USAID
FROM THE AMERICAN PEOPLE

SECTOR ENVIRONMENTAL GUIDELINES

SMALL HEALTHCARE FACILITIES

September 2013

This document was prepared by The Cadmus Group, Inc. under USAID's Global Environmental Management Support Program, Contract Number GS-10F-0105J. The contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government.

Cover Photo: USAID helped set up basic health care units like this one after the October 2005 earthquake cut villagers off from doctors and hospitals. More than 50,000 people have access to the units, and health workers are reaching out to nearby communities to provide care and education.

Photograph: Pakistan: A Doctor in the Neighborhood. Kaukab Jhumra Smith, 2006.

About this document and the *Sector Environmental Guidelines*

This document presents one sector of the *Sector Environmental Guidelines* prepared for USAID under the Agency's Global Environmental Management Support Project (GEMS). All sectors are accessible at www.usaidgems.org/bestPractice.htm.

Purpose. The purpose of this document and the *Sector Environmental Guidelines* overall is to support environmentally sound design and management (ESDM) of common USAID sectoral development activities by providing concise, plain-language information regarding:

- the typical, potential adverse impacts of activities in these sectors;
- how to prevent or otherwise mitigate these impacts, both in the form of general activity design guidance and specific design, construction and operating measures;
- how to minimize vulnerability of activities to climate change; and
- more detailed resources for further exploration of these issues.

Environmental Compliance Applications. USAID's mandatory life-of-project environmental procedures require that the potential adverse impacts of USAID-funded and managed activities be assessed prior to implementation via the Environmental Impact Assessment (EIA) process defined by 22 CFR 216 (Reg. 216). They also require that the environmental management/mitigation measures ("conditions") identified by this process be written into award documents, implemented over life of project, and monitored for compliance and sufficiency.

The procedures are USAID's principal mechanism to assure ESDM of USAID-funded Activities—and thus to protect environmental resources, ecosystems, and the health and livelihoods of beneficiaries and other groups. They strengthen development outcomes and help safeguard the good name and reputation of USAID.

The Sector Environmental Guidelines directly support environmental compliance by providing: information essential to assessing the potential impacts of activities, and to the identification and detailed design of appropriate mitigation and monitoring measures.

However, the Sector Environmental Guidelines *are* ***not*** *specific to USAID's environmental procedures. They are generally written, and are intended to support ESDM of these activities by all actors, regardless of the specific environmental requirements, regulations, or processes that apply, if any.*

Region-Specific Guidelines Superseded. The *Sector Environmental Guidelines* replace the following region-specific guidance: (1) *Environmental Guidelines for Small Scale Activities in Africa* ; (2) *Environmental Guidelines for Development Activities in Latin America and the Caribbean*; and (3) Asia/Middle East: *Sectoral Environmental Guidelines.* With the exception of some more recent Africa sectors, all were developed over 1999–2004.

Development Process & Limitations. In developing this document, regional-specific content in these predecessor guidelines has been retained. Statistics have been updated, and references verified and some new references added. However, this document is not the result of a comprehensive technical update.

Further, *The Guidelines* are not a substitute for detailed sources of technical information or design manuals. Users are expected to refer to the accompanying list of references for additional information.

Comments and corrections. Each sector of these guidelines is a work in progress. Comments, corrections, and suggested additions are welcome. Email: gems@cadmusgroup.com.

Advisory. *The Guidelines are advisory only. They are not official USAID regulatory guidance or policy. Following the practices and approaches outlined in the Guidelines does not necessarily assure compliance with USAID Environmental Procedures or host country environmental requirements.*

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SMALL HEALTHCARE FACILITIES

Because many patients already have compromised (or burdened) immune systems, they are at particular risk from poor waste management and deficient biosafety practices that elevate pathogen levels and facilitate patient to patient transmission.

Photo credit: Jen Antilla. 2008. A health worker in a health facility provides medicine to the mother of a sick child.

BRIEF DESCRIPTION OF THE SECTOR

Small-scale healthcare facilities play a vital role in public health and are a key part of integrated community development.

The staff at rural health posts (including immunization and reproductive health posts), mobile and emergency healthcare programs, urban clinics and small hospitals are not only tasked with treating the sick. They are also responsible for disease prevention, and health communication and education and serve as the front line of defense against epidemics such as AIDS, malaria, and cholera. Health service professionals at these facilities provide family planning, nurture child and adult health, prevent disease, cure debilitating illnesses, and alleviate the suffering of the dying.

However, environmentally poor design and management of these facilities can adversely affect patient and community health countering the very benefits they are intended to deliver.

This *Guideline* describes the mechanisms by which environmental and health risks arise and recommends mitigation and monitoring measures to reduce them and otherwise strengthen project outcomes. It also includes a number of checklists for environmentally sound design and management (ESDM) of small health facilities.

Because in recent years, many communities have also been stressed by abnormal weather patterns indicative of a changing climate, this *Guideline* also focuses on climate change. Climate change is requiring a focus on adaptation, defined as adjustments in natural or human systems in response to actual or

expected climate change stresses, which moderate harm or take advantage of beneficial opportunities. By focusing on adaptation, project managers can improve the likelihood of long-term success in their projects. Project managers can also do their part to minimize the project's contribution to climate change by identifying cost-effective ways to minimize greenhouse gas emissions.

ESDM of small health facilities:

- Requires attention to issues of medical waste management, water supply and sanitation, and the environmental dimensions of construction, among others. These topics are covered in more detail in separate *Sector Environmental Guidelines*. This *Guideline* responds to the need for guidance that integrates these issues in the specific context of small health facilities. It cannot treat each of the ESDM dimensions in detail, and users are referred to relevant *guidelines* for more specific information.

- Is an integral part of overall good practice—and particularly of good biosafety design and practice to safeguard patients, staff, visitors and community from heightened risks of infection. Therefore, the checklists and guidance in this *Guideline* extend beyond the strictly environmental aspects of sound design and management.

As in other sectors, reduction of environmental and health risks is much easier if potential impacts are identified and addressed early in the design and construction of the facility.

This guidance can also be applied to large health clinics and hospitals. However, larger facilities may pose additional environmental management issues not addressed here, such as management of radioactive wastes.

Small health facilities

Health posts are generally one- or two-room facilities and may not be staffed full-time. Staff typically consists of a full- or part-time primary health worker or community birthing attendant.

Services available at health posts typically include the treatment of minor illnesses, minor injuries, and assisted childbirth.

A nurse, doctor, or mobile health team may visit periodically from a larger facility nearby to provide additional services (childhood immunization, family planning, laboratory diagnostics, etc).

Small health clinics are generally a step up in size from health posts. More importantly, they usually have one or more full-time nurse(s). A health clinic thus can provide services like childhood immunization vaccinations and laboratory analysis. A clinic might have one or two beds for seriously ill or injured patients.

Large health clinics are likely to have a full-time doctor present. Often a large clinic will have beds for seriously ill patients and offer advanced services (surgery, rehabilitation, radiology, etc). In addition to the doctors present, the clinic will have supporting staff such as nurses, nurse's aides, maintenance workers, and volunteers.

POTENTIAL ADVERSE ENVIRONMENTAL AND HEALTH IMPACTS OF SMALL HEALTH FACILITIES

Many—but not all—of the potential environmental impacts and consequent health risks posed by health care facilities are associated with **healthcare wastes** and their management.

Healthcare waste includes all waste generated by the health care activities of a healthcare facility. Much of this is **general waste**, and is similar or identical to domestic waste. The remainder is **hazardous or highly hazardous** and includes hypodermic needles, syringes, soiled dressings body parts and fluids (including blood), diagnostic samples, diapers, laboratory cultures, chemicals, pharmaceuticals, medical devices, batteries, and thermometers. These wastes either pose risks of infection or present chemical hazards. Radioactive materials are also a hazardous healthcare waste, but they are typically not generated by the small health facilities and not addressed here.

Please also read the healthcare waste *Guideline* to better understand the medical waste stream, its risks, and its management.

The key potential environmental and health impacts of small health facilities are as follows:

ENVIRONMENTAL CONTAMINATION AND PATIENT, STAFF, AND COMMUNITY EXPOSURE

Biological and chemical contamination of ground and surface water may result from poorly sited, designed, and managed latrines, septic and wastewater systems and waste pits. Contamination can occur through overland flow into surface waters, seepage into ground water, or by direct disposal into waterways. Three issues should be particularly noted:

- **Human excreta** from health care facilities present particularly high risks for the transmission of "oral-fecal route" diseases between patients or to the community at large. Examples of such diseases include cholera, typhoid, and dysentery. Poorly sited/designed, operated, or maintained sanitary facilities significantly increase the chances of ground and surface water contamination—and thus of such disease transmission. (See the *Sector Environmental Guideline* on Water Supply and Sanitation.) (WATSAN)

- **Grey water** is the waste water from bathing and laundry. Grey water generated by health care facilities is likewise higher-risk than that produced from domestic sources. If allowed to seep

How serious are the risks to patients from poor waste management?

While data from Africa are very scarce, **iatrogenic** diseases and nosocomial infections are serious risks to patients in health care facilities throughout the world.

Iatrogenic diseases—from the Greek meaning "doctor generated" —are diseases that result purely from a doctor's or nurse's action, behavior, or therapy, especially as a complication of treatment.

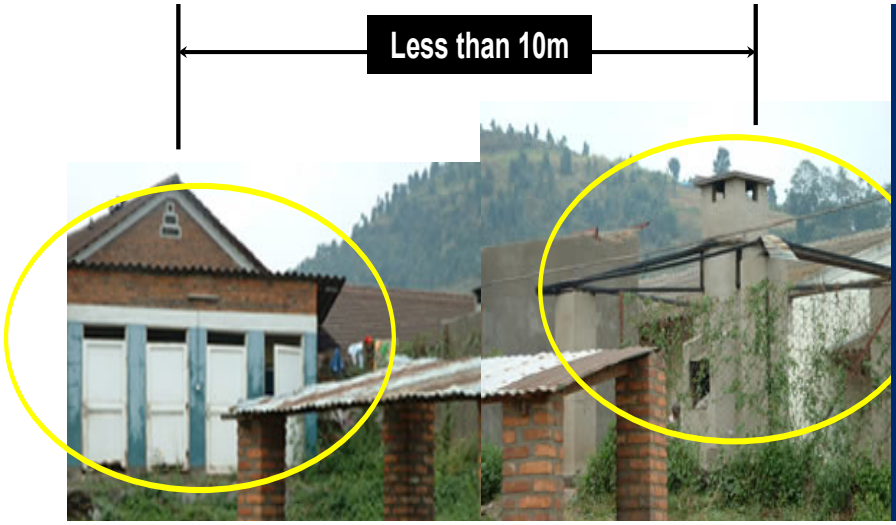
Nosocomial infections originate or occur in a hospital or health care setting due to the combination of factors—high prevalence of pathogens, high prevalence of compromised hosts, and an efficient mechanism of transmission from patient to patient.

The most common types of nosocomial infections are urinary tract infections, pneumonia, and bacterial infections from surgical incisions.

into bare ground, gray water can contaminate drinking water sources with pathogens and pollutants.

- **Pharmaceuticals** pose particular hazards when disposed of without proper precautions. Throughout the world, typical practice has been to dispose of expired pharmaceuticals as non-hazardous waste via latrines or sewers, landfills or burial pits. Recently, relatively high concentrations of drugs have been found in surface waters that are used by fish, wildlife, and people. Although the extent of the health hazards presented by these drugs is still unknown, studies have shown that at the concentrations found, they can affect the reproductive cycle of fish and wildlife, and can result in birth defects. Effects on human health and reproduction are likely as well.

Spread of pathogens from unsecured infectious waste (e.g. in open waste pits) and from "black water" (waste containing human excrement, e.g. from, unscreened pit latrines) by insect vectors, birds, mice, livestock etc.



Poor design facilitates the spread of pathogens.

Unscreened simple pit latrines (at left) and a newly constructed open-air kitchen (at right) are separated by less than 10m at this district hospital in East Africa.

Mark Stoughton/The Cadmus Group

Other poor waste and facilities management that attracts/facilitates breeding of disease vectors. Besides hazardous wastes, clinics generate a variety of solid wastes including organic materials, papers and packaging, empty containers from cleaning products, and other miscellaneous wastes.

These wastes must be collected and properly disposed of to avoid attracting disease vectors and to prevent contamination of soils, groundwater, and surface water. (See the *Sector Environmental Guideline* on Solid Waste for more information.)

If water pools or stands (e.g., from a water supply point or grey water discharge, or rainwater runoff in a waste pit), it may provide a breeding medium for vectors transmitting malaria and other water-borne diseases.

Many health facilities include a communal kitchen where meals are prepared for patients—often by their relatives—and sometimes for staff. Poor kitchen hygiene can attract pests, which may become vectors for disease transmission.

Climate change may lead to the spread of disease vectors into new areas. Therefore, these considerations may become important in the near future for those areas that are less concerned with particular disease vectors today.

Toxic or nuisance air pollution produced by improperly operated incinerators, open burning of waste, and/or poorly ventilated and designed cooking facilities.

Healthcare waste has a high plastic content and open burning or poor incineration practices can produce highly toxic smoke. The practice of using old tires for incinerator fuel likewise produces toxic smoke.

Open or improper disposal of sharps (e.g., used needles, blades, lancets). These pose a direct risk of injury and infection particularly to children, livestock and wildlife. HIV/AIDS and hepatitis are two serious diseases commonly transmitted by improperly handled sharps.

Because many patients already have compromised (or burdened) immune systems, they are at particular risk from poor waste management and deficient biosafety practices that elevate pathogen levels and facilitate patient to patient transmission.

PESTICIDE SPILLS AND EXPOSURES

Health facilities are often sites where bed nets are treated with insecticide and then distributed. Pesticides recommended by the World Health Organization (WHO) for use in Insecticide-Treated Materials (ITM) are classified by the US Environmental Protection Agency (EPA) as only "moderately" toxic to humans, and with adequate safety precautions, the risk of adverse effects on bed net users is slight.

However, significant risks to human health do arise from pesticide storage, use (i.e., bed net treatment), distribution, and disposal in the quantities used by bed net distribution programs. Severe poisonings have been reported from exposure to highly concentrated solutions used in treating bed nets. (For detailed information, see Hirsch et al, 2002)

ITM pesticides are also highly toxic to aquatic organisms. Precautions are necessary to ensure that pesticides used in ITM programs do not contaminate lakes, streams and other bodies of water.

(For more detailed information on the proper storage and handling of pesticides refer to the Pesticide Handling section of Environmental Elements table at the end of this *Guideline*, or the *Sector Environmental Guidelines* on Safer Pesticide Use)

ASBESTOS CONTAMINATION AND EXPOSURE

While not a consideration for construction of new facilities[1], demolition or upgrading of older clinics may involve contact with asbestos-treated materials.

Asbestos (a mineral fiber) was commonly used in insulation materials, roof shingles, flooring, millboard, and other paints and coating materials. If left undisturbed, these materials do not usually present a health risk. Removing and disposing of asbestos, however, can release asbestos fibers, which in high concentrations can lead to lung cancer, mesothelioma, and asbestosis.[2]

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[1] There are a number of developing countries such as India where the use of asbestos continues.

[2] www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/asbestos-amiante-eng.php

The construction phase typically presents the highest risks from asbestos exposure. However, disposal of asbestos materials in unsecured landfills can expose waste-pickers, children, and others to asbestos.

Other infection risks to patients, staff, and visitors

Poor waste management can expose patients and the community at large to increased risks of infection.

Beyond waste management practices, a set of design issues and other biosafety practices significantly affect pathogen exposures and infection risks to patients, staff and visitors.

These are not environmental issues per se, but we note them here as waste management is one component of good biosafety design and practice, and usually not separable in the context of clinic operations.

Lack of sterilization of facilities and instruments can lead to fatal complications. Surgery and childbirth present particular risks—for example, maternal and neonatal tetanus, transmitted by non-sterile instruments during childbirth, has a fatality rate of 70-100% in newborns. But poor sterile practices can transform even simple health problems into complicated and even life-threatening health issues.

Inadequate or contaminated water supply: Health facilities require a clean, year-round water supply in sufficient quantity for drinking, laundry, cleaning and sterilization, cooking, etc.

Drinking and sterilization particularly require very clean water. Unsafe drinking water will add to the disease burden of patients, and pose a serious risk to visitors and clinic staff.

Poor design, including cramped waiting rooms, insufficient air circulation, and permanently damp conditions all increase pathogen concentrations and infection risks.

Inadequate barriers (e.g., fences, screens, and bed netting) to livestock, birds and insects likewise heighten infection risks, particularly for patients with weakened immune systems.

Inadequate hand-washing stations for staff, patients and visitors greatly increase the risk of oral-fecal disease transmission and patient-to-patient transmission.

DEGRADATION OR LOSS OF LOCAL ENVIRONMENTAL RESOURCES FROM POOR CONSTRUCTION OR OPERATING PRACTICES

CONSTRUCTION IMPACTS

Environmental impacts during construction are mainly related to sourcing, extraction and placement of construction material. Erosion and sedimentation, habitat degradation, and local deforestation are some of the potential impacts.

In a well-managed construction project, impacts should be minor if materials sourcing and the disposition of construction debris are handled in an environmentally sensitive manner. For example, local deforestation during construction is caused by intensive local harvesting of timber (for structures)

and fuelwood (for workers). See the *Sector Environmental Guideline* on Construction for recommended mitigation and monitoring measures.

LOCAL DEFORESTATION

Fuelwood harvesting in the immediate vicinity of the facility can lead to deforestation (particularly if relatives are cooking meals for patients). Local deforestation can contribute to more intense flooding; therefore, areas where flooding is already a problem or where increased intense precipitation events are a likely near-term impact of climate change should take particular care to curb practices leading to deforestation.

INDUCED SETTLEMENT AND IN-MIGRATION

Finally, health facilities are usually constructed in response to an existing need. But as a critical social service, they (along with roads and schools) may encourage additional in-migration and settlement, placing additional demands on the local environment. This effect is largely out of the control of health facility project proponents. However, project proponents may want to discuss likely settlement trends with district or town planners—both to help the healthcare sector plan for a growing population, and to help planners provide for this from environmental management and social services perspectives.

OVERVIEW OF ENVIRONMENTAL BEST PRACTICE IN CLINIC DESIGN

DESIGN FOR EXPECTED CLIMATE AND ENVIRONMENTAL CONDITIONS

Poor design for local climate can mean that typical temperature variations and events such as seasonal rains, sand or dust storms can have significant adverse effects on clinic accessibility and operations.

Site clinics to take advantage of natural features including drainage, predominant wind patterns, and shade cover. Also, consider potential risks from natural disasters (e.g. earthquakes, floods), as well as projected local impacts of climate change, when choosing a building site and design. Built facilities intended to last for decades need to be designed to withstand exposure to an altered climate.

Waste management plans

Suitable waste management facilities are necessary but not sufficient for environmentally sound waste management.

Correct utilization of these facilities requires a waste management plan covering all types of wastes, including expired pharmaceuticals.

For details on medical waste management plans, see USAID Sector Environmental Guideline on Healthcare Waste.

CHOOSE APPROPRIATE LOCATIONS WITHIN A VILLAGE OR TOWN

Poor siting can make it difficult to keep facilities clean due to airborne dust and particulates from road traffic and can expose staff and patients to unpleasant odors and noise from nearby activities. Poor siting in coastal areas and near flood plains, rivers, and wetlands may result in flooding and property damage due to predicted climate change-related impacts.

DESIGN FOR WASTE MANAGEMENT

Latrines and infrastructure/facilities for management of grey water, medical wastes (including sharps), and normal solid waste must be an integral part of health facility design.

Typical medical waste disposal options are: burying on-site, burying off-site at a designated landfill, burning on-site, or incinerating on or off-site.

It is critical to ensure that medical waste pits, latrines, and grey water systems will not contaminate water supplies; that waste pits are not open to insects, birds, and animals; and that medical waste storage and disposal areas are secured from children. See the healthcare waste *Guideline* for disposal options and guidance. Consider projected sea level and groundwater rise due to climate change when designing waste disposal options.

ENSURE SUFFICIENT WATER SUPPLY AND SANITARY MANAGEMENT CAPACITY

Climate change may impact the availability of fresh water in some areas and outbreaks of highly infectious diseases such as cholera or typhoid can place far higher-than-normal demands on a small health facility's water supply and sanitation systems. If these systems are designed only to meet "normal" demands, they may be overwhelmed, increasing the risk of nosocomial infections and posing further threats to community health.

CLIMATE CHANGE

PLANNING FOR A CHANGING CLIMATE

Climate change impacts such as temperature increase and changes in the frequency, intensity, and duration of extreme events such as floods, high winds, and tropical storms could affect small healthcare facilities and practices for managing medical wastes.[3] Health posts, clinics, and hospitals designed to last for decades need to plan for exposure to an altered climate. Plans to build new facilities need to consider projected impacts within the timeframe that the facility is intended to be operational, and ensure that the appropriate materials and locations are selected to reduce vulnerability. This is especially important because health facilities are often key community spaces used as safe havens during and after storms and other emergencies, and need to be fully operational and able to provide services. Health care facilities may also need to be prepared to handle increased visitors as a result of changing disease vectors or injuries from extreme weather events.

ADAPTING TO CLIMATE CHANGE BY MINIMIZING VULNERABILITY THROUGH PROJECT DESIGN

Adapting infrastructure planning, design, construction, operation, and maintenance to climate change involves ensuring that healthcare facilities and the systems that sustain them are able to withstand climate change impacts in order to protect healthcare professionals, staff, patients, and visitors.

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[3] For more information on climate change in relation to medical waste management, refer to the Climate Change section of the Healthcare Waste Sector Environmental Guideline.

Healthcare facility designers and project managers must incorporate information on climate from historical records, recent trends, and future projections. The intended operational timeframe of the facility should be considered when selecting climate information, particularly the timeline of future projections. For example, if you expect the facility is expected to serve people for 20-30 years, medium-term projections should be used so the investment is sustainable for that duration. Note that near-term projections are more reliable and less uncertain than long-term emissions and climate predictions. In many cases managing for greater uncertainty rather than specific trends may be most appropriate.

From a public health **risk management** perspective, it is vital to design for the potential direct and indirect impacts of climate change on healthcare facilities and the people who rely on them to avoid a loss of service.

In the context of EIA, mitigation is the implementation of measures designed to eliminate, reduce or offset the undesirable effects of a proposed action on the environment.

In the context of climate change, mitigation is an intervention to reduce the sources or enhance the sinks of greenhouse gases in order to limit the magnitude and/or rate of climate change.

For example, design and siting for healthcare facilities in coastal areas should take into account projected sea level rise and storm surges. The same principle applies to posts near flood plains, rivers and wetlands. In locations where annual average temperatures are rising, facility designs should plan for increased cooling capacity to protect staff, patients, and supplies. In locations prone to drought, supplies and storage of fresh water are essential to medical procedures and everyday facility operations. Project managers should implement procedures to closely monitor water use, repair leaking pipes, and install water efficient appliances. In some locations, harvesting rainwater for use during dry periods and recycling gray water for non-drinking purposes, such as irrigation of hospital grounds, may be beneficial.

It is particularly important for healthcare facilities to consider the vulnerability of their electricity source, and build resilient systems that can withstand the projected impacts of climate change. Integrating renewable energy sources—such as solar power—as a primary or back-up source may help keep the facility running if electricity is not available through the grid, or if fossil fuels needed for generators are not available following an extreme weather event. Natural ventilation can be used to maintain systems for infection control in the event of power failure. Reducing fossil fuel use can help prevent many asthma and disease-causing pollutants from entering the air and water, contributing to improved public health, and can contribute to reductions in greenhouse gas emissions, as described in the next section.

MINIMIZING GREENHOUSE GAS EMISSIONS AND MAXIMIZING SEQUESTRATION

In designing, building, and operating healthcare facilities and managing medical wastes, steps should be taken, where feasible, to reduce greenhouse gas emissions that contribute to climate change. The activity should aim not only to reduce emissions immediately, but also to support sustained low-emissions development through investments that will lead to reduced emissions in the future. This can be done, for example, by using energy efficient appliances to store medical supplies, powering clinics with renewable energy sources, using green building practices and taking advantage of shade and natural ventilation, and siting clinics in places that minimize travel distances for the intended beneficiaries and that allow the use of public transportation options.

DESIGN, CONSTRUCTION, OPERATIONS, & MAINTENANCE GUIDANCE

This section contains design, construction, and operation guidance organized in three tables, as summarized below:

- **Environmental elements.** This table addresses facility siting, construction materials & management, asbestos, sanitation, waste disposal, wastewater disposal, and pesticide handling.
- **Mixed elements.** This table addresses elements that are not exclusively environmental, but have strong environmental dimensions: water supply, biosafety and infectious disease control, kitchen management, and laboratory management.
- **Non-environmental elements.** This table addresses clinic functionality, security, and electricity supply.

As noted in the introduction to this guidance, **environmentally sound design and operation** of small health facilities are an integral part of overall good practice for this sector. Therefore, mixed and non-environmental elements of small health facility design, construction, operations and maintenance that are closely linked to environmental elements are addressed in this section.

The tables provide concise guidance and references for more detailed assistance. These references include the **siting, design and operations checklists** at the end of this chapter. Checklists are provided for latrines, hand wash stations, potable water wells, burn pits, hazardous waste storage areas, and overall operations and maintenance.

ENVIRONMENTAL ELEMENTS

Note: Many of the problems listed in the table below may be affected by climate change, or may impact climate. The associated mitigation measures may be particularly helpful for increasing adaptive capacity, or for decreasing sensitivity or exposure to potential climate changes.

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
Location/ Siting	Is terrain sloping? Does water pool anywhere in the clinic grounds? How might climate change impact the terrain and water accumulation? Will site be located near schools or in high density habitats? Where does water drain? How might water drainage be impacted by climate change? Does site have any trees for shade cover? What are seasonal temperature norms? Does the area have a rainy season, windy season, cold season, etc? How are temperatures and seasons expected to change due to climate change? What are the risks of natural hazards (earthquake, landslide, flooding)? How are weather-related risks expected to change due to climate change? Does the location have special cultural or aesthetic value to the local community? Will site be located in or near pristine areas? Will climate change increase the vulnerability or importance of these areas? Will construction encourage population in-migration/settlement? Will the proposed site be exposed to any new or more severe weather shocks as a result of climate change?	Select a location with access to safe drinking water; consider how climate change may impact water supplies in the future. Avoid locations that pose greater risks of exposure to children and the general population. Avoid siting in a wetland or next to a river, stream, or lake. Leave a 50-m wide strip to prevent erosion around riparian zones. Retain and plant native trees around the facility to add more shade in hot climates, sequester GHG emissions, and protect against wind and dust storms. Consider how climate change may impact planted trees. Include a high roof, porches, and large windows with shutters for buildings in hot climates and in areas that are expected to get hotter due to climate change. Construct gutters and concrete aprons around buildings to prevent rainwater damage and soil erosion around buildings. Construct soak pits and canals to prevent stagnant water from pooling around clinic grounds and to receive gray water. Upgrade roads to allow facility access during rainy seasons using techniques to minimize soil erosion and the creation of multiple tracks. Assess normal wind patterns and site clinic upwind of latrines and the burn pit. Burn pits should be sited away from settlements and people; if a burn pit is being constructed in an urban area, a smokestack should be constructed to mitigate health hazards. Meet with town/village planners to discuss likely settlement trends, so that they are better able to anticipate future environmental management and social services needs. Consider need for structure to be used as a refuge or	*USAID Sector Environmental Guideline*: Water and Sanitation

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
		community gathering place in times of disaster, and ways to design or site the clinic to facilitate that role. Consider and plan for climate impacts, such as increased temperatures that could impact worker health.	
Construction Materials and Management	How will contractor prevent soil erosion during and after construction? Consider how soil erosion may increase over time due to severe events associated with climate change. How will contractor prevent pollution of surface waters and groundwater during construction? Consider how climate change may change precipitation patterns. How will contractor dispose of construction waste? Will construction contribute to deforestation? Note that deforestation is an important source of GHG emissions. Can local building materials be utilized without adverse impacts? Is it possible to select local construction materials, or construction materials that have been sourced in a way that reduces GHG emissions?	Minimize size of cleared areas. Limit earth moving to dry seasons. Use locally available materials for construction in order to reduce maintenance costs, except where such materials may be taken from protected areas or their extraction may create significant adverse impacts on the local environment. Backfill borrow pits when no longer needed, to prevent accumulation of standing water, use for waste disposal, and potential falls Dispose of construction waste in controlled dumps with provisions for groundwater and surface water protection. Revegetate with native grasses and shrubs to stabilize soil after construction is complete. Avoid building in forested areas. In the case where deforestation is unavoidable, invest in reforestation or protection of nearby forested areas. Provide potable water, and appropriate sanitary and solid waste disposal facilities for use by construction workers. Consider and plan for climate impacts.	*USAID Sector Environmental Guideline*: Construction
Asbestos	Does clinic contain any asbestos-treated materials? Can asbestos materials be safely contained and/or left undisturbed by construction or other activities? How can asbestos materials be disposed of in a safe manner?	Label and leave undamaged materials alone. To the extent possible, prevent them from being damaged, disturbed, or touched. Periodically inspect for damage or deterioration. Check with local health, environmental, or other appropriate officials to find out about proper handling and disposal procedures, and availability of secured disposal sites. Seal asbestos materials in place by covering with a layer of primer and paint, or a layer of PVC adhesive. If asbestos material must be removed, determine availability of	Consumer Product Safety commission, US EPA, and American Lung Association, *Asbestos in the Home* Worker's Health Centre, Asbestos Removal Fact Sheet

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
		local expertise in asbestos removal and disposal and request on-site assistance. Thoroughly soak material with water containing a few drops of detergent before removing or disturbing asbestos materials. Never break removed material into small pieces. This could release asbestos fibers into the air. Asbestos pipe insulation is typically installed in preformed blocks and should be removed in complete pieces. After removal, clean the area well with wet mops, wet rags, sponges, or HEPA (high efficiency particulate air) vacuum cleaners. Wetting helps reduce the chance of spreading asbestos fibers in the air. The work site should be visually free of dust and debris. All asbestos materials, disposable equipment, and clothing used in the job must be placed in sealed, leakproof, and labeled plastic bags. Dispose of all asbestos materials in sealed, lined bins or a leak-proof container.	
Sanitation	Where to site toilets/latrines? How might climate impacts such as increased precipitation or severe storms inform the siting of toilets/latrines? How might changes in precipitation associated with climate change impact the availability of fresh water?	Construct improved latrines. Include hand-washing stations located close to latrines. Provide separate facilities for clinic staff. Teach basic sanitation and hygiene practice to clinic patients and family members. Consider and plan for climate impacts. Invest in IWM or water storage to ensure availability of fresh water.	Latrine siting and design checklist *(in this Guideline)* Handwash station siting and design checklist *(in this Guideline)* *USAID Sector Environmental Guideline*: Water and Sanitation for discussion on latrine siting, sizing, design, construction and management
Waste disposal	How will the facility handle medical waste? Will the facility generate hazardous waste? If so, how will they handle it?	Site waste storage and disposal areas away from main clinic buildings. Establish a system of source separation: provide clearly labeled	Hazardous Waste Storage Area Siting and Design Checklist *(in this*

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
	How will the facility handle solid waste? How will the facility handle expired medications? Is climate change expected to bring an increase in strong winds or flooding in waste storage areas?	buckets for sharps, non-hazardous waste, disposable hazardous waste (dressings, tissue), and non-disposable hazardous materials (sheets, towels). Boil recyclable hazardous waste. Incinerate non-recyclable hazardous waste, sharps, and expired pharmaceuticals. Do not use Incinerators and burn pits for storage of hazardous materials. (See *USAID Sector Environmental Guideline* on Healthcare Waste for definition of hazardous materials.) Avoid storage of hazardous material on the floor by storing hazardous waste on shelves or in elevated drums in a location well-protected from the elements. Store hazardous waste in a dedicated, concrete-lined area that is surrounded by a berm to prevent spills from escaping. Screen burn pits to reduce disease transmission by insects, birds and mammals. Cover burn residue in pit with soil after each burn. Fence the area around burn pits to prevent access by animals, children and others. Also design fence to serve as a wind barrier to prevent unburned or partially burned materials from blowing out of the pit.	*Guideline)* Burn pit siting and design checklist *(in this Guideline)* *USAID Sector Environmental Guideline*: Healthcare Waste for detailed discussion and further guidance. T. Grayling, Guidelines for Safe Disposal of Unwanted Pharmaceuticals In and After Emergencies for guidance on disposal of expired medication S. Batterman, Assessment of Small-Scale Incinerators for Health Care Waste for guidance on incinerator design.
Wastewater disposal	How much grey water will be produced in a given day? Week? Can wastewater be disposed of in a local sewer system? Can burn pit be used for disposal? Is climate change expected to bring an increase in strong winds? Will the volume of water create pooling? Will the water be treated before it is disposed of? Who will be in charge of disposal?	Where possible, dispose of grey water in public sewer systems. Grey water should never be allowed to mix with surface water or to pool and stagnate (e.g., in clay-lined burn pits or bare ground behind the facility) Site grey water soak pits 3 m away from vegetation and 30m away from groundwater sources Ensure bottom of soak pit is at least 1m above the water table during the wettest period, and 1m above impermeable layers of soil Consider and plan for climate impacts.	*USAID Sector Environmental Guideline*: *WATSAN* for discussion of soak pit construction.

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
Pesticide Handling (insecticide-treated bed-nets)	Will the facility have a bed net treatment and distribution program? Will climate change impact the range and incidence of disease vectors and the need for these types of programs?	Identify specific staff that will be responsible for storage, treatment and disposal. No other staff members should be involved in these activities. Train staff in the safe handling of these pesticides, disposal of waste and cleanup of spills. Impermeable gloves and face protection should be worn by anyone handling concentrated solution and by persons treating nets. Minimize the effects of inhaling solvent vapors by treating nets in a well-ventilated area and using shallow basins for dipping so that the vapors can escape. The best approach to this problem is to choose water-based formulations. Ensure insecticide is safely transported and stored, away from foodstuffs and accidental access by untrained persons and children. Provide materials for and operating procedures for cleaning up spills. Provide facilities and operating procedures for disposing of excess insecticide solution, as needed. Leftover solution, if all the solution is not absorbed by the net, should be dumped into a safely sited latrine or garbage pit. Similarly, empty liquid pesticide containers should be rinsed before disposal, and the rinse water disposed of properly. Empty containers should always be cleaned out, as far as practicable, before disposal; If possible, they should then be disposed of according to UNFAO recommendations. As long as they are not heavily contaminated, cardboard and fiberboard containers should be burnt on a fire in the open (except those contaminated with phenoxy acid herbicides). [Note – any burning should be upwind.] Heavily contaminated material and all other containers should be rendered unusable and sent to a central location for disposal by the national authority. Glass containers should be broken and plastic or metal containers punctured or crushed. Containers can then be buried	*USAID Sector Environmental Guideline*: Safer Pesticide Use. B. Hirsch et al, Programmatic Environmental Assessment for Insecticide-Treated Materials in USAID Activities in Sub-Saharan Africa for guidance on ITN issues World Health Organizations Pesticide Evaluation Scheme (WHOPES) for additional links and guidance about appropriate ITN insecticide use and handling.

CLINIC ELEMENT	TO AVOID ADVERSE IMPACTS, ASK…	MITIGATION MEASURES	REFERENCES FOR FURTHER GUIDANCE
		in an isolated area at least 50 cm below ground surface. Train staff in appropriate emergency response in the case of pesticide poisoning, and make certain treatment facilities have soap and water and medical charcoal available.	

DESIGN, CONSTRUCTION, OPERATIONS, & MAINTENANCE GUIDANCE—MIXED ELEMENTS

These elements are not exclusively environmental, but have strong environmental dimensions.

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
Water supply	How much water is required for clinic operations? What are the available water sources? How do they vary seasonally in quantity? How do they vary seasonally in quality? How might they vary in quality and quantity in the near- and medium-term as a result of climate change? How will regular water quality testing (coliform bacteria, nitrates, arsenic and heavy metals) be managed? How will water source(s) be kept clean?	Health facilities should have dedicated water sources (well, water tower, rainwater collection cistern, etc.) that are not shared with communities or schools and that are not in areas that may be damaged or inaccessible due to climate change impacts. Water sources should provide adequate water under projected climate changes. Locate well upstream (upgradient) from the hazardous waste pit or storage areas, solid waste disposal area, and latrines. For clean well water, ensure water table is at least 3 m below ground level in all seasons, as above this, the water quality is typically equal to that of surface water. Construct an apron around the well covering at least a 1.5 m radius extending from the well opening. Construct a channel around the apron that diverts the wastewater to a soak away pit that is at least 10 m from the apron. Add a well cover and pump to prevent contamination of well water. Bury surface pipes, wherever possible, to avoid damage from vehicles, animals, or community members who may be tempted to "hack" into the water supply. Where a pump is not feasible, use only one rope and bucket suspended from the wellhead to collect water. Disinfect well with a 1% chlorine solution before first use and test for coliform bacteria every month to ensure water quality.	Water well siting and design checklist *(in this Guideline)* Sphereweb guidelines *USAID Sector Environmental Guideline*: Water and Sanitation
Biosafety and Infectious disease control	How will equipment and instruments be sterilized? How will treatment areas be cleaned and sterilized? What protections will staff and	Install screens in windows and place curtains over doorways to control insects and other pests. Use universal precautions to protect patients and staff. Wash all surgical instruments with soap and water, then autoclave where feasible.	

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
	patients need against spread of disease? What protections will be necessary during large disease outbreaks (cholera epidemic, typhoid, meningitis outbreak, malaria high seasons, etc)? What disease outbreaks may become more common as a result of climate change?	Autoclave instruments daily (minimum requirement). Hot air sterilizers should be replaced by autoclaves. If only autoclaving once per day, wash and immerse instruments in a chlorine bleach for 30 min before next use. Where autoclaving is not feasible, boil all instruments prior to reuse. Translate autoclave instructions into local language. Clean floors and surfaces daily with a chlorinated bleach. Provide gloves and protective wear for cleaning staff, and train all staff in proper handling of chlorine bleach. Establish a disease surveillance system by recording the diagnosis of every patient seen in the clinic to gain an idea of general disease trends, which diseases predominated in the community, and for early detection of outbreaks/epidemics of disease to reduce their impact. Provide weather and climate forecasts to help identify possible areas at risk and gather appropriate medical supplies. Create an emergency outbreak plan that identifies a site for makeshift beds and plans for emergency toilet facilities. Keep a separate store of medicines and supplies reserved for emergency situations.	
Kitchen Management	Will the facility provide meals (to patients, as part of child nutrition programs, for staff, other)? If not, does the facility have a designated space for family members to prepare meals for patients? How will kitchens control pests? What type of stove in kitchen? What fuel supply for stove?	Locate kitchen in an area not visited by patients, away from the latrines, and close to the well. Construct windows for ventilation and lighting, and screen windows to reduce flies and other insects. Design entries to prevent entry by insects, rats and mice. Remove all kitchen waste from the facility daily and dispose of waste in an area separate from the storage location for hazardous wastes. Use energy efficient stoves (e.g., improved cookstoves) to reduce fuel consumption and improve indoor air quality. Plant a windbreak around clinic of plant species that produce good fuel for cookstoves. Consult with local community about preferred plant species.	

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
Laboratory Management	Will the facility have a laboratory?	Ensure laboratory safety requirements are posted and understood by all staff.	WHO *Laboratory Biosafety Manual* for guidance on laboratory design and operations

DESIGN, CONSTRUCTION, OPERATIONS, & MAINTENANCE GUIDANCE—OTHER ELEMENTS

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
Clinic Functionality	How can you minimize congestion and thereby minimize patient-to-patient disease transmission? What services will be offered? How many staff will be working there? Is there adequate, secured space for their personal belongings? Are there cultural requirements for separate treatment of male and female patients? Will the facility accommodate overnight patients? Will there be separate wards/treatment areas for special needs patients (HIV/AIDS, TB, etc)? Does the facility have adequate and separate space for:	Design each building to allow easy cleaning and sterilization. Use a layout that provides for "circular flow" (see box: "Other Design Best Practices") . Separate patient waiting areas from the examination area by a solid wall. Provide a door which can be closed. Ensure examination rooms are private with either closable doors or curtains to allow for privacy during visits. Provide suitable ventilation and natural lighting for examination rooms. Provide at least one secured space for nursing staff and volunteers to store belongings in large clinics. Provide training for staff about patient privacy & record confidentiality. Include adequate, discrete locations for health education, sex education, counseling sessions, and family planning services. If meals will not be prepared in a central kitchen for patients, add a designated space for family members to cook. Include amenities such as a radio to increase the likelihood of staff	

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
	• Health education programs? • If applicable, sex education, family planning & counseling programs? • Patient waiting? • Storage Will the facility support a mobile health team?	retention. Provide a separate and safe play/waiting area for accompanying well children to minimize their exposure to disease while their parents or siblings are being treated.	
Security	How will clinic prevent unauthorized access to facilities (human and animal)? How will clinic secure medicines and medical equipment against theft? How will clinic secure key infrastructure (solar panels, radio, computers, etc) against theft?	Build a wall or fence around the clinic to prevent animals, children and others from wandering in buildings. Provide secured storage cabinets and secured storerooms for medicines and medical equipment. Install metal gratings or bars over storeroom windows. Consider hiring a security guard.	
Electricity supply	What are clinic power requirements? How will clinic ensure reliability of power supply?	Install electric lighting in treatment rooms and maternity. Use solar panel/battery systems to supply electricity in rural areas. Install backup power sources for clinics that rely on municipal power supply or generation from sources that may be impacted by climate change. Consider installation of an inverter which can manage inputs from the power grid, a generator, and alternative energy sources as local availability and priorities dictate. Use compression-type refrigerators and ice pack freezers for cold-chain programs. Provide electricity for radios as an amenity for clinic staff (photovoltaic or hand crank devices may be appropriate for rural areas).	A. Jimenez and K. Olson, *Renewable Energy for Rural Health Clinics* for information about clinic power requirements and renewable energy supply options

CLINIC ELEMENT	KEY QUESTIONS	GUIDANCE	REFERENCES FOR FURTHER GUIDANCE
		Use clinic electricity as an income generating activity (charging batteries, cell phones, etc).	

RESOURCES AND REFERENCES

http://health.bih.nic.in/Docs/Community-Health-Centres.pdf

http://www.mohfw.nic.in/NRHM/Task_grp/Task_group_IPHS.pdf

http://www.doh.gov.za/docs/policy/2011/guidelines_a.pdf

http://www.healthlink.org.za/uploads/files/normstd.pdf

http://www.who.int/management/district/assessment/assessment_tool.pdf

http://www.cdc.gov/malaria/malaria_worldwide/reduction/itn.html

OTHER USAID SMALL-SCALE GUIDELINES

A number of the issues summarized in this guidance are treated in more detail in other chapters of the *Sector Environmental Guidelines.* Refer to these specific guidelines listed below for detailed information on specific issues:

- Small-Scale Construction
- Healthcare Waste: Generation, Handling, Treatment, and Disposal
- Safer Pesticide Use
- Solid Waste
- Water and Sanitation

ADDITIONAL REFERENCES AND SUGGESTED RESOURCES INCLUDE:

- S. Batterman. *Assessment of Small-Scale Incinerators for Health Care Waste*. WHO. Geneva, Switzerland. 2004. http://www.who.int/immunization_safety/publications/waste_management/en/assessment_SSIs.pdf

  This report provides an analysis of low cost small-scale incinerators used to dispose of health care waste in developing countries, specifically sharps waste (used and possibly infected syringes and needles). The report includes a situation analysis, a "best practices" guide to small-scale incineration, a screening level health risk assessment for ingestion and inhalation exposure to dioxin-like compounds, and other information related to the operation and evaluation of the incineration option for health care waste.

- Consumer Product Safety commission, US EPA, and American Lung Association, *Asbestos in the Home* http://www.cpsc.gov/CPSCPUB/PUBS/453.html

- Belinda Greenwood-Smith (MBBS). *Environmental Health Issues in a Basic Health Care Center in Ghurian, Afghanistan*. http://www.tropmed.org/rreh/vol1_1.htm

  This is the report of measures taken to ensure proper inclusion of environmental health issues while rehabilitating a clinic in rural Afghanistan.

- T. Grayling. *Guidelines for Safe Disposal of Unwanted Pharmaceuticals In and After Emergencies*. WHO. Geneva, Switzerland. 1999. http://www.who.int/entity/water_sanitation_health/medicalwaste/unwantpharm.pdf

  These guidelines provide advice on the implementation of safe disposal of unusable pharmaceuticals in emergencies and in countries in transition where official assistance and advice

may not be available. A number of methods for safe disposal of pharmaceuticals are described. These are methods which involve minimal risks to public health and the environment, and include those suitable for countries with limited resources and equipment. The adoption of the guidelines by ministries of health, environment and other relevant ministries, and their practical application, will contribute to the safe and economical elimination of stockpiles of unusable pharmaceuticals.

- B. Hirsch, C. Gallegos, W. Knausenberger, and A. Arata. *Programmatic Environmental Assessment for Insecticide-Treated Materials in USAID Activities in Sub-Saharan Africa.* U.S. Agency for International Development, Bureau for Africa, Office of Sustainable Development, Agriculture, Natural Resources and Rural Enterprise Division. 2002. http://pdf.usaid.gov/pdf_docs/PNACP696.pdf

- *Environmentally Responsible Management of Health Care Waste With a Focus on Immunization Waste*. Washington, DC. 2002. http://www.bvsde.paho.org/bvsacd/cd48/reponsible.pdf

  The document was prepared by Health Care Without Harm (HCWH) A coalition of international NGOs, scientists, and medical professionals) thatadvocates for safe handling, treatment and disposal of medical waste. HWCH works to discourage antiquated approaches to waste management that produce harmful environmental and public health impacts, and replace them with innovative thinking and approaches that makes the best use of technology and management skills to solve this problem.

- Health Care Without Harm. *MedWaste Management resources*. http://www.noharm.org/us_canada/issues/waste/resources.php

  A collection of resources on proper medical waste management including fact sheets on: Waste Minimization, Segregation, and Recycling in Hospitals; 10 Ways to Reduce Medical Wastes; Guidelines for Optimizing Waste Segregation; and Waste Minimization Resources.

- Jimenez, A. and K. Olson. *Renewable Energy for Rural Health Clinics*. National Renewable Energy Laboratory. Golden, Colorado. 1998. http://www.greenstar.org/NREL%20Solar%20Health.pdf

  The National Renewable Energy Laboratory's (NREL) Village Power Program has commissioned this guidebook to help communicate the appropriate role of renewables in providing rural health care services. It combines technical analysis and practical design, deployment, and training experience with renewables as a serious option for electrifying rural health clinics. It is useful to renewable energy practitioners in defining the parameters for designing and deploying their products for health clinic needs.

- Kevens, RM, J Edwards, C Richards, T Horan, R Gaynes, D Pollock, and D Cardo. "Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002." *Public Health Reports.* March–April 2007 Volume 122 pp 160–166. Available at http://www.cdc.gov/ncidod/dhqp/pdf/hicpac/infections_deaths.pdf.

- Pruss, A, E. Giroult, and P. Rushbrook (Eds). *Safe Management of Wastes from Health-Care Activities*. ISBN 92 4 154525 9. WHO, Geneva. 1999. http://www.who.int/water_sanitation_health/medicalwaste/wastemanag/en/

  This handbook is a comprehensive, user-friendly guide for practical management of health-care waste in local facilities. It provides guidelines for the responsible national and local administrators, and offers globally relevant advice on the management of health-care waste.

- Sehulster LM, Chinn RYW, Arduino MJ, Carpenter J, Donlan R, Ashford D, Besser R. Fields B, McNeil MM, Whitney C, Wong S, Juranek D, Cleveland J. Guidelines for environmental infection control in health-care facilities. Recommendations from CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Chicago IL; American Society for Healthcare Engineering/American Hospital Association; 2004. http://www.cdc.gov/ncidod/dhqp/gl_environinfection.html

  This is an environmental infection-control guideline that reviews and reaffirms strategies for the prevention of environmentally-mediated infections, particularly among health-care workers and immuno-compromised patients. The recommendations are evidence-based whenever possible. The contributors to this guideline reviewed predominantly English-language articles identified from MEDLINE literature searches, bibliographies from published articles, and infection-control textbooks.

- The Sphere Project. Humanitarian Charter and Minimum Standards in Disaster Response: Minimum Standards in Water Supply, Sanitation, and Hygiene Promotion. Geneva, Switzerland. 2004. http://www.sphereproject.org/handbook/

  This chapter is divided into six main sections: Hygiene Promotion, Water Supply, Excreta Disposal, Vector Control, Solid Waste Management and Drainage. Each contains the following:

  - *The minimum standards:* these are qualitative in nature and specify the minimum levels to be attained in the provision of water and sanitation responses;

  - *Key indicators:* these are 'signals' that show whether the standard has been attained. They provide a way of measuring and communicating the impact, or result, of programs as well as the process, or methods, used. The indicators may be qualitative or quantitative;

  - *Guidance notes:* these include specific points to consider when applying the standard and indicators in different situations, guidance on tackling practical difficulties, and advice on priority issues. They may also include critical issues relating to the standard or indicators, and describe dilemmas, controversies or gaps in current knowledge.

- WHO. *Laboratory Biosafety Guidelines (3rd edition).* ISBN 92 4 154650 6. Geneva, Switzerland. 2004 http://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf

  For more than 20 years, since it was first published in 1983, the *Laboratory Biosafety Manual* has provided practical guidance on biosafety techniques for use in laboratories at all levels. Laboratory biosecurity concepts are introduced, and the latest regulations for the transport of infectious substances are reflected. Material on safety in health-care laboratories, previously published elsewhere by WHO, has also been incorporated for the 3rd edition.

- WHO. *Management of Solid Health-Care Waste at Primary Health-Care Centres: A Decision-Making Guide*. ISBN 92 4 159274 5. Geneva, Switzerland. 2005. http://www.who.int/entity/water_sanitation_health/medicalwaste/decisionmguiderev221105.pdf

  This document is to provide guidance for selecting the most appropriate options for safely managing solid waste generated at Primary Health-Care centers (PHCs) in developing countries. The main tool of this guide consists of six decision-trees aimed at assisting the user in identifying appropriate waste management methods. The guide takes into consideration the most relevant local conditions, the safety of workers and of the general public as well as of environmental criteria.

- WHO, Pesticide Evaluation Scheme. http://www.who.int/whopes/en/

  Excerpt from the website: "The WHO Pesticide Evaluation Scheme (WHOPES) was set up in 1960. WHOPES promotes and coordinates the testing and evaluation of pesticides for public health. It functions through the participation of representatives of governments, manufacturers of pesticides and pesticide application equipment, WHO Collaborating Centres and research institutions, as well as other WHO programmes, notably the International Programme on Chemical Safety.

  In its present form, WHOPES comprises a four-phase evaluation and testing programme, studying the safety, efficacy and operational acceptability of public health pesticides and developing specifications for quality control and international trade."

- Worker's Health Centre, Asbestos Removal Fact Sheet, http://www.workershealth.com.au/images/pdf_uploads/002AsbestosRemoval.pdf

CLIMATE CHANGE-SPECIFIC

Note: USAID's Global Climate Change (GCC) Office can provide support on the climate change aspects of this Guideline. To contact the GCC office, please email: climatechange@usaid.gov

- USAID. 2007. Adapting to Climate Variability and Change: A Guidance Manual for Development Planning. http://pdf.usaid.gov/pdf_docs/PNADJ990.pdf

- USAID. 2009. Adapting to Coastal Climate Change: A Guidebook for Development Planners. http://pdf.usaid.gov/pdf_docs/PNADO614.pdf

  The guidances provide information to assist planners and stakeholders as they cope with a changing climate throughout the project cycle.

- AGC of America. 2009. Climate Change and the Construction Industry. *http://www.agc.org/galleries/advy/ClimateChangeandConstruction.pdf*

- U.S. Green Building Council. http://www.usgbc.org/

- Leadership in Energy and Environmental Design (LEED). https://www.leedonline.com/irj/servlet/prt/portal/prtroot/com.sap.portal.navigation.portallauncher.anonymous

- International Association for Impact Assessment (IAIA). FasTips #3. February 2013. Climate Smart Decisions. http://www.iaia.org/publicdocuments/special-publications/fast-tips/Fastips_3%20Climate%20Smart%20Decisions.pdf

- National Institute of Building Sciences. Whole Building Design Guide. 2013. Passive Solar Heating. http://www.wbdg.org/resources/psheating.php

- World Health Organization. Health Care Without Harm. Discussion Draft. Healthy Hospitals, Healthy Planet, Healthy People: Addressing Climate Change in Health Care Settings. 2009. http://noharm.org/lib/downloads/climate/Healthy_Hosp_Planet_Peop.pdf

- Lomas, K. J., and J. Yingchun. Resilience of Naturally Ventilated Buildings to Climate Change: Advanced Natural Ventilation and Hospital Wards. Science v. 41, 6. 629-653. 2009. http://www.sciencedirect.com/science/article/pii/S0378778809000036

DOCUMENTOS DISPONIBLES EN ESPAÑOL

- Guias sobre medio ambiente salud y seguridad para la instalaciones de atencion sanitaria. *Corporación Financiera Internacional. 30 Abril 2007*. http://www1.ifc.org/wps/wcm/connect/65b19780488555b1b7b4f76a6515bb18/Healthcare_-_Spanish_-_Final-%2Brev%2Bcc.pdf?MOD=AJPERES&CACHEID=65b19780488555b1b7b4f76a6515bb18

DOCUMENTS DISPONIBLE EN FRANCAIS

- Directives environnementales, sanitaires et sécuritaires pour les établissements. Société financière internationale. Avril 2007 http://www1.ifc.org/wps/wcm/connect/5606648048855559b644f66a6515bb18/013_Health%2BCare%2BFacilities.pdf?MOD=AJPERES&CACHEID=5606648048855559b644f66a6515bb18

SITING, DESIGN AND OPERATIONS CHECKLISTS

The checklists in this section provide more detailed guidance on key issues, supplementing the tables in the "Design, Construction, Operations, & Maintenance Guidance" section. Included are checklists for: *latrines, hand wash stations, potable water wells, burn pits, hazardous waste storage areas, and overall operations and maintenance.*

Latrine Siting and Design Checklist

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
SITING				
Soil type 1. Is soil permeable (does the soil allow water to drain away)? 2. Is the soil stable enough to support the latrine?				Certain soils such as clay do not allow liquids to leach out of the pit. This results in solids and liquids accumulating in the latrine pit, causing it to fill faster. Pit latrines are not suitable for impermeable soils. Choose a different location with permeable soil, or select a different type of latrine. Latrines built on unstable soils will need a foundation or frame to give the structure stability. These latrines should be designed with a long life in mind (5+ years).
Rocky Soils 1. Are there rocks at depth that will make it difficult to dig? 2. Are there boulders or fissures?				Identify an alternative location to construct the facility—this will likely be at the same site. If boulders can be avoided from the outset, time and money will be saved.
Water table characteristics 1. What is the depth of the water table? 2. Does it fluctuate seasonally?				Ask community representatives, especially elders about seasonal conditions and historical trends In flooded or high water table environments, it may be necessary to build elevated toilets or septic tanks to contain excreta. (See COMWASH project flowchart for latrine selection in Appendix) Also see the WELL Fact Sheet on *Raised Latrines for On-site sanitation in areas with a high groundwater table* at: http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/lcsahgt.htm
Distance from the clinic 1. How far is latrine site from clinic buildings?				Latrines should be within a convenient distance to encourage use, yet situated at a safe enough distance to reduce odors and the potential spread of disease. Wind direction may vary seasonally, so the ideal location should take this into account. However, latrines should be no more than 50 meters from the clinic buildings.

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
Relationship to water sources 1. Will latrines be located 30 meters away from potential water sources, including wells, pumps, rivers and streams? 2. Will bottom of pit be at least 1.5 meters above the water table (at projected 5-10 year seasonal maximum height)? 3. Are latrines located downgradient (down stream) of any surface water source or shallow groundwater source? 4. Are soils (1) very fine or (2) overlaying fissured rock?				Pit latrines and soakaways (for most soils) must be at least 30 meters from any groundwater source. The bottom of any latrine must be at least 1.5 meters above the water table. Drainage or spillage from defecation systems must not run towards any surface water source or shallow groundwater source. The distances given above may be increased for fissured rocks and limestone, or decreased for fine soils which provide filtration.
DESIGN & OPERATIONS				
Latrine Capacity 1. Will the design capacity be adequate for the expected daily use of the latrine? 2. Will the planned capacity be sufficient for a 5-year lifespan? 3. Does the site allow for separate facilities for staff and patients? 4. Would the latrine be able to accommodate an outbreak in the community? 5. Is there a secondary location on site once this latrine has reached capacity? 6. Will runoff into the latrine pit be a potential issue?				WHO suggests no more than 25 persons per latrine. The design life should be a minimum of 5 years. The suggested size is $1m^3$ per 25 people per year. For a latrine serving 50 people for 5 years, the pit would need to be at least $10m^3$. Ideally, there should be separate facilities for staff and patients. The patient latrine should be located near the waiting area while the staff latrine should be located at a less accessible location for patients. Planning ahead for an outbreak situation and a secondary location is important. It will allow for an easy transition if a latrine needs to be closed for any reason. If runoff may enter the pit, a drainage channel should be dug around it. Alternatively, the latrine can be elevated.
Alternative systems 1. Are alternative systems (natural, mechanical) available? 2. Does the latrine choice require maintenance (sludge removal)?				While these systems may not be required for the site, they should be evaluated to see if they would provide a significant benefit. Latrine designs that require sludge removal will need a maintenance plan that establishes responsibility within the community for sludge removal.
Pest Control 1. Will the latrine be designed to reduce insect vectors?				Use improved latrine designs (such as VIP latrines) and screens to minimize insect vectors and prevent spread of disease.
Maintenance Considerations 1. Can the latrines be easily cleaned and maintained? 2. Has responsibility for cleaning the latrines been clearly established?				Latrines should be cleaned daily. Include smooth, easy to clean floors (concrete, smooth wood, steel) for ease of cleaning. Dump ash or other cover material into the latrine regularly to reduce odors and flies.

Hand Wash Station Siting and Design Checklist

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
1. Are the stations close enough to the latrines to encourage use?				Locate stations close to latrines to encourage use.
2. Are the hand washing stations near the well/pump?				Hand washing stations should be located away from pumps and wells. People should not look at the well as an option for washing. Using the water pump after using the latrine or being in contact with biological hazards will increase the risk of spreading disease.
3. Is a hand washing station located by the hazardous (medical waste) waste storage area?				It is important to have a wash station located near the hazardous waste storage area so the staff member transporting the waste can wash after their duties. The wash station should only be used by the staff member transporting the waste, and this staff member should not use the same station as those using the latrines.
4. Will hygiene signs be posted to promote good hygiene?				Signs and posters should be posted in the latrine, near the hand washing stations, and throughout the clinic to remind individuals to practice good hygiene. Signs should be bright and highly visible and should address patients, visitors, and staff. The signs should be easy to understand and have appropriate pictures and wording.
5. Are there stations for both children and adults?				Stations should be installed that are the proper height to encourage use by both children and adults. Stations for children need to be short enough so that younger children can reach them.

Well Siting and Design Checklist (for Potable Water Supply)

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
1. Is well site located upstream/upgradient of: • Hazardous Material Storage Area • Burn Pit • Latrines • Clinic • Grey Water Disposal (soakaways)				Water wells should be located and designed by competent engineers who should ensure the location is safe, flow is adequate for the facility, and that water quality testing is conducted prior to construction. In addition, the engineer, along with hospital staff should design an environmental management plan that includes water quality testing and identifies a responsible party to conduct testing (see #7 below).
2. Is the well conveniently located for health care staff, but not patients?				The well should only be used by clinic staff; patient and community use may result in contamination and the spread of disease.
3. Will the well meet the water requirements for the clinic, even as climate changes occur?				Estimates are 5 l/day for outpatients and 50 l/day for in-patients. Staff will also likely use 5 l/day. Additional water will be needed for cleaning, washing, laundry, kitchen, and laboratory.
4. Will there be a significant draw on this well in comparison to the available resource?				A large draw can have an impact on groundwater and in some cases surface water. A large draw could result in unforeseen contamination or damage to the pump and well.
5. Will the community have access to the well?				The community should not have access to the well; the use of the well should be restricted to clinic use only.
6. Has responsibility for well and pump maintenance been determined?				Maintenance of wells and pumps is critical. If a pump breaks it should be repaired as soon as possible to prevent staff from getting water at alternative locations.
7. Has a plan for water quality testing and maintenance been determined?				Water quality must be tested for bacteriological contaminants at least monthly. Regular chlorination or any other form of disinfection is recommended to insure daily water quality, even for capped, pumped wells and boreholes.

Hazardous Waste Storage Area Siting and Design Checklist

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
1. Will hazardous waste be treated & buried on-site?				Hazardous waste storage area should be located in close proximity to the burn pit or incinerator, but should be in a location to ensure that hazardous material will not ignite from burn pit or incinerator operations.
2. Will the storage area be secure?				The storage area should not be accessible to waste pickers, children, or other non-staff. Windows, if any, should not be accessible from ground level Facility should be locked, and only those with responsibility for handling hazardous waste should have access to the key.
3. Will the storage area be clearly marked?				Signs and posters should be used to make people aware of the location and purpose of the area.
4. Will the storage area have enough capacity? • Will the waste be treated onsite? • Will waste be shipped off site? If so, how often?				As a rule of thumb, on-site hazardous waste storage should be sufficient for one month's accumulation. This provides reserve capacity in the event of, e.g., incinerator break-down or shut-down of the primary disposal site. Satellite waste storage capacity within the clinic and lab should be less than half of the total capacity of the main storage area.
5. Will chemical and biological wastes be stored in the same area?				If so, they should be clearly labeled and placed be in different locations in the storage area. Allow for appropriate ventilation. Some chemicals may pose a health or explosion risk if indoor air concentrations exceed threshold limits. (See the International Programme on Chemical Safety, http://www.inchem.org/)
6. Have seasonal wind directions been considered?				Wind directions during all seasons needs to be reviewed to ensure fumes from the storage area will not be carried into any building on site or in the local area.
7. Will the storage area be contained so that leaks or spills will be prevented from contaminating nearby waters and land?				Waste storage area should have a concrete berm to contain leaks or spills. The facility should be constructed down-gradient from waterways and at least 50 meters away from any wetland or waterway.
8. Will protective equipment and training be provided?				The storage area should have a sink WITH soap, and depending on the waste to be stored, mask, glove, shower, and other protective clothing and equipment. Only a limited number of staff should be allowed to enter the facility and they should receive training on hazardous waste management, including regular training updates.

BURN PIT SITING AND DESIGN CHECKLIST

Note that *incinerators* are environmentally preferable to burn pits, and advances in appropriate-technology incinerators make high-temperature incineration feasible for small-scale facilities in many cases. However, proper incinerator operation and maintenance is critical to good incinerator performance. If an incinerator is to be constructed or installed a competent engineer with expertise in this field should be consulted. For an overview of incinerator technologies, see USAID Sector Environmental Guideline: *Healthcare Waste*.

If a burn pit is to be used, see *USAID* Sector Environmental *Guideline: Healthcare Waste* to help determine what type of waste will be burned.

SITING AND DESIGN CONSIDERATIONS	YES	NO	DON'T KNOW	COMMENT
1. Will the site be located near the hazardous waste storage area?				If the pit will be used to burn hazardous waste, the burn pit should be located near the hazardous waste storage area to allow for easy treatment. However, some hazardous and general waste should never be burned. Prior to deciding what type of waste may be burned in the burn pit, ensure that a chemical engineer or similar specialty is consulted.
2. Can the site potentially affect groundwater or surface water?				If the location of the pit could lead to contamination of groundwater the pit should be lined (usually with clay) or relocated. Pit should have a windbreak and roof to prevent rains or winds disbursing pit contents.
3. Could the burn pit cause poor or dangerous air quality for the surrounding community and the health facility's patients?				If possible, pit should be located so that prevailing winds pull the fumes away from patients and the community. Burns should be undertaken at times of the day when air movement is away from population centers and the health facility. Only materials that will not create hazardous fumes should be burned.
4. Does the site allow for an ash or other cover material storage area?				An area close to the burn pit should be dedicated to storing cover material. Cover material can also be used to reduce odors and insects in latrines.
5. Does burn pit have sufficient capacity?				See also S. Batterman. *Assessment of Small-Scale Incinerators for Health Care Waste*. http://www.who.int/immunization_safety/publications/waste_management/en/assessment_SSIs.pdf
6. Is burn pit secured against unauthorized access?				Consider constructing a fence around the pit and placing danger signs.
7. Does burn pit have a maintenance plan?				Ensure a maintenance plan is prepared with participation of facility staff.

OPERATION AND MAINTENANCE CHECKLIST

Use this operation and maintenance checklist (revised for the specific facility) to make sure that facility guidelines are adhered to. Appropriate parts of the checklist should be incorporated into and used in conjunction with a health facility's routine program of quality assessment and assurance and should be made available for health facility staff to review.

PLANNING FOR OPERATIONS AND MAINTENANCE	COMMENT
1. Create an emergency response plan and train staff annually for handling disease outbreaks	
2. Create a waste management plan (including safe disposal of expired or unused pharmaceuticals) and train staff annually	See "Minimum elements of a complete waste management program" in USAID Sector Environmental Guideline: Healthcare Waste
3. Create a plan and train staff annually in safe clean-up of chemical spills and hazardous wastes	
4. Create a plan and train staff annually for chemical/pesticide poisoning	
5. Create a plan and train staff annually in safe use of chemicals for bed-net treatment programs	
DAILY CLEANING AND MAINTENANCE	**COMMENT**
6. Sweep clinic buildings, latrines, laboratories, kitchen, and verandas	
7. Clean and disinfect clinic floors, sinks, and surfaces	
8. Dust furniture with a clean cloth	
9. Remove spider webs, bird's nests, and wasps nests from walls and rafters	
10. Water trees, shrubs, gardens, and live fencing at the roots in the evening for maximum water retention	
11. Wedge doors and shutters securely to prevent wind damage to walls and door frames	
12. Empty all waste bins (including bins in latrines and kitchens) daily and remove full sharps containers to waste sorting areas	
13. Inspect incinerators and burn pits for unburned wastes	Incinerators and burn pits must never be used for storage of hazardous materials
14. Clean and disinfect latrines and handwashing stations	
15. Clean all surgical instruments with soap and water, the autoclave daily (or more frequently depending on clinic needs).	If autoclaving only once per day, wash and immerse instruments in a chlorine bleach for 30 min before next use. If autoclaving not feasible, boil all instruments prior to reuse.

16. Add ash from kitchen fires to latrine pits to control odor	
17. Disinfect water supply system (including storage tanks) with 1% chlorine solution	
18. Inspect storage areas and waste storage areas to insure that no trash or water is in the area	Store wastes and supplies on shelves on in elevated drums in a location well-protected from the elements. Line storage areas for insecticides and hazardous materials and wastes with concrete and surround with an earthen berm to control potential spills
19. Inspect storage areas and waste storage areas to ensure that materials for cleaning up spills are available	
20. Ensure soap, bleach, and medical charcoal are available in storage facilities and treatment areas	
REGULAR PREVENTATIVE MAINTENANCE	COMMENT
21. Build low embankments around clinic buildings (including latrines) to protect foundations	
22. Weed clinic grounds regularly	
23. Wash walls and furniture each month	
24. Channel run-off from gutters into rainwater harvesting basins or soakpits	
25. Grease hinges, doorknobs, and locks on all doors	
26. Clean gutters, funnels, screens, and drains	
27. Repair screens over windows in clinic buildings, latrines, and kitchens immediately	
28. Inspect security bars or gratings over windows monthly and repair damage immediately	
29. Inspect secured storage cabinets and locks on secured storerooms monthly and repair damage immediately	
30. Inspect furniture for cracks and broken supports	
31. Inspect waste storage areas and repair fencing and wind breaks	
32. Plant live fencing around clinic grounds to prevent animals, children, and others from wandering in buildings	
33. Plant native trees around the facility to add more shade in hot climates, and protect against wind and dust storms	
34. Test water supply for bacterial contamination at least monthly	
35. Inspect water supply pumps, tanks, and pipes for leaks and cracks	
36. Regularly inspect emergency medicines and supplies for spoilage, expired medications, and loss of supplies	

37. Boil recyclable hazardous waste before reusing	
38. Incinerate non-recyclable hazardous waste, sharps, and expired pharmaceuticals	If using a burn pit, bury burn residue under a layer of soil after every burn.
39. Clean pesticide/chemical containers before disposal	See instructions in mitigation and monitoring tables for safe disposal of pesticide storage containers.
PERIODIC/ANNUAL MAINTENANCE	COMMENT
40. Repair cracks in building walls, floors, and roofs	
41. Repair cracks walls or fencing around clinic	
42. Repair holes and gaps in roofing material	
43. Repair or replace broken equipment (beds, chairs, desks, cabinets, shelves, etc)	
44. Repair gutters, funnels, and screens before start of rainy season	
45. Repaint cracked or chipped walls and furniture	
46. Repair water supply pumps immediately	
47. Apply anti-termite treatment according to manufacturer's instructions	
48. Provide gloves and protective wear for cleaning staff, and train all staff in proper handling of chlorine bleach	
49. Inspect clinic grounds after every rainstorm to identify areas of water pooling	