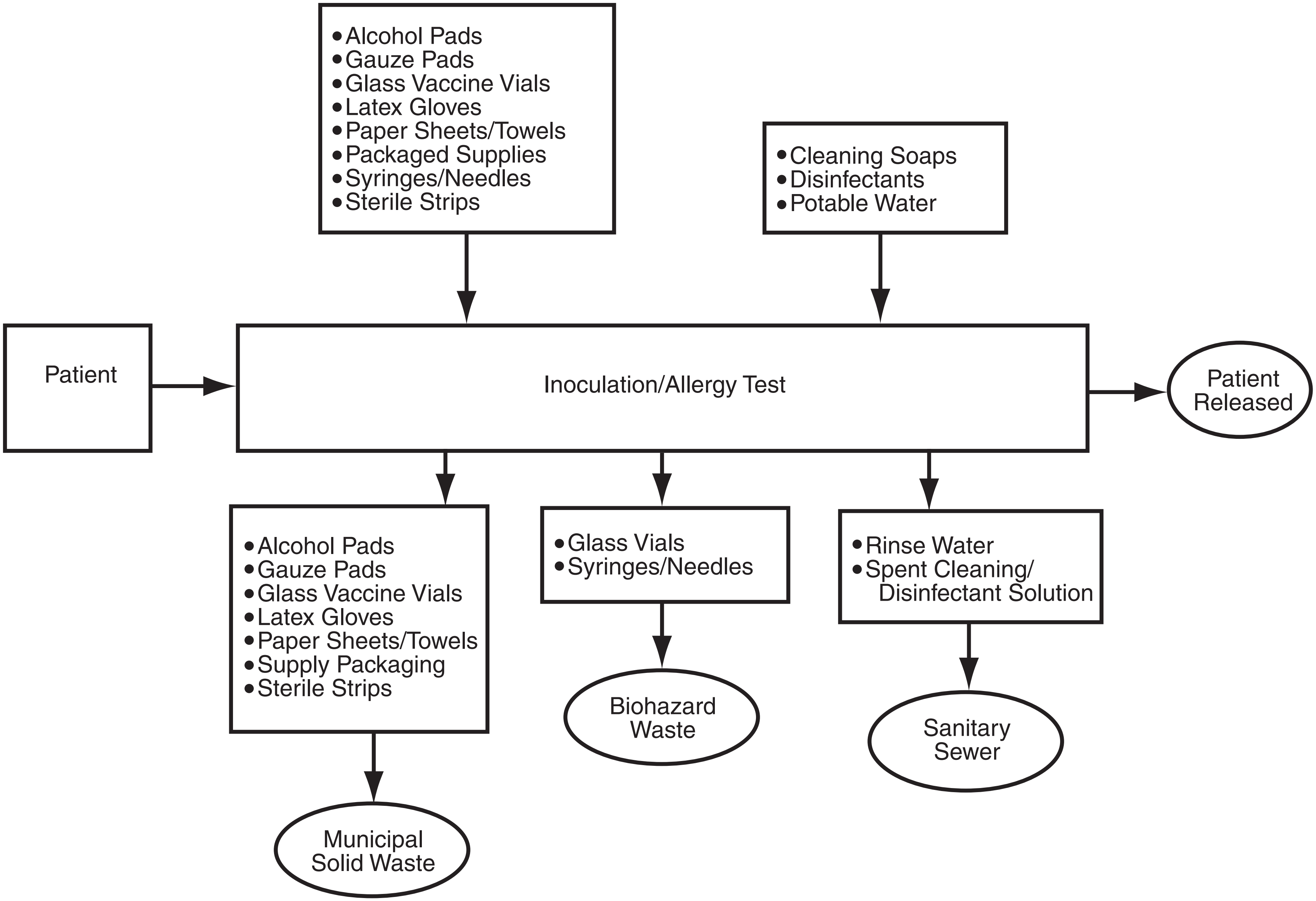


Figure C-5 Process Flow Diagram - Optometry

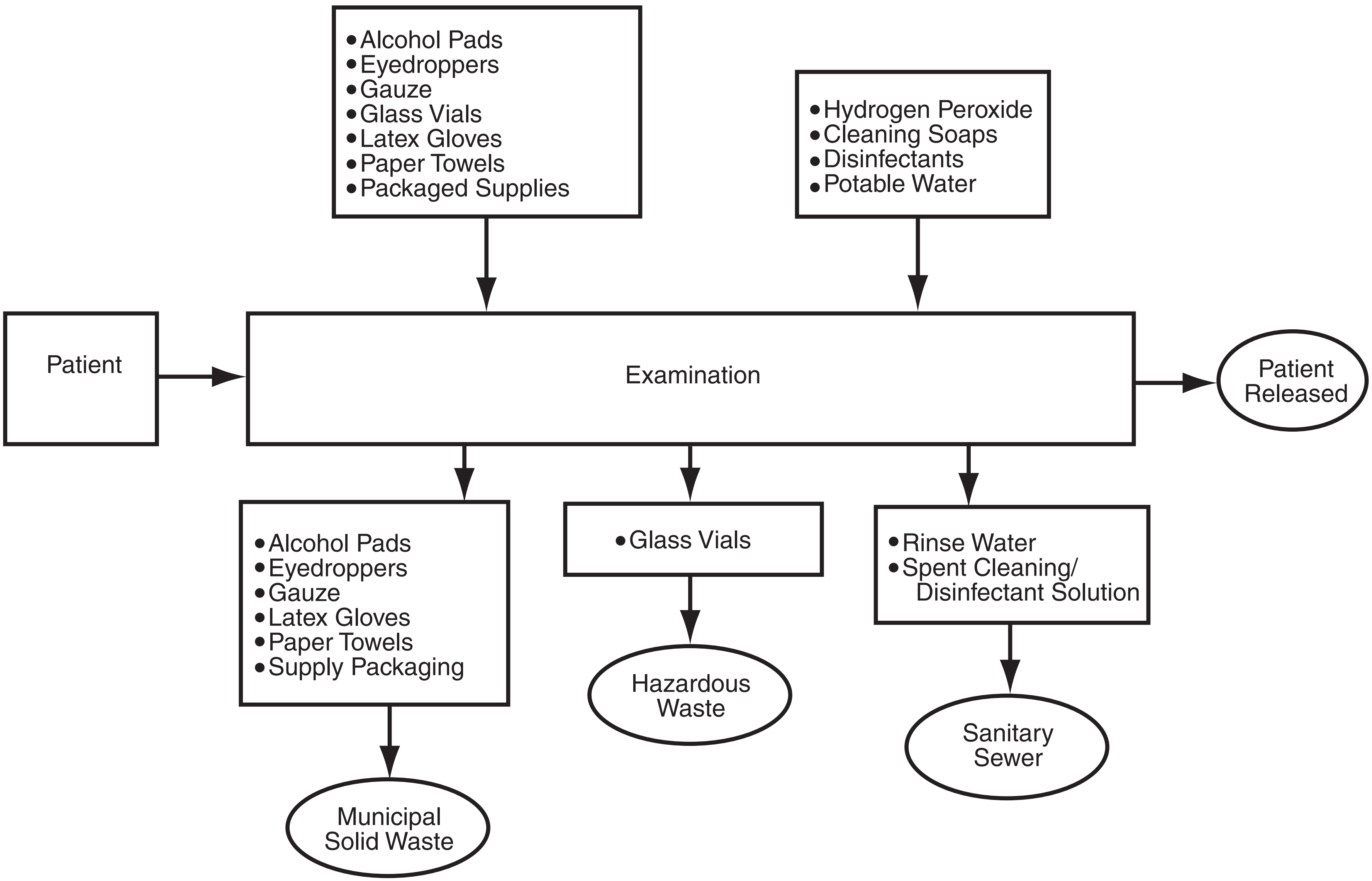


Figure C-6 Process Flow Diagram - Medical Readiness

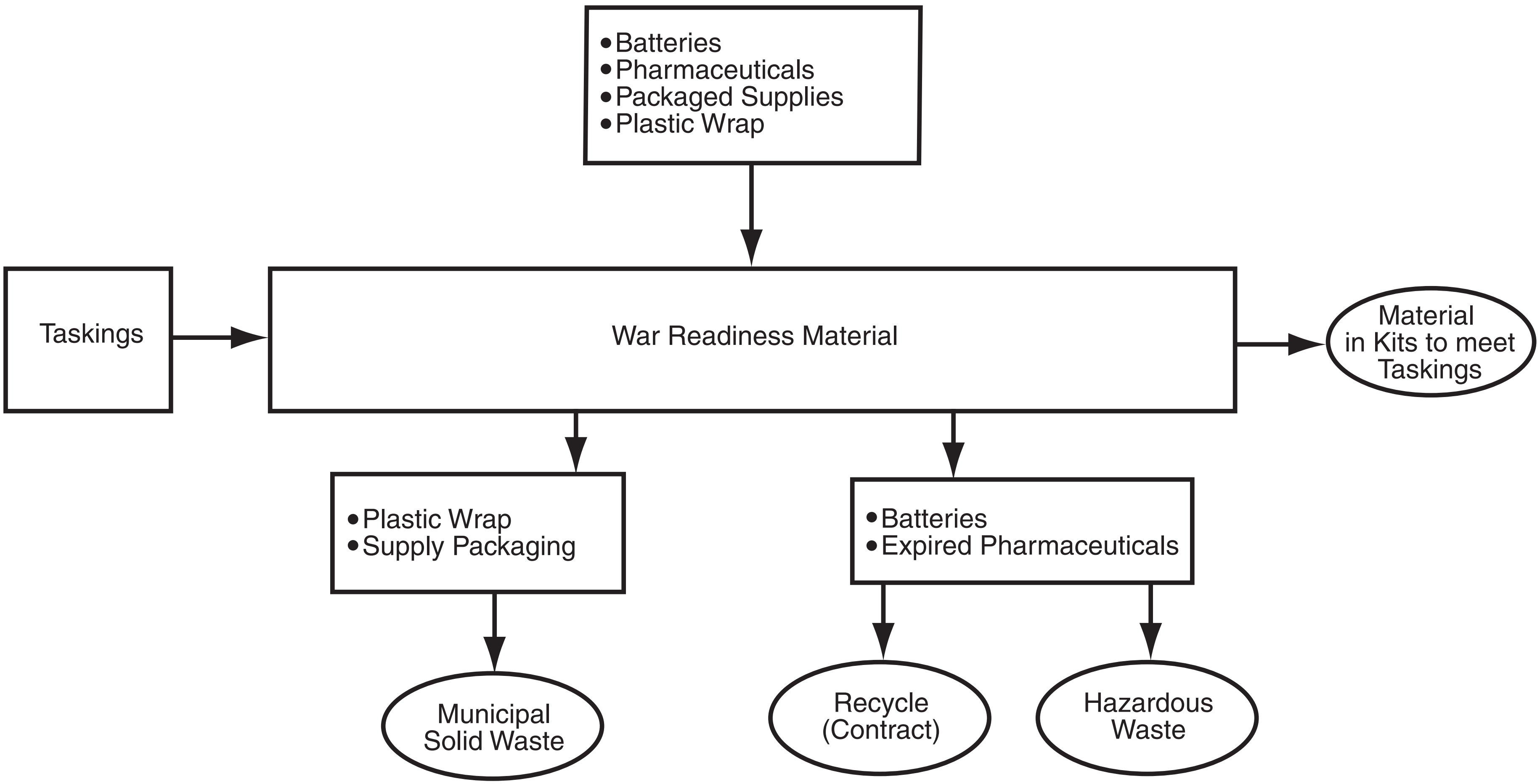


Figure C-7 Process Flow Diagram - Dental Screening Examination Work Center

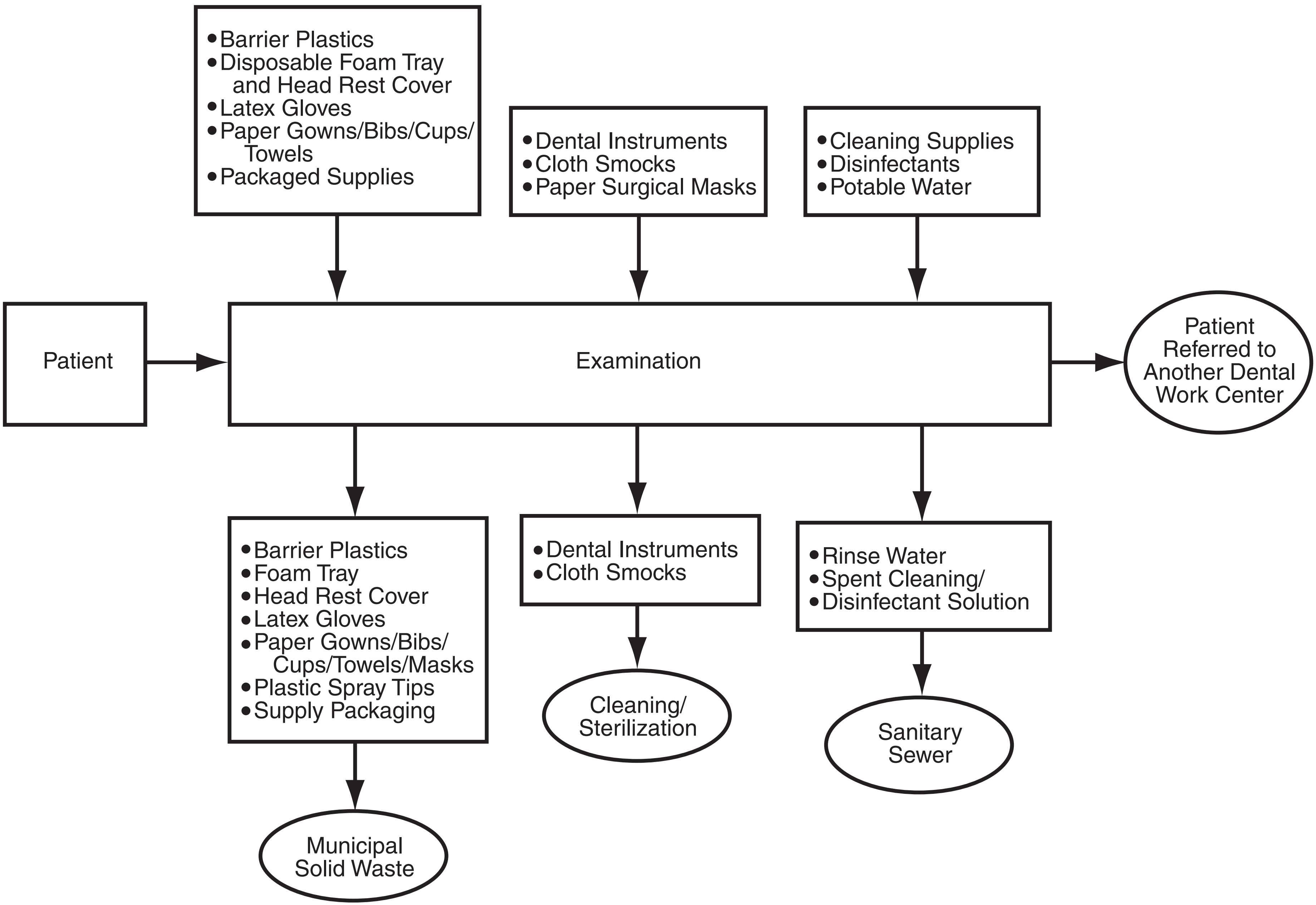


Figure C-8 Process Flow Diagram - Preventive Dentistry/Oral Hygiene

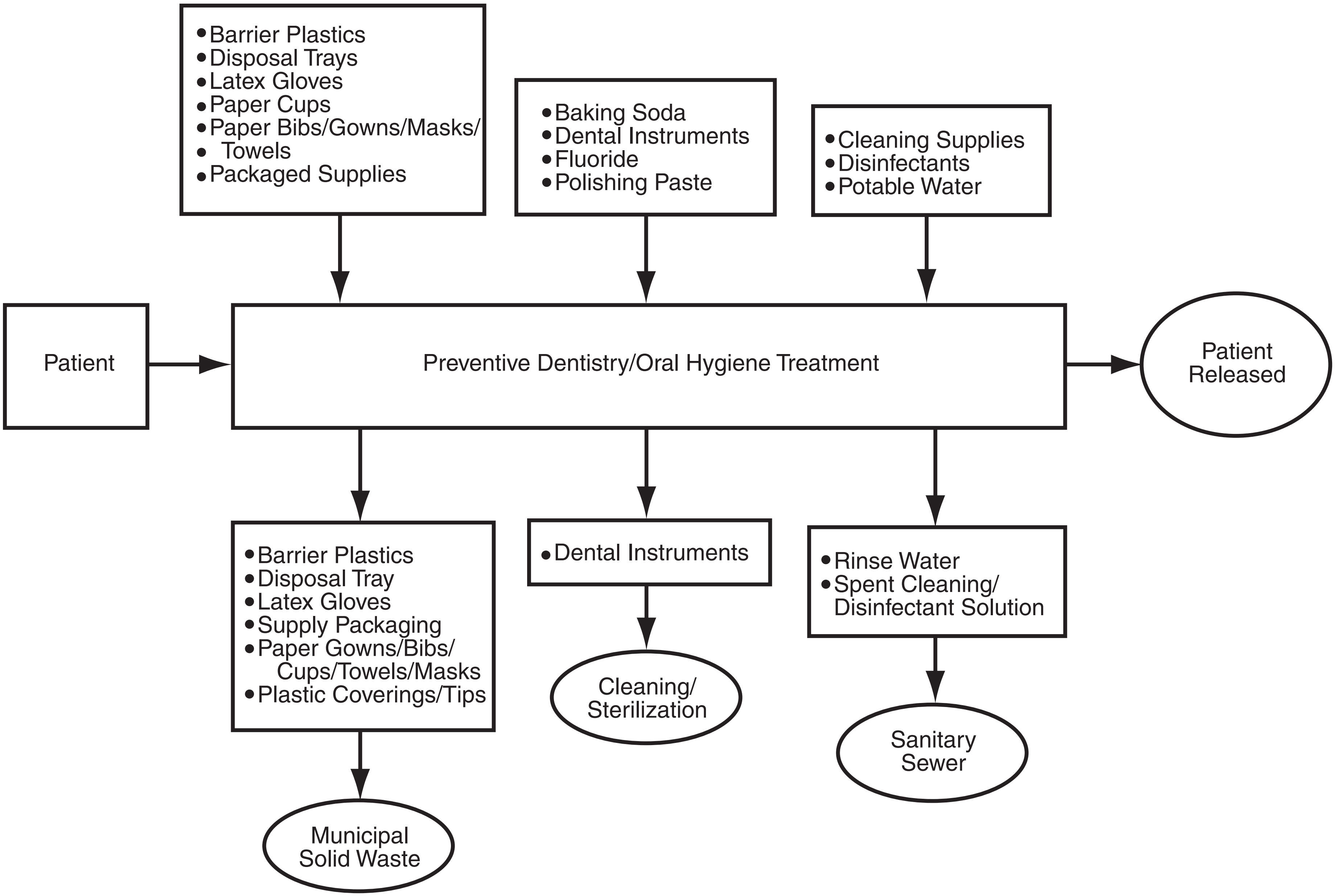


Figure C-9 Process Flow Diagram - Dental Restoration Work Center

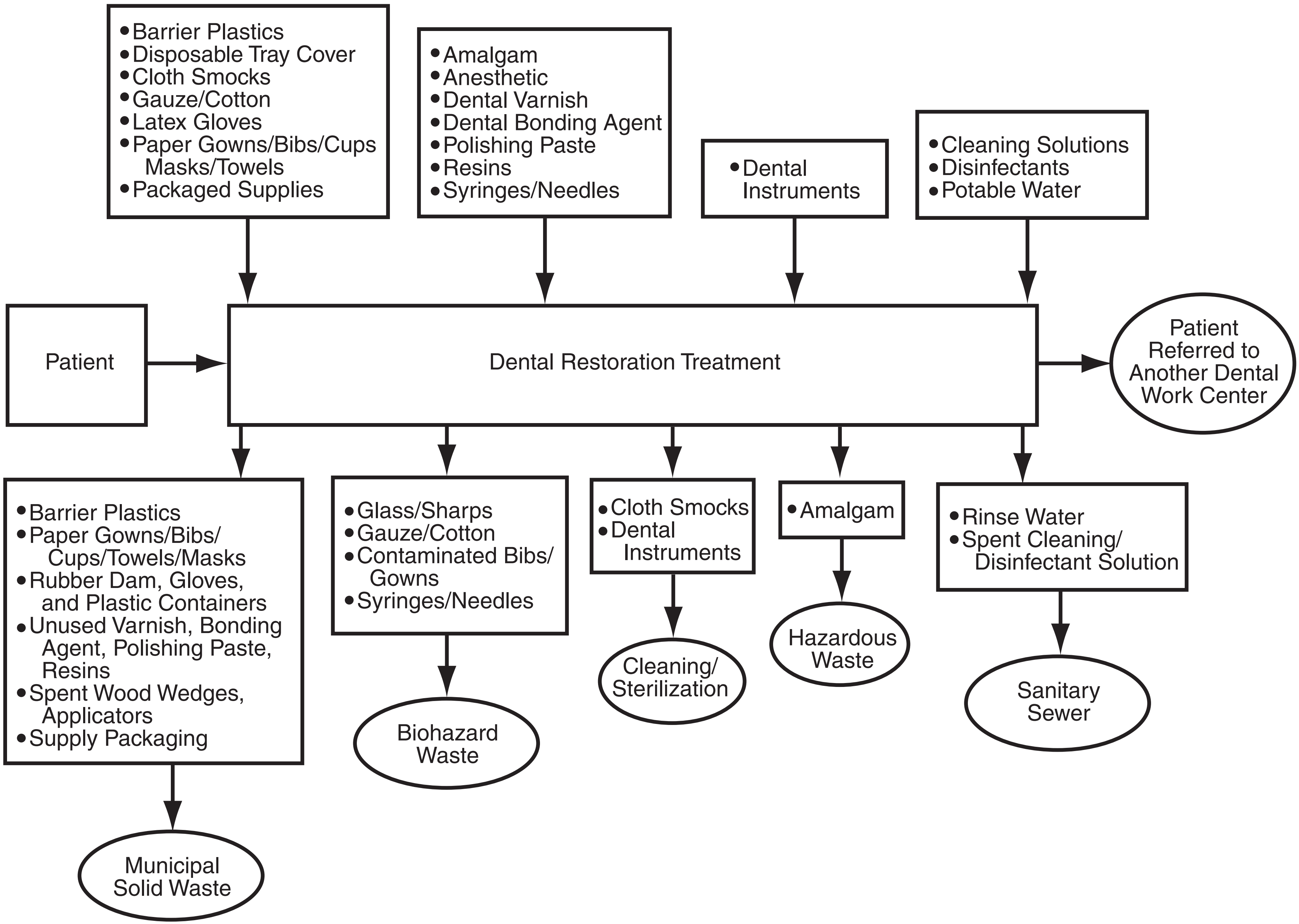


Figure C-10 Process Flow Diagram - Endontics Work Center

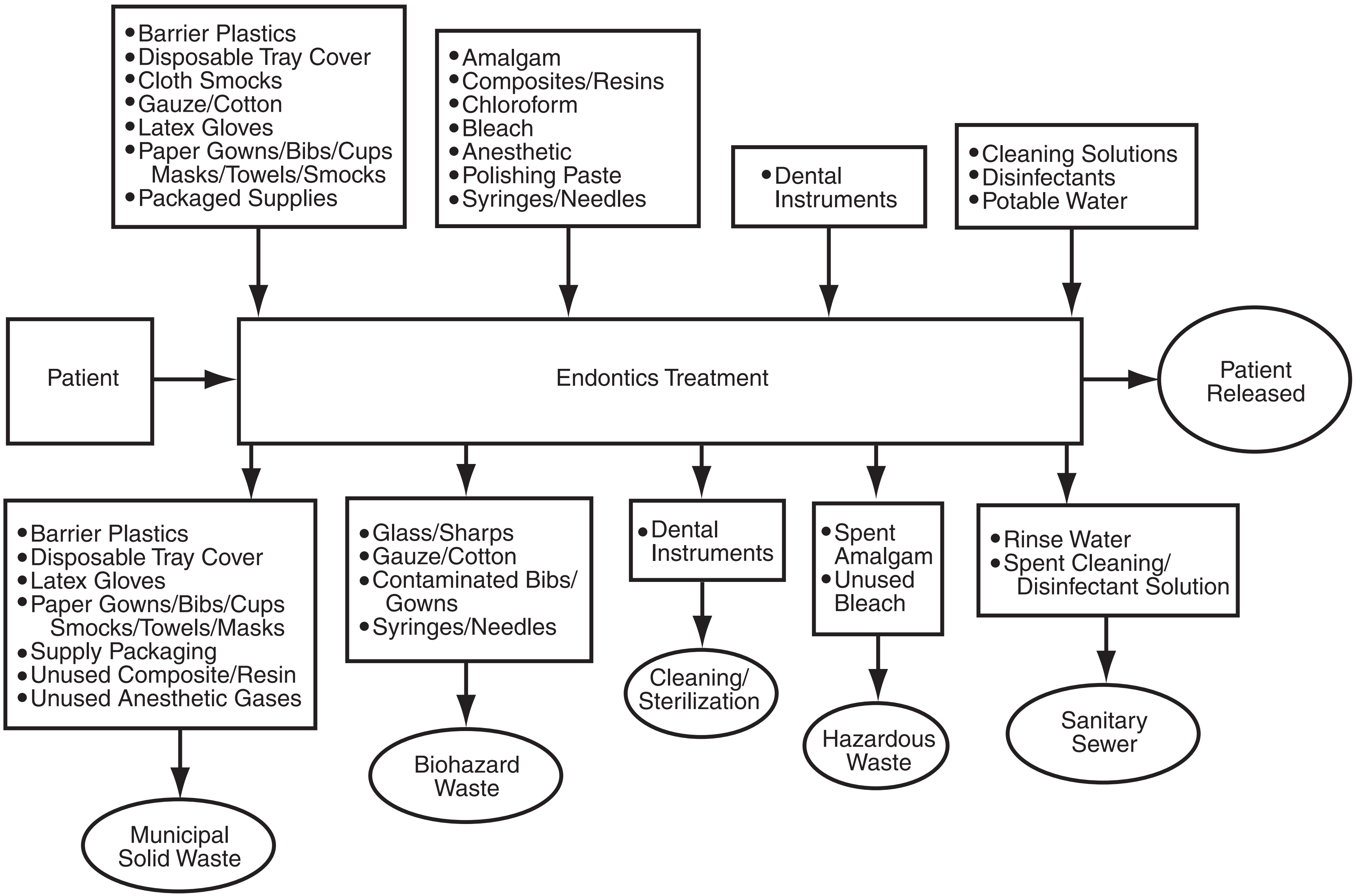


Figure C-11 Process Flow Diagram - Oral Surgery

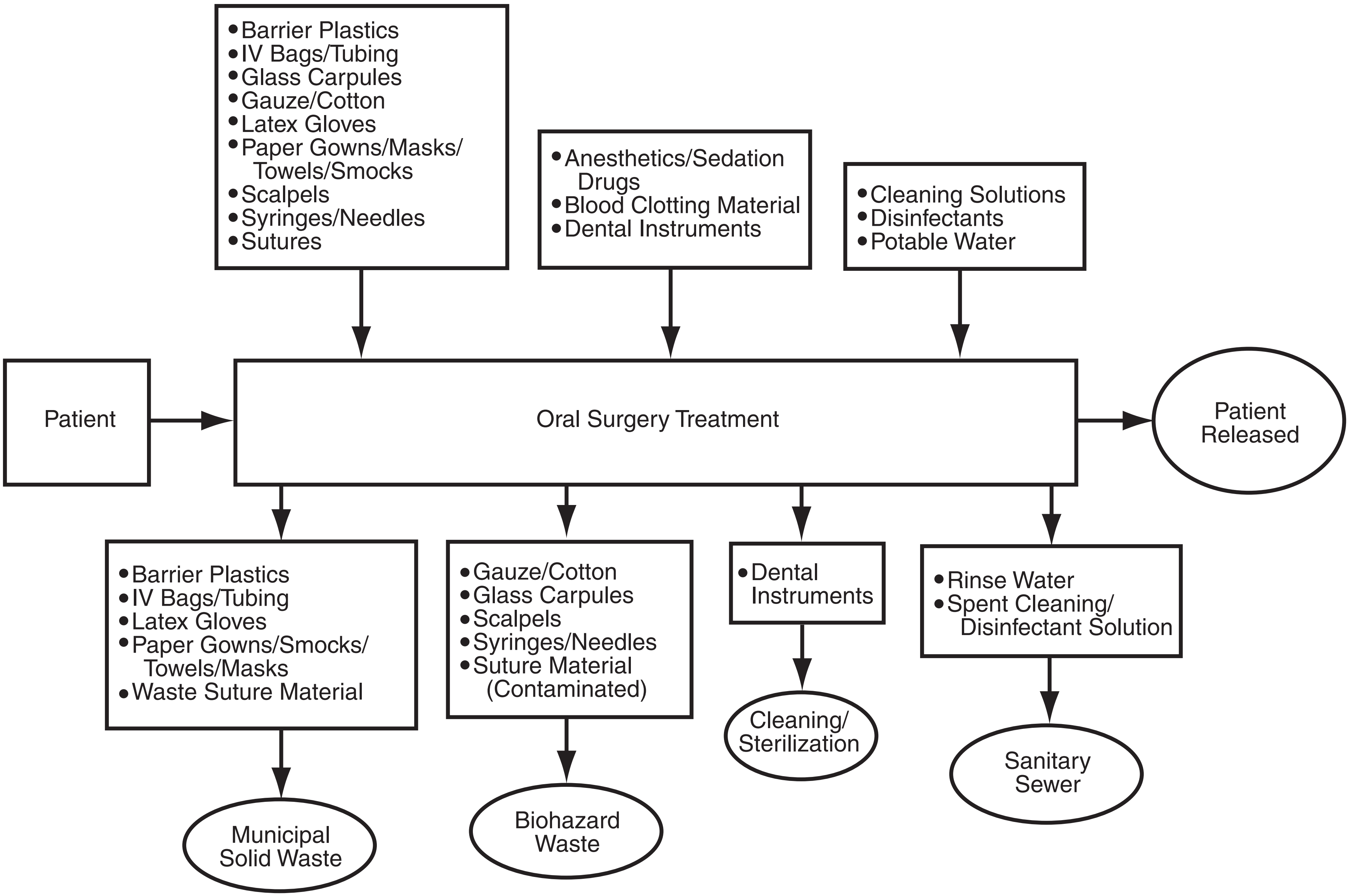


Figure C-12 Process Flow Diagram - Prosthodontics Work Center

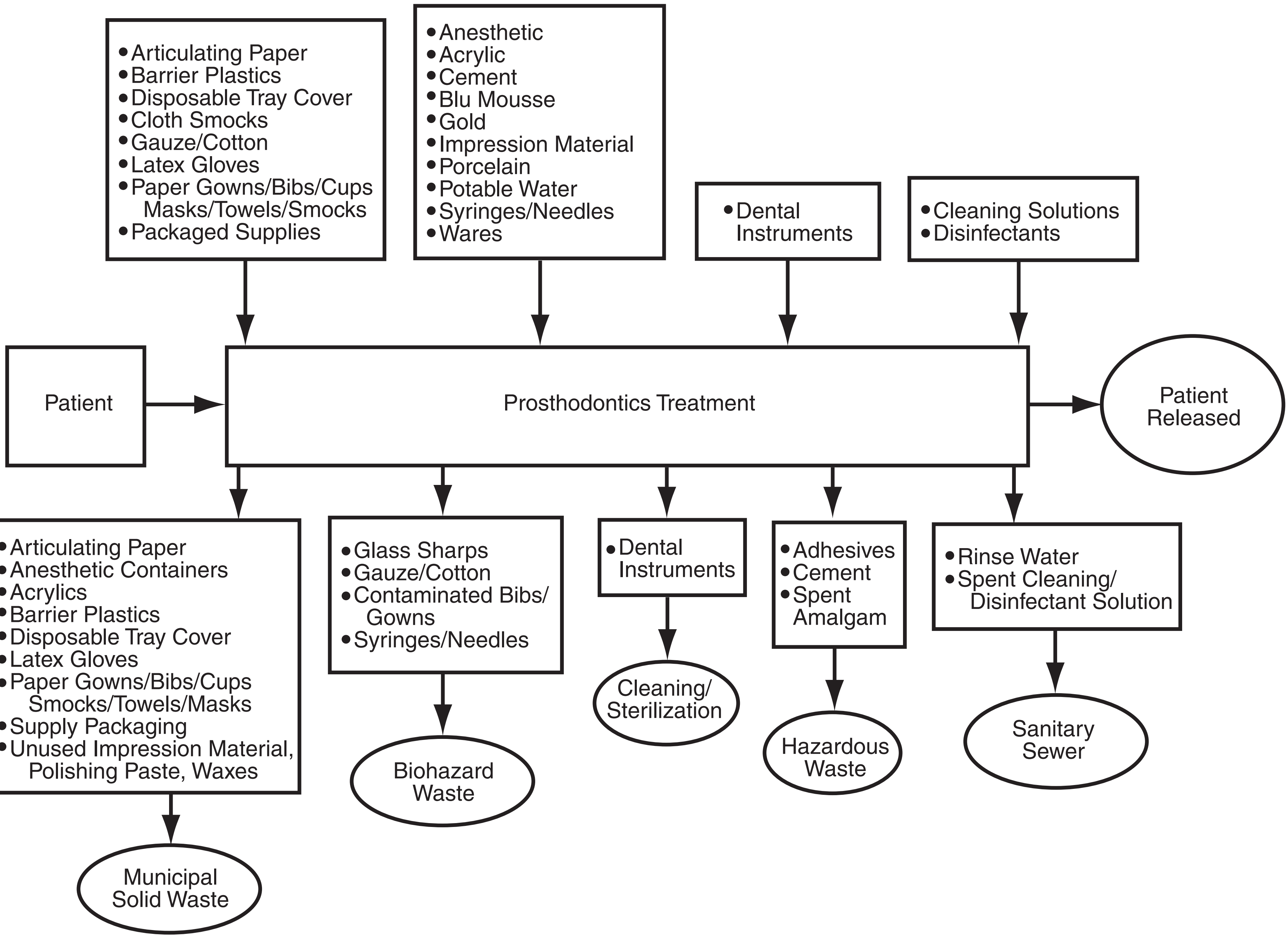


Figure C-13 Process Flow Diagram - Dental Crown Preparation Work Center

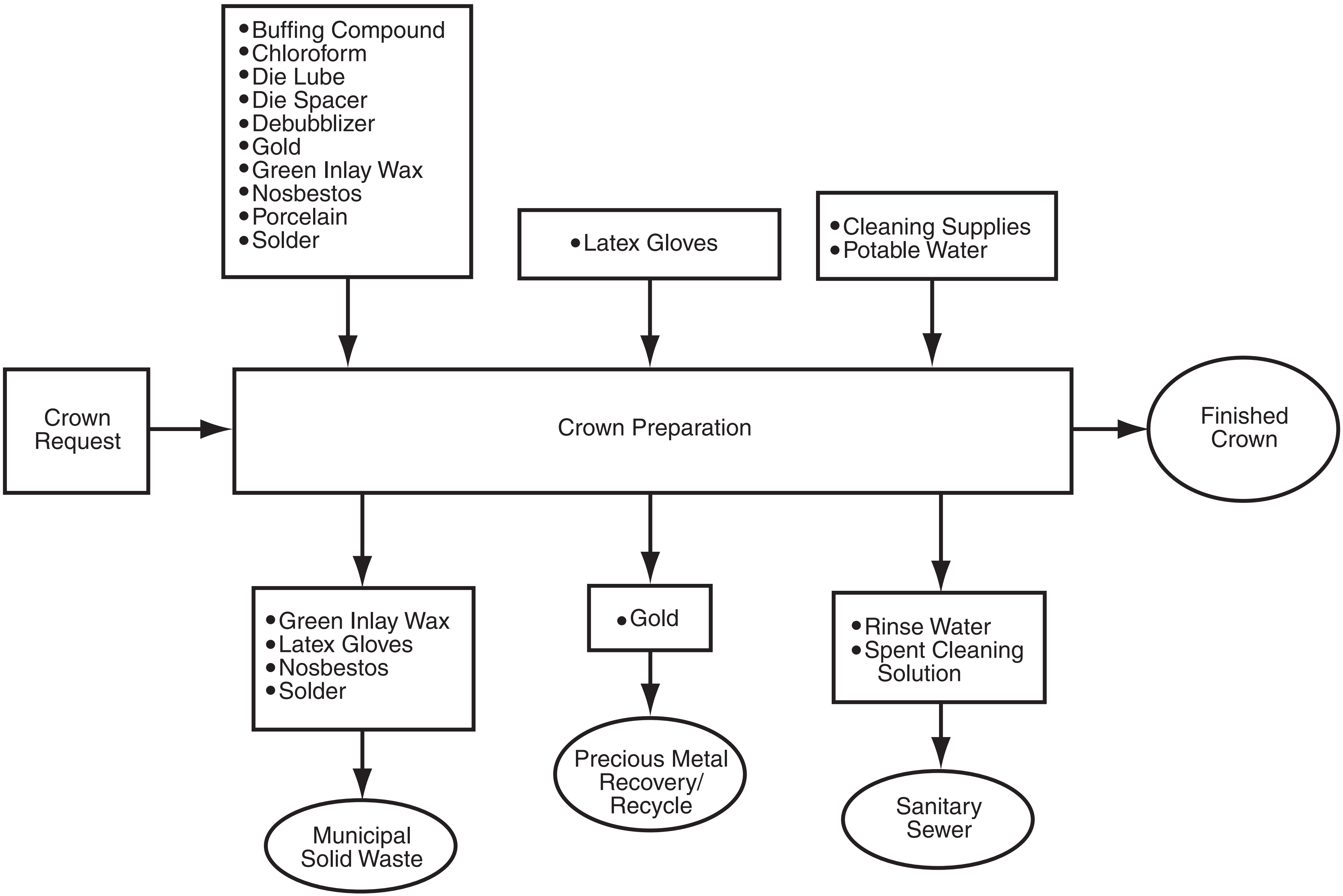


Figure C-14 Process Flow Diagram - Denture/Custom Tray Preparation Work Center

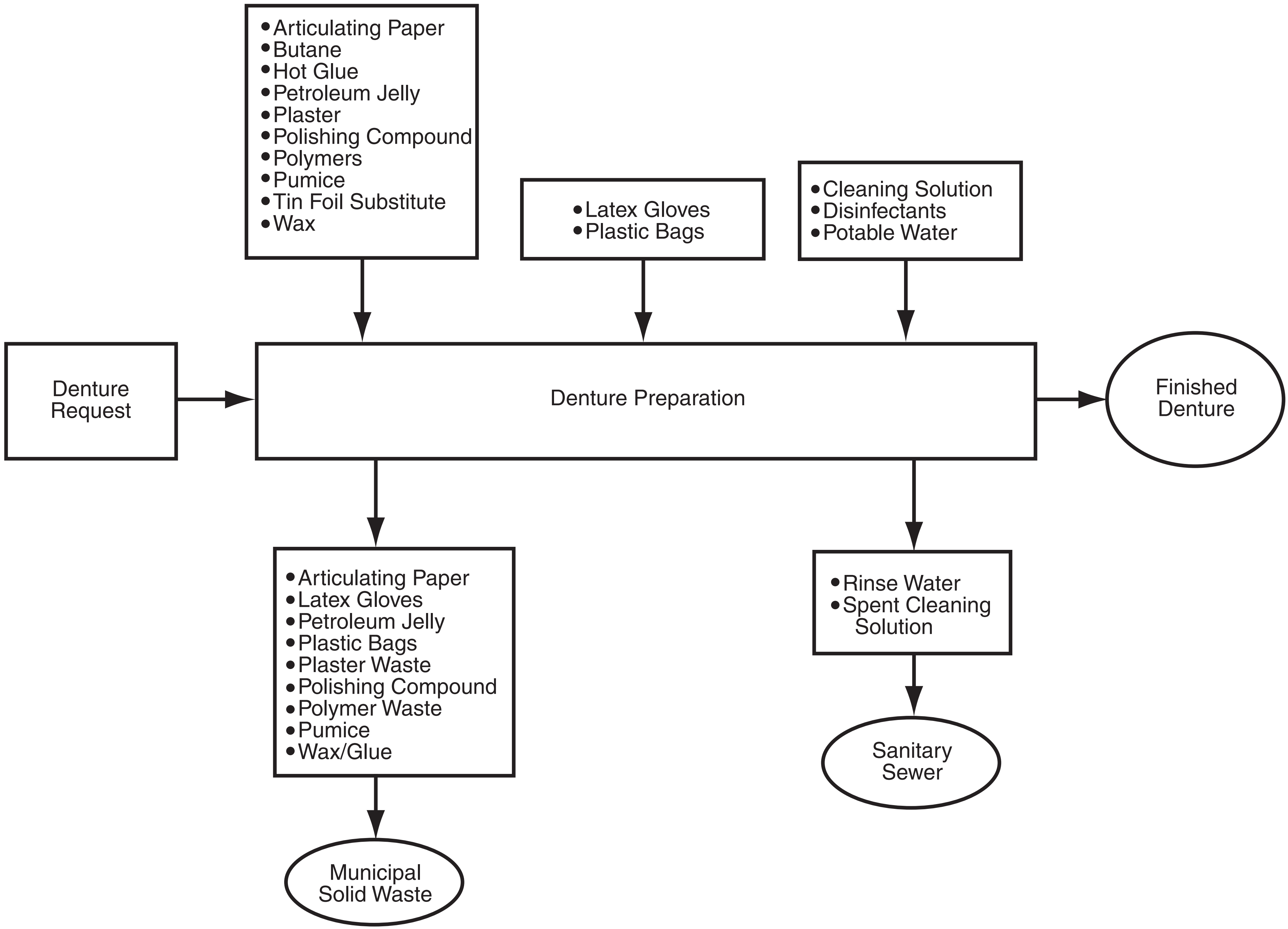


Figure C-15 Process Flow Diagram - Dental Radiography "Wet Process"

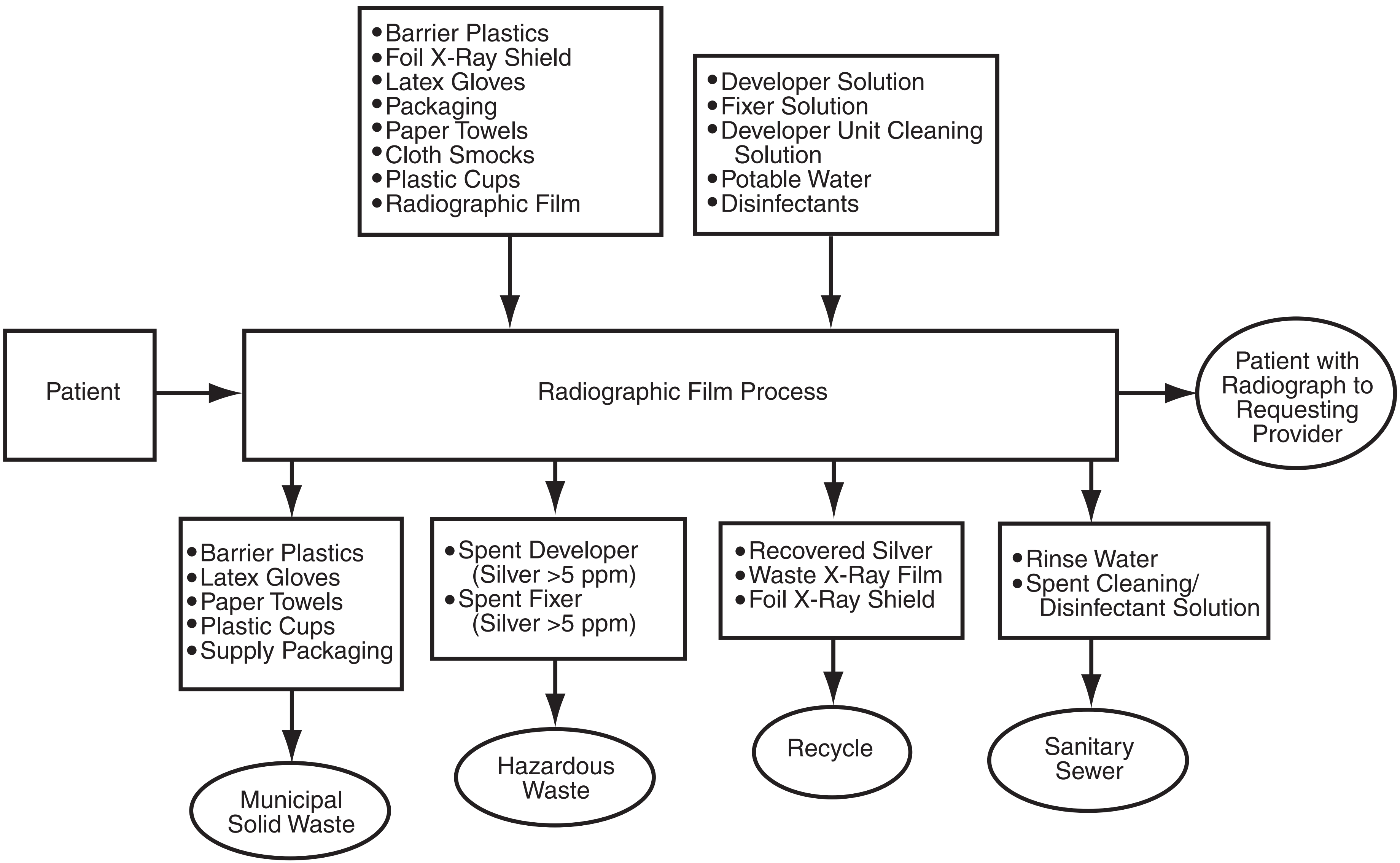


Figure C-16 Process Flow Diagram - Dental Instrument Sterilization

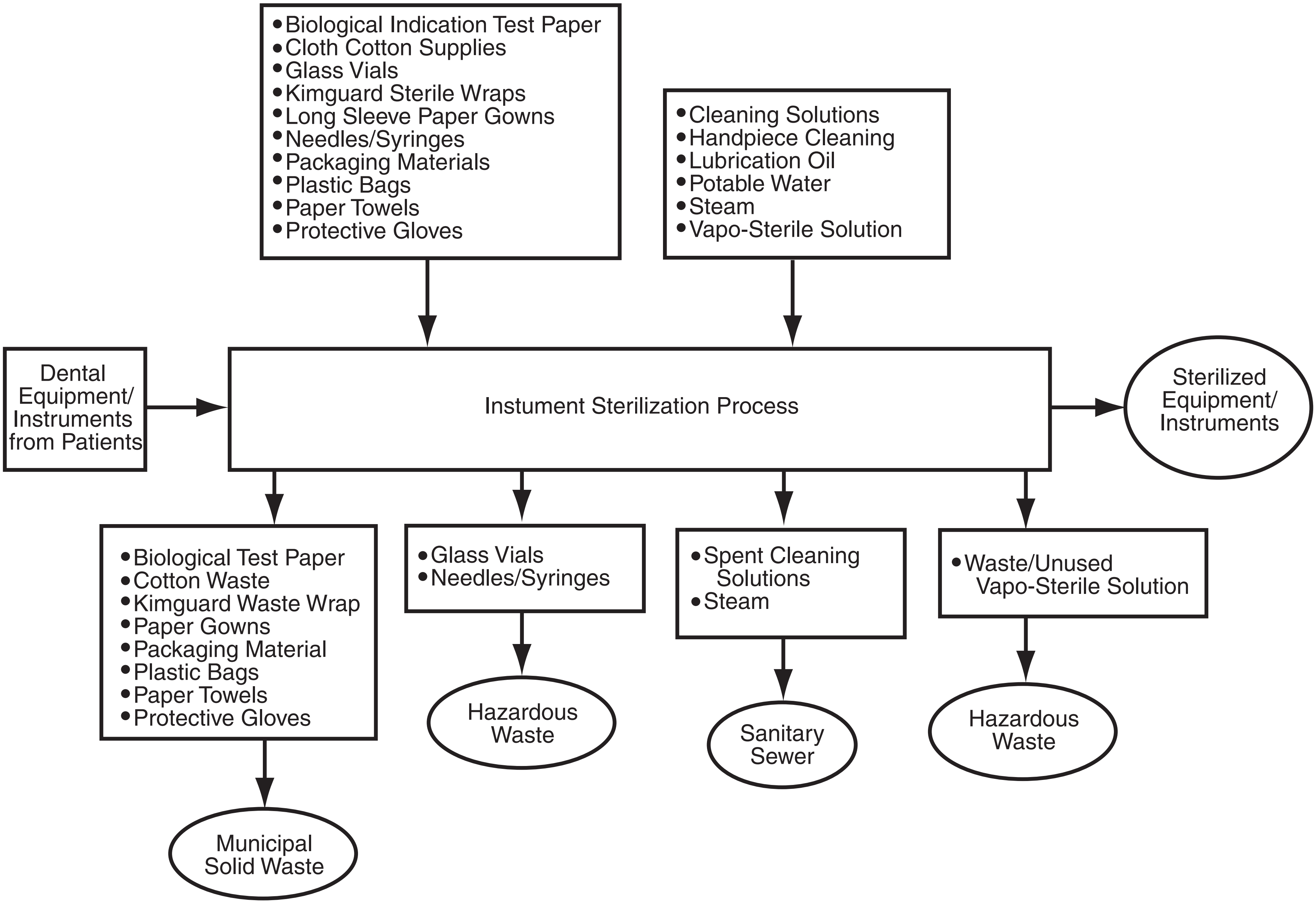


Figure C-17 Process Flow Diagram - Emergency Services

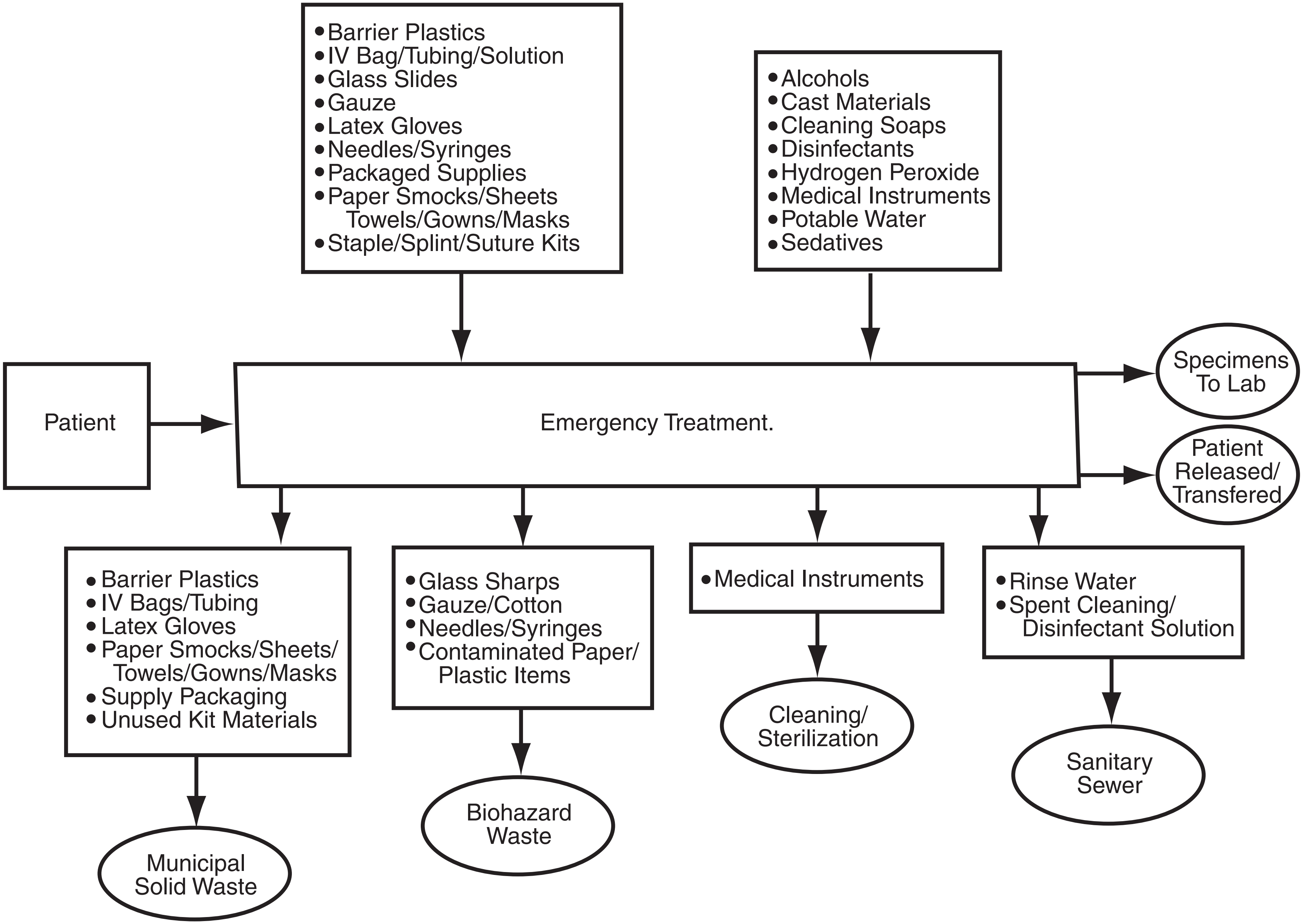


Figure C-18 Process Flow Diagram - Cardiopulmonary

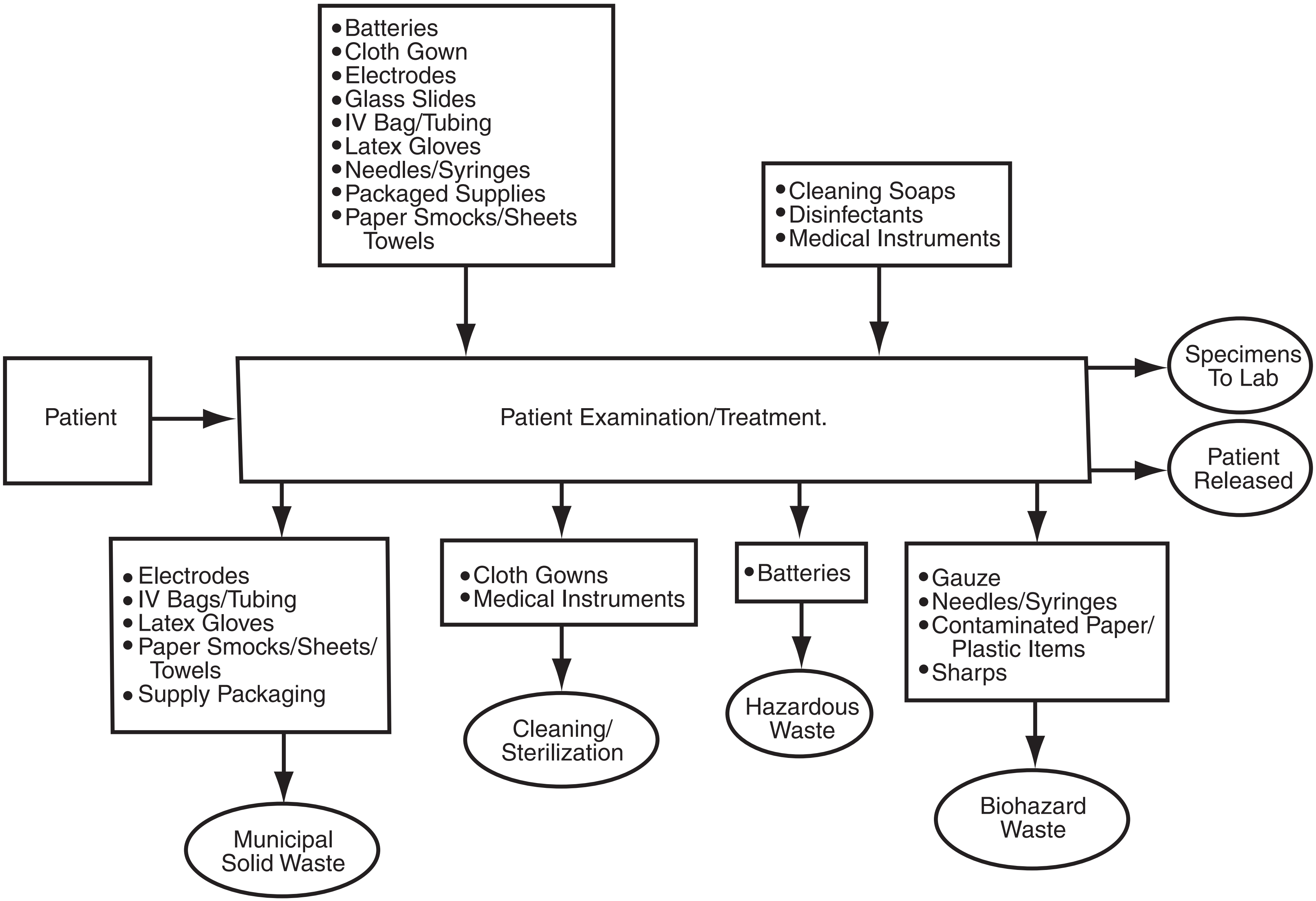


Figure C-19 Process Flow Diagram - Dermatology

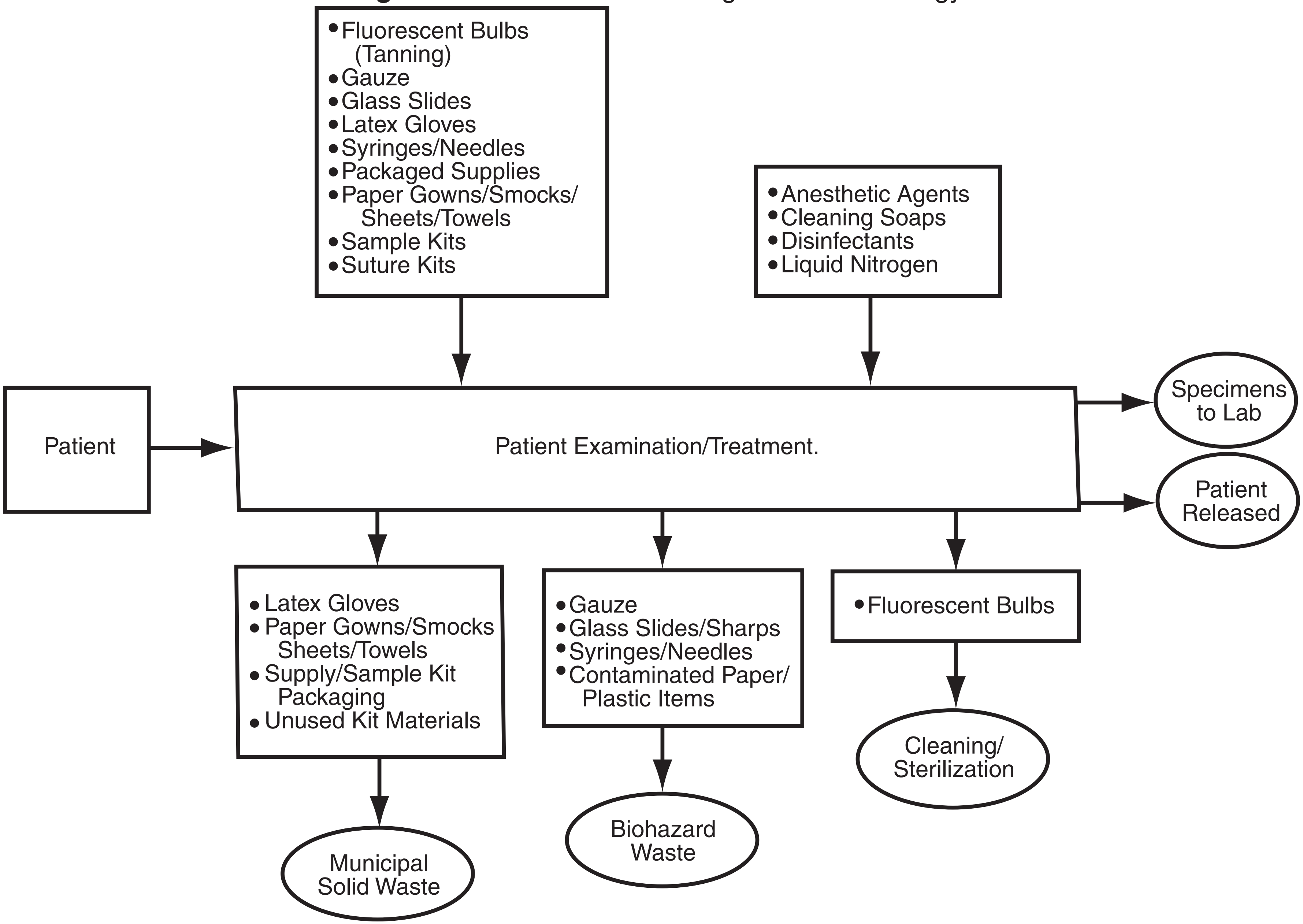


Figure C-20 Process Flow Diagram - Family Practice

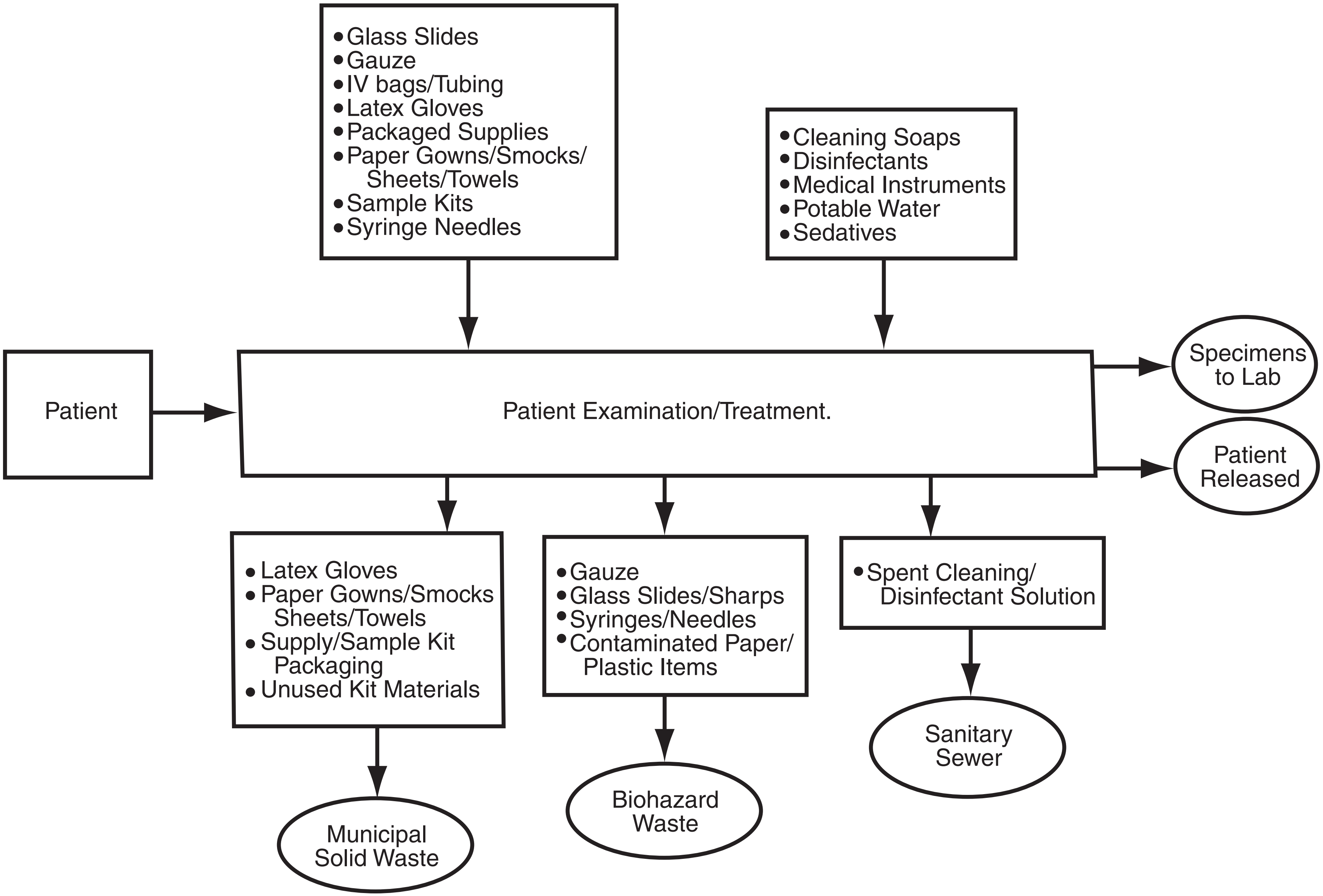


Figure C-21 Process Flow Diagram - Gastroenterology

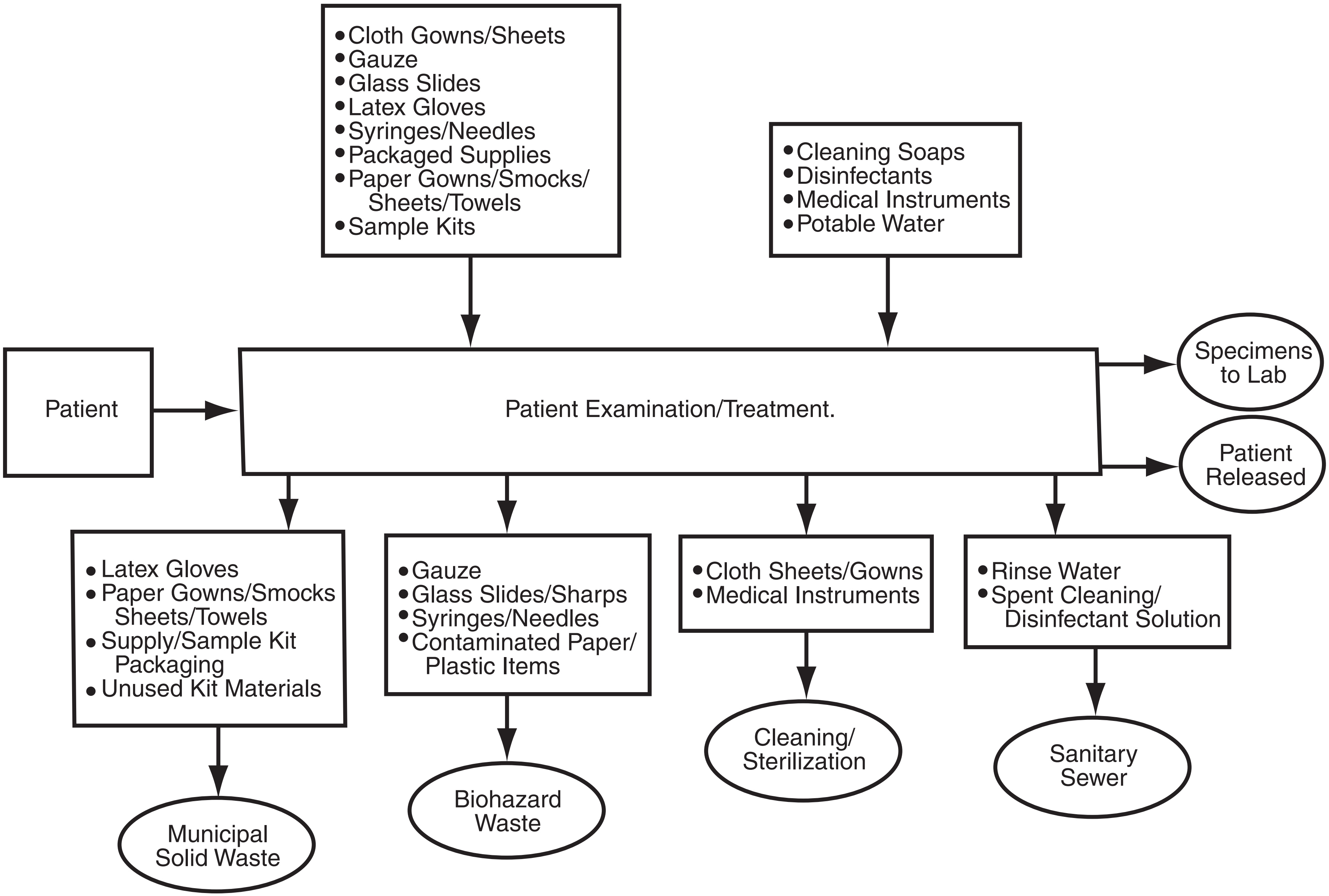


Figure C-22 Process Flow Diagram - Neurology

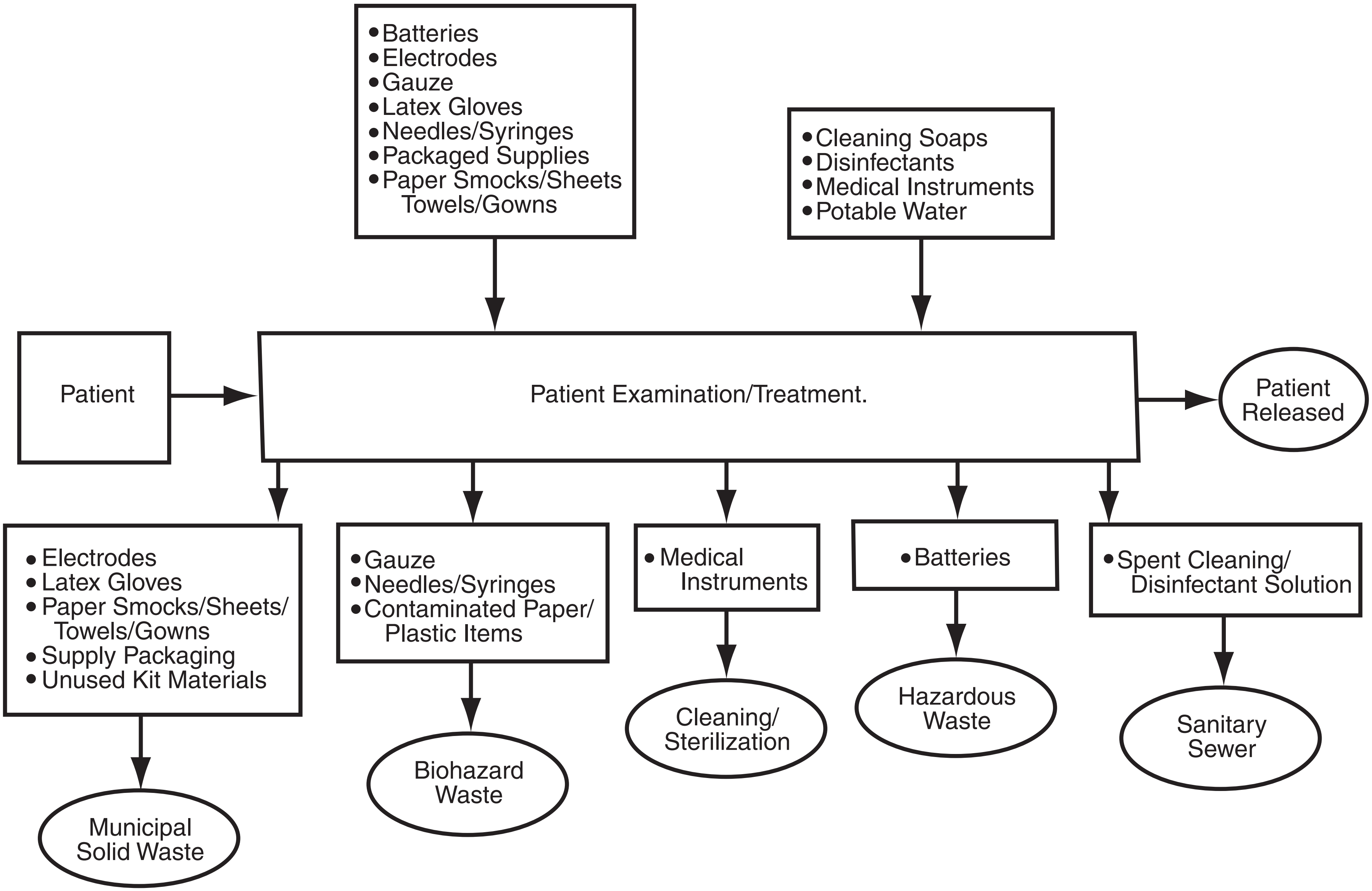


Figure C-23 Process Flow Diagram - Otorhinolaryngology (ENT)

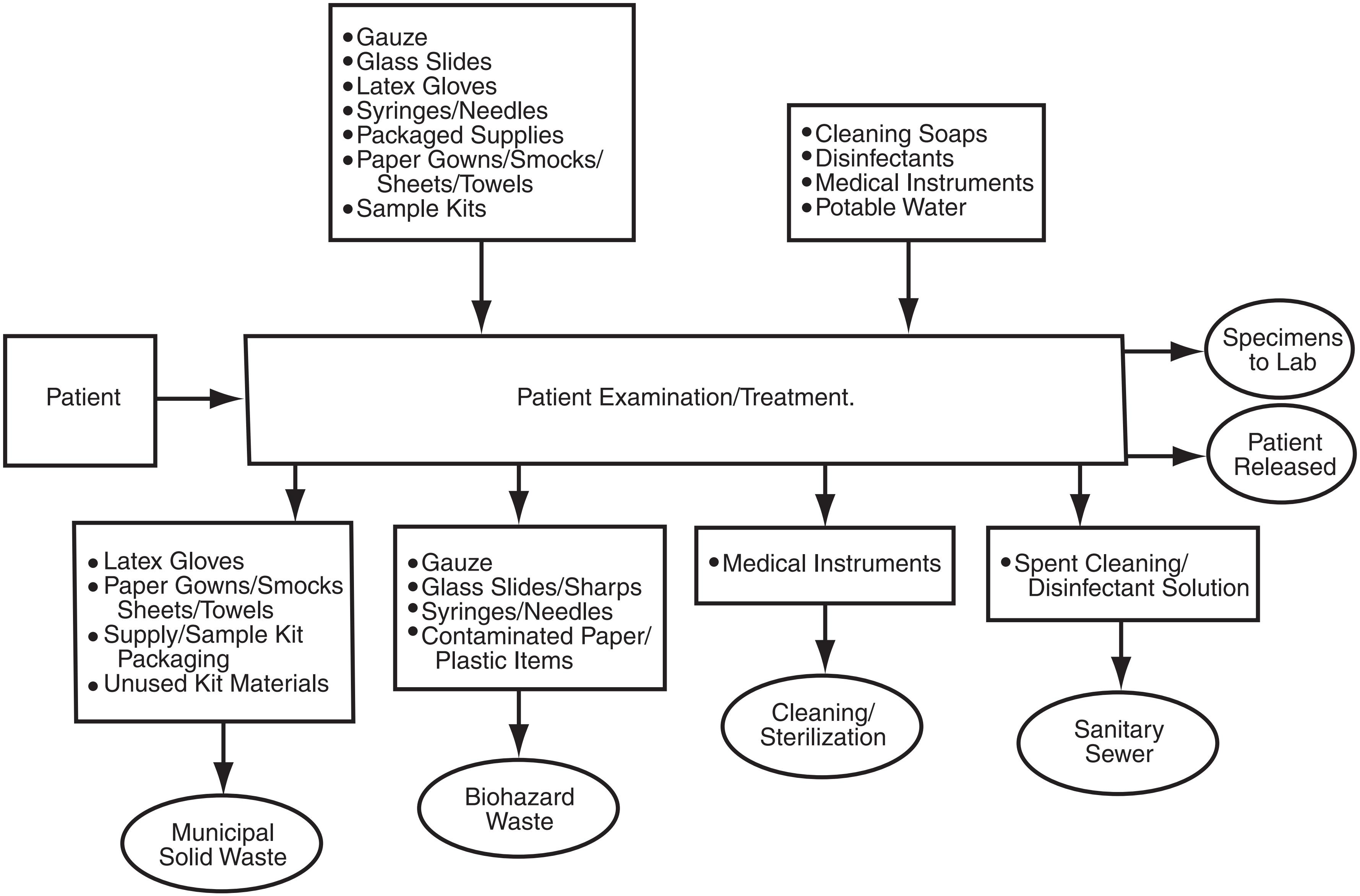


Figure C-24 Process Flow Diagram - In-patient Services (Wards)

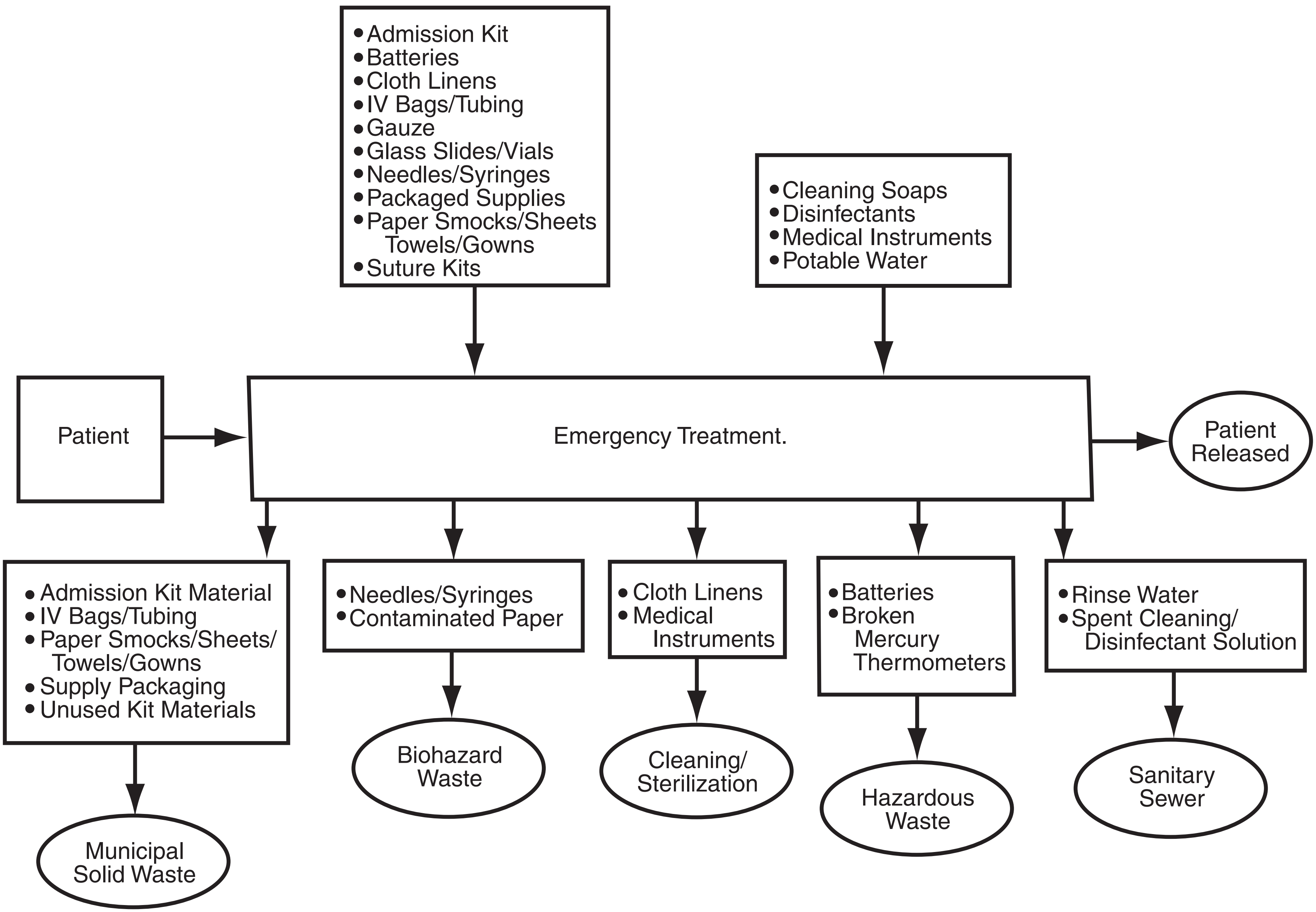


Figure C-25 Process Flow Diagram - OB/GYN Exam Treatment

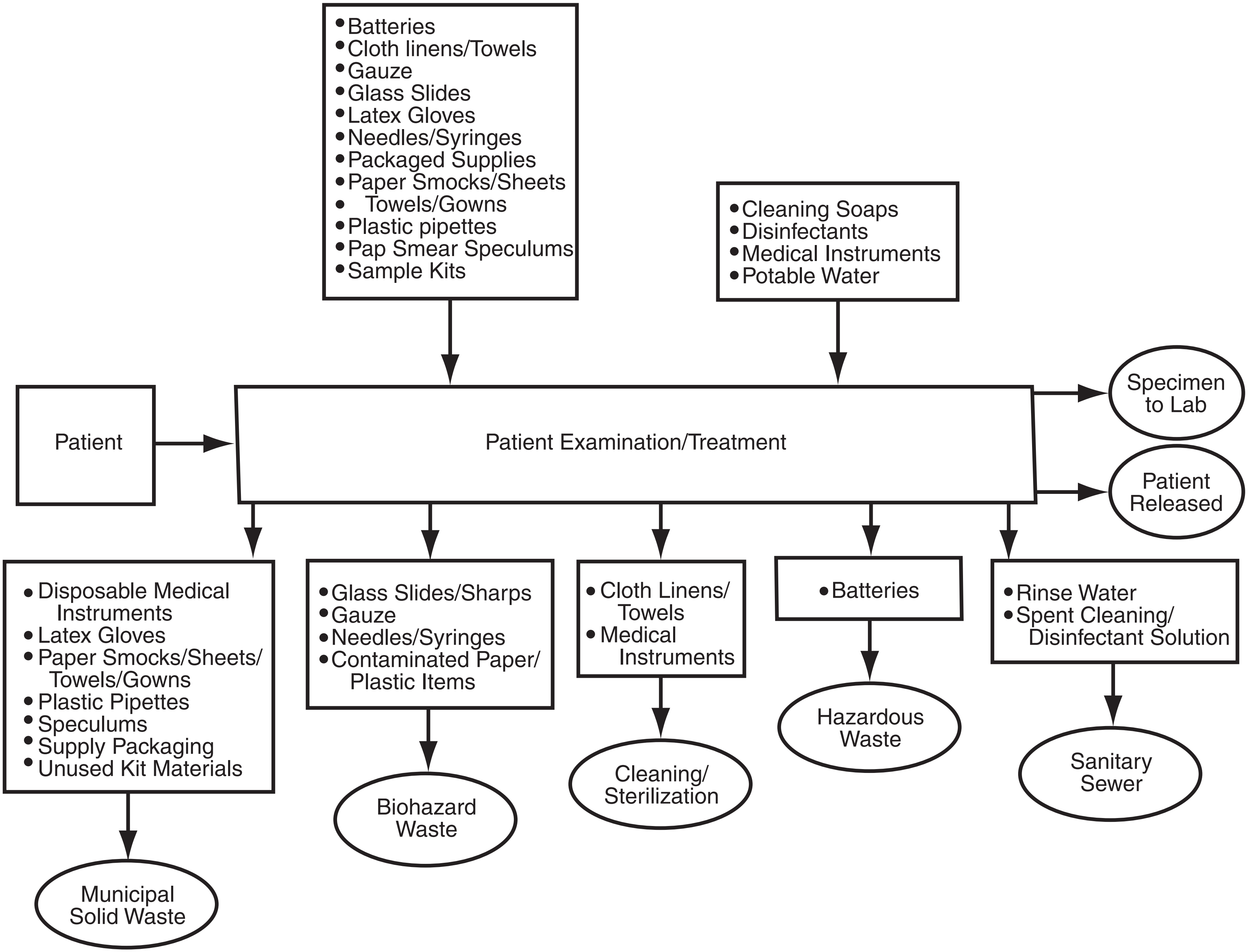


Figure C-26 Process Flow Diagram - OB/GYN Labor/Delivery

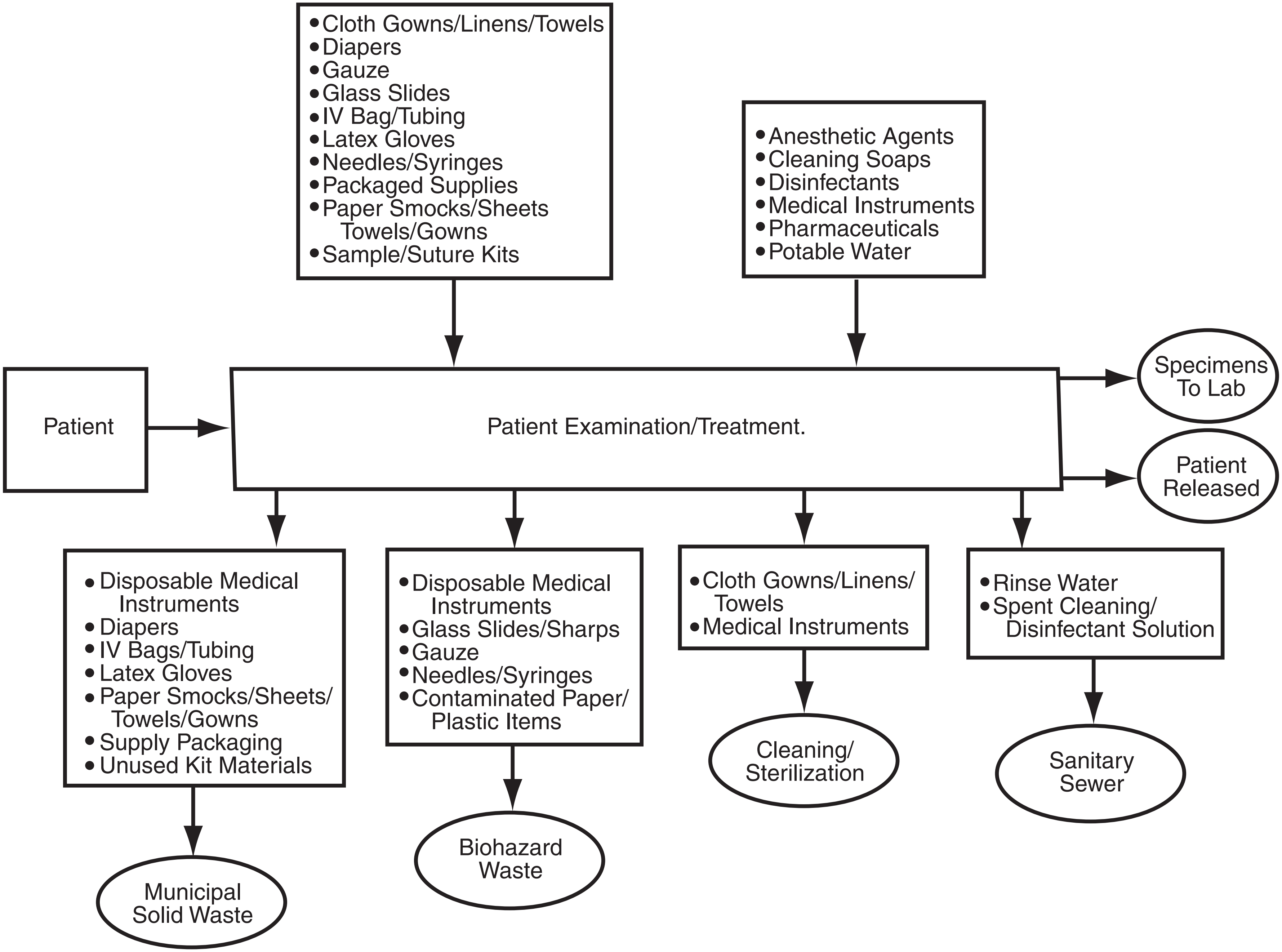


Figure C-27 Process Flow Diagram - Pediatrics

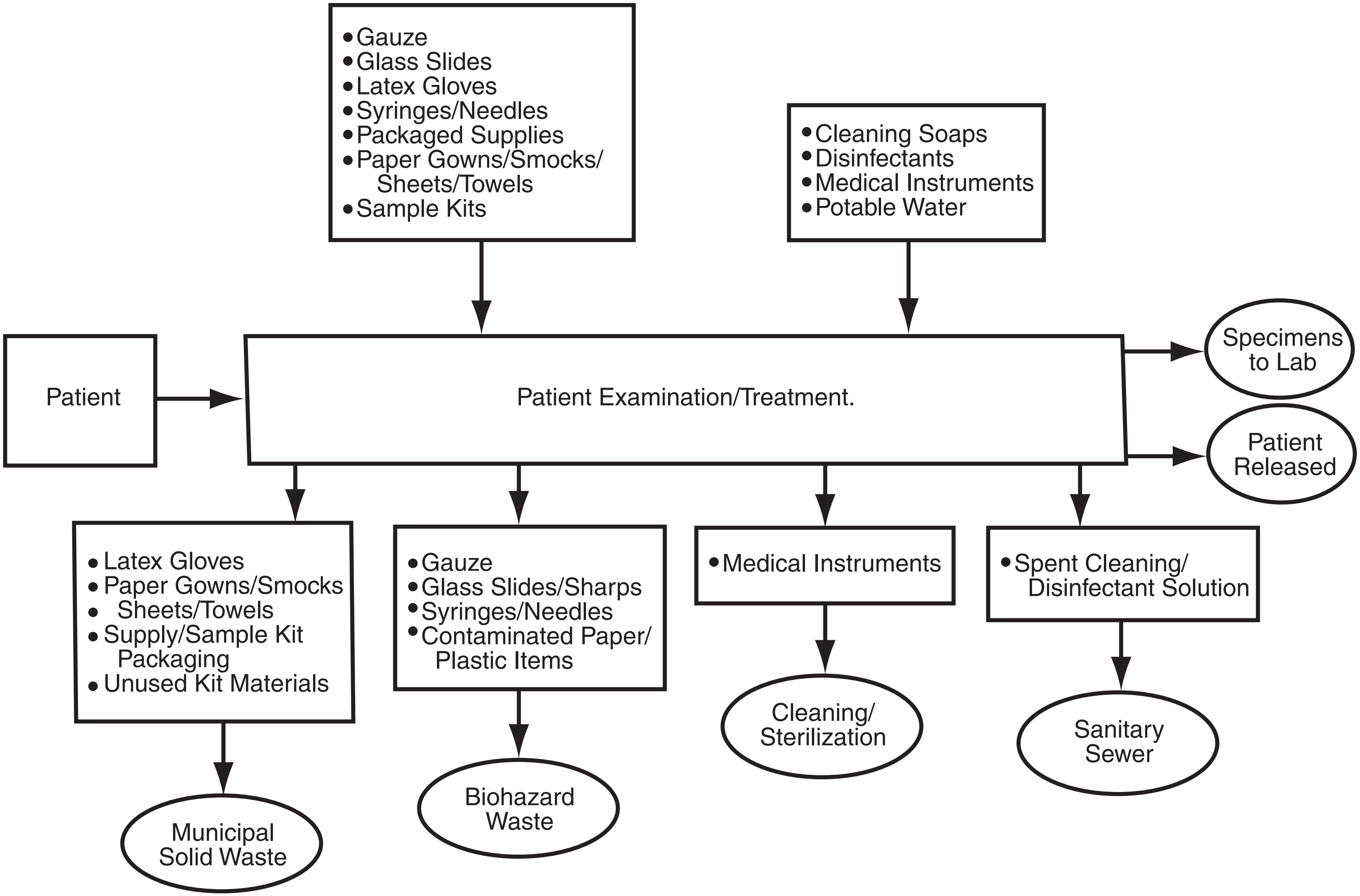


Figure C-28 Process Flow Diagram - Physical Therapy

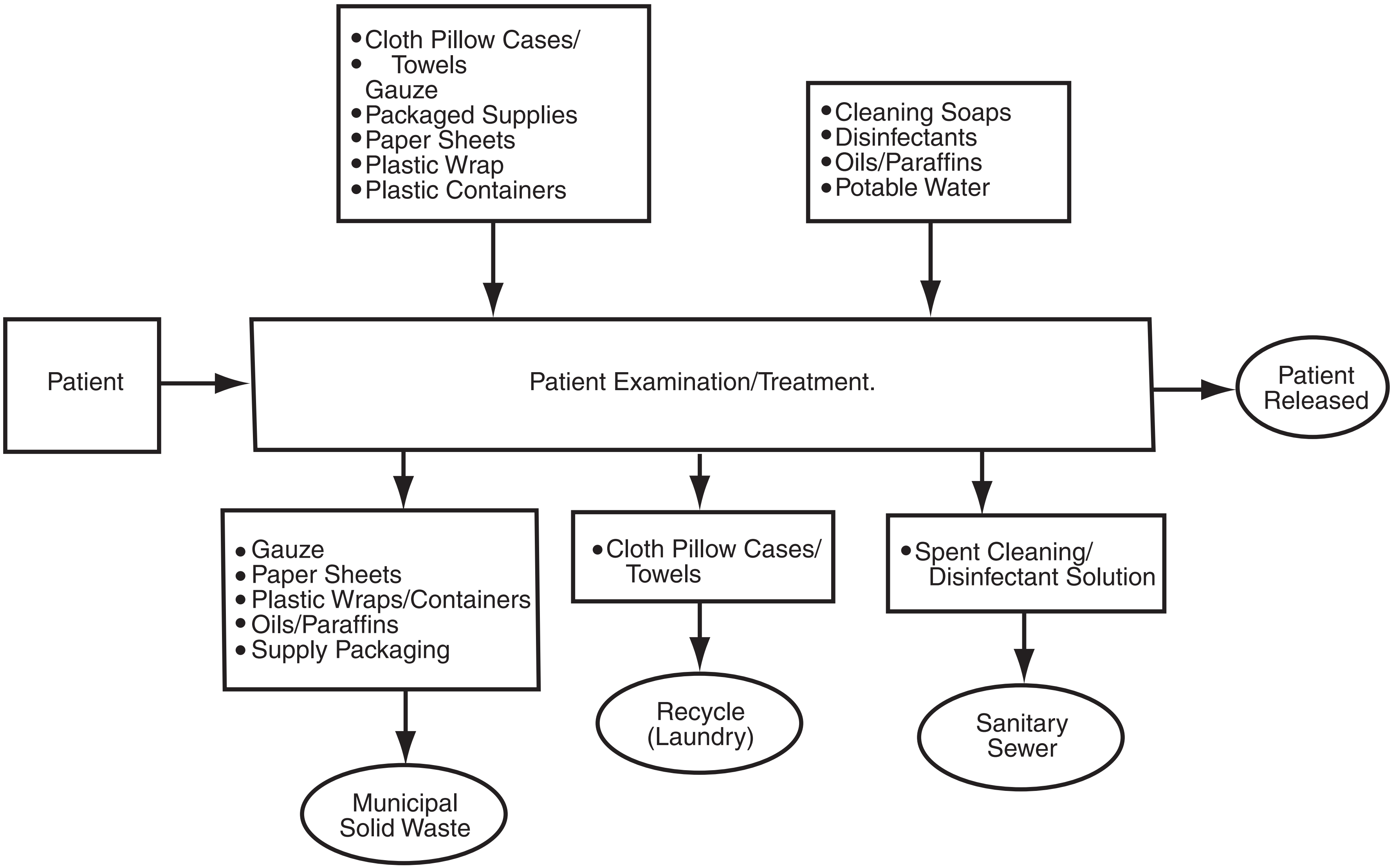


Figure C-29 Process Flow Diagram - Central Sterile Supply

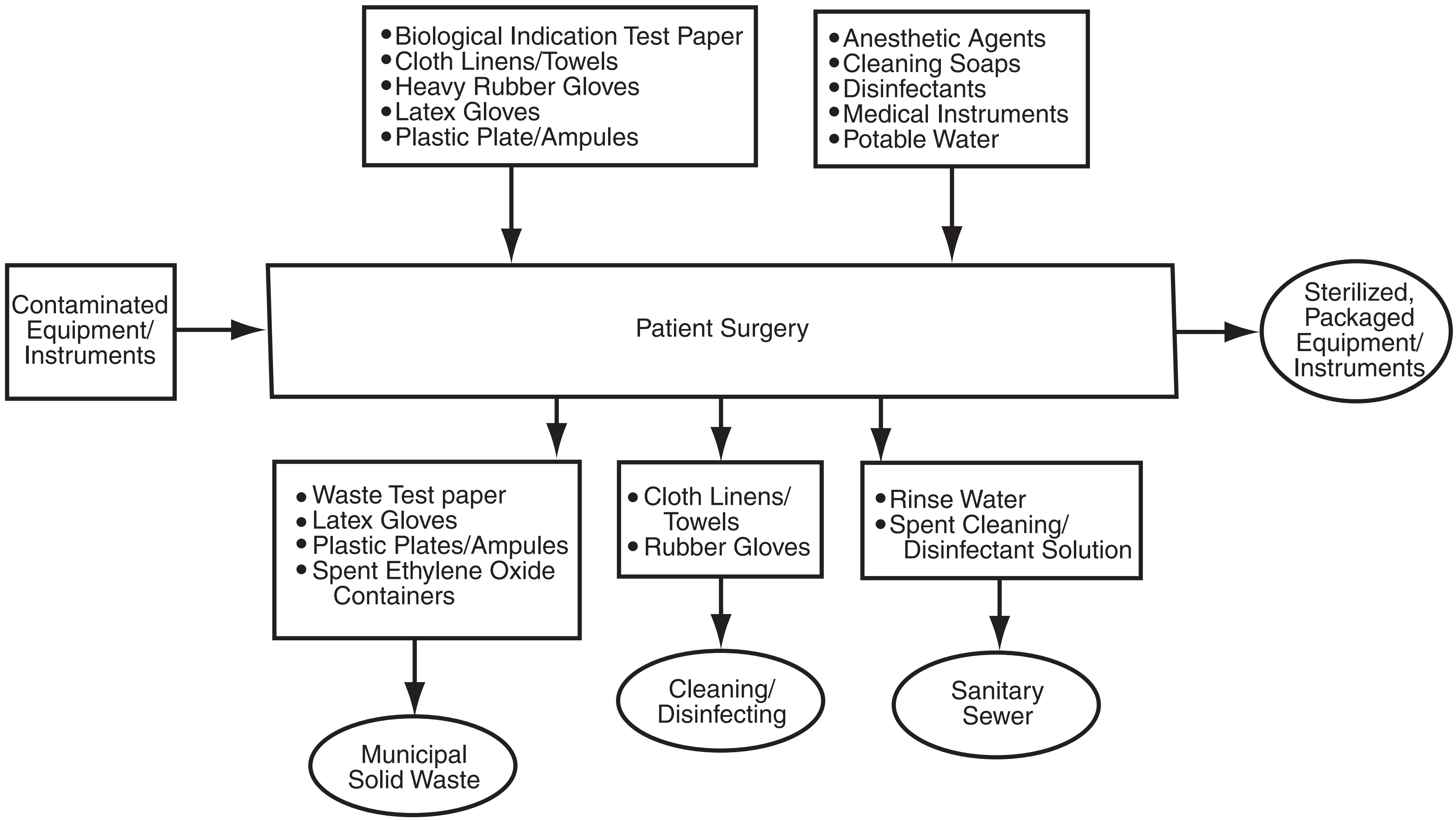


Figure C-30 Process Flow Diagram - Surgery

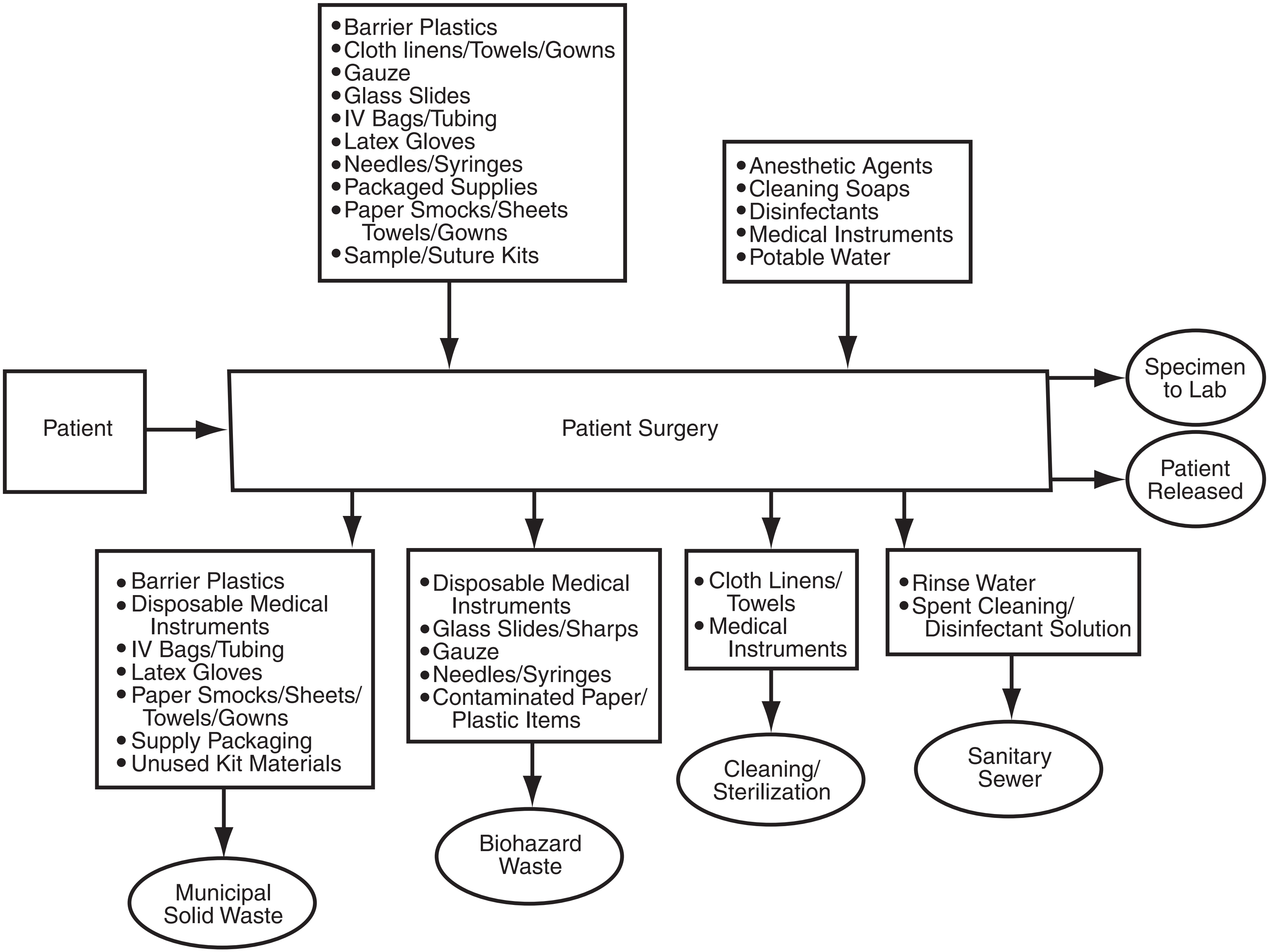


Figure C-31 Process Flow Diagram - Orthopedics

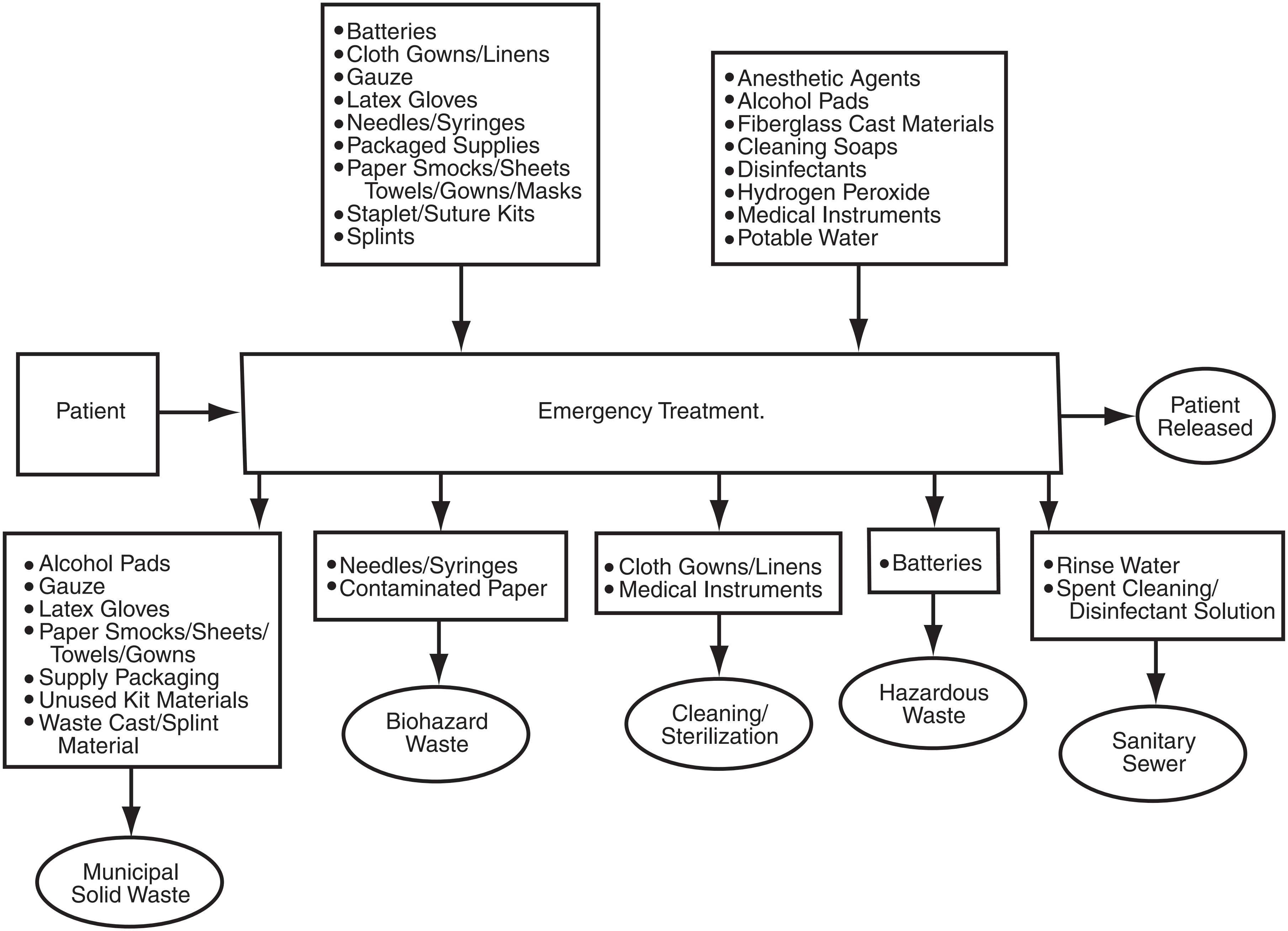


Figure C-32 Process Flow Diagram - Ureology

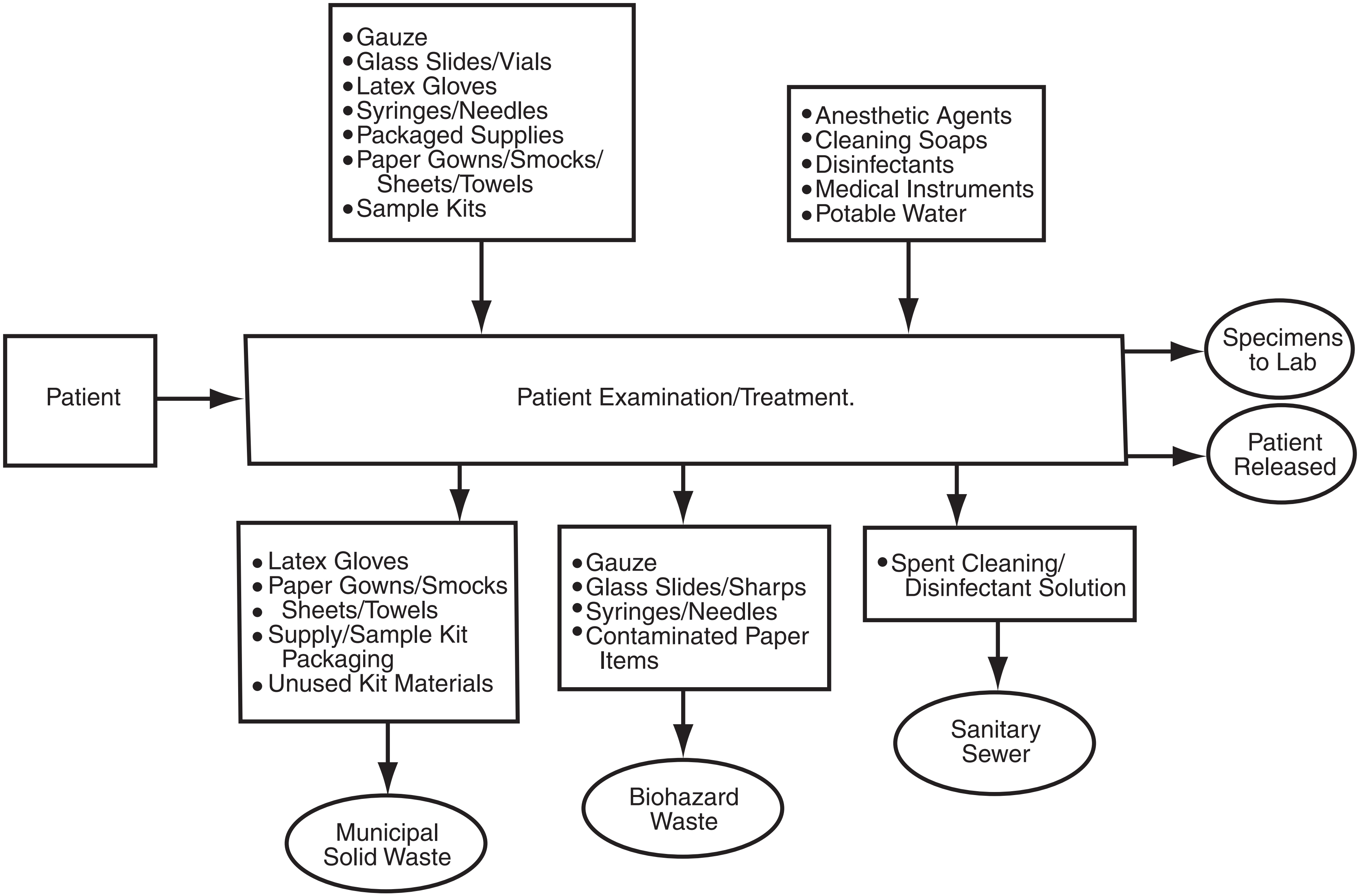


Figure C-33 Process Flow Diagram - Medical Laboratory, Anatomic Pathology

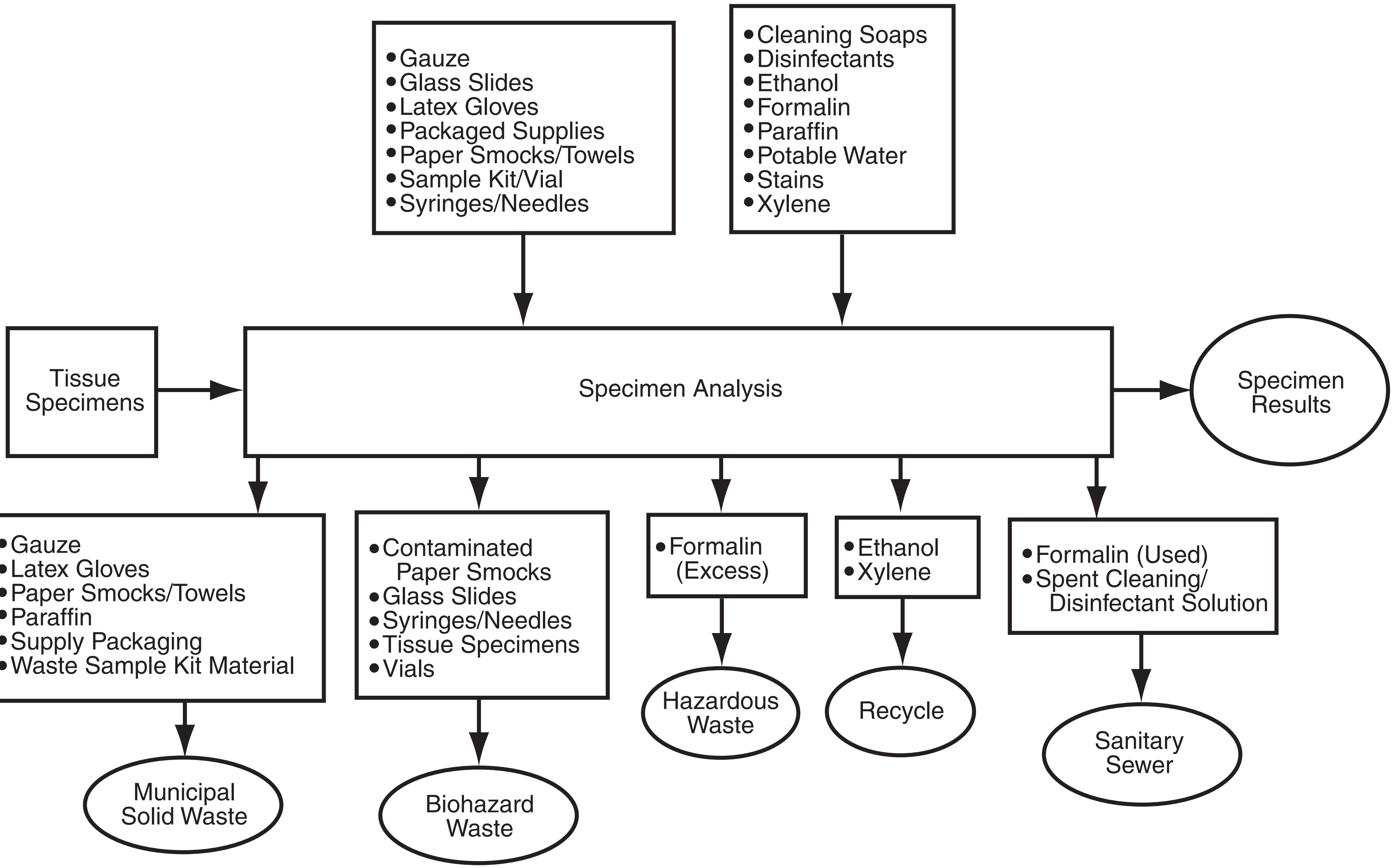


Figure C-34 Process Flow Diagram - Medical Laboratory, Blood Bank

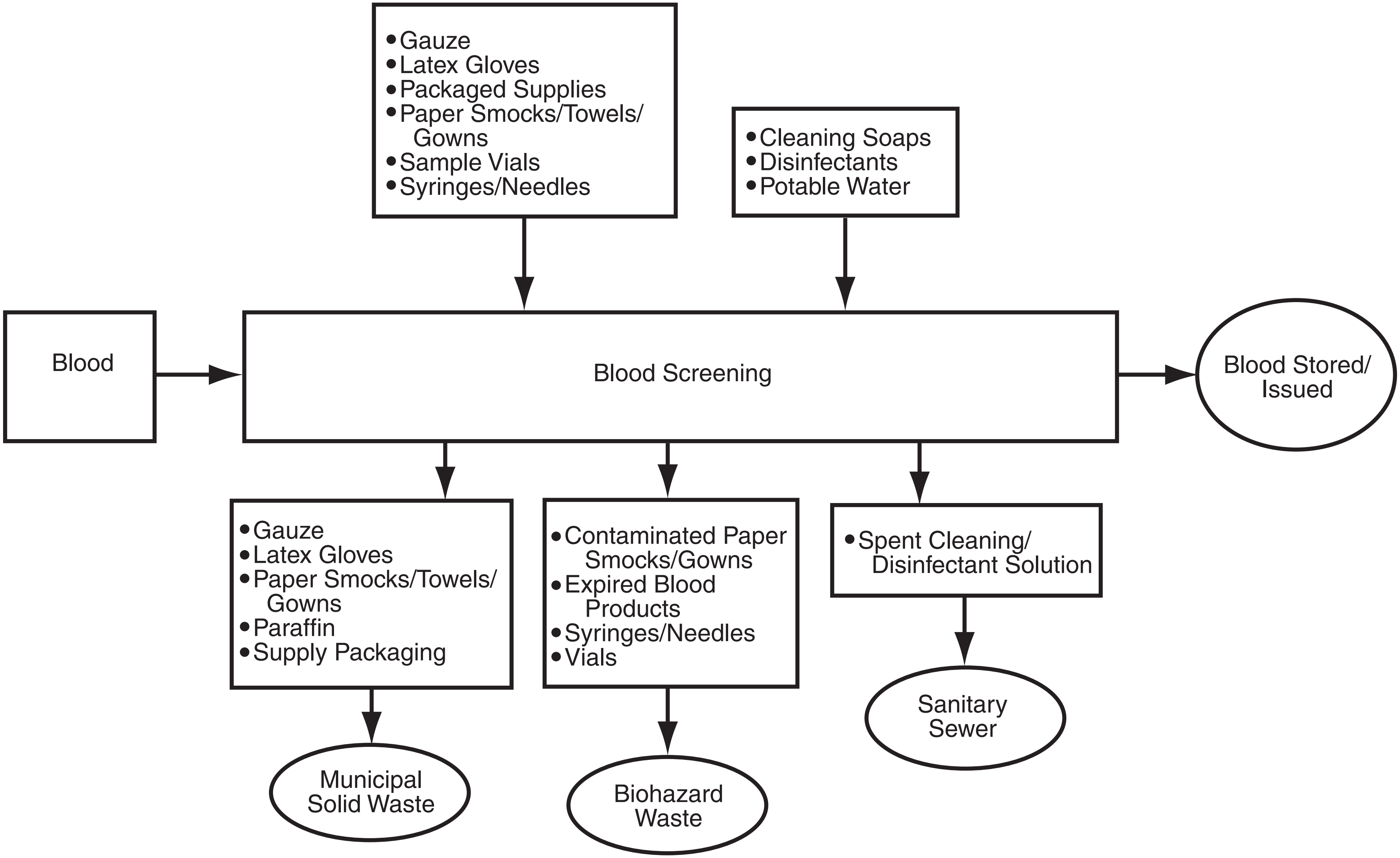


Figure C-35 Process Flow Diagram - Medical Laboratory, Blood Chemistry/Toxicology

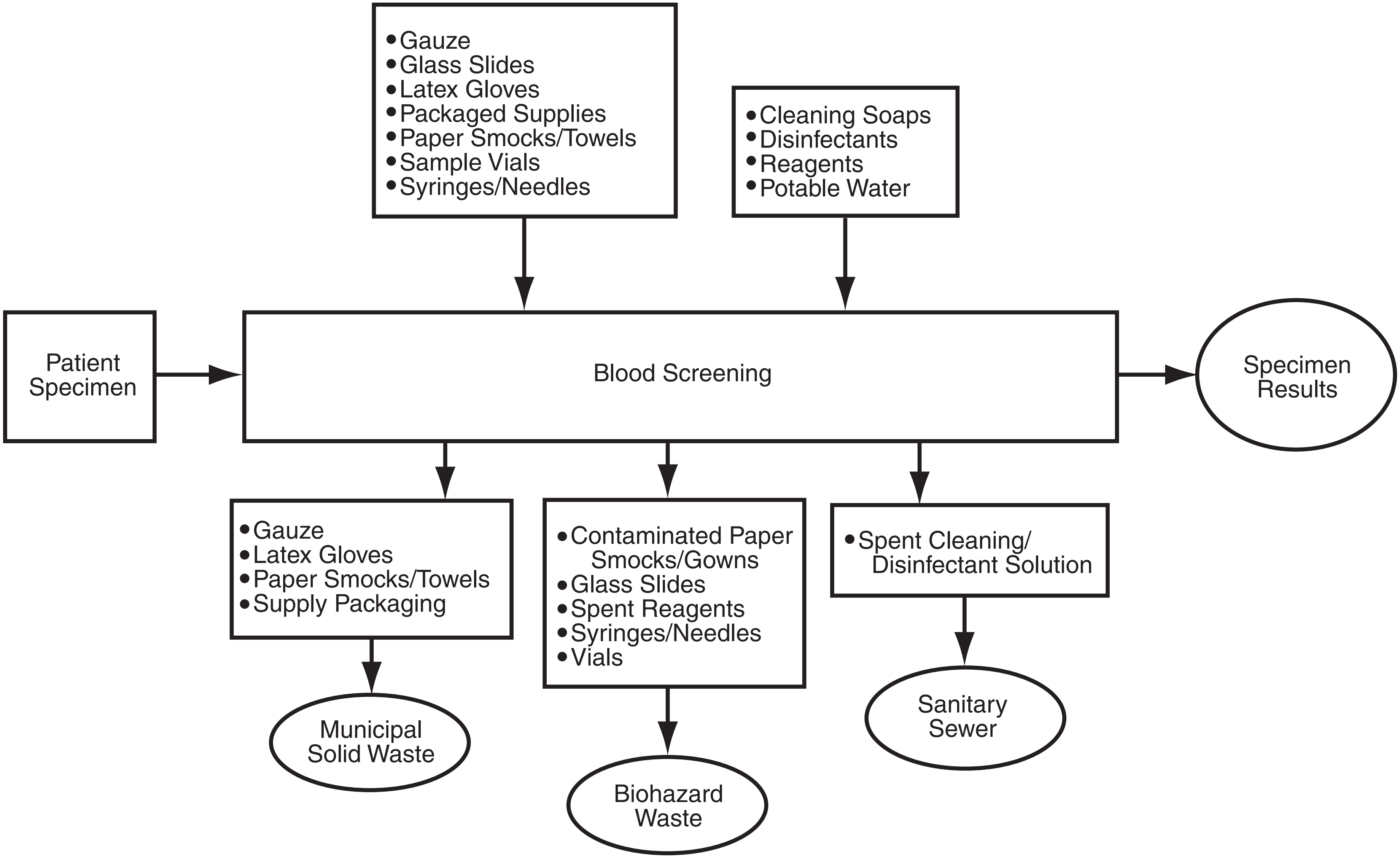


Figure C-36 Process Flow Diagram - Medical Laboratory, Hematology

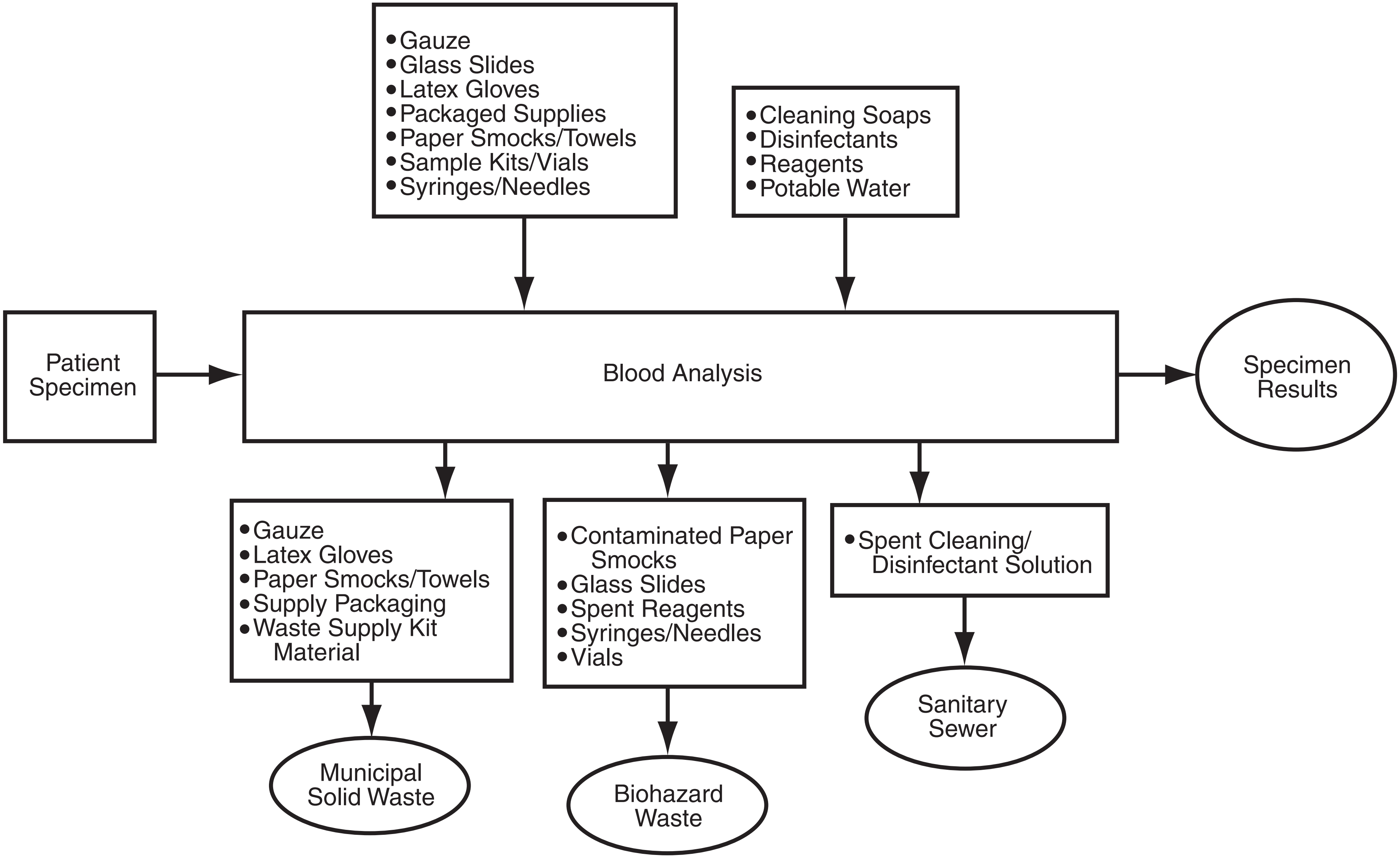


Figure C-37 Process Flow Diagram - Medical Laboratory, Microbiology

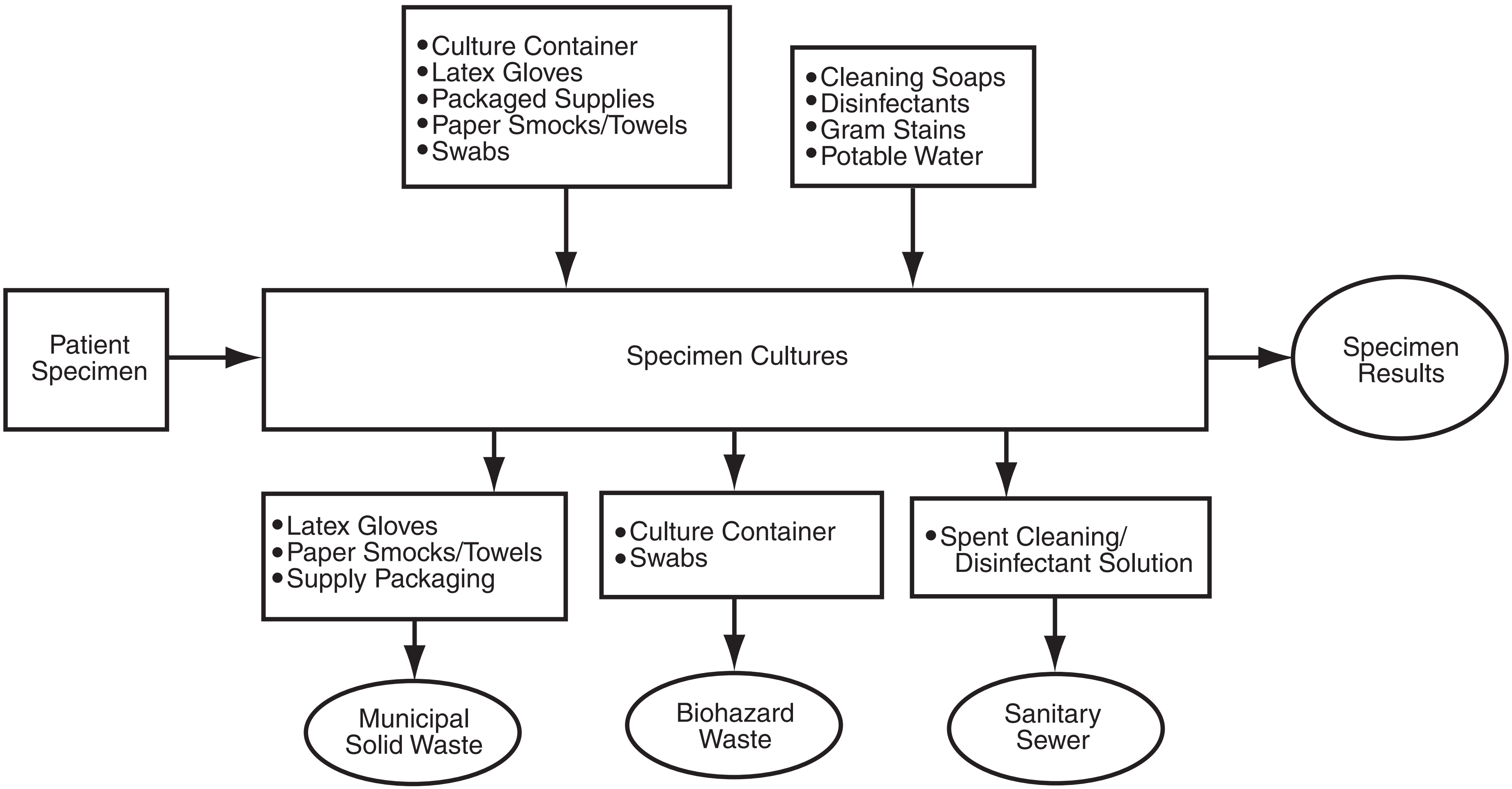


Figure C-38 Process Flow Diagram - Medical Laboratory, Serology/Immunology

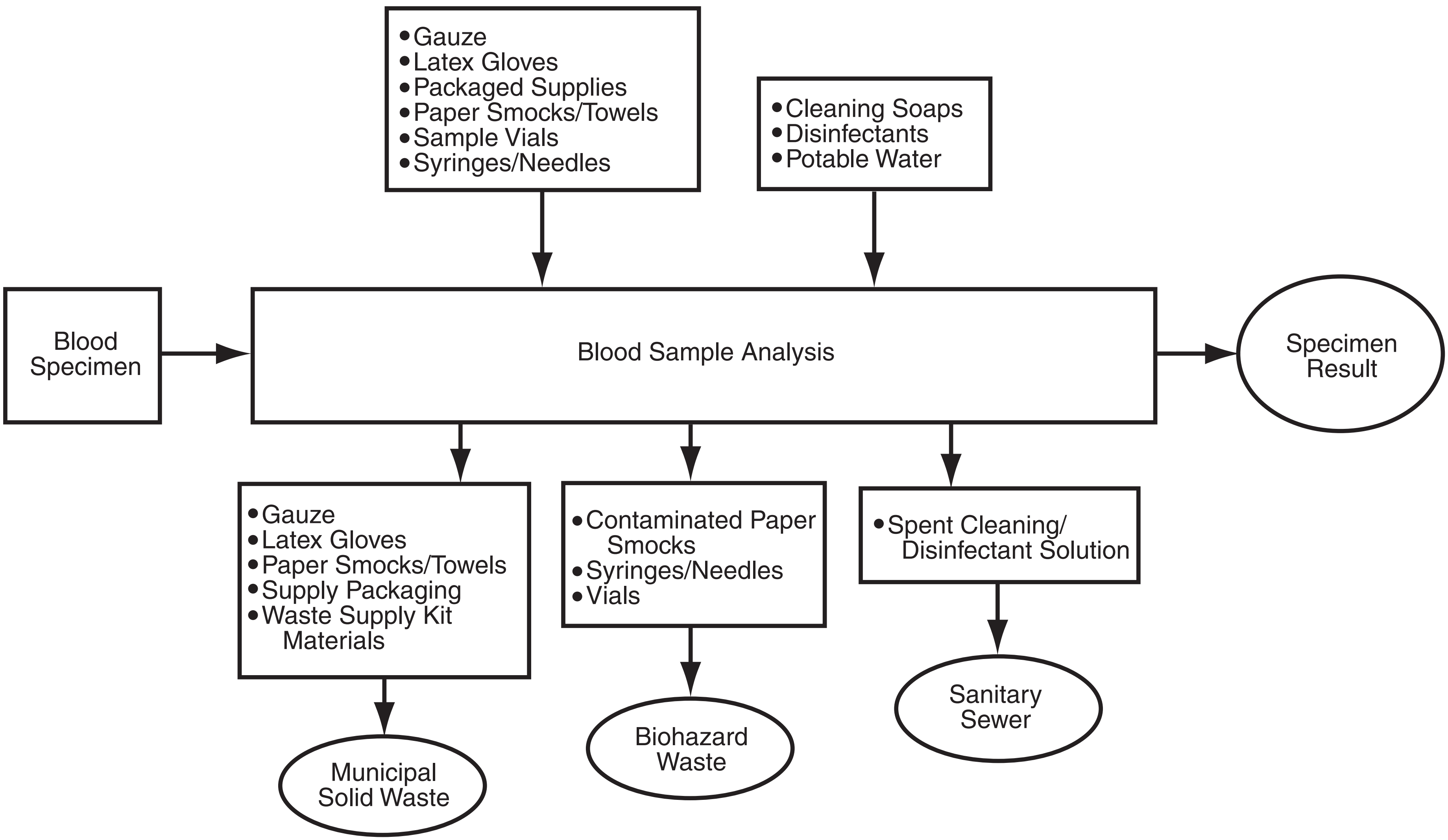


Figure C-39 Process Flow Diagram - Medical Laboratory, Urinalysis

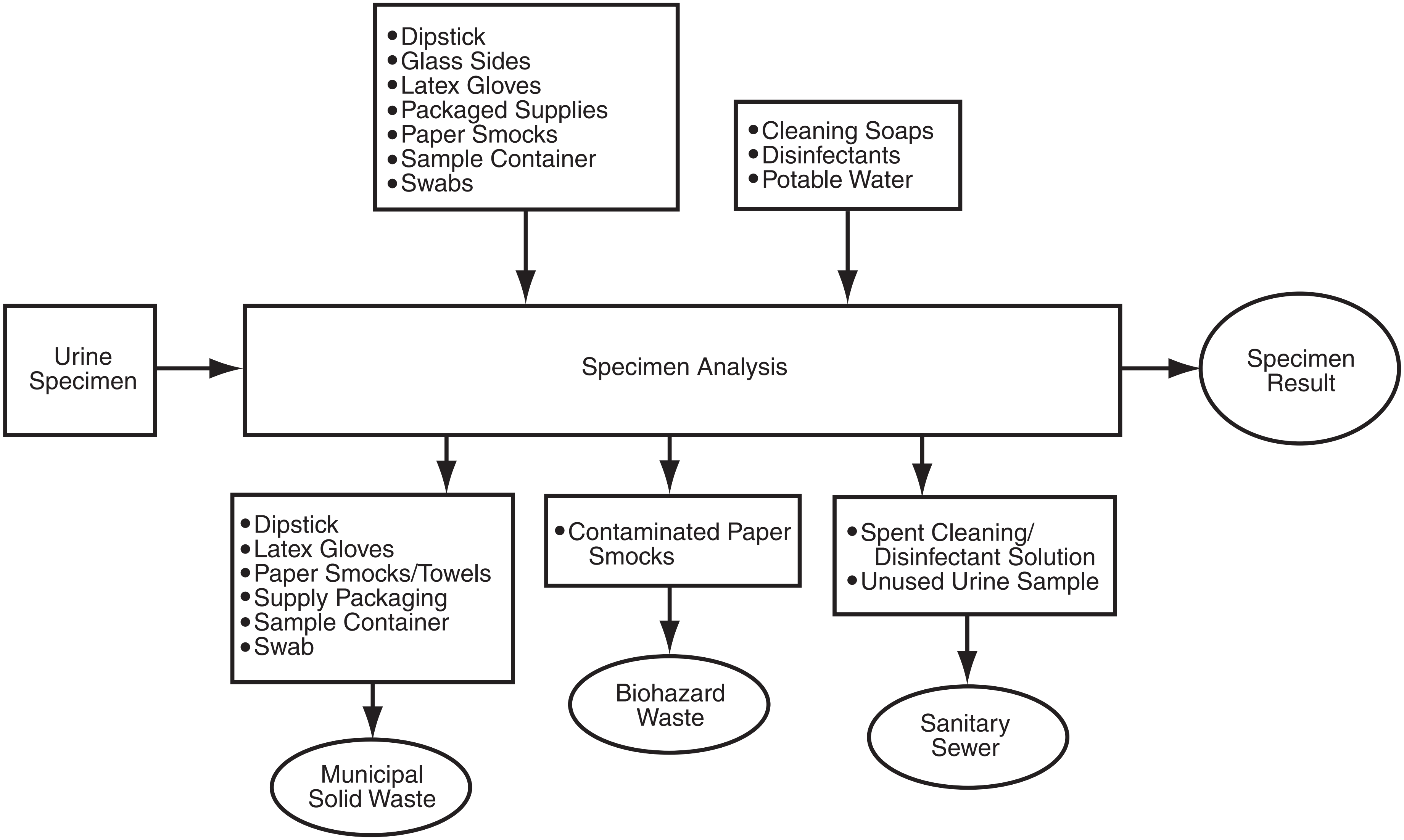


Figure C-40 Process Flow Diagram - Medical Logistics, Supply Procurement

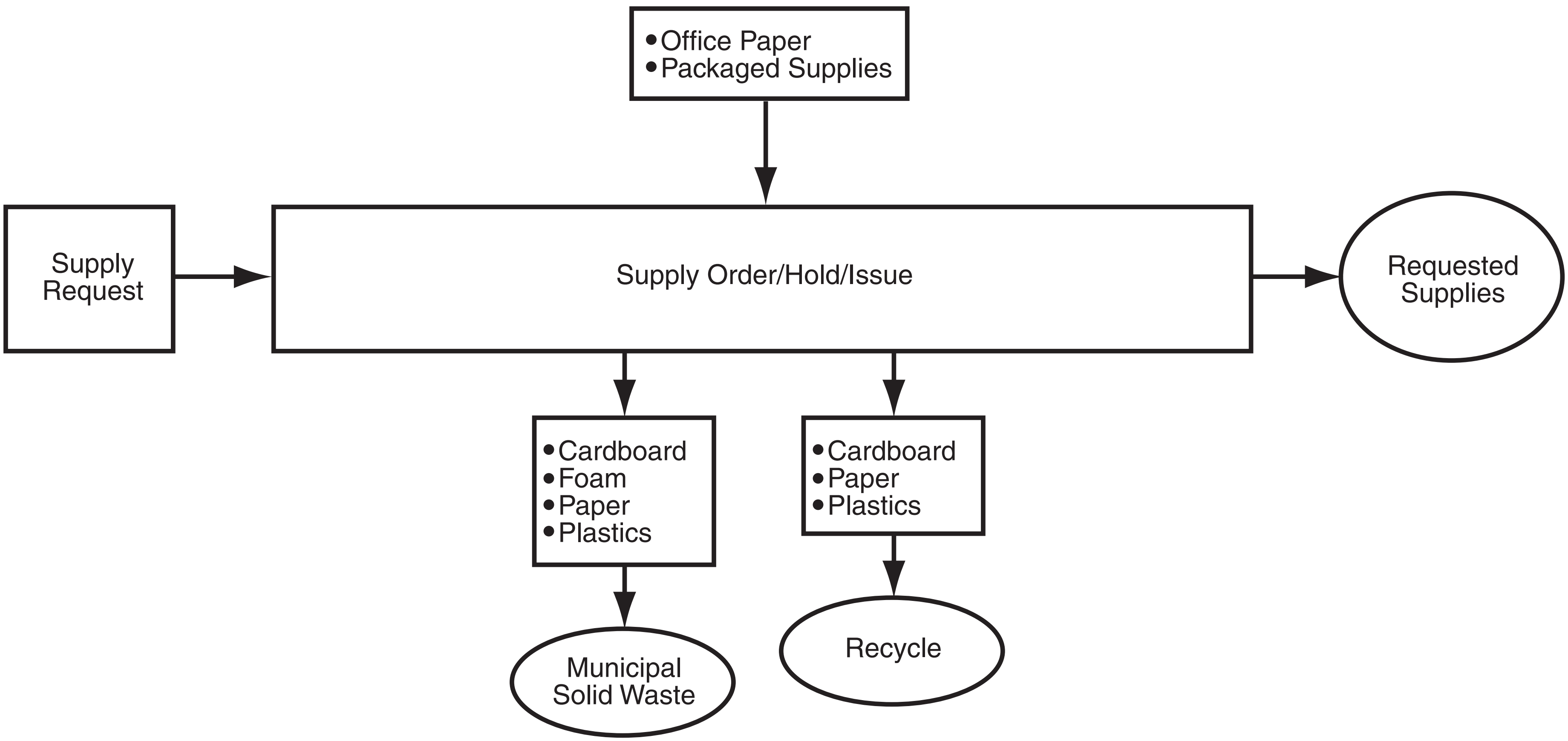


Figure C-41 Process Flow Diagram - Medical Equipment Repair

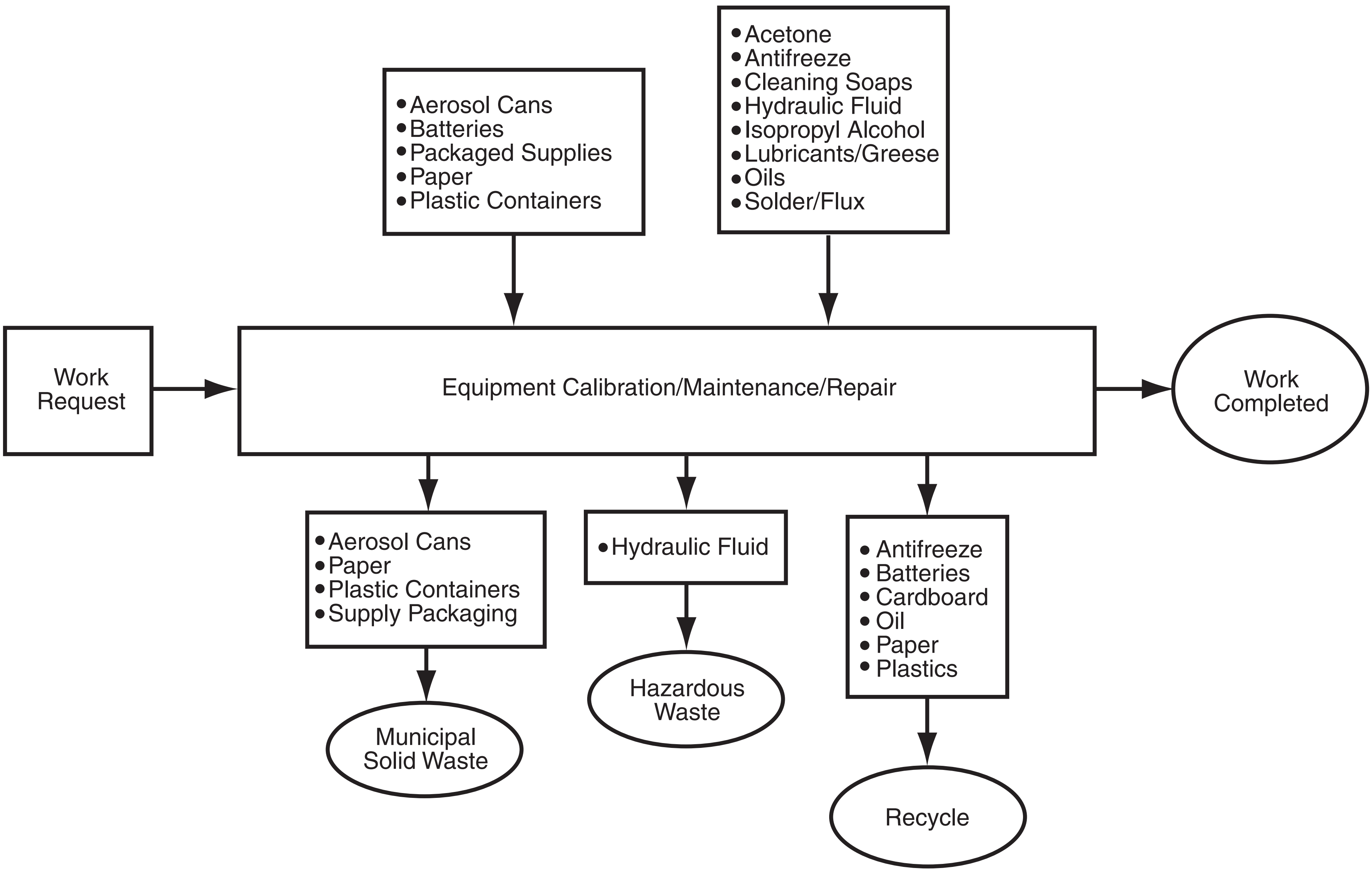


Figure C-42 Process Flow Diagram - General Housekeeping

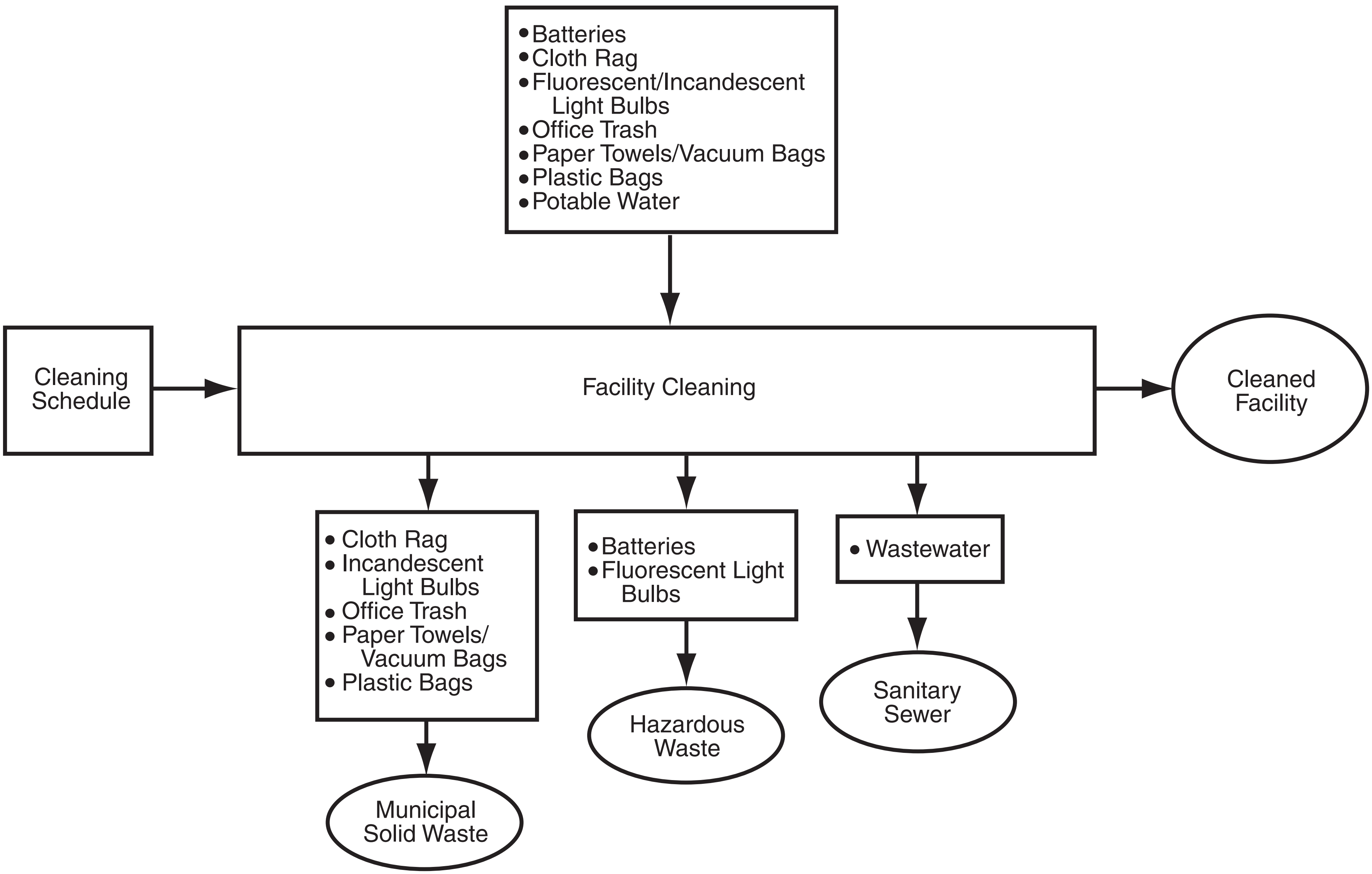


Figure C-43 Process Flow Diagram - Housekeeping, Cleaning and Disinfecting

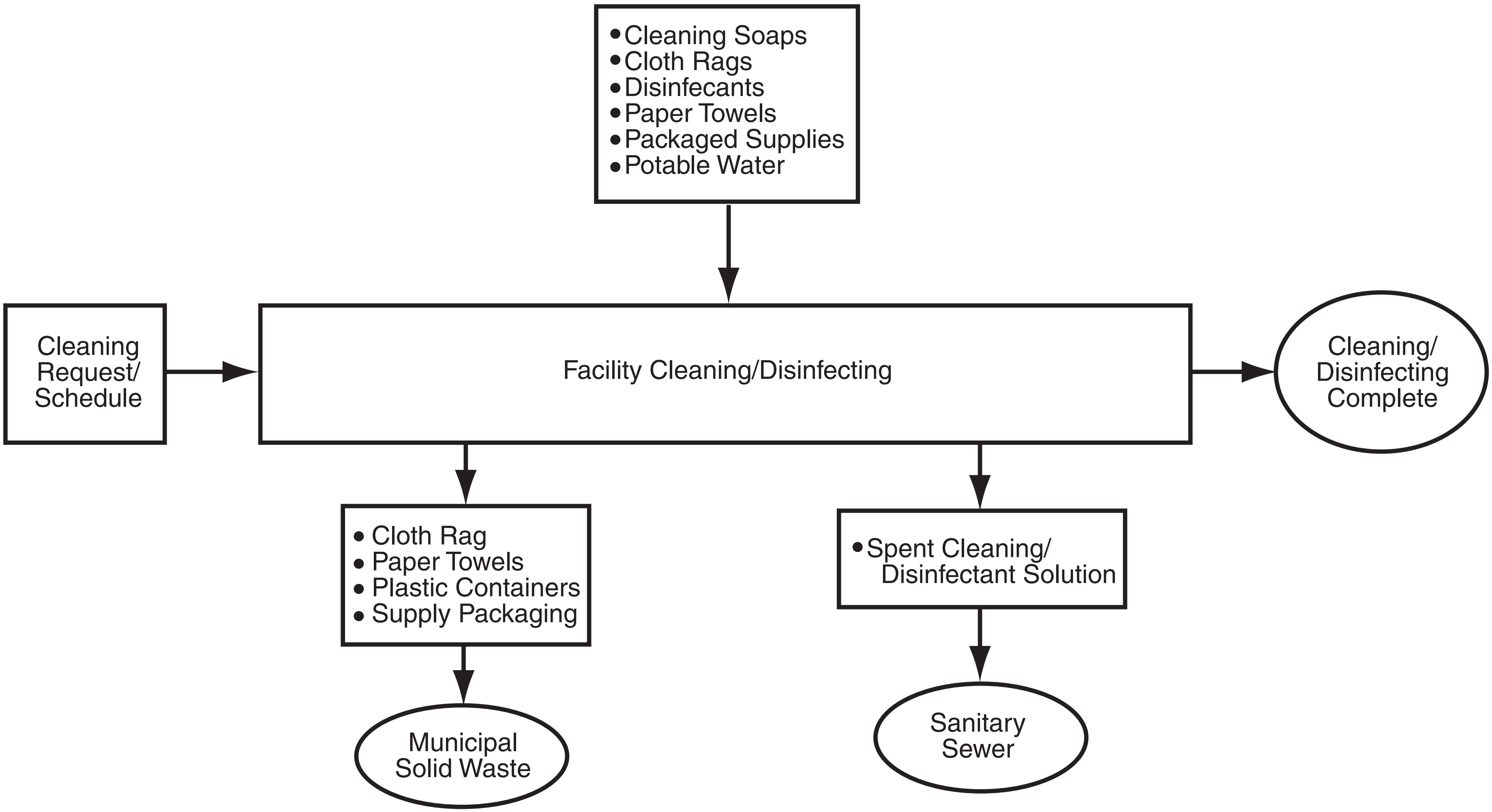


Figure C-44 Process Flow Diagram - Housekeeping, Autoclave and Incinerator

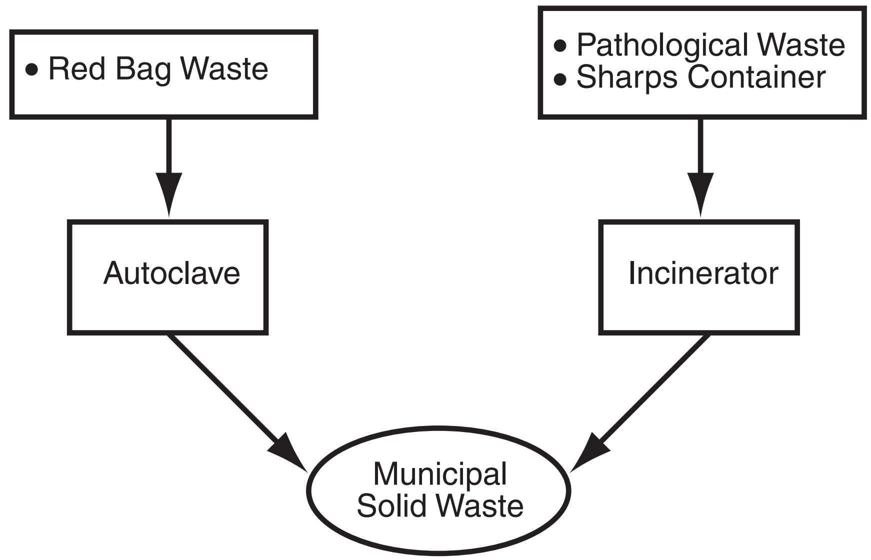


Figure C-45 Process Flow Diagram - Nutritional Medicine, Food Service

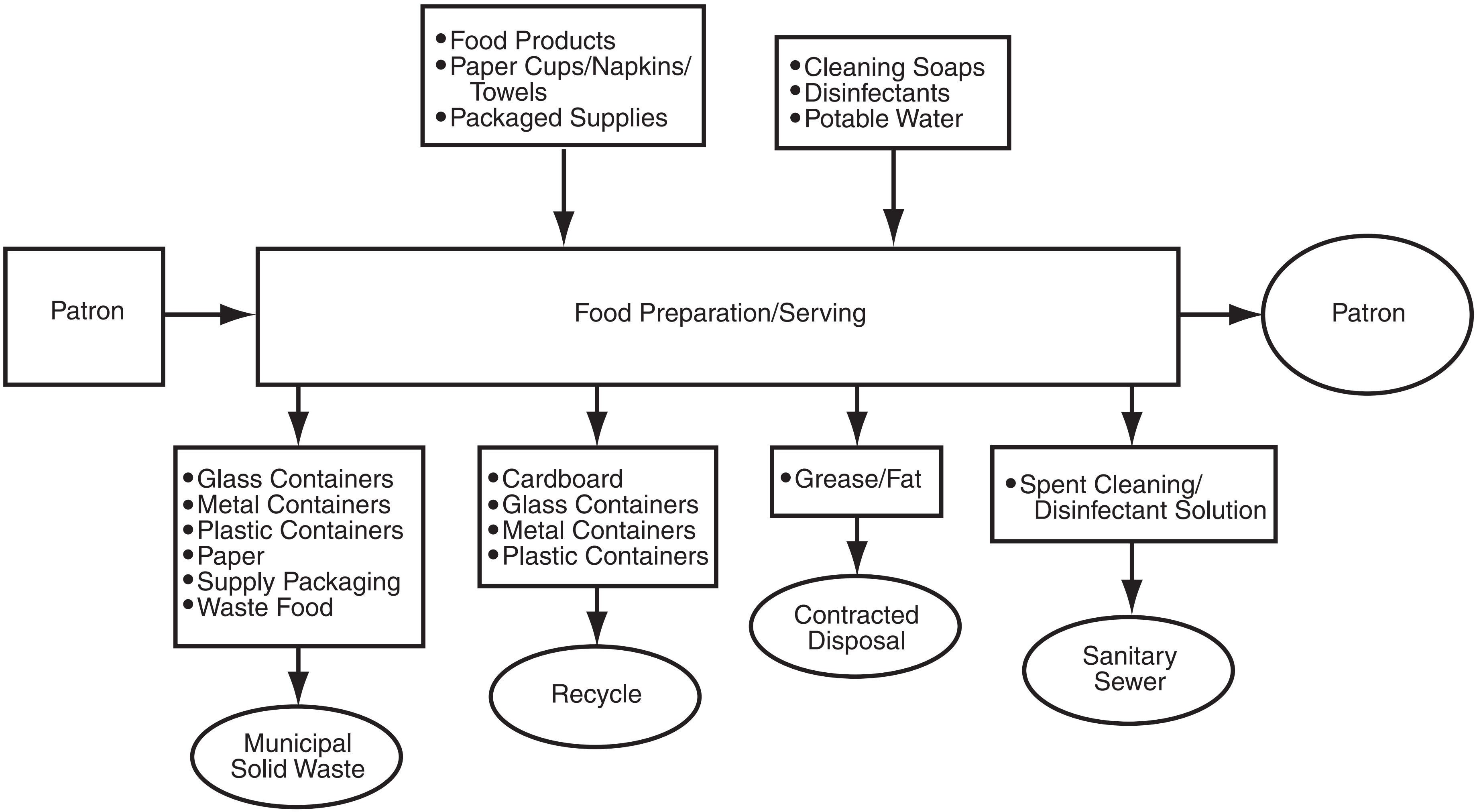


Figure C-46 Process Flow Diagram - Pharmacy, In-patient

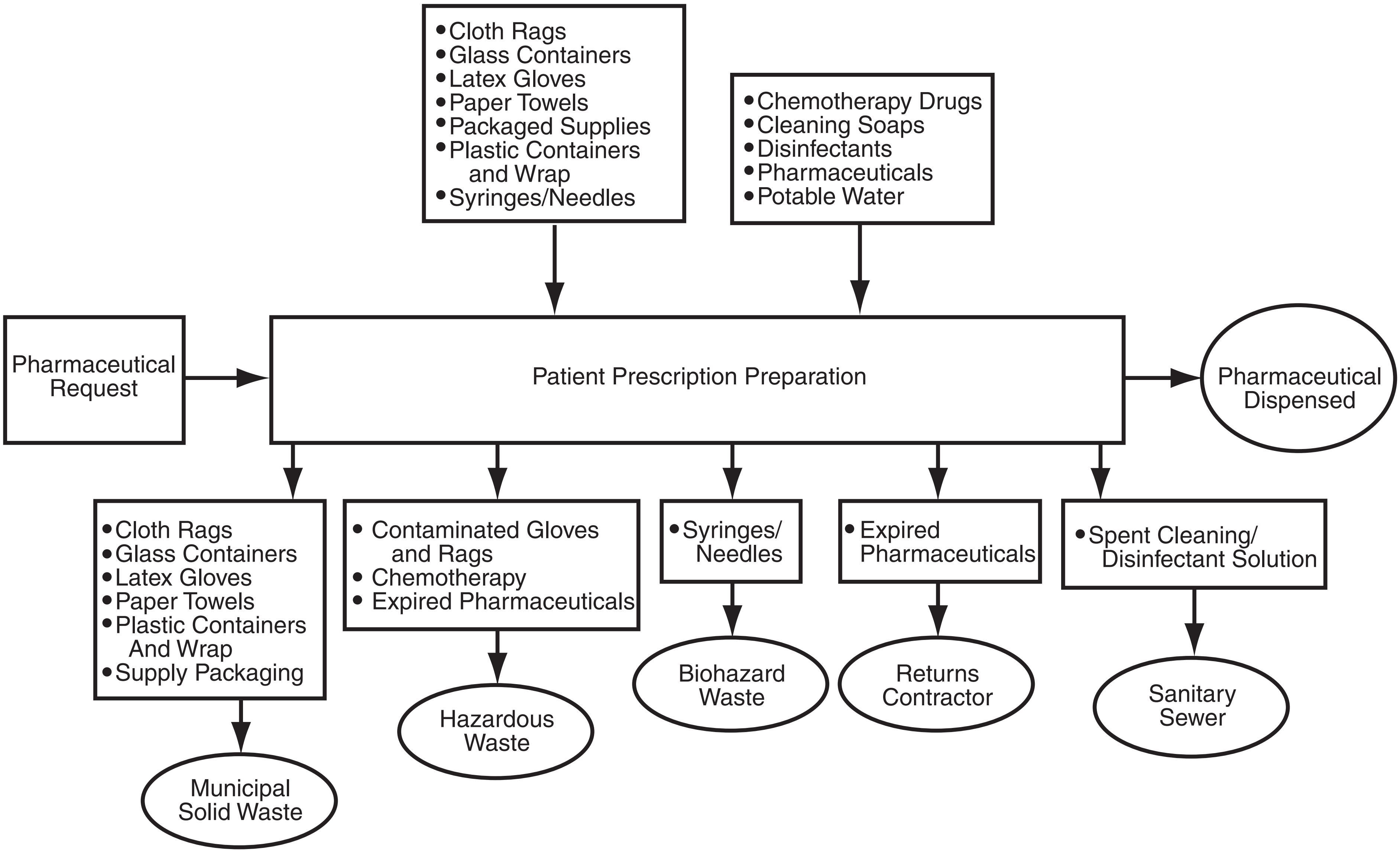


Figure C-47 Process Flow Diagram - Pharmacy, Out-patient

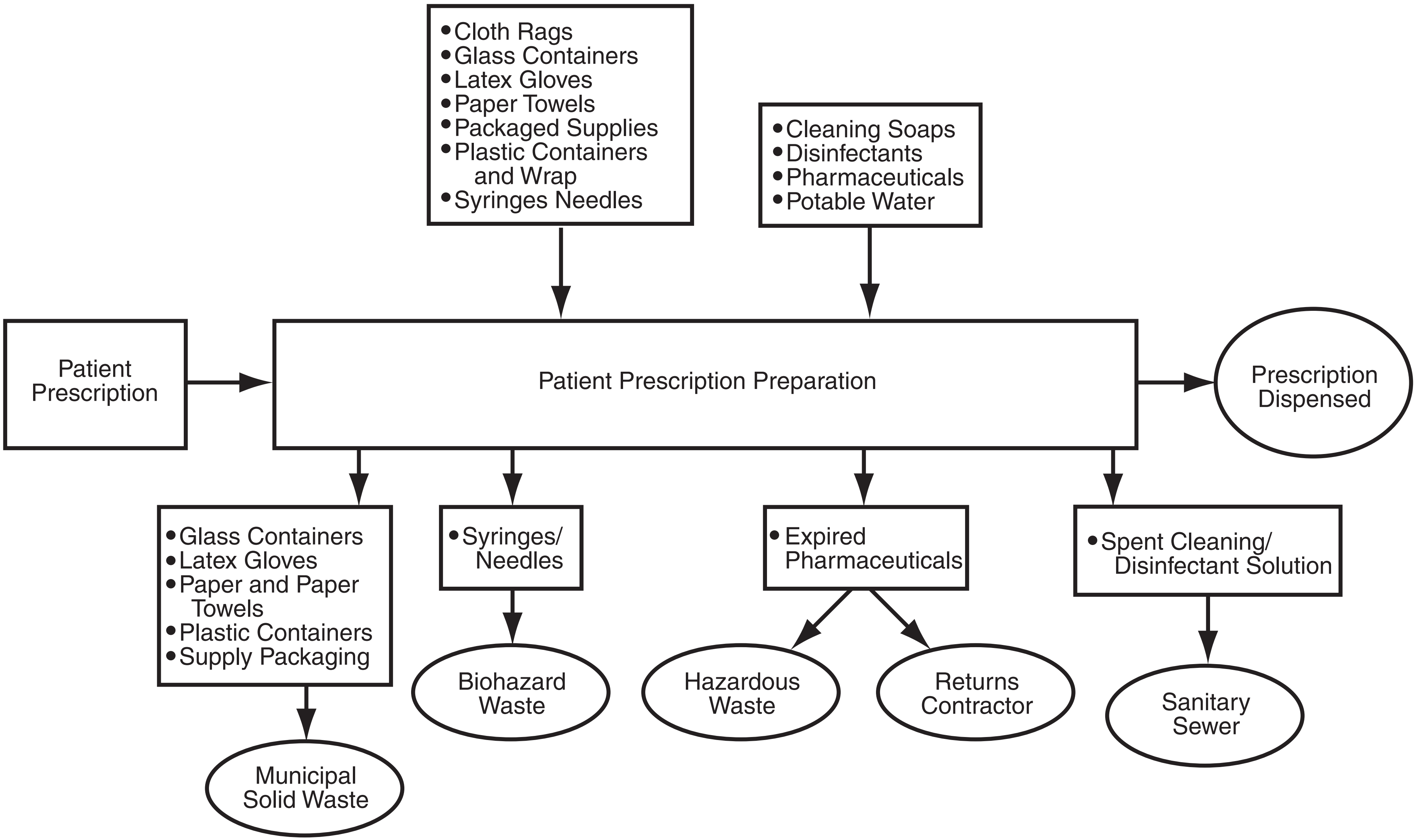


Figure C-48 Process Flow Diagram - Pharmacy, Satellite

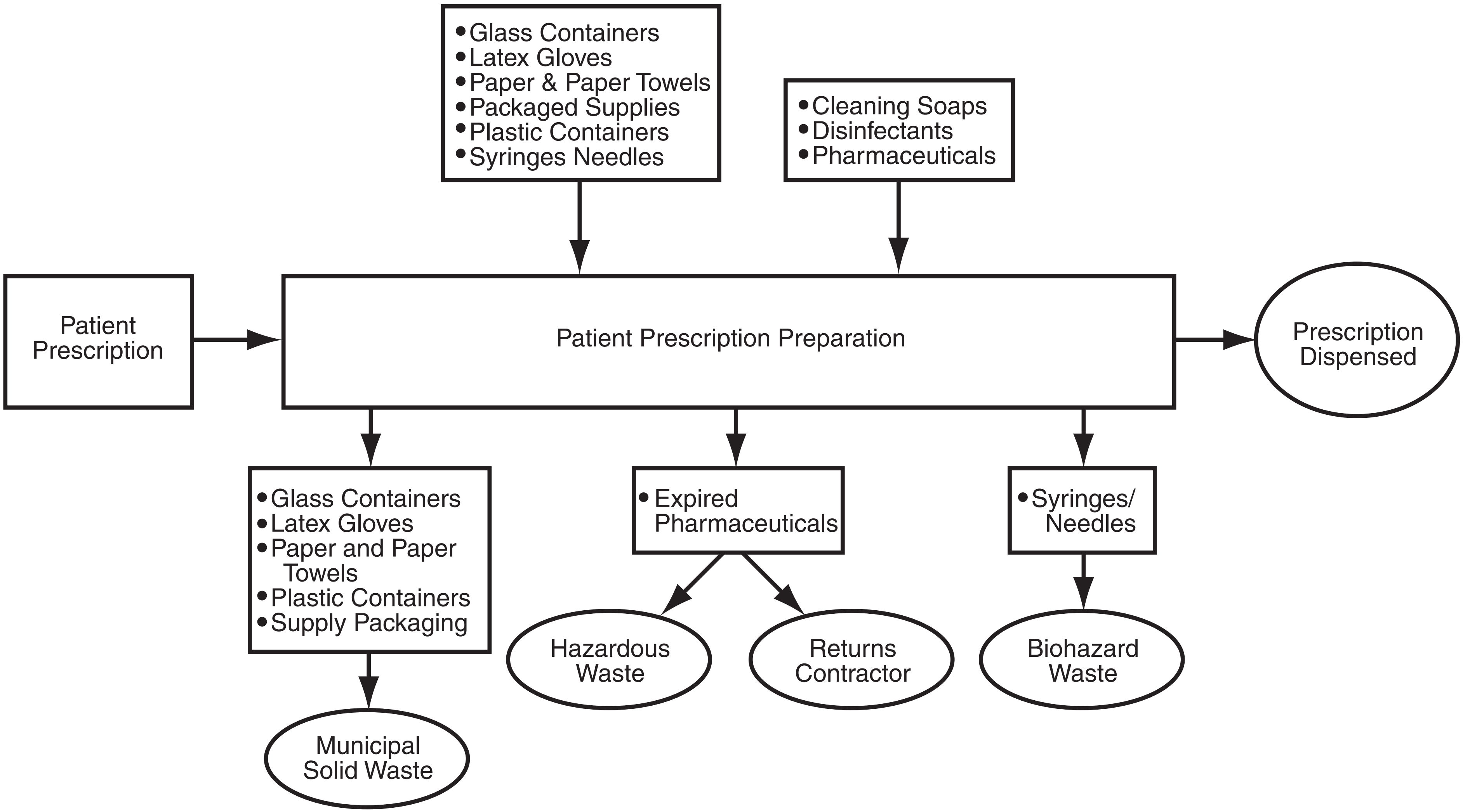


Figure C-49 Process Flow Diagram - Radiography, "Wet Process" Film Development

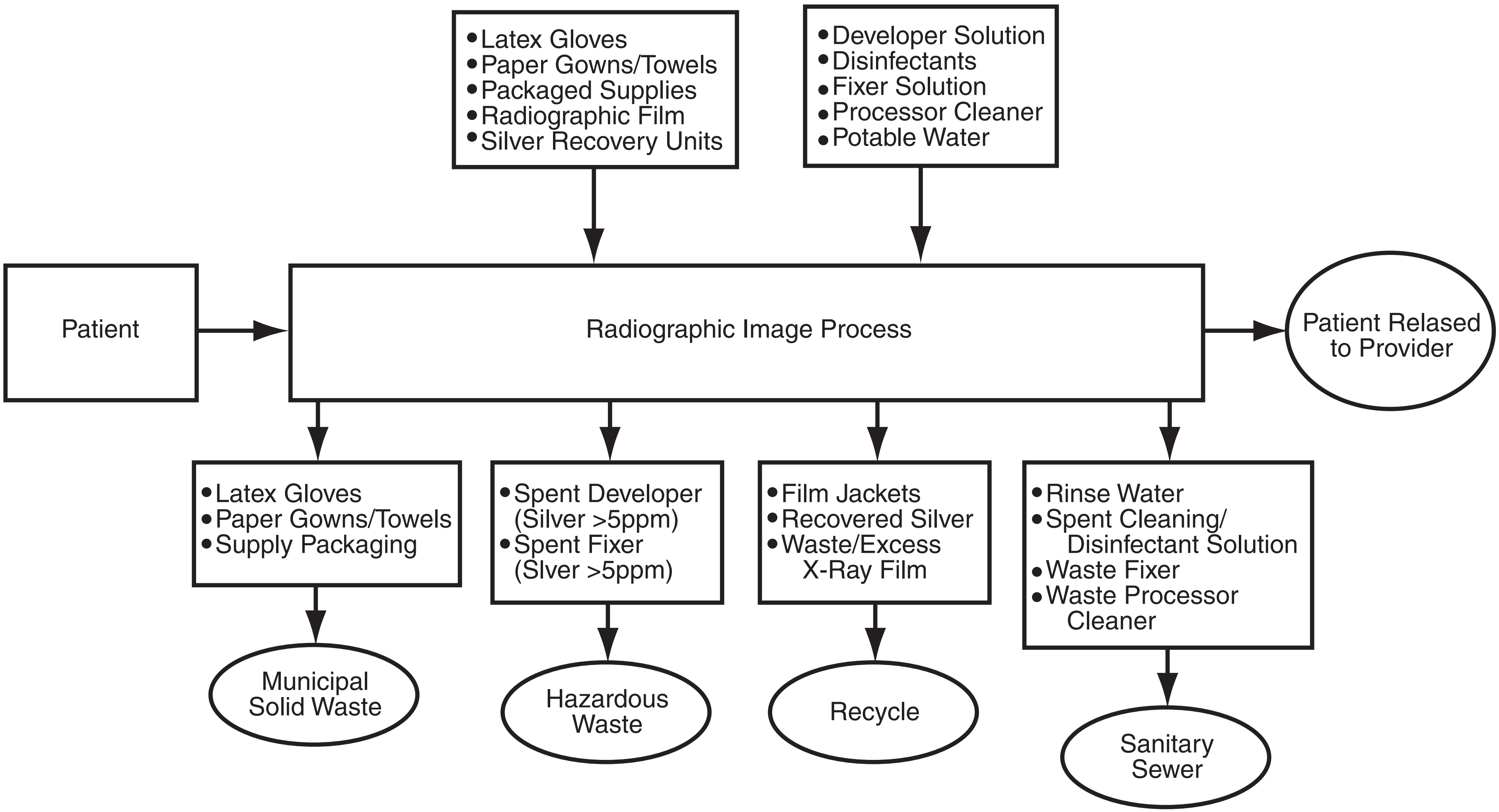


Figure C-50 Process Flow Diagram - Radiography, Digital Film Development

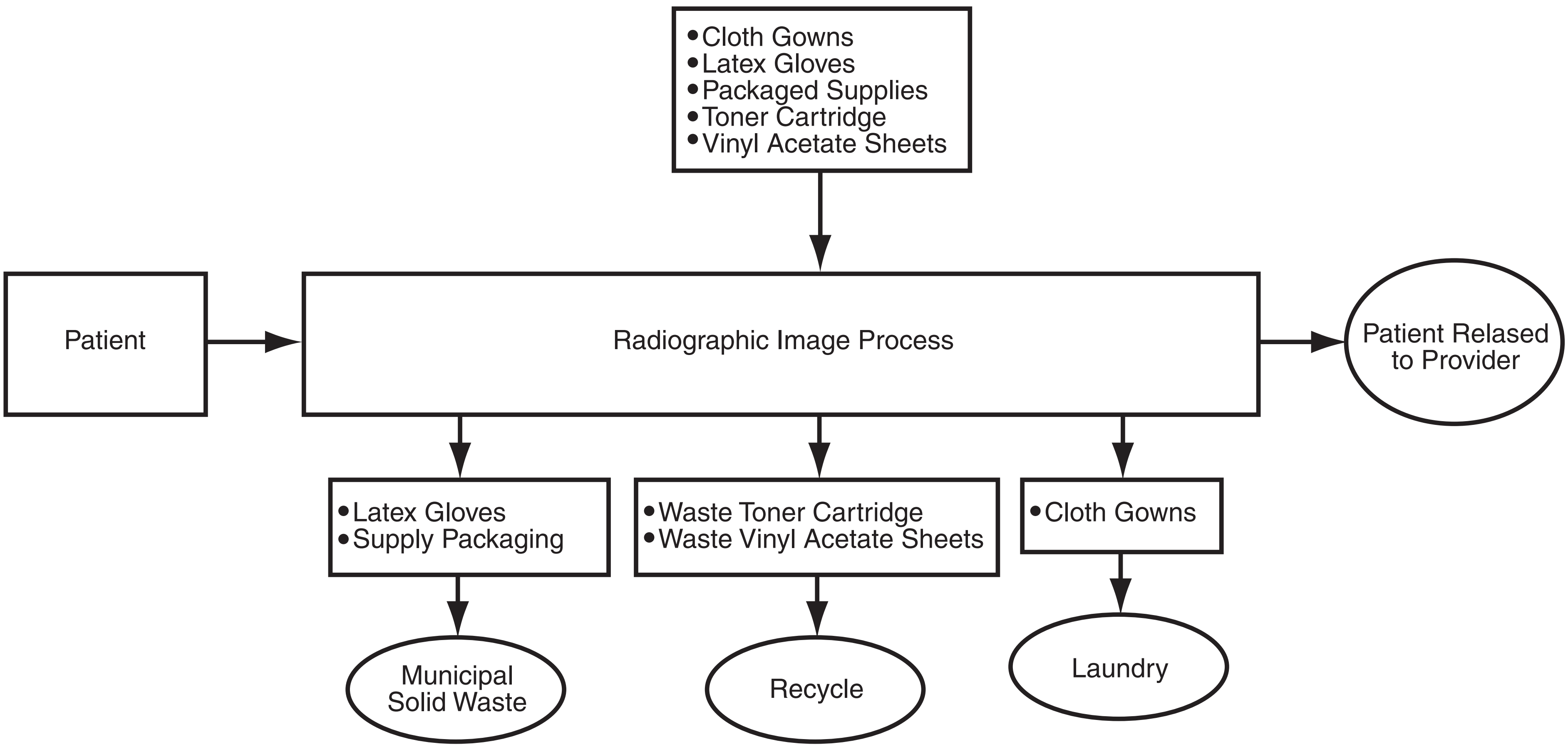
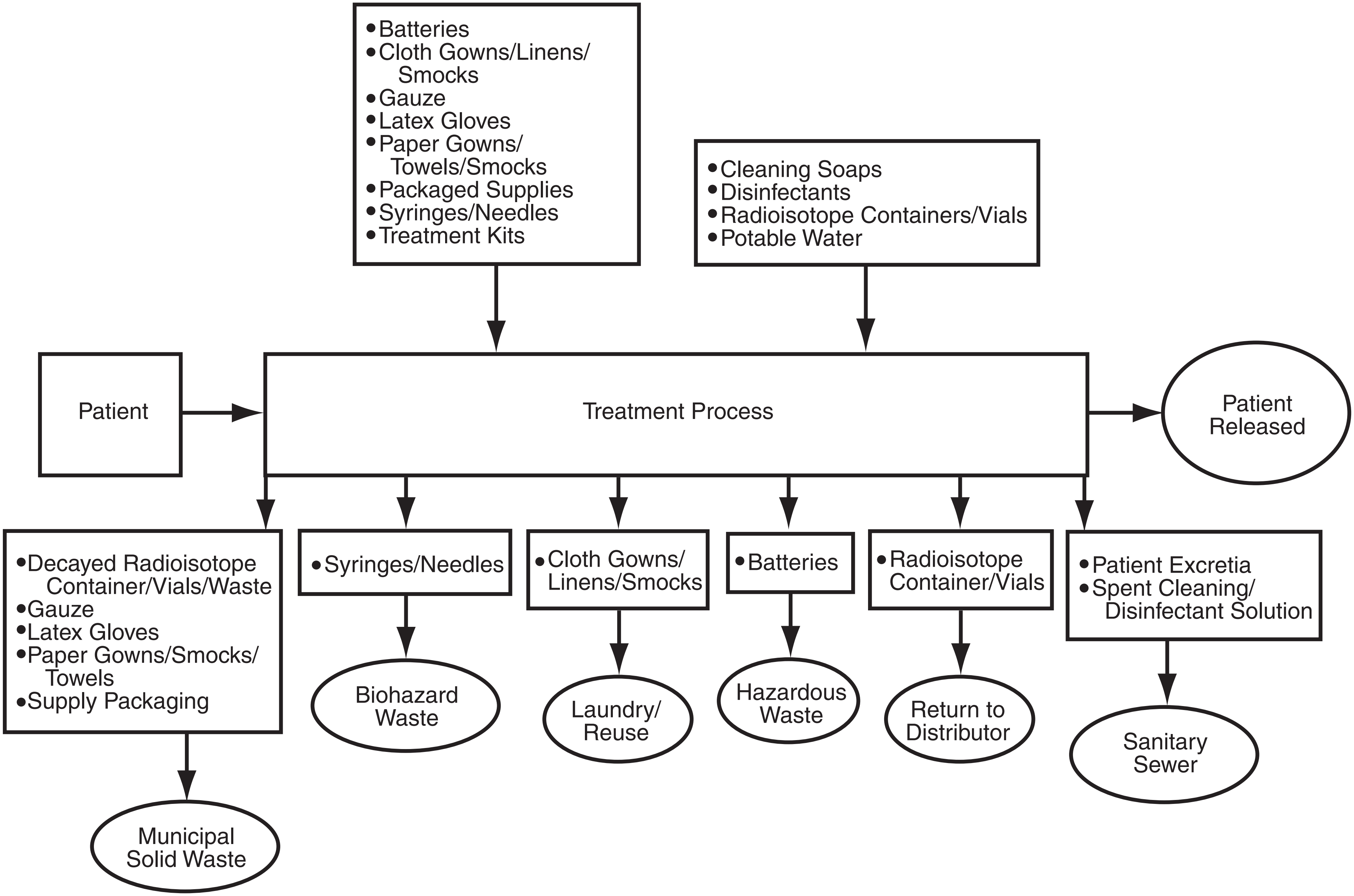


Figure C-51 Process Flow Diagram - Nuclear Medicine



APPENDIX D

APPENDIX D-1
ALTERNATIVE METHODS OF MEDICAL WASTE TREATMENT
MIDWEST RESEARCH INSTITUTE REPORT

APPENDIX D-2
ALTERNATIVE METHODS OF MEDICAL WASTE TREATMENT
PATHOLOGICAL WASTE TREATMENT ALTERNATIVES
VENDORS INFORMATION

APPENDIX D-3
ALTERNATIVE METHODS OF MEDICAL WASTE TREATMENT
SHARPS DISPOSAL ALTERNATIVE VENDORS INFORMATION

APPENDIX D-4
ALTERNATIVE METHODS OF MEDICAL WASTE TREATMENT FORMALIN SUBSTITUTION AND SOLVENT DISTILLATION VENDORS INFORMATION

APPENDIX D-5
WATER SAVINGS DEVICES
SENSORED FAUCET VENDORS INFORMATION

APPENDIX D-6
PHARMACEUTICAL RETURN CONTRACT VENDOR INFORMATION

APPENDIX E

ECONOMIC ANALYSIS WORKBOOK

APPENDIX E
ECONOMIC ANALYSIS WORKBOOK

This appendix provides the entire economic analysis workbook. It evaluates the current and alternative work processes from an environmental protection, safety and occupational health (ESOH) perspective and accounts for the work center's personnel time required to accomplish the work process under evaluation. This workbook strives to capture both the work center and the supporting agencies time and cost in the evaluation of the work process. It is not inclusive of all cost. Additional items can be added to the worksheets as necessary to better define the total cost of the project.

Each worksheet is provided with line by line instructions to help the user provide the appropriate data to refine the economic analysis. The data entered in the worksheets are based upon annual cost, unless otherwise noted such as hours per week. The workbook is presented in a Microsoft Excel 97 format and can be customized for the specific conditions at the user's work center.

The manpower/labor cost used in the spreadsheets for the officer, enlisted and civilian categories were derived from the fiscal year (FY) 99 values assigned[1] when evaluating competitive sourcing alternatives. These are the rates applied when converting personnel funds into operation and maintenance funds for contract funding. The hourly rates were calculated by using the yearly dollar amounts for each category ($80,042 for officers; $38,585 for enlisted; and $40,440 for civilians); dividing by 2080 hours/year (40 hours/week X 52 weeks/year); and then rounding to the nearest tenth of a dollar. The user is urged to adjust the other cost for organizational specific values. For example, overseas locations could include the various cost of living allowances. It should be noted that not all cost elements would apply to each alternative. Finally, the yearly cost factors can be adjusted as needed based upon pay raises received by the individual category.

The electronic version of this report includes the Excel workbook spreadsheets that can be accessed by double clicking anywhere on the spreadsheet. This will allow the user direct access to the workbook. The individual can then perform an opportunity assessment economic analysis. Rows that are **shaded** do not require any adjustments by the user. The workbook automatically calculates these rows/cells.

[1] Value obtained from the Headquarters (HQ) Air Education and Training Command (AETC)/SGAC office, April 1999. The values are the values AETC uses when evaluating competitive sourcing options for it's installations. The values may be higher in overseas locations where cost of living allowances have to be included into the personnel cost.

Table F-1
CRO/PPO Economic Analysis Worksheet

Row	Cost Item	Current Method	Alternative 1	Alternative 2
1	**Capital Cost**			
2				
3	**Additional Requirements Cost**			
4	Permit, e.g., Air Permit ($)			
5	Initial PPE Required ($)			
6	Equipment Installation ($)			
7	Equipment Removal ($)			
8	**Total Additional Requirements Cost ($)**	$ -	$ -	$ -
9	**Total Installed Costs($)**	$ -	$ -	$ -
10	**Annual Cost**			
11	**Utility Cost**			
12	Electricity ($)			
13	Potable Water ($)			
14	Sewerage ($)			
15	Steam ($)			
16	Waste Generated			
17	Medical ($)			
18	Hazardous ($)			
19	Radiological ($)			
20	Municipal Solid ($)			
21	**Total Utility Cost ($)**	$ -	$ -	$ -
22	Work Center Training & Exam Cost ($)	$ -	$ -	$ -
23	Work Center Labor & PPE Costs ($)	$ -	$ -	$ -
24	**Total Work Center Labor Cost ($)**	$ -	$ -	$ -
25	ECSAM Cost ($)	$ -	$ -	$ -
26	Occupational Health Cost ($)	$ -	$ -	$ -
27	Cost of Materiel Used in Process ($)			
28	Annual Maintenance Contract Cost ($)			
29	**Total Operating Cost ($)**	$ -	$ -	$ -
30	**Total Annual Cost ($)**	$ -	$ -	$ -
31	**Payback Period (years)**	N/A	#DIV/0!	#DIV/0!
32	**First Year Savings ($)**	N/A	$ -	$ -
33	**Three Year Savings ($)**	N/A	$ -	$ -

A negative payback period means that the alternative annual cost exceeds the status quo annual cost.
N/A = not applicable.
Double Click in Spreadsheet to Open

Table F-2
Explanation of CRO/PPO Spreadsheet Entries Shown in Table F-1

Row	Explanation
1	CAPITAL COST This is the heading for the capital cost category and **does not require editing**. The user enters the equipment, installation, and other start-up cost associated with the alternative. No capital cost will be associated with the status quo operation.
2	EQUIPMENT COST ($) This row includes the total purchase and warranty cost of the piece or pieces of equipment. The user enters the name(s) of the new pieces of equipment.
3	ADDITIONAL REQUIREMENTS COST This is a sub-category heading of capital cost and **does not require editing**. The user enters the permit fees and the cost associated with equipment installation and removal.
4	PERMIT FEE COST ($) This row contains permit fee cost for the installation, use, storage, and/ or removal of equipment being replaced or installed. All cost except manpower associated with the preparation and processing the permit application should be included in this cost. Include the manpower cost in the ECSAM cost table.
5	INITIAL PPE REQUIRED This row contains the total cost for purchasing required personal protective equipment to protect the health and safety of the workers. PPE includes respiratory protection, hard hats, goggles, faceshields, aprons, protective suits, shoes, etc. Estimates of the **ANNUAL** maintenance, supplies such as filters and breathing air refill cost and existing PPE used for the current method is captured in the work center Process Labor & PPE Cost sheet.
6	INSTALLATION COST ($) This row contains the cost to install the alternative method identified equipment including facility modifications (such as electrical, water, sewage, and ventilation), required to complete the installation. The user enters a lump sum value in only the alternative columns.
7	EQUIPMENT REMOVAL COST ($) This row contains the removal and disposal cost of any equipment no longer needed by the alternative method. Include any associated environmental clean up cost. The user enters a lump sum value in only the alternative columns. If the current methods equipment is already scheduled for removal within three years of installing the alternative's equipment, then do not enter any cost in the worksheet. If the existing equipment salvage value is greater that the cost associated with removing the equipment, enter this difference as a negative number indicating that there is a credit.
8	TOTAL ADDITIONAL REQUIREMENTS COST ($) This row calculates the total cost required for implementing the alternative. The calculation is based on data from Rows 4 to 7. **The user does not manipulate this row**.
9	TOTAL INSTALLED COST ($) This row calculates the total cost required implementing the alternative. The calculation is based on data from Rows 2 & 8. **The user does not manipulate this row**.

10	ANNUAL COST This is the heading for the annual cost category and **does not require editing**. The user enters the utility and waste generation cost. The work center personnel training and medical examination cost; work center process labor cost; environmental compliance, sampling and monitoring (ECSAM) cost; occupational health cost; and cost of materiel used are imported from other worksheets associated with this table.
11	UTILITY COST This is the heading for the annual utility cost and **does not require editing**. The user enters the specific cost associated with the various utilities used on an **ANNUAL** basis.
12	ELECTRICITY ($) This row contains the **ANNUAL** electrical cost associated with all the methods. The user enters a lump sum value.
13	POTABLE WATER ($) This row contains the **ANNUAL** potable water cost associated with all the methods. The user enters a lump sum value.
14	SEWAGE ($) This row contains the **ANNUAL** sewage cost associated with all the methods. This cost will probably be a based upon the potable water used times the per gallon cost associated with sewage treatment. The user enters a lump sum value.
15	STEAM ($) This row contains the **ANNUAL** cost for the steam used in the process such as the amount of steam used in the sterilization process. The user enters a lump sum.
16	WASTE GENERATED This is the heading for the various types of waste that may generated from the process. Include, if possible, the savings or cost that can be received by recycling the waste stream. **This row does not require editing.**
17	MEDICAL ($) This row contains the annual cost for the disposal of the medical waste generated by the process. A lump sum **ANNUAL** cost is entered.
18	HAZARDOUS ($) This row contains the annual cost for the disposal of the hazardous waste generated by the process. A lump sum **ANNUAL** cost is entered.
19	RADIOLOGICAL ($) This row contains the annual cost for the disposal of the radiological waste generated by the process. A lump sum **ANNUAL** cost is entered.
20	MUNICIPAL SOLID ($) This row contains the annual cost for the disposal of the municipal waste generated by the process. A lump sum **ANNUAL** cost is entered.
21	TOTAL UTILITY COST ($) This row calculates the total utility cost required for the methods under consideration. The calculation is based on data from Rows 12 to 20. **The user does not manipulate this row.**
22	WORK CENTER TRAINING AND EXAMINATON COST ($) This row contains the manpower training cost to the work center for the specific work process training needed to properly use/operate the methods under consideration along with the associated occupational health and safety training cost to it's workers. It also incorporates the work center manpower cost associated with occupational health examinations for their employees. These data are imported from the work center T&E worksheet. **The user does not manipulate this row.**

23	WORK CENTER PROCESS LABOR & PPE COST ($) This row contains the manpower cost to the work center required to perform the work using the work process under consideration. These data are imported from the process labor cost worksheet. **The user does not manipulate this row.**
24	TOTAL WORK CENTER LABOR COST ($) This row calculates the total work center labor cost required for the methods under consideration. The calculation is based on data from Rows 22 and 23. **The user does not manipulate this row.**
25	ECSAM COST ($) This row contains the environmental compliance, sampling, analysis and monitoring cost associated with the work process under consideration. These data are imported from the ECSAM worksheet. **The user does not manipulate this row.**
26	OCCUPATIONAL HEALTH COST ($) This row contains the occupational health cost to the medical group associated with each method under consideration. It incorporates the cost of industrial hygiene surveillance; medical manpower cost for any required occupational health examinations and the cost for supplies and analysis. These data are imported for the Occupational Health Cost worksheets. **The user does not manipulate this row.**
27	COST OF MATERIEL USED IN THE PROCESS This row contains the annual cost of the materiel used for the process under consideration. A lump sum **ANNUAL** cost is entered.
28	ANNUAL MAINTENANCE CONTRACT COST ($) This row contains the annual cost of a maintenance contract for the process under consideration. The **ANNUAL** maintenance lump sum cost is entered.
29	TOTAL OPERATING COST ($) This row sums the cost of the required ECSAM, occupational health surveillance and examinations, the annual cost of the materials used in the process and any annual maintenance contract cost. The calculation is based on data from Rows 25 through 28. **The user does not manipulate this row.**
30	TOTAL ANNUAL COST ($) This row sums the total annual cost of each method under consideration. The calculation is based upon data from Rows 21, 24 and 29. **The user does not manipulate this row.**
31	PAYBACK PERIOD (in years) The payback period is the length of time it takes to recover the initial capital investment from the savings achieved by implementing the CRO/PPO. This value is a measure of whether the investment produces a positive or negative return. The payback period is never applicable for the current method. If the calculated payback period is zero, there is no initial investment and the payback period is not applicable (N/A). If the calculated payback period is less than zero, the alternative costs more than the current practice and the value of the initial investment will never be recovered. The payback period is computed for each alternative by dividing the total installed cost by any annual savings. **The user does not manipulate this row.**
32	FIRST YEAR SAVINGS This row is calculated by subtracting the first year cost of the alternative(s) from the total annual cost for the current method, Row 30. The first year saving with the current method is always zero or N/A. For the alternatives, this value will be the first year savings gained by implementing the new practice. If this value is negative, then the new process actually nets a first year cost, i.e. no savings, for implementing the new alternative. **The user does not manipulate this row.**

33	THREE YEAR SAVINGS This row is calculated by subtracting the total installed cost of the alternative (Row 9) and three times the total annual cost of the alternative (Row 30) from three times the current method annual cost. The three-year savings with the current method are always zero or N/A. For alternatives other than the current method, this value will be the three-year savings gained by implementing the new practice. If the payback period is less than three years, the alternative is considered to be cost effective and should be pursued for implementation. If this value is negative, then the alternative will actually net a three-year cost for implementing the new alternative. **The user does not manipulate this row.**

Table F-3
Environmental Compliance, Sampling,
Analysis and Monitoring (ECSAM) Cost

Row	Cost Factor	Off (hrs)	Enl (hrs)	Civ (hrs)	Costs ($)
	Current Method				
1	**Manpower**				
2	Collection				$ -
3	Sample Preparation/ Shipping				$ -
4	Data Analysis/ Report Preparation				$ -
5	**Manpower Costs**	0	0	0	$ -
6	**Other Cost Items**				
7	Costs of Analysis				
8	Costs of Supplies				
9	Costs of Sampling Equipment				
10	**Total Current ECSAM Costs**				$ -
11					
12	**Alternative 1**				
13	**Manpower**				
14	Collection				$ -
15	Sample Preparation/ Shipping				$ -
16	Data Analysis/ Report Preparation				$ -
17	**Manpower Costs**	0	0	0	$ -
18	**Other Cost Items**				
19	Costs of Analysis				
20	Costs of Supplies				
21	Costs of Sampling Equipment				
22	**Total Alternative 1 ECSAM Costs**				$ -
23					
24	**Alternative 2**				
25	**Manpower**				
26	Collection				$ -
27	Sample Preparation/ Shipping				$ -
28	Data Analysis/ Report Preparation				$ -
29	**Manpower Costs**	0	0	0	$ -
30	**Other Items**				
31	Costs of Analysis				
32	Costs of Supplies				
33	Costs of Sampling Equipment				
34	**Total Alternative 2 ECSAM Costs**				$ -

Double Click to Open the Spreadsheet

ECSAM Table F-4
Explanation of PPO Spreadsheet Entries Shown in ECSAM Table F-3

Row	Explanation
1	MANPOWER This is the heading for the **ANNUAL** manpower used by Bioenvironmental Engineering or another flight that has the responsibility for collecting, analyzing, interpreting and reporting the environmental monitoring of the process. The user enters the applicable officer, enlisted and civilian time in hours annually required monitoring the current method. The time will be reported to the nearest whole hour. **This row does not require editing.**
2	COLLECTION (HOURS) User enters actual time required to accomplish the task. The Cost column is automatically calculated once the user enters in the time. **The user does not manipulate the cost cell.**
3	SAMPLE PREPARATION/SHIPPING (HOURS) User enters actual time required to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
4.	DATA ANALYSIS / REPORT WRITING (HOURS) User enters actual time required to perform the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
5	MANPOWER COST (HOURS AND $) This row totals the manpower hours and dollar cost to accomplish ECSAM for the current method. **The user does not manipulate this row.**
6	OTHER COST ITEMS This is the heading for the **ANNUAL** cost for equipment and supplies used by Bioenvironmental Engineering or other flight that has the responsibility for sampling, analysis and monitoring the environmental aspects of the current process. The user enters a lump sum value in the Cost column. **This row does not require editing**.
7	COST OF ANALYSIS ($) This row contains the analytical laboratory charges for the analysis of the samples that monitor the compliance with environmental requirements. The user enters a lump sum value.
8	COST OF SUPPLIES ($) This row contains the cost for the supplies required for ECSAM associated with the process. The user enters a lump sum value.
9	COST OF SAMPLING EQUIPMENT ($) This row contains the cost to purchase of any new or to rent SAM equipment that will be required to monitor this method for environmental compliance. The user enters a lump sum value.
10	TOTAL CURRENT ECSAM COST ($) This row calculates the total **ANNUAL** ECSAM cost for the current method and **does not require editing**. It sums the cost values from rows 5, 7, 8, and 9. This value is exported to row 25 in Table F-1 (Table 2.5.1).
11	INTENTIONALLY LEFT BLANK
12	ALTERNATIVE 1 This is the heading for the estimated **ANNUAL** ECSAM cost associated with the first alternative being evaluated. Hopefully, the alternative under evaluation will require little to no ECSAM cost. **This row does not require editing.**

13	MANPOWER This is the heading for the estimation of the **ANNUAL** manpower that would be required by Bioenvironmental Engineering or other flight that has the responsibility for collecting, analyzing, interpreting and report writing for the environmental monitoring of the process. The user enters the estimated officer, enlisted and civilian hours that would be required annually to monitor this alternative method. The times will be reported to the nearest whole hour. **This row does not require editing.**
14	COLLECTION (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time the hours. **The user does not manipulate the cost cell.**
15	SAMPLE PREPARATION/SHIPPING (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
16.	DATA ANALYSIS / REPORT WRITING (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
17	MANPOWER COST (HOURS AND $) This row totals the estimated **ANNUAL** manpower hours and dollar cost to accomplish ECSAM for this alternative method. **The user does not manipulate this row.**
18	OTHER COST ITEMS This is the heading for the estimated **ANNUAL** cost for equipment and supplies to be used by Bioenvironmental Engineering or other flight that has the responsibility for sampling, analysis and monitoring the environmental aspects of this alternative process. The user enters a lump sum value in the Cost column. **This row does not require editing**.
19	COST OF ANALYSIS ($) This row contains the estimated analytical laboratory charges for the analysis of the samples that would be required to monitor for environmental compliance. The user enters a lump sum value.
20	COST OF SUPPLIES ($) This row contains the estimated cost for the supplies required for ECSAM associated with this alternative. The user enters a lump sum value.
21	COST OF SAMPLING EQUIPMENT ($) This row contains the estimated cost to purchase any new or to rent SAM equipment that will be required to monitor this alternative for environmental compliance. The user enters a lump sum value.
22	TOTAL ALTERNATIVE 1 ECSAM COST ($) This row calculates the total estimated **ANNUAL** ECSAM cost for this alternative method and **does not require editing**. It sums the cost values from rows 17, 19, 20,and 21. This value is exported to row 25 in Table F-1 (Table 2.5.1).
23	INTENTIONALLY LEFT BLANK
24	ALTERNATIVE 2 This is the heading for the estimated **ANNUAL** ECSAM cost associated with the second alternative being evaluated. Hopefully, the alternative under evaluation will require little to no ECSAM cost. **This row does not require editing.**

25	MANPOWER This is the heading for the estimation of the **ANNUAL** manpower that would be required by Bioenvironmental Engineering or other flight that has the responsibility for collecting, analyzing, interpreting and report writing for the environmental monitoring of this alternative. The user enters the estimated officer, enlisted and civilian hours that would be required to monitor this alternative method. The time will be reported to the nearest whole hour. **This row does not require editing.**
26	COLLECTION (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
27	SAMPLE PREPARATION/SHIPPING (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
28	DATA ANALYSIS / REPORT WRITING (HOURS) User enters estimated time to accomplish the task. The Cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
29	MANPOWER COST (HOURS AND $) This row totals the estimated **ANNUAL** manpower hours and dollar cost to accomplish ECSAM for this alternative method. **The user does not manipulate this row.**
30	OTHER COST ITEMS This is the heading for the estimated cost for equipment and supplies to be used by Bioenvironmental Engineering or other flight that has the responsibility for sampling, analysis and monitoring the environmental aspects of this alternative method. The user enters a lump sum value in the Cost column. **This row does not require editing**.
31	COST OF ANALYSIS ($) This row contains the estimated analytical laboratory charges for the analysis of the samples that would be required to monitor for environmental compliance. The user enters a lump sum value.
32	COST OF SUPPLIES ($) This row contains the estimated cost for the supplies required for ECSAM associated with this alternative. The user enters a lump sum value.
33	COST OF SAMPLING EQUIPMENT ($) This row contains the estimated cost to purchase any new or to rent SAM equipment that will be required to monitor this alternative for environmental compliance. The user enters a lump sum value.
34	TOTAL ALTERNATIVE 2 ECSAM COST ($) This row calculates the total estimated **ANNUAL** ECSAM cost for this alternative method and **does not require editing**. It sums the cost values from rows 29, 31, 32 and 33. This value is exported to row 25 in Table F-1 (Table 2.5.1).

Table F-5
Annual Occupational Health Cost for Current Method

Row	Cost Factor	Officer (hrs)	Enlisted (hrs)	Civilian (hrs)	Costs ($)
1	**Industrial Hygiene Surveillance Manpower**				
2	Air Monitoring				$ -
3	Electromagnetic Radiation				$ -
4	Ergonomic Evaluation				$ -
5	Noise Monitoring				$ -
6	Thermal Stress Monitoring				$ -
7	Ventilation				$ -
8	Manpower Sub Total	0	0	0	$ -
9	**Other Industrial Hygiene Surveillance Costs**				
10	Respirator Fit Testing				$ -
11	Respirator Fit Testing Supplies				
12	Industrial Hygiene Supplies				
13	Analysis				
14	Packaging and Shipping				
15	Other IH Surveillance Sub Total				$ -
16	**Total Surveillance Costs**	0	0	0	$ -
17					
18	**Occupational Health Examination Manpower**				
19	Audiometry				$ -
20	Laboratory				$ -
21	Optometry				$ -
22	Physical Exam Administration (paperwork)				$ -
23	Pulmonary Evaluation				$ -
24	Radiology				$ -
25	Provider Examination				$ -
26	Manpower Sub Total	0	0	0	$ -
27	**Other Occupational Health Examination Costs**				
28	Supplies				
29	External laboratory analytical cost				
30	Other OH Costs SubTotal				$ -
31	Occupational Health Exam Sub Total				$ -
32	**Total Current OH Costs**	0	0	0	$ -

Double Click to Open Spreadsheet

Table F-6
Explanation of Entries of Annual Occupational Health Cost for Current Method

Row	Explanation
1	INDUSTRIAL HYGIENE SURVEILLANCE MANPOWER This is the heading for the **ANNUAL** manpower expended by Bioenvironmental Engineering, and possibly Public Health, to perform industrial hygiene (IH) monitoring of the current process. Included are collecting, analyzing, interpreting and reporting data and associated health risk to the process work center. The user enters the applicable **ANNUAL** officer, enlisted and civilian hours expended monitoring the current method. The time will be reported to the nearest whole hour. Not all rows will need to be completed; only those applicable. **This row does not require editing.**
2	AIR MONITORING (HOURS) User enters actual time (hours) expended accomplishing this task. Includes time developing sampling protocol, equipment calibration, accomplishing area and personal air sampling, preparing and shipping samples for analysis, interpreting results and reporting results to the work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
3	ELECTROMAGNETIC RADIATION (HOURS) User enters actual time (hours) expended accomplishing this task. Preparing, accomplishing, analyzing data and report writing for ionizing radiation, ultraviolet, visible, infrared, microwave/radiofrequency, and laser surveys are included. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
4	ERGONOMIC EVALUATION User enters actual time (hours) expended accomplishing this task. Includes work center health survey, process evaluation, analysis of results and report writing. Also, include Public Health and any medical provider's involvement in this evaluation. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
5	NOISE MONITORING User enters actual time (hours) expended accomplishing this task. Includes collecting area and personal dosimetry data, analyzing, interpreting and reporting data and associated health risk back to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
6	THERMAL STRESS MONITORING User enters actual time (hours) expended accomplishing this task. Includes collecting, analyzing, interpreting and reporting data and associated health risk back to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
7	VENTILATION User enters actual time (hours) expended accomplishing this task. Includes pre-survey preparation, accomplishing the survey, interpreting and reporting survey results to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**

8	MANPOWER SUB TOTAL This row calculates the total **ANNUAL** IH surveillance manpower hours and dollar cost associated with the current method. It sums the hours and cost values from rows 2 through 7. **This row does not require editing.**
9	OTHER INDUSTRIAL HYGIENE SURVEILLANCE COST This is the heading for the **ANNUAL** times (hours) and cost to accomplish additional IH surveillance of the work center's current process. **This row does not require editing.**
10	RESPIRATOR FIT TESTING User enters actual time (hours) expended by Bioenvironmental Engineering and/or contractor personnel accomplishing this task. Includes worker scheduling, preparing for and accomplishing fit and leak testing, documenting respirator effectiveness, cleaning up and OH worker education for the individuals in the current methods work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
11	RESPIRATOR FIT TESTING SUPPLIES This row contains the cost for the supplies expended for respirator fit testing that can be assigned to fit testing the work centers personnel. User enters a lump sum.
12	INDUSTRIAL HYGIENE SUPPLIES This row contains the cost for the supplies expended for the IH surveillance that can be assigned to monitoring the work center process. The user enters a lump sum.
13	ANALYSIS This row contains the total analytical laboratory charges for the analysis of the samples taken to monitor the work center's area or personnel. The user enters a lump sum.
14	PACKAGING AND SHIPPING This row contains the cost for packaging and shipping the samples to the laboratory for analysis. The user enters a lump sum.
15	OTHER IH SURVEILLANCE SUB TOTAL This row calculates the total other **ANNUAL** IH surveillance cost associated with the current method. It sums the cost values from rows 10 through 14. **The user does not manipulate this row.**
16	TOTAL SURVEILLANCE COST This row calculates the total **ANNUAL** IH surveillance cost associated with the current method. It sums the cost values from rows 8 and 15. **The user does not manipulate this row.**
17	INTENTIONALLY LEFT BLANK
18	OCCUPATIONAL HEALTH EXAMINATON MANPOWER This is the heading for the actual **ANNUAL** time (hours) expended by the various medical group work centers in support of the occupational health (OH) program for the current method. Under this heading the user enters applicable **ANNUAL** officer, enlisted and civilian hours expended monitoring the current method. The time will be reported to the nearest whole hour. Not all rows will need to be completed; only those applicable. **This row does not require editing.**

19	AUDIOMETRY This row contains the actual time (hours) expended to conduct the audiometric testing of the individuals on the hearing conservation program in the current methods work center. Also, included are the time (hours) expended by IH and OH personnel to fit test the hearing protection devices and to conduct the hearing conservation education for the workers. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
20	LABORATORY This row contains the actual time (hours) expended to conduct the medical laboratory evaluations of the individuals on the OH program in the current methods work center. Also, included is the time (hours) expended by IH and OH personnel to conduct the OH education for the workers. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
21	OPTOMETRY This row contains the actual time (hours) expended to conduct the visual examinations of the individuals on the OH program in the current methods work center. Also, included are the hours expended by IH and OH personnel to conduct the OH education for the workers. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
22	PHYSICAL EXAM ADMINISTRATION This row contains the actual time (hours) expended to accomplish the OH program administrative documentation for the work center personnel. Included is the scheduling of personnel, entering data into OH computer based programs, and reviewing completed forms. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
23	PULMONARY EVALUATION This row contains the actual time (hours) expended to conduct the pulmonary evaluations of the individuals on the OH program in the current methods work center. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
24	RADIOLOGY This row contains the actual time (hours) expended to conduct the radiographic evaluations of the individuals on the OH program in the current methods work center. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
25	PROVIDER EXAMINATION This row contains the actual time (hours) expended by medical providers to accomplish the OH examinations for the current method's work center personnel. Include the time of providers not included in rows 19 through 24. Do not include the time that work center personnel receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**

26	MANPOWER SUB TOTAL This row calculates the total **ANNUAL** OH examination manpower hours and dollar cost associated with the current method. It sums the hours and cost values from rows 19 through 25. **This row does not require editing.**
27	OTHER OCCUPATIONAL HEALTH EXAMINATION COST This is the heading for the **ANNUAL** cost for supplies and external laboratory analytical cost to support the OH requirements of the personnel in the current methods work center. **This row does not require editing.**
28	SUPPLIES This row contains the cost for the supplies expended for conducting the OH program not included in rows 19 through 24. The user enters a lump sum value.
29	EXTERNAL LABORATORY ANALYTICAL COST This row contains the analytical laboratory charges for the analysis of any OH specimen analysis that can not be performed in the medical group's medical laboratory. The user enters a lump sum value.
30	OTHER OH COST SUB TOTAL This row calculates the **ANNUAL** other OH cost for supplies and external laboratory analysis. It sums the cost values from rows 28 and 29**. This row does not require editing.**
31	OCCUPATIONAL HEALTH EXAM SUB TOTAL This row calculates the total **ANNUAL** occupational health examination cost. It sums the cost values from rows 26 and 30. **This row does not require editing.**
32	TOTAL CURRENT OH COST This row calculates the total **ANNUAL** occupational health cost associated with the current method. It sums the cost values from rows 16 and 31. This value is exported to Table F-1 (Table 2.5.1), Row 26. **This row does not require editing.**

Table F-7
Alternative 1 Estimated Annual Occupational Health Cost

Row	Cost Factor	Officer (hrs)	Enlisted (hrs)	Civilian (hrs)	Costs ($)
1	**Industrial Hygiene Surveillance Manpower**				
2	Air Monitoring				$ -
3	Electromagnetic Radiation				$ -
4	Ergonomic Evaluation				$ -
5	Noise Monitoring				$ -
6	Thermal Stress Monitoring				$ -
7	Ventilation				$ -
8	Manpower Sub Total	0	0	0	$ -
9	**Other Industrial Hygiene Surveillance Costs**				
10	Respirator Fit Testing				$ -
11	Respirator Fit Testing Supplies				
12	Industrial Hygiene Supplies				
13	Analysis				
14	Packaging and Shipping				
15	Other IH Surveillance Sub Total				$ -
16	**Total Surveillance Costs**	0	0	0	$ -
17					
18	**Occupational Health Examination Manpower**				
19	Audiometry				$ -
20	Laboratory				$ -
21	Optometry				$ -
22	Physical Exam Administration (paperwork)				$ -
23	Pulmonary Evaluation				$ -
24	Radiology				$ -
25	Provider Examination				$ -
26	Manpower Sub Total	0	0	0	$ -
27	**Other Occupational Health Examination Costs**				
28	Supplies				
29	External laboratory analytical cost				
30	Other OH Costs SubTotal				$ -
31	Occupational Health Exam Sub Total				$ -
32	**Total Alternative 1 OH Costs**	0	0	0	$ -

Double Click to Open the Spreadsheet

Table F-8
Explanation of Entries of Alternative 1
Estimated Annual Occupational Health Cost

Row	Explanation
1	INDUSTRIAL HYGIENE SURVEILLANCE MANPOWER This is the heading for the estimated **ANNUAL** manpower that would be required by Bioenvironmental Engineering, and possibly Public Health, to perform industrial hygiene (IH) monitoring of alternative 1. Includes collecting, analyzing, interpreting and reporting data and associated health risk to the process work center. Under this heading the user enters the estimated **ANNUAL** officer, enlisted and civilian time (hours). The time will be estimated to the nearest whole hour. Not all rows need to be completed; only those applicable. **This row does not require editing.**
2	AIR MONITORING (HOURS) User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for developing sampling protocol, equipment calibration, accomplishing area and personal air sampling, preparing and shipping samples for analysis, interpreting results and reporting results to the work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
3	ELECTROMAGNETIC RADIATION (HOURS) User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for preparing, accomplishing, analyzing data and report writing for ionizing radiation, ultraviolet, visible, infrared, radiofrequency/microwave, and laser surveys. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
4	ERGONOMIC EVALUATION User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for work center health survey, process evaluation, analysis of results and report writing. Also, includes estimated Public Health and any medical provider's involvement in this evaluation. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
5	NOISE MONITORING User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for collecting area and personal dosimetry data, analyzing, interpreting and reporting data and associated health risk to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
6	THERMAL STRESS MONITORING User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for collecting, analyzing, interpreting and reporting data and associated health risk to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
7	VENTILATION User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for pre-survey preparation, accomplishing the survey, interpreting and reporting survey results to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**

8	MANPOWER SUB TOTAL This row calculates the estimated total **ANNUAL** IH surveillance manpower hours and dollar cost associated with alternative 1. It sums the hours and cost values from rows 2 through 7. **This row does not require editing.**
9	OTHER INDUSTRIAL HYGIENE SURVEILLANCE COST This is the heading for the estimated **ANNUAL** time (hours) and cost to accomplish additional IH surveillance of the work center's alternative 1 process. **This row does not require editing.**
10	RESPIRATOR FIT TESTING User enters estimated Bioenvironmental Engineering and/or contractor personnel time (hours) to accomplish this task. Includes time for worker scheduling, preparing for and accomplishing fit and leak testing, documenting respirator effectiveness, cleaning up and OH worker education for work center personnel using alternative 1. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
11	RESPIRATOR FIT TESTING SUPPLIES This row contains the estimated cost for the supplies to be expended for respirator fit testing that can be assigned to fit testing the work centers personnel. The user enters a lump sum.
12	INDUSTRIAL HYGIENE SUPPLIES This row contains the estimated cost for the supplies to be expended for the IH surveillance that can be assigned to monitoring the work center's alternative 1. The user enters a lump sum.
13	ANALYSIS This row contains the total estimated analytical laboratory charges for the analysis of the samples taken to monitor the work centers area or personnel. The user enters a lump sum.
14	PACKAGING AND SHIPPING This row contains the estimated cost for packaging and shipping samples to the laboratory for analysis. The user enters a lump sum.
15	OTHER IH SURVEILLANCE SUB TOTAL This row calculates the estimated total **ANNUAL** other IH surveillance cost associated with alternative 1. It sums the cost values from rows 10 through 14. **The user does not manipulate this row.**
16	TOTAL SURVEILLANCE COST This row calculates the estimated total **ANNUAL** IH surveillance cost associated with alternative 1. It sums the cost values from rows 8 and 15. **The user does not manipulate this row.**
17	INTENTIONALLY LEFT BLANK
18	OCCUPATIONAL HEALTH EXAMINATON MANPOWER This is the heading for the estimated **ANNUAL** time (hours) that would be expended by the various medical group work centers in support of the occupational health (OH) program for alternative 1. Under this heading the user enters estimated **ANNUAL** officer, enlisted and civilian time. The time will be reported to the nearest whole hour. Not all rows need to be completed; only those applicable. **This row does not require editing.**

19	AUDIOMETRY This row contains the estimated time (hours) to conduct the audiometric testing of the individuals who would be on the hearing conservation program for alternative 1. Includes the estimated time (hours) by IH and OH personnel to fit test the hearing protection devices and to conduct any required the hearing conservation education for the workers. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
20	LABORATORY This row contains the estimated time (hours) to conduct the medical laboratory evaluations of the individuals on the OH program for alternative 1. Includes the estimated time (hours) by IH and OH personnel to conduct any required OH education for the workers. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
21	OPTOMETRY This row contains the estimated time (hours) to conduct the visual examinations of the individuals on the OH program for alternative 1. Includes the time (hours) by IH and OH personnel to conduct any required OH education for the workers. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
22	PHYSICAL EXAM ADMINISTRATION This row contains the estimated time (hours) to conduct the OH program administrative documentation for alternative 1's work center personnel. Includes the scheduling of personnel, entering data into OH computer based programs, and reviewing completed forms. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
23	PULMONARY EVALUATION This row contains the estimated time (hours) to conduct the pulmonary evaluations of the individuals on the OH program for alternative 1. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
24	RADIOLOGY This row contains the estimated time (hours) to conduct the radiographic evaluations of the individuals on the OH program for alternative 1. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
25	PROVIDER EXAMINATION This row contains the estimated time (hours) for medical providers to accomplish the OH examinations for alternative 1's work center personnel. Includes the time of providers not included in rows 19 through 24. Do not include the time that alternative 1 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**

26	MANPOWER SUB TOTAL This row calculates the estimated total **ANNUAL** OH examination manpower hours and dollar cost associated with alternative 1. It sums the hours and cost values from rows 19 through 25. **This row does not require editing.**
27	OTHER OCCUPATIONAL HEALTH EXAMINATION COST This is the heading for the estimated **ANNUAL** cost for supplies and external laboratory analytical cost to support the OH requirements of the personnel for alternative 1. **This row does not require editing.**
28	SUPPLIES This row contains the estimated cost for the supplies to conduct the OH program not included in rows 19 through 24. The user enters a lump sum value.
29	EXTERNAL LABORATORY ANALYTICAL COST This row contains the estimated OH specimen analytical laboratory cost from other than the medical group's medical laboratory. The user enters a lump sum value.
30	OTHER OH COST SUB TOTAL This row calculates the estimated **ANNUAL** other OH cost for supplies and external laboratory analysis. It sums the cost values from rows 28 and 29. **This row does not require editing.**
31	OCCUPATIONAL HEALTH EXAM SUB TOTAL This row calculates the estimated total **ANNUAL** occupational health examination cost for alternative 1. It sums the cost values from rows 26 and 30. **This row does not require editing.**
32	TOTAL ALTERNATIVE 1 OH COST This row calculates the estimated total **ANNUAL** occupational health cost associated with alternative 1. It sums the cost values from rows 16 and 31. This value is exported to Table F-1 (Table 2.5.1), Row 26. **This row does not require editing.**

Table F-9
Alternative 2 Estimated Annual Occupational Health Cost

Row	Cost Factor	Officer (hrs)	Enlisted (hrs)	Civilian (hrs)	Costs ($)
1	**Industrial Hygiene Surveillance Manpower**				
2	Air Monitoring				$ -
3	Electromagnetic Radiation				$ -
4	Ergonomic Evaluation				$ -
5	Noise Monitoring				$ -
6	Thermal Stress Monitoring				$ -
7	Ventilation				$ -
8	Manpower Sub Total	0	0	0	$ -
9	**Other Industrial Hygiene Surveillance Costs**				
10	Respirator Fit Testing				$ -
11	Respirator Fit Testing Supplies				
12	Industrial Hygiene Supplies				
13	Analysis				
14	Packaging and Shipping				
15	Other IH Surveillance Sub Total				$ -
16	**Total Surveillance Costs**	0	0	0	$ -
17					
18	**Occupational Health Examination Manpower**				
19	Audiometry				$ -
20	Laboratory				$ -
21	Optometry				$ -
22	Physical Exam Administration (paperwork)				$ -
23	Pulmonary Evaluation				$ -
24	Radiology				$ -
25	Provider Examination				$ -
26	Manpower Sub Total	0	0	0	$ -
27	**Other Occupational Health Examination Costs**				
28	Supplies				
29	External laboratory analytical cost				
30	Other OH Costs SubTotal				$ -
31	Occupational Health Exam Sub Total				$ -
32	**Total Alternative 2 OH Costs**	0	0	0	$ -

Double Click to Open the Spreadsheet

Table F-10
Explanation of Entries of Alternative 2
Estimated Annual Occupational Health Cost

Row	Explanation
1	INDUSTRIAL HYGIENE SURVEILLANCE MANPOWER This is the heading for the estimated **ANNUAL** manpower that would be required by Bioenvironmental Engineering, and possibly Public Health, to perform industrial hygiene (IH) monitoring of alternative 2. Includes collecting, analyzing, interpreting and reporting data and associated health risk to the process work center. Under this heading the user enters the estimated **ANNUAL** officer, enlisted and civilian time (hours). The time will be estimated to the nearest whole hour. Not all rows need to be completed; only those applicable. **This row does not require editing**.
2	AIR MONITORING (HOURS) User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for developing sampling protocol, equipment calibration, accomplishing area and personal air sampling, preparing and shipping samples for analysis, interpreting results and reporting results to the work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
3	ELECTROMAGNETIC RADIATION (HOURS) User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for preparing, accomplishing, analyzing data and report writing for ionizing radiation, ultraviolet, visible, infrared, microwave/ radiofrequency, and laser surveys. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
4	ERGONOMIC EVALUATION User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for work center health survey, process evaluation, analysis of results and report writing. Also, includes estimated Public Health and any medical provider's involvement in this evaluation. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
5	NOISE MONITORING User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for collecting area and personal dosimetry data, analyzing, interpreting and reporting data and associated health risk to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
6	THERMAL STRESS MONITORING User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for collecting, analyzing, interpreting and reporting data and associated health risk to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
7	VENTILATION User enters estimated **ANNUAL** time (hours) to accomplish this task. Includes time for pre-survey preparation, accomplishing the survey, interpreting and reporting survey results to the process work center. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**

8	MANPOWER SUB TOTAL This row calculates the estimated total **ANNUAL** IH surveillance manpower hours and dollar cost associated with alternative 2. It sums the hours and cost values from rows 2 through 7. **This row does not require editing.**
9	OTHER INDUSTRIAL HYGIENE SURVEILLANCE COST This is the heading for the estimated **ANNUAL** time (hours) and cost to accomplish additional IH surveillance of the work center's alternative 2 process. **This row does not require editing.**
10	RESPIRATOR FIT TESTING User enters estimated **ANNUAL** Bioenvironmental Engineering and/or contractor personnel time (hours) to accomplish this task. Includes time for worker scheduling, preparing for and accomplishing fit and leak testing, documenting respirator effectiveness, cleaning up and OH worker education for work center personnel using alternative 2. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
11	RESPIRATOR FIT TESTING SUPPLIES This row contains the estimated cost for the supplies to be expended for respirator fit testing that can be assigned to fit testing the work centers personnel. The user enters a lump sum.
12	INDUSTRIAL HYGIENE SUPPLIES This row contains the estimated cost for the supplies to be expended for the IH surveillance that can be assigned to monitoring the work center's alternative 2. The user enters a lump sum.
13	ANALYSIS This row contains the total estimated analytical laboratory charges for the analysis of the samples taken to monitor the work center's area or personnel. The user enters a lump sum.
14	PACKAGING AND SHIPPING This row contains the estimated cost for packaging and shipping samples to the laboratory for analysis. The user enters a lump sum.
15	OTHER IH SURVEILLANCE SUB TOTAL This row calculates the estimated total **ANNUAL** other IH surveillance cost associated with alternative 2. It sums the cost values from rows 10 through 14. **The user does not manipulate this row.**
16	TOTAL SURVEILLANCE COST This row calculates the estimated total IH surveillance cost associated with alternative 2. It sums the cost values from rows 8 and 15. **The user does not manipulate this row.**
17	INTENTIONALLY LEFT BLANK
18	OCCUPATIONAL HEALTH EXAMINATON MANPOWER This is the heading for the estimated **ANNUAL** time (hours) that would be expended by the various medical group work centers in support of the occupational health (OH) program for alternative 2. Under this heading the user enters estimated **ANNUAL** officer, enlisted and civilian time. The time will be reported to the nearest whole hour. Not all rows need to be completed; only those applicable. **This row does not require editing.**

19	AUDIOMETRY This row contains the estimated time (hours) to conduct the audiometric testing of the individuals who would be on the hearing conservation program for alternative 2. Includes the estimated time (hours) by IH and OH personnel to fit test the hearing protection devices and to conduct any required the hearing conservation education for the workers. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
20	LABORATORY This row contains the estimated time (hours) to conduct the medical laboratory evaluations of the individuals on the OH program for alternative 2. Includes the estimated time (hours) by IH and OH personnel to conduct any required OH education for the workers. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
21	OPTOMETRY This row contains the estimated time (hours) to conduct the visual examinations of the individuals on the OH program for alternative 2. Includes the time (hours) by IH and OH personnel to conduct any required OH education for the workers. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
22	PHYSICAL EXAM ADMINISTRATION This row contains the estimated time (hours) to conduct the OH program administrative documentation for alternative 2's work center personnel. Includes the scheduling of personnel, entering data into OH computer based programs, and reviewing completed forms. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
23	PULMONARY EVALUATION This row contains the estimated time (hours) to conduct the pulmonary evaluations of the individuals on the OH program for alternative 2. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
24	RADIOLOGY This row contains the estimated time (hours) to conduct the radiographic evaluations of the individuals on the OH program for alternative 2. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**
25	PROVIDER EXAMINATION This row contains the estimated time (hours) for medical providers to accomplish the OH examinations for alternative 2's work center personnel. Includes the time of providers not included in rows 19 through 24. Do not include the time that alternative 2 work center personnel are estimated to expend to receive this support; it is captured in Table F-13, T & E Manpower Cost. **The user does not manipulate the cost cell.**

26	MANPOWER SUB TOTAL This row calculates the estimated total **ANNUAL** OH examination manpower hours and dollar cost associated with alternative 2. It sums the hours and cost values from rows 19 through 25. **This row does not require editing.**
27	OTHER OCCUPATIONAL HEALTH EXAMINATION COST This is the heading for the estimated **ANNUAL** cost for supplies and external laboratory analytical cost to support the OH requirements of the personnel for alternative 1. **This row does not require editing.**
28	SUPPLIES This row contains the estimated cost for the supplies to conduct the OH program not included in rows 19 through 24. The user enters a lump sum value.
29	EXTERNAL LABORATORY ANALYTICAL COST This row contains the estimated OH specimen analytical laboratory cost from other than the medical group's medical laboratory. The user enters a lump sum value.
30	OTHER OH COST SUB TOTAL This row calculates the estimated **ANNUAL** other OH cost for supplies and external laboratory analysis. It sums the cost values from rows 28 and 29. **This row does not require editing.**
31	OCCUPATIONAL HEALTH EXAM SUB TOTAL This row calculates the estimated total **ANNUAL** occupational health examination cost for alternative 2. It sums the cost values from rows 26 and 30. **This row does not require editing.**
32	TOTAL ALTERNATIVE 2 OH COST This row calculates the estimated total **ANNUAL** occupational health cost associated with alternative 2. It sums the cost values from rows 16 and 31. This value is exported to Table F-1 (Table 2.5.1), Row 26. **This row does not require editing.**

Table F-11
Work Center Labor & PPE Cost

Row	Method	Officer (hrs/wk)	Enlisted (hrs/wk)	Civilian (hrs/wk)	Cost ($)
1	Total Labor Cost				
2	Current				$ -
3	Alternative 1				$ -
4	Alternative 2				$ -
5	Annual Personal Protective Equipment Cost *				**Cost ($)**
6	Current				
7	Alternative 1				
8	Alternative 2				
9	Total Labor and PPE Cost				**Cost ($)**
10	Current				$ -
11	Alternative 1				$ -
12	Alternative 2				$ -

* Annual PPE cost includes replacement parts, new units and supplies.
Double Click in Spreadsheet to Open

Table F-12
Explanation of Entries of Work Center Labor & PPE Cost

Row	Explanation
1	TOTAL LABOR COST This is the heading for the **ANNUAL** labor cost associated with the current process or the estimated labor cost to be associated with the alternative(s). **This row does not require editing.**
2	CURRENT (HOURS) User enters expended time (hours) per week to accomplish the current process/task. Include time to: order supplies for the process; preparation for the process/task, such as start-up/warm-up of equipment, mixing of chemicals, room/area preparation with protective covering, etc.; process/task operation time; and clean-up of the room/area after the process/task is completed. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
3	ALTERNATIVE 1 (HOURS) User enters estimated time (hours) per week to accomplish alternative 1's process/task. Include time to: order supplies for the process; preparation for the process/task, such as start-up/warm-up of equipment, mixing of chemicals, room/area preparation with protective covering, etc.; process/task operation time; and clean-up of the room/area after the process/task is completed. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
4	ALTERNATIVE 2 (HOURS) User enters estimated time (hours) per week to accomplish alternative 2's process/task. Include time to: order supplies for the process; preparation for the process/task, such as start-up/warm-up of equipment, mixing of chemicals, room/area preparation with protective covering, etc.; process/task operation time; and clean-up of the room/area after the process/task is completed. The cost column is automatically calculated once the user enters the time. **The user does not manipulate the cost cell.**
5	ANNUAL PERSONAL PROTECTIVE EQUIPMENT COST This is the heading for the **ANNUAL** personal protective equipment cost category and **does not require editing**. User enters the total cost or the estimated total cost for all the personal protective equipment (PPE) mandated/used to protect the worker(s) associated with the process.
6	CURRENT ($) User enters the **ANNUAL** total cost of all the personal protective equipment mandated/used with the current process. Include the purchase of new equipment and replacement/ repair parts for the existing equipment plus maintenance contract cost, refill cost and disposal cost. The user enters a lump sum value.
7	ALTERNATIVE 1 ($) User enters the estimated **ANNUAL** total cost of all the personal protective equipment that would be mandated/used with the alternative 1 process. Include the purchase of new equipment and replacement/repair parts for the existing equipment plus maintenance contract cost, refill cost and disposal cost. The user enters a lump sum value.

8	ALTERNATIVE 2 ($) User enters the estimated **ANNUAL** total cost of all the personal protective equipment that would be mandated/used with the alternative 2 process. Include the purchase of new equipment and replacement/repair parts for the existing equipment plus maintenance contract cost, refill cost and disposal cost. The user enters a lump sum value.
9	TOTAL LABOR AND PPE COST This is the heading for the summation of the total labor cost and PPE cost for the current process or each alternative listed. Under this heading the total labor cost and the PPE requirements are summed for each process/alternative. **This row does not require editing.**
10	CURRENT ($) This row calculates the current process cost for labor and PPE by summing the cost from rows 2 and 6. **This row does not require editing.** This value is exported to row 23, Current Method column in Table F-1 (Table 2.5.1).
11	ALTERNATIVE 1 ($) This row calculates alternative 1 process estimated cost for labor and PPE by summing the cost from rows 3 and 7. **This row does not require editing.** This value is exported to row 23, Alternative 1 Method column in Table F-1 (Table 2.5.1).
12	ALTERNATIVE 2 ($) This row calculates alternative 1 process estimated cost for labor and PPE by summing the cost from rows 4 and 8. **This row does not require editing.** This value is exported to row 23, Alternative 2 Method column in Table F-1 (Table 2.5.1).

Table F-13
Annual Work Center Training & Examination Cost

Row	Requirement	Personnel Trained			Time per Person (Hrs)			Costs ($)
		Officer	Enlisted	Civilian	Officer	Enlisted	Civilian	
1	**Current Method**							
2	**Training**							
3	Electromagnetic Radiation							$ -
4	Ergonomic							$ -
5	Hazard Communication							$ -
6	Hazardous Noise							$ -
7	OSHA Specific Standard							$ -
8	Process Specific							$ -
9	Respiratory Program							$ -
10	Personal Protective Equipment							$ -
11	**Special Medical Items**							
12	Physical Examination Work-up							$ -
13	**Annual Current T&E Costs**	0	0	0	0	0	0	$ -
14								
15	**Alternative 1**							
16	**Training**							
17	Electromagnetic Radiation							$ -
18	Ergonomic							$ -
19	Hazard Communication							$ -
20	Hazardous Noise							$ -
21	OSHA Specific Standard							$ -
22	Process Specific							$ -
23	Respiratory Program							$ -
24	Personal Protective Equipment							$ -
25	**Special Medical Items**							
26	Physical Examination Work-up							$ -
27	**Annual Alternative 1 T&E Costs**	0	0	0	0	0	0	$ -
28								
29	**Alternative 2**							
30	**Training**							
31	Electromagnetic Radiation							$ -
32	Ergonomic							$ -
33	Hazard Communication							$ -
34	Hazardous Noise							$ -
35	OSHA Specific Standard							$ -
36	Process Specific							$ -
37	Respiratory Program							$ -
38	Personal Protective Equipment							$ -
39	**Special Medical Items**							
40	Physical Examination Work-up							$ -
41	**Annual Alternative 2 T&E Costs**	0	0	0	0	0	0	$ -

NOTE: 1. This worksheet is based on each worker requiring the line item one time per year. If workers require the line item two or more times per year, increase the number of personnel for that requirement.
NOTE 2: Examples of OSHA Specific Standards are the Asbestos, Bloodborne Pathogens, Ethylene Oxide, Formaldehyde, Laboratory and Lead Standards.
Double Click to Open Spreadsheet

Table F-14
Explanation of Entries of Annual Work Center Training & Examination Cost

Row	Explanation
1	CURRENT METHOD This is the heading for the **ANNUAL** training and special occupational health medical examinations required for personnel who work in the work center where the current method's process is being evaluated. **This row does not require editing.**
2	TRAINING This is the heading for the **ANNUAL** hours expended by personnel from the work center where the process is being evaluated. It includes the number of personnel in each category and the average time (hours) for each category. Include the time for the workers to go to and from the training site plus the time they spend at the training site. If workers require training more than one time per year, then increase the number of personnel trained. For example, if 10 enlisted need respiratory program training twice per year, then enter 20 (10X2) in the enlisted column. **This row does not require editing.**
3	ELECTROMAGNETIC RADIATION User enters number of personnel and the actual time (hours) expended to receive and present, if applicable, health and safety training required for ionizing, ultraviolet, visible, infrared, microwave/radiofrequency and laser radiation. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
4	ERGONOMIC User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
5	HAZARD COMMUNICATION User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
6	HAZARDOUS NOISE User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
7	OSHA SPECIFIC STANDARD User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training for specific processes or chemicals regulated by OSHA, such as asbestos, benzene, bloodborne pathogens, ethylene oxide, formaldehyde, lead, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**

8	PROCESS SPECIFIC User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required operator equipment and process, health, and/or safety training that is required by the Air Force. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
9	RESPIRATORY PROGRAM User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training related to the wearing of respiratory protective devices including fit and leak testing. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
10	PERSONAL PROTECTIVE EQUIPMENT User enters number of personnel and actual time (hours) expended to receive and present, if applicable, required health and safety training associated with the wearing of personal protective equipment such as protective gloves, goggles, face shields, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
11	SPECIAL MEDICAL ITEMS This is the heading for the average time (hours) work center personnel spend having occupational health examinations performed on them. It includes the time to and from the examination location plus the time during the examination. If personnel require a repeat visit include the repeat visit as a separate visit in the appropriate category in the personnel column. For example, if 4 enlisted need follow-up examinations, then increase the enlisted personnel number by 4. **This row does not require editing.**
12	PHYSICAL EXAMINATION WORK-UP User enters number of personnel and actual time (hours) expended by work center personnel who receive occupational health examinations related to exposure to the hazards associated with the work process under assessment. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the time (hours). **The user does not manipulate the cost cell.**
13	ANNUAL CURRENT T&E COST This row calculates the total **ANNUAL** training and medical examination hours and associated cost for the personnel in the work center using the current method. It sums the values from rows 3 through 12. This value is exported to Table F-1 (Table 2.5.1), row 22. **This row does not require editing.**
14	INTENTIONALLY LEFT BLANK
15	ALTERNATIVE 1 This is the heading for the estimated **ANNUAL** training and special occupational health medical examination hours and cost. It is applicable for personnel who work in the work center where alternative 1 is being evaluated. **This row does not require editing.**

16	TRAINING This is the heading for the estimated hours and associated cost expended by personnel from the work center where alternative 1 is being evaluated. It includes the number of personnel in each category and the average time (hours) for each category. Include the time for the workers to go to and from the training site plus the time they would spend at the training site. If workers require training more than one time per year, then increase the number of personnel trained. For example, if 10 enlisted need respiratory program training two times per year, then enter 20 (10X2) in the enlisted column. **This row does not require editing.**
17	ELECTROMAGNETIC RADIATION User enters number of personnel and estimated time (hours) required to receive and present, if applicable, health and safety training for ionizing, ultraviolet, visible, infrared, microwave/ radiofrequency and laser radiation. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
18	ERGONOMIC User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
19	HAZARD COMMUNICATION User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
20	HAZARDOUS NOISE User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
21	OSHA SPECIFIC STANDARD User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training for specific processes or chemicals regulated by OSHA, such as asbestos, benzene, bloodborne pathogens, ethylene oxide, formaldehyde, lead, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
22	PROCESS SPECIFIC User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required operator equipment and process, health, and/or safety training that is required by the Air Force. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**

23	RESPIRATORY PROGRAM User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training related to the wearing of respiratory protective devices including fit and leak testing. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
24	PERSONAL PROTECTIVE EQUIPMENT User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training associated with the wearing of personal protective equipment such as protective gloves, goggles, face shields, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
25	SPECIAL MEDICAL ITEMS This is the heading for the estimated average time (hours) work center personnel would have to spend on occupational health examinations performed on them. It includes the time to and from the examination location plus the time during the examination. If personnel require a repeat visit include the repeat visit in the appropriate personnel category in the personnel column. For example, if 4 enlisted need follow-up examinations, then increase the enlisted personnel number by 4. **This row does not require editing.**
26	PHYSICAL EXAMINATION WORK-UP User enters number of personnel and estimated time (hours) required by work center personnel who would receive occupational health examinations related to exposure to the hazards associated with alternative 1. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
27	ALTERNATIVE 1 ANNUAL T&E COST This row calculates the total estimated **ANNUAL** training and medical examination hours and associated cost for alternative 1. It sums the values from rows 17 through 26. This value is exported to Table F-1 (Table 2.5.1), row 22. **This row does not require editing.**
28	INTENTIONALLY LEFT BLANK
29	ALTERNATIVE 2 This is the heading for the estimated **ANNUAL** training and special occupational health medical examination hours and cost for alternative 2. It is applicable for personnel who work in the work center where the second alternative is being evaluated. **This row does not require editing.**
30	TRAINING This is the heading for the estimated hours and associated cost expended by personnel from the work center where alternative 2 is being evaluated. It includes the number of personnel in each category and the average time (hours) for each category. Include the time for the workers to go to and from the training site plus the time they would spend at the training site. If workers require training more than one time per year, then increase the number of personnel trained. For example, if 10 enlisted need respiratory program training two times per year, then enter 20 (10X2) in the enlisted column. **This row does not require editing.**

31	ELECTROMAGNETIC RADIATION User enters number of personnel and estimated time (hours) required to receive and present, if applicable, health and safety training for ionizing, ultraviolet, visible, infrared, microwave/ radiofrequency and laser radiation. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
32	ERGONOMIC User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
33	HAZARD COMMUNICATION User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
34	HAZARDOUS NOISE User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
35	OSHA SPECIFIC STANDARD User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training for specific processes or chemicals regulated by OSHA, such as asbestos, benzene, bloodborne pathogens, ethylene oxide, formaldehyde, lead, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
36	PROCESS SPECIFIC User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required operator equipment and process, health, and/or safety training that is required by the Air Force. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
37	RESPIRATORY PROGRAM User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training related to the wearing of respiratory protective devices including fit and leak testing. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**

38	PERSONAL PROTECTIVE EQUIPMENT User enters number of personnel and estimated time (hours) required to receive and present, if applicable, required health and safety training associated with the wearing of personal protective equipment such as protective gloves, goggles, face shields, etc. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the number of hours. **The user does not manipulate the cost cell.**
39	SPECIAL MEDICAL ITEMS This is the heading for the estimated average time (hours) work center personnel would have to spend on occupational health examinations performed on them. It includes the time to and from the examination location plus the time during the examination. If personnel require a repeat visit include the repeat visit in the appropriate personnel category in the personnel column. For example, if 4 enlisted need follow-up examinations, then increase the enlisted personnel number by 4. **This row does not require editing.**
40	PHYSICAL EXAMINATION WORK-UP User enters number of personnel and estimated time (hours) required by work center personnel who would receive occupational health examinations related to exposure to the hazards associated with alternative 2. The Cost column is automatically calculated once the user enters the number of personnel in the appropriate column and the time (hours). **The user does not manipulate the cost cell.**
41	ALTERNATIVE 2 ANNUAL T&E COST This row calculates the total estimated **ANNUAL** training and medical examination hours and associated cost for alternative 2. It sums the values from rows 31 through 40. This value is exported to Table F-1 (Table 2.5.1), row 22. **This row does not require editing.**