

SHARPS DISPOSAL CONTAINERS: SELECTION, EVALUATION, AND USE

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ABSTRACT

Occupational transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) has been documented. The risk of infection with HIV following one needlestick exposure is approximately 0.3% and ranges from 6% to 30% for FMV and from 3.3% to 10% for hepatitis C. The diversity of health care settings makes selection of a single sharps disposal container design inappropriate in many cases. No single sharps disposal container design meets all the disposal containment needs for an entire facility. Selection of any specific container(s) should be based on a comprehensive site-specific hazard analysis. Criteria for the design, selection, and appropriate use of sharps containers were developed. The sharps disposal container safety performance criteria are divided into four areas. First, containers should remain **functional** during their entire usage. Second, containers must be **accessible** to workers who use, maintain, or dispose of sharp devices. Third, containers should be **visible** to the workers who must use them. Last, container designs should provide **accommodation** to the user, the facility, and the environment. Although engineering controls, such as needleless IV systems and "safety" needles, will reduce injuries, proper selection and use of disposal containers is still important. Prevention strategies include implementation of engineering controls, use of personal protective equipment, training, and the involvement of occupational health professionals and workers.

INTRODUCTION

The Occupational Safety and Health Administration (OSHA) estimates that more than 5.6 million workers in health care and related occupations are at risk of occupational exposure to bloodborne pathogens, including human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus

(HCV), and other potentially infectious agents (OSHA, 1991). Occupational transmission of bloodborne pathogens (including HBV, HCV, and HIV) has been well documented (Shapiro, 1995; Mitsui, 1992; Polish, 1993; Lanphear, 1994; Marcus, 1988; CDC, 1992; CDC, 1995; Chambers, 1995; CDC Surveillance Report, 1995; CDC, 1996). Ongoing surveillance of needlestick injuries (NSIs) and other sharps-related injuries indicate that occupational bloodborne pathogen exposure remains an important public health concern.

The primary route of occupational exposure to bloodborne pathogens is percutaneous injury (i.e., needlestick injury [NSI]). Health care workers (HCWs) handle sharp devices and equipment such as hypodermic and suture needles, intravenous blood collection devices, phlebotomy devices, and scalpels. Centers for Disease Control and Prevention (CDC) studies have estimated that the rate of seroconversion following occupational parenteral exposure to infected blood is approximately 6-30% for HBV exposures, 5-10% for HCV exposures (Nfitsui, 1992; Polish, 1993; Lanphear, 1994), and 0.3% for HIV exposures (Chamberland, 1995; Tokars, 1993).

In hospitals, nursing staff and phlebotomists sustain the highest percentage of reported injuries (Slagle, 1994; McCormick, 1991a; Whitby, 1991; McCormick, 1991b, Oakley, 1992). Other workers at risk of injury include laboratorians, animal handlers, surgeons, dental workers, and housekeepers and laundry workers. The use of safer needle-bearing products and other measures for preventing sharps injuries should be part of an overall strategy to prevent NSIs (Ribner, 1987; Jagger, 1988). Compliance with standard precautions for prevention of exposure to bloodborne pathogens should also be part of this overall strategy (Garner, 1996). Moreover, surveillance of NSIs is an integral part of sharps injury prevention and control.

Hospital NSI studies have shown that many of these injuries occur after the device is used and during disposal activities (Slagle, 1994; McCormick,

1991a, Jagger, 1990). As many as one-third of all sharps injuries have been estimated to be related to the disposal process. These injuries have most often been related to a number of factors, including inappropriate sharps disposal practices by the user, inadequate sharps disposal container design, inappropriate sharps disposal container placement, and overfilling of sharps disposal containers.

The correct and consistent use of rigid sharps disposal containers in the health care environment has been demonstrated to reduce the number of NSIs (Haiduven, 1992). Studies indicate that placement of disposal boxes in all patient and treatment rooms decreases the frequency of sharps injury (Slagle, 1994; McCormick, 1991a; Haiduven, 1992). Investigators have concluded that appropriately placed sharps disposal containers reduce NSIs related to recapping of sharps by as much as 80% (Linnemann, 1991). Cost-benefit studies show that when the increased costs of materials management are compared with the decrease in injury compensation costs, sharps disposal containers are cost-effective—even when both direct and indirect costs (medical evaluation and follow up, treatment costs, and lost workdays) of injury reduction are considered (Jagger, 1990).

The purpose of this document is to provide a framework for selecting sharps disposal containers and evaluating their efficacy as part of an overall NSI prevention plan.

RESULTS

The performance/evaluation criteria were developed, in part from focus groups to obtain user input about sharps disposal container design, safety and management. Studies were conducted by NIOSH Educational Resource Centers (ERCs) during fiscal years 1992-1994. Four major criteria for sharps disposal container safety performance were defined: functionality, accessibility, visibility and accommodation.

1. **Functionality:** Containers should remain **functional** during their entire usage. Sharps disposal containers should be designed to permit safe disposal of sharps. They should be durable, closable, leak proof on their sides and bottom, and puncture resistant until final disposal. They should be simple and easy to operate. The disposal opening should prevent spills of the contents while in use in the intended upright position, during the closure, and during transportation within the facility before final disposal. The design should also minimize any catching or snagging of sharps during insertion into the sharps disposal container.

Sharps disposal containers should be of sufficient thickness or construction design to be durable, leak proof, and puncture resistant under normal use and stresses imposed during storage, handling, installation, use, closure, and transport within the user facility before final disposal.¹

Durability and puncture resistance should remain unaffected by moderate variation in temperatures during storage and use.² Brackets and locking mechanisms used for installation should also be durable.

Closure mechanisms should be designed to minimize exposure to contents and injury to the hand. Once activated, the final closure mechanism of a sharps disposal container should be resistant to manual opening.

Containers (including those designed to be "kicked" or wheeled) should be stable when placed on a horizontal surface and when used as described in the product labeling.

Where workers handle sharp devices, a sufficient quantity of containers should be available in the appropriate size and shape. Sharps disposal containers should be of sufficient size to accommodate the largest type of sharp used at the workstation it serves. Containers should also be shaped to accommodate the particular type of sharp that requires disposal. At a minimum, one sharp disposal container should be provided at each work-site where sharps are predictably generated or found.

¹No requirements exist for sharps disposal containers to meet Department of Transportation certification for shipping containers. Sharps disposal containers are generally placed within DOT-certified containers before shipping to a final disposal site.

²Caution must be exercised when handling sharps disposal containers at extremes of temperature—such as those encountered by home-health care providers when transporting sharps disposal containers in their cars. Sharps disposal containers are not typically designed for high- and low-temperature conditions.

Sharps disposal containers should also be of sufficient size to accommodate the volume of sharps typically generated at the site between maintenance operations. Providing sharps disposal containers of sufficient size will minimize the possibility of overfilling the sharps disposal container, which would compromise the safe operation of the container.

2. **Accessibility:** Containers should be **accessible** to workers who use, maintain, or dispose of sharp devices. Containers should be conveniently placed and, if necessary, portable within the workplace. Security may be a concern in some areas of facilities using sharps disposal containers. For instance, to prevent children and others from putting their hands into the containers, the facility should consider selecting containers with guards that prevent hands or fingers from entering the containers. Where safety features are added to restrict access, these features should not interfere with the worker's vision of the inlet opening. Injury to visitors may also be a problem (Weltman, 1995).

Proper sharps disposal container location and placement should ensure that containers are readily visible and within easy horizontal reach of the user. The disposal opening should be identifiable and accessible by the user and should facilitate one-handed disposal. Where containers are fixed to walls or other permanent sites, the vertical height should allow the worker to view the opening or access way of the container.

Sharps disposal containers should be placed in an area that is unobstructed by obstacles between the work site and the container. Unsafe locations may force workers to make unnecessary movements while holding a sharp and accessing the container which may result in injuries to the HCW. Standard operating procedures and practices should be developed to allow the worker to dispose of the device as soon as possible after use—preferably without needing to put the device down and pick it up again.

Installation of a container at an appropriate height for the user may reduce sharps-related injuries. Sharps disposal containers should be placed within arm's reach and below eye level at their point of use. For certain types of permanently fixed, wall-mounted containers, an ergonomically acceptable range of installation height can be calculated

using standard anthropometric tables to determine the normal range of human physical variation (CDC/NIOSH, 1997). Fixture heights are commonly designed to accommodate 95% of the adult population. The following criteria should be used to determine the optimal range for fixed installation height: (1) users should have a clear, unobstructed view of the container inlet opening; (2) the container should be located within arm's reach; and (3) the fixture height should be below the eye level of 95% of adult female workers. The upper and lower ranges for the installation height are calculated by allowing for the reach behavior of workers. Using these criteria, an optimal installation range of 56 to 52 inches at a standing work station, and 42 to 38 inches for a seated work station were calculated (CDC/NIOSH, 1997).

3. **Visibility:** Containers should be plainly **visible** to the workers who use them. Workers should be able to see the degree to which the container is full, proper warning labels, and color coding. The disposal opening or access mechanism and current fill status should be visible to the user before sharps are placed in the container.

Sharps disposal containers should carry a hazard warning labeling. Such labels and device colors should imply danger. Either the device color or a warning label should be visible to the user to warn of a potential hazard before sharps are placed in the container. The current fill status of the container should be easily observable by the user before sharps are placed in the container. Sufficient illumination is needed at the container to determine whether any sharp object is protruding from the container or whether the container is grossly soiled at holding points or on opening mechanisms. Container fill status should be obvious under lighting conditions at the installation location. Safety features, security measures, and aesthetics should not distort recognition of the container, fill status, warning labels, or the disposal opening or access.

OSHA's bloodborne pathogens standard [29 CFR 1910.1030, section (g)(1)(1)(C)] contains very specific requirements about the labeling of containers for contaminated sharps. "These labels shall be fluorescent orange or orange-red or predominantly so, with lettering or symbols in a contrasting color." The standard also requires that the biohazard sym-

bol and the word *Biohazard*, be displayed (note, however, “[r]ed bags or red containers may be substituted for labels” in section (g)(1)(I)(E)).

4. Accommodation: Container designs should be **accommodating** or convenient for the user and the facility, and they should be environmentally sound (i.e., free of heavy metals and composed of recycled materials). Accommodation also includes ease of storage and assembly and simplicity of operation.

Container designs should be accommodating to the user, the facility, and the environment. Accommodation is a measurement of ease of storage and assembly, minimal worker training requirements, ease of operation, and flexibility in design. Special aesthetic, operational, or safety features should not hide or impede free access to the device, the inlet, or the closure process. Users should be able to assemble containers easily, if required. Placement in and removal from mounting systems should be simple and uncomplicated and should not compromise safety and security. To ensure proper fit and functioning of the container mounting system, mounting systems should be used only for the sharps disposal containers for which they were designed. Manufacturers of sharps disposal containers should provide recommended user training information.

Strategy for Selecting and Using Sharps Disposal Containers

A strategy for selecting and using sharps disposal containers should be implemented as part of an overall NSI prevention plan. Selection of a container or combination of containers should be based on a site-specific hazard analysis. Components of a site-specific hazard analysis should include the following:

- Assessment of workplace hazards (biological, physical, chemical, and radiological hazard containment needs)
- Assessment of size and type of sharps to be disposed of
- Assessment of the volume of sharps to be disposed of at each point of use
- Assessment of the frequency of sharps disposal container emptying and mounting bracket servicing by maintenance staff
- Compliance with Federal, State, and local regulations

- Security requirements
- Container transport or mobility needs
- Clinician/laboratorian and procedural variability and movement
- Laboratory equipment variability and movement
- Environmental and disposal constraints
- Economic considerations
- Continued evaluation of medical device technology, including ongoing changes in equipment design and barrier materials

An individual or a group should be assigned the responsibility for regular monitoring and maintenance of sharps disposal containers.

A flow chart describing a decision logic for selecting a sharps disposal container is presented in Figure 1. This decision logic can be used alone or in conjunction with the performance evaluation questionnaire (Appendix A). Based on the four performance criteria, the questionnaire is designed to assign appropriate criteria and priorities to each step and can be used to frame the selection process. The questionnaire should assist product evaluation committees, facility management, and individual health care workers with proactive sharps disposal container selection and evaluation. Although it is not possible to provide precise guidelines for evaluating questionnaire scores, the lower the score, the better the sharps disposal container (the “best” score would be 44 points and the “worst” would be 220 points). A priority or value must be assigned to a criterion on a case-by-case basis. It may be useful to compare the model of sharps disposal container currently in use with the replacement models under consideration by using the questionnaire scoring system.

Before a new sharps disposal container is introduced, workers should be trained on the proper use, handling, storage, and disposal of sharps disposal containers. All workers who might come into contact with sharps should be included in this training (i.e., maintenance and laundry service staff). Where appropriate, multilingual educational materials should be developed.

No single container type that meets the disposal containment needs for an entire facility. The diversity of health care and laboratory settings and procedures makes selecting a single container impossible.

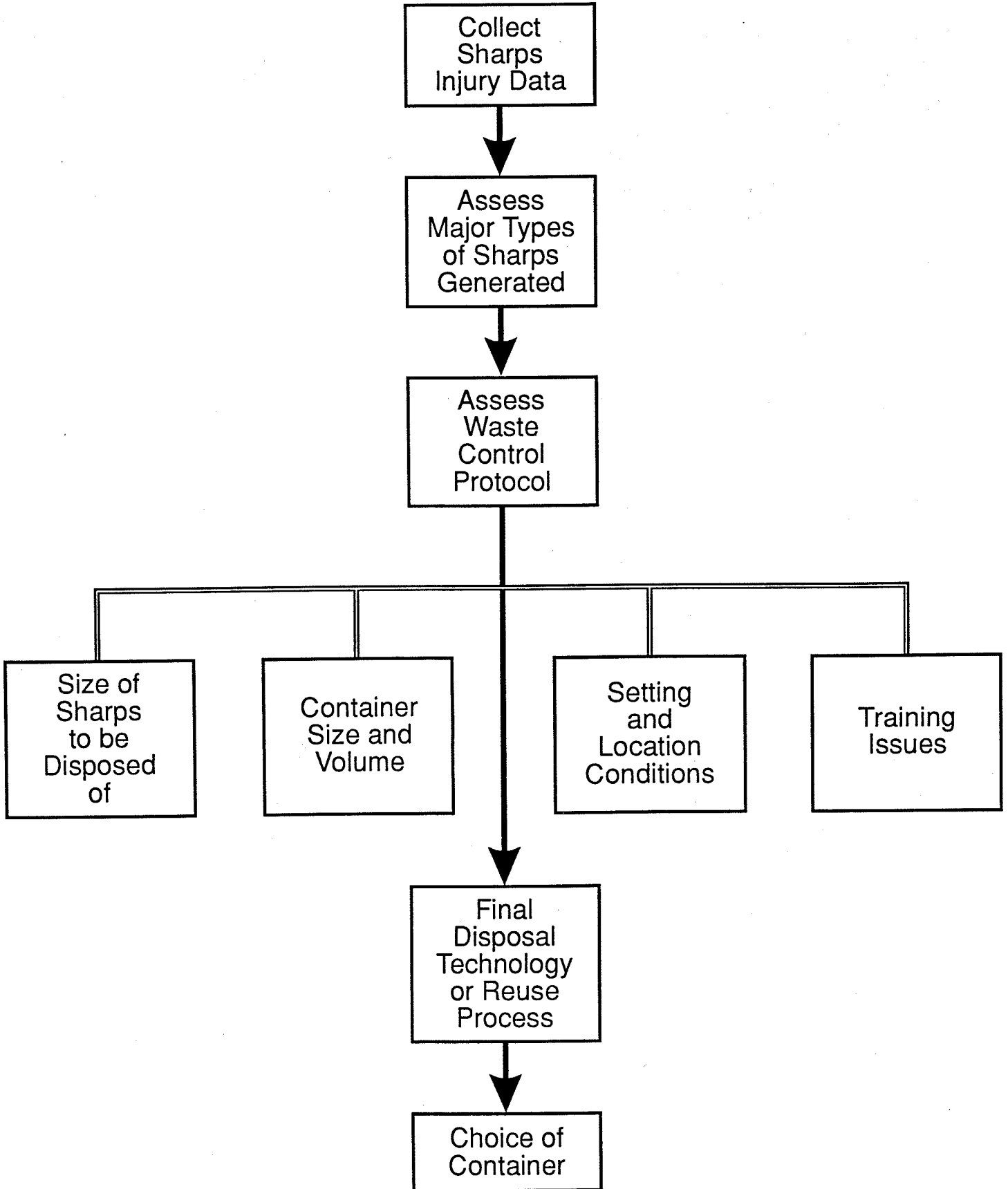


Figure 1. Decision logic for sharps disposal container selection.

CONCLUSION

Sharps disposal containers that are functional, accessible, secure from patient and/or visitor tampering (if necessary), visible, and convenient to use will decrease the risk of percutaneous sharps injury. Sharps disposal container use should be part of an institutional process that supports surveillance of sharps injury, eliminates unnecessary sharps, promotes worker education and training in the proper use of sharps disposal containers and safety devices, immunizes HCWs at risk of exposure to hepatitis B virus (HBV), and advocates compliance with standard precautions.

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APPENDIX A

QUESTIONNAIRE FOR EVALUATING SHARPS DISPOSAL CONTAINER PERFORMANCE

The decision logic may be followed by a questionnaire designed to evaluate container performance based on each of the four performance criteria (functionality, accessibility, visibility, and accommodation). The questionnaire should assist product evaluation committees, facility management, and individual health care workers in proactive sharps disposal container selection and evaluation. Users of this questionnaire should be aware that the ideal product may not exist and that this evaluation tool was constructed on the basis of common product designs available at the time.

At this time, there is no quantitative score that indicates a container is sufficient for a particular purpose. Although it is not possible to provide precise guidelines for evaluating a particular score from the questionnaire, the lower the score from the questionnaire, the better the Sharps disposal container (the "best" score would be 44 points and the "worst" score would be 220 points). The application of priority or value to a criterion must be

done on a case-by-case basis. It may be useful to submit the currently used sharps disposal container to the questionnaire scoring system to compare it with the replacement models under consideration.

Note on cost: The waste management system represents a considerable investment for health care operations. Sharps disposal containers should be economical to acquire, store, assemble, use, and dispose of. Low unit prices do not always result in lowest overall costs. Total cost for the employer is best measured as a function of wear life, unit cost, capacity utilization, labor cost, capital investment, employee training, installation cost, disposal cost, savings in employee injury costs, employee task confidence, and compliance with standard precautions (23) and 29 CFR 1910.1030 (OSHA's blood-borne pathogens standard). Moreover, evaluation of cost is an ongoing process that may be a driving force in deciding when new sharps disposal containers are required or relocation of existing sharps disposal containers is more appropriate.

QUESTIONNAIRE FOR EVALUATING SHARPS DISPOSAL CONTAINER PERFORMANCE

The following product selection questionnaire was developed by the Centers for Disease Control

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INSTRUCTIONS:

Product evaluators should inspect and operate containers to be evaluated in side-by-side comparisons. Representative sharps (syringes, IV sets, blades, biopsy needled, pipettes, etc.) should be used to test candidate products. Actual use conditions should be simulated, impossible. Prior to inserting test sharps, attempt to reopen sealed containers and attempt to spill or remove contents from unsealed containers, if this is a functional requirement. Evaluation facilitators should provide product manufacturer literature and visual instructions, and should demonstrate proper operation of each of the containers. Use of this guideline requires knowledge that the ideal product may not exist, and that this evaluation tool was based on common product designs available at the time.

Please circle your response

FUNCTIONALITY

	Agree			Disagree	
Container is stable when placed on horizontal surface and when used as described in the product labeling for use in trays, holders, or enclosures	1	2	3	4	5
Container provides for puncture, leak, and impact resistance	1	2	3	4	5
Container, labels, warning devices, and brackets are durable	1	2	3	4	5
Container is autoclavable, if necessary	1	2	3	4	5
Container is available in various sizes and capacities	1	2	3	4	5
Container is available with auxiliary safety features (i.e., restricted access to sharps in the container), if required	1	2	3	4	5
Closure mechanism will not allow needlestick injury	1	2	3	4	5

	Agree			Disagree	
Closure mechanism provides secure seal	1	2	3	4	5
Design minimizes needle-tip flipback	1	2	3	4	5
Design promotes clinical performance (i.e., will not compromise sterile field or increase injury or infection control hazards)	1	2	3	4	5
Design resists easy reopening after sealing for final disposal or autoclaving	1	2	3	4	5
Inlet design defeats waste removal when open	1	2	3	4	5
Inlet design prevents spillage of contents (physical or liquid) while sharps disposal container in use in the intended upright position	1	2	3	4	5
Containers designed to be reopenable have removable lids design with tight closure that facilitates ease of removal with grip safety and comfort	1	2	3	4	5
Mounting brackets are rugged and designed for ease of service and Decontamination	1	2	3	4	5
ACCESSIBILITY					
Container available in various opening sizes and shapes	1	2	3	4	5
Containers are supplied in sufficient quantity	1	2	3	4	5
Container has an entanglement-free opening/access way	1	2	3	4	5
Container opening/access way and current fill status visible to user prior to placing sharps into container	1	2	3	4	5
Internal design/molding of container does not impede ease of use	1	2	3	4	5
Handles, if present, located above full fill level	1	2	3	4	5
Handles, if present, facilitate safe vertical transport and are located away from opening/access way and potentially soiled surfaces	1	2	3	4	5
Fixed locations place container within arm's reach of point of waste Generation	1	2	3	4	5
Fixed locations allow for installation of the container below horizontal vision level	1	2	3	4	5
If necessary, in high patient and/or visitor traffic areas, container should provide for security against tampering	1	2	3	4	5

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VISIBILITY	Agree			Disagree	
	1	2	3	4	5
Color or warning label implies danger	1	2	3	4	5
A warning indicator (i.e., color or warning label) is readily visible to the user prior to user placing sharps into container	1	2	3	4	5
Overfill level provided and current fill status is readily visible to the user prior to use placing sharps into container	1	2	3	4	5
Sharps disposal container complies with OSHA requirements	1	2	3	4	5
Disposal opening/access way is visible prior to user placing sharps into Container	1	2	3	4	5
Security, mounting, aesthetic, and safety features do not distort visibility of the opening/access way or fill status indicator	1	2	3	4	5
ACCOMMODATION					
No sharp edges in construction or materials	1	2	3	4	5
Safety features do not impede free access	1	2	3	4	5
Promotes patient and user satisfaction (i.e., aesthetic to extent possible)	1	2	3	4	5
Is simple to operate	1	2	3	4	5
Any emissions from final disposal comply with pollution regulations	1	2	3	4	5
Easy assembly, if required	1	2	3	4	5
Components of containers that require assembly are easy to store prior to use	1	2	3	4	5
Use allows one-handed disposal	1	2	3	4	5
Product available in special designs for environments with specific needs (i.e., laboratories, emergency rooms, emergency medical services, pediatrics, correctional facilities)	1	2	3	4	5
Mounting system durable, secure, safe, cleanable, and, where appropriate, lockable	1	2	3	4	5
Mounting systems allow height adjustments	1	2	3	4	5
Design promotes task confidence	1	2	3	4	5
Cost effectiveness	1	2	3	4	5

OTHER COMMENTS

What design or performance requirements are missing from the product you evaluated that are really needed to safely or more comfortably conduct your job or sharps-related task?

Additional Evaluator Concerns and Comments: