GUIDANCE FOR INCLUSION OF EMERGING INFECTIOUS DISEASES IN HEALTH AND ENVIRONMENTAL IMPACT ASSESSMENTS
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>1</td>
</tr>
<tr>
<td>Industrial Development Projects and Emerging Infectious Diseases</td>
<td>2</td>
</tr>
<tr>
<td>Emerging Infectious Diseases and Impact Assessments</td>
<td>3</td>
</tr>
<tr>
<td>Screening</td>
<td>5</td>
</tr>
<tr>
<td>Checklist</td>
<td>5</td>
</tr>
<tr>
<td>Scope</td>
<td>7</td>
</tr>
<tr>
<td>Additional Baseline Data to be Collected</td>
<td>7</td>
</tr>
<tr>
<td>Assessing Potential Vulnerabilities to Emerging Infectious Diseases</td>
<td>8</td>
</tr>
<tr>
<td>Action Plan</td>
<td>13</td>
</tr>
<tr>
<td>Monitoring and Evaluation</td>
<td>17</td>
</tr>
<tr>
<td>Figures</td>
<td></td>
</tr>
<tr>
<td>Figure 1: Hotspot Risk Map of Wildlife EIDs</td>
<td>2</td>
</tr>
<tr>
<td>Figure 2: Planning Tool Applications in Project Cycle</td>
<td>4</td>
</tr>
<tr>
<td>Figure 3: Cascading Effects of On-Shore Oil Development</td>
<td>9</td>
</tr>
<tr>
<td>Figure 4: Transmission Routes</td>
<td>15</td>
</tr>
<tr>
<td>Figure 5: Preventative Measures</td>
<td>16</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
</tr>
<tr>
<td>A: Zoonotic and Vector-Borne Viruses of Concern</td>
<td>18</td>
</tr>
<tr>
<td>B: Example Preventative Mitigation Measures</td>
<td>20</td>
</tr>
<tr>
<td>Selected References</td>
<td>25</td>
</tr>
</tbody>
</table>
Executive Summary

Recent outbreaks of emerging infectious diseases (EIDs)—including the 2014-2016 Ebola virus crisis in West Africa—have had major economic impacts on industries operating in the affected areas in the form of trade, travel, and supply chain disruptions. In some cases, they have completely shut down operations. EIDs have cost the global economy billions of dollars over recent decades, and the rate of disease emergence appears to be increasing, with the majority of recent EIDs originating from animals (“zoonoses”), primarily wildlife. The highest risk is in “hotspots” that have rich biodiversity, poor public health infrastructure, and ecological disruptions to landscapes. While EIDs seem to appear without warning, and public health measures to address EIDs have primarily been reactive, it is possible to anticipate risks and take preventative steps against vulnerabilities and potential impacts to business operations.

This Planning Tool and its associated Audit Guidelines are intended as resources to aid industries and funders in identifying potential project vulnerabilities to EIDs and proactively taking steps to be more resilient to the risk of many different types of communicable disease events. These documents are intended to supplement (not replace) existing guidelines (e.g. IFC, World Bank, and internal), as exposure to zoonotic pathogens requires a more holistic analysis than normally taken in environment and social impact assessments or health impact assessments. Importantly, many of the measures that can be used to prevent emergence and spread of zoonotic diseases may also reduce the burden of vector-borne, water-borne, and food-borne illness, and other endemic diseases (e.g. TB, Malaria, Dengue, HIV & other STIs, etc.), in addition to promoting environmental safeguards.

The Planning Tool provides background information on EIDs, including risk factors for their emergence and their transmission routes. A screening checklist is provided to determine whether EID risk should be considered in an impact assessment (health, environment, or social). The tool highlights additional baseline information not routinely collected during environmental, social, and health impact assessments. In addition, it details how such information can enhance the existing planning process, and provides examples and templates for known zoonotic disease risk for specific locations (most based on publically available information). Most tangibly, specific transmission mitigation opportunities are highlighted with their indicators, surveillance methods, and sectoral responsibilities noted.

While individual pathogens and transmission factors may be complex, the Planning Tool and Audit Checklist focus on exposure and transmission pathways, and broad measures that can help identify and reduce transmission risk. Many of the assessment topics will be familiar to planning managers, but the tools provide additional considerations that can help assess EID vulnerabilities.

While the guidelines emphasize minimizing contact or avoiding opportunities with animals and vectors (mosquitos, ticks, etc.), it is important to note that animal extermination/culling measures around a facility are rarely appropriate as the associated loss of biodiversity may have negative health outcomes (select exceptions may be warranted, e.g. extermination of commensal rats in living areas, but emphasis should be placed on rodent-proofing structures and food sources that may attract pests). Thus, the Planning and Audit Tools promote measures based on the best available science, and are designed to balance health and environmental considerations, encouraging involvement of wildlife authorities/environmental managers in addition to health experts on decision-making for pest control.

The Planning Tool and Audit Guidelines provide science-based guidance (with key technical sources provided) compiled by a team of infectious disease, biodiversity and international development experts under the USAID Emerging Pandemic Threats program. Please note that this is a living document and is subject to revision as new information becomes available.
Industrial Development Projects and Emerging Infectious Diseases

The 2014-2016 Ebola outbreak in West Africa brought to light the devastating effects of emerging infectious diseases on the local population as well as the severe disruption to economies and in many cases, large-scale industrial activities. Although Ebola had never been documented in that part of West Africa, the conditions were present and not fully appreciated not only for the presence of Ebola, but also for its widespread transmission. Ebola is not the only emerging infectious disease disrupting work flows. Outbreaks of Marburg hemorrhagic fever, caused by a virus related to Ebola and harbored by select bat species, resulted in the shutdown of gold and lead mining sites as well as caves popular with ecotourists. The majority of human infectious pathogens have originated from animal transmission to humans (“zoonotic diseases”), and of these, the majority of emerging and re-emerging infectious diseases originate in wildlife. Three wild animal groups, which comprise approximately 70 percent of mammal species, are considered most likely to spread new infections to people: bats (Corona virus responsible for SARS and Marburg, Nipah, and Rabies viruses), rodents (Lassa, hanta, and monkeypox viruses) and non-human primates (transmission of Ebola and origins of HIV). People contract these diseases by inhalation of aerosolized contaminated feces and urine; through direct contact via scratches, bites, and bodily fluids—such as blood and saliva—that can occur during hunting, butchering, and food preparation; and by ingesting contaminated food, water, or undercooked meat.

Figure 1: Hotspot Risk Map of Wildlife Emerging Infectious Diseases

A study conducted by Jones et. al. (2008) analyzed the drivers for disease emergence and identified where emerging infectious diseases are likely to originate. These places are informally known as disease “hot spots” (see Figure 1). The emergence of infectious diseases of zoonotic origin was associated with high wildlife biodiversity and human population density. While the “hot spot” map
identifies locations in both developed and developing countries, the weaker health care, water, food, and waste management infrastructures of developing countries may not be able to identify or address existing health needs or ones that could be associated with emerging or re-emerging diseases of zoonotic origin. Industrial development in these types of areas can cause a population influx of job seekers and their families that further stresses the already taxed infrastructures. Stressed systems are more likely to break down, creating ideal conditions for increased communicable or infectious disease transmission.

Population growth in combination with industrial development can lead to changes in the distribution and abundance of wildlife and its associated pathogens. Especially in remote areas, people may interact with wildlife with which human contact was previously limited or non-existent, exposing them to novel pathogens for which they have no prior immunity. Increasing contact among people, domestic animals (e.g. livestock), and wildlife populations increases the likelihood of disease transmission among/between species. For example, wildlife may become a nuisance by taking advantage of new food sources and habitats created at construction camps, canteens, and villages. Wildlife may raid crops in fields that border their habitat, invade labor camps and homes, become violent, or eat infected animals. Hunting pressure for bushmeat may increase.

Although we cannot predict exactly when emerging infectious disease outbreaks are going to occur, there are public health prevention, environmental, and social strategies that industry can employ to minimize risks associated with both known and emerging infectious diseases. This tool is designed for industries to proactively examine their proposed projects in “hot spot” areas in order to identify vulnerabilities to zoonotic pathogens and to develop strategies to minimize risks of emerging infectious diseases while minimizing exposure to food-, water-, and certain vector-borne infectious diseases.

Emerging Infectious Diseases and Impact Assessments

Addressing emerging infectious diseases is an environmental, health, and social issue, requiring a collaborative approach that bridges these fields. This document provides the steps to incorporate emerging infectious diseases of zoonotic origin into a health, social, or environmental impact assessment, and into a company’s internal hazard or risk assessment process. Examining the issues that can lead to zoonotic pathogen exposure requires a more holistic analysis than normally taken because those issues are associated with a range of industrial activities including biodiversity/conservation management, facilities management (camp, canteen, water, and waste), worker health, and community health/corporate social responsibility. Other analyses would not normally be conducted in either an environmental, health, or social impact assessment, so this document provides guidance on the topics to consider, how analyses could be conducted, and what mitigation measures could be adopted.

While this document is not intended to provide definitive guidance on how to incorporate zoonotic diseases into impact assessments, it does aim to provide sufficient information and guidance for a practitioner to know what information needs to be gathered and analyzed to determine the possibility of exposure and guide risk mitigation. This document is part of a set of guidance documents and other tools that can be used by industry to assess and address their vulnerabilities to zoonotic diseases. Figure 2 illustrates where this planning tool falls in the industrial project cycle and the environmental, social, and health impact assessment cycle.
Figure 2: Planning Tool Applications in Project Cycle
This document assumes that a practitioner has a basic knowledge of impact assessment processes.

Adding this type of analysis supplements the depth of an impact assessment and addresses portions of the following IFC Performance Standards:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labor and Working Conditions
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

**Screening**

To determine whether emerging infectious diseases of zoonotic origin should be considered in an impact assessment, a basic understanding of the zoonotic disease exposure potential is essential. The following screening checklist seeks to identify whether a proposed/existing project is in an area with a potential for zoonotic disease exposure and to identify if there will be/are activities that might exacerbate the risk of transmission.

**Table 1**

<table>
<thead>
<tr>
<th>Screening Questions</th>
<th>Yes/No</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>1. Will the project be located in an area where there are wildlife species that could host zoonotic diseases? (See Appendix A.) Is the site ecologically similar to areas where zoonotic diseases have emerged?</td>
<td></td>
<td>Hot spots with a higher risk of emerging infectious diseases are located throughout the world, but especially in those places with increased land-use change, human population growth, and high biodiversity. (See Figure 1.)</td>
</tr>
<tr>
<td>2. Will the project be located in a previously undeveloped area or natural area? Will existing land use cover change significantly so that wildlife habitat will be lost or significantly modified in or near the project site?</td>
<td></td>
<td>The likelihood of contact with wildlife, their fluids, or excreta increases in areas being converted from natural habitats to developed areas.</td>
</tr>
<tr>
<td>3. Will the project require constructing new roads or rail or transmission line/pipeline corridors through relatively intact forest or otherwise natural habitats?</td>
<td></td>
<td>Roads and corridors increase the interaction of human and wildlife by opening up new areas for hunting, logging, and agricultural colonization. Habitats are often modified, and certain species are favored at the road interface. Roads are used to transport bushmeat, livestock, and animals destined for the wildlife trade.</td>
</tr>
<tr>
<td>4. Will an onsite temporary or permanent camp be established?</td>
<td></td>
<td>Camps, canteens, and food/waste/water management facilities can attract pests/wildlife, increasing potential contact between people and wildlife and their excreta, and increasing transmission risk.</td>
</tr>
<tr>
<td>Screening Questions</td>
<td>Yes/No</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------------</td>
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</tr>
<tr>
<td>5. Will there be a fly-in/fly-out population? Will workers travel in and out of the project area, with the potential to carry infectious diseases acquired in the project location to their home locations and introduce diseases from outside into the project area? Within the country? Internationally?</td>
<td>Exposed people could leave the facility without knowing that they are sick and expose others along transportation routes.</td>
<td></td>
</tr>
<tr>
<td>6. Will the infrastructure in surrounding communities be insufficient to accommodate any anticipated population expansion? Is this already a problem?</td>
<td>Insufficient potable water, sanitation, health care, and vector control can amplify any infectious disease that occurs locally.</td>
<td></td>
</tr>
<tr>
<td>7. Do the local communities have inadequate health care facilities to address local health care requirements? Are existing medical treatment and diagnostic services insufficient to manage an outbreak of infectious diseases known to be in the project location?</td>
<td>Inadequate or insufficient local health care facilities can mean that diseases in the local communities can be brought to the facility.</td>
<td></td>
</tr>
<tr>
<td>8. Will an international medical evacuation plan be required or available to transport and treat workers with potentially contagious infectious diseases?</td>
<td>International movement may facilitate international spread.</td>
<td></td>
</tr>
<tr>
<td>9. Will a relatively large labor influx occur compared to the existing population?</td>
<td>New immigrants to an area may not have immunity to endemic diseases or may bring new diseases to an area. Project-induced labor and other in-migration can strain local health and other infrastructure systems. Poorly functioning water and waste management as well as health care systems can result in the amplification of infectious disease transmission.</td>
<td></td>
</tr>
<tr>
<td>10. Will the employees have to source their own food (i.e., the company will not provide a food source)?</td>
<td>The increase on food demand from the new facility on the local area could exacerbate pressure on existing food sources, availability and pricing, and natural resources, therefore increasing hunting pressure and the use of non-forest timber products, including expanding agriculture into new areas that may have been previously undisturbed. If a reliable protein source is not provided, employees may have to rely on food from hunting.</td>
<td></td>
</tr>
<tr>
<td>11. Will livestock be on-site or near the site? Will staff be allowed to have pets on-site?</td>
<td>Pathogens can be transmitted between wildlife and domestic animals. People can then acquire pathogens from domestic animals. Likewise, livestock introduced to new areas may bring diseases for wildlife and people.</td>
<td></td>
</tr>
<tr>
<td>12. Will there be on-site agricultural production? Will additional in-migration lead to agriculture expansion in adjacent areas?</td>
<td>Grain and fruit production attracts wildlife and pests. Food products can be contaminated from animal byproducts and/or direct contact with wildlife.</td>
<td></td>
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</tbody>
</table>
While no individual item(s) from the checklist necessarily implies that a project would be vulnerable to zoonotic diseases, a combination of factors could increase the potential for exposure to zoonotic or other communicable diseases. Therefore, if the answer to question 1 and any other question(s) is “yes,” it is worthwhile to further examine the potential of emerging infectious diseases for your project area.

Please keep in mind when going through the screening checklist that emergence events are rare, but when they occur there can be devastating consequences. The risk of potential exposure needs to be balanced with the other risks inherent in the proposed project. However, many of the steps highlighted can also reduce the risk of endemic, food-, water-, and vector-borne diseases, as well as manage environmental and social risks.

**Scope**

Since this assessment is intended to be incorporated into an existing or ongoing assessment, it is presumed that the geographic and temporal boundaries of any analysis have already been established as have the potentially vulnerable populations. Unlike many standard environmental, social, or health impact assessments, both worker and local populations must be considered. Worker populations are considered in company risk or hazard assessments, but in this assessment they are considered on a continuum with the local population as they may reside in the community (if on-site housing is not provided), or come into frequent contact with the community.

**Additional Baseline Data to be Collected**

Baseline environmental, social, and health data are collected to support the impact assessment process. To assess the potential for exposure to zoonotic pathogens, it is necessary to not only understand the characteristics and behaviors of wildlife species endemic to a project area, but to also take into account a local community’s relationship to them. These data would supplement various components of the baseline data. Table 2 provides suggested topic areas where these data would supplement the baseline data collection and indicates whether that data is normally collected as part of an ESIA or HIA.

**Table 2**

<table>
<thead>
<tr>
<th>Data To Be Collected</th>
<th>ESIA</th>
<th>HIA</th>
<th>Usually Included?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain or generate a species list of wildlife endemic to the area, including rodents.</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Determine whether the most common wildlife species are known carriers of zoonotic pathogens, what their ecological behaviors are (e.g. roosting in caves), and what they typically eat.</td>
<td>No</td>
<td>Maybe</td>
<td></td>
</tr>
<tr>
<td>Have there been outbreaks of those diseases? Among people? Wildlife? Livestock? When? Are there any undiagnosed illnesses reported by health authorities or local clinics?</td>
<td>No</td>
<td>Maybe</td>
<td></td>
</tr>
<tr>
<td>Determine how the project will feed its personnel. Will the project provide food for all staff or only expatriate staff?</td>
<td>No</td>
<td>Maybe</td>
<td></td>
</tr>
<tr>
<td>Determine sources of protein for existing and increased population; if bushmeat is used as a source of protein, what species are hunted?</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Determine what methods are used in harvesting, butchering, transporting, and preparing bushmeat.</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Data To Be Collected</td>
<td>ESIA Usually Included?</td>
<td>HIA Usually Included?</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Determine how local communities interact with rodents, bats, and non-human primates, and what potential exposure pathways exist between these animals and humans in the area.</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>What wildlife species are considered pests? What are the local methods to control these pests?</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Determine the capacity of the local community’s infrastructure with respect to potable water supply, sanitation, and vector control.</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Determine the capacity of the local community’s infrastructure with respect to health care and veterinary services.</td>
<td>No</td>
<td>Maybe</td>
<td></td>
</tr>
<tr>
<td>Assess potential sources of food for rapidly increasing population, including the extent and location of potentially arable land.</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Current population of the project area.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>If possible, collect data from local governmental and non-governmental organizations regarding existing local wildlife diseases.</td>
<td>No</td>
<td>Maybe</td>
<td></td>
</tr>
<tr>
<td>Assess types of nearby wildlife habitat, its integrity, and the extent to which it is at risk of conversion, fragmentation, and/or degradation due to project-induced population influx.</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Please note that a general social/livelihoods baseline is important to enable holistic understanding of local community and their potential to adapt to changes and social management plans (including management of health risks).

**Assessing Potential Vulnerabilities to Emerging Infectious Diseases**

A project’s potential vulnerability to emerging infectious diseases were identified in the screening checklist and illustrated below.
To assess areas of vulnerability, this guidance’s approach is to examine the components of projects that could increase or decrease vulnerability to EID exposure as a means of identifying where prevention measures could be used. Unlike other impact analyses that focus on the changes that occur to the environment and local populations, this analysis also evaluates how the project will protect its employees from exposure to food- and water-borne diseases and communicable diseases. Therefore, one of the first steps is to examine how the camp and facilities will be managed. The other areas that have to be examined are wildlife management, community health, and infrastructure. The following provides questions that should be evaluated during impacts for each topic areas.

### Table 3

**WORKER HEALTH**

1. *Living Quarters:* If temporary or permanent living quarters will be constructed at the facility, it is necessary to determine whether the quarters are designed to minimize the potential for transmission of communicable disease.
   a. Will the on-site housing comply with international standards with respect to ventilation, space, and sanitation? Will it be designed to prevent communicable disease transmission?
   b. Will there be measures to protect facilities against non-human primate, rodent, and bat infestations – Are pest animals considered in the design? Are there measures to prevent pest wildlife and vectors from entering offices, residences, and facilities?

2. *Canteen:* If the camp will have a canteen, measures to ensure the quality of the food as well as how waste food would be handled should be considered.
   a. Food handling – Will food handling procedures be in place to minimize transmission of any

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**Figure 3: Cascading Effects of On-Shore Oil Development on Increasing Contact Among People, Domestic Animals, Vectors and Wildlife**

![Figure 3: Cascading Effects of On-Shore Oil Development on Increasing Contact Among People, Domestic Animals, Vectors and Wildlife](image-url)
**WORKER HEALTH**

- communicable disease in the food preparation or serving process?
- Food supply chain and storage – Will food storage be such that food cannot be contaminated by pest animals or insects? Will the food supply chain be inspected to ensure no contamination?
- Food waste – Will food be disposed of in a manner that it will not attract pest animals or insects?

3. **Clinic:** If an on-site healthcare facility will be available, measures to address communicable disease and potential outbreaks should be considered.
   a. Capacity (for treatment; for preventive services) – Will the facility be able to diagnose communicable diseases? Will the facility have sufficient capacity to treat an outbreak?
   b. Disease outbreak preparedness plan – Will the facility have an outbreak plan? Will it cover the endemic communicable diseases? Will it address how to deal with unknown diseases? Do health technicians query about contact with animals or their excreta?
   c. Laboratory – Will the on-site clinic have an on-site laboratory? Will the clinic have access to a laboratory for advanced diagnostics if the on-site laboratory is unable to confirm diagnoses?
   d. Will the clinic communicate and share information with the local health facility about infectious disease incidences and unusual illnesses? Will it provide weekly surveillance data to the local health authority?
   e. Will there be a laboratory and/or dedicated healthcare waste management system?

4. **Waste Management/Pest Control:** All camps and facilities have to manage waste. Improper waste management can attract pest or nuisance animals. Aspects of waste management to consider are listed below.
   a. Landfill management – Will international or local standards be used for the construction and operation of the landfill? Will the landfill be managed so that it does not attract pest animals?
   b. Trash management – Will garbage be managed so that it will not attract pest animals? (covered containers, picked up regularly)
   c. Pest control measures – Will the facility have a pest management control program to address pest/nuisance animals and other vectors?
   d. If agricultural production is allowed within a concession:
      i. Will there be measures to protect livestock from wildlife?
      ii. Will there be measures to exclude wildlife from crops or fruit trees?
      iii. Will there be measures to exclude wildlife or pests from crop storage areas?
      iv. Will there be measures to safely manage livestock biowaste (e.g. from diseased animals, animal waste if treated with pharmaceuticals, etc.)?

5. **Water Management:** Water can be a habitat for insect vectors and can also be contaminated if not properly stored.
   a. Vector control measures – Will measures be in place to minimize the amount of standing water that could provide vector habitat?
   b. Water purification – Will drinking water be treated?
   c. Water storage – Will water storage be secure from potential contamination?
   d. Other wastes – Are wastewater, sewage, food, and any other waste materials disposed of according to local or IFC/World Bank standards?

**BIODIVERSITY/WILDLIFE MANAGEMENT**

6. **Wildlife Species and Pathogens:** All wildlife species may host pathogens; however, not all will adversely affect people.
   a. Are the wildlife species present known to host pathogens of concern for people?

---

1 Water and sanitation, including wastewater and sewage: [http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-Water%2Band%2BSanitation.pdf?MOD=AJPERES](http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES)

Waste management, including food waste, trash, and landfills: [http://www.ifc.org/wps/wcm/connect/1cd72a00488557cfdbf4ff6a6515bb18/Final%2BWaste%2BManagement%2BFacilities.pdf?MOD=AJPERES&d id=1323162538174](http://www.ifc.org/wps/wcm/connect/1cd72a00488557cfdbf4ff6a6515bb18/Final%2BWaste%2BManagement%2BFacilities.pdf?MOD=AJPERES&d id=1323162538174)
### Biodiversity monitoring and management strategy

Habitat changes, such as creating corridors or fragmenting habitat can alter biodiversity, favoring animal species that are more tolerant of people or that seek out human-made resources, such as rodents. Some of these types of animals are known to host zoonotic diseases.

- Will the biodiversity management program consider animals that carry zoonotic diseases, such as rodents?
- Will hunting be allowed on the concession? Within the project footprint?
- Will there be an internal system for reporting wildlife morbidity or mortality? Will there be an external system in place for reporting wildlife morbidity or mortality to wildlife authorities?

### COMMUNITY HEALTH

#### 8. Community Clinic

Many on-site workers are from the local communities, so infectious diseases in the community can spread to the workplace. Community health can also be affected by the influx of workers and other migrants.

- Do the local communities have a health care facility?
- Does the community health care facility have the capacity and equipment to address the health needs of the communities it serves?
- Does the health care facility track local disease outbreaks? Does it have a laboratory? Does it have access to a laboratory for advanced diagnostics for unknown diseases?
- Does the facility have a healthcare waste management strategy?

#### 9. Community Infrastructure

Is the community vulnerable to infectious disease transmission due to deficiencies in its infrastructure? Is the infrastructure adequate to address the needs of the existing population and the anticipated growth in population?

- Do the communities have features to prevent pest/nuisance animals from accessing agriculture and food storage? Community waste disposal? Drinking water sources?
- Does the community have a sanitation system?
- Does the community maintain a landfill?
- Do the communities have adequate drainage to prevent creation of vector habitat?

#### 10. Community Practices

Is the community vulnerable to infectious disease transmission due to cultural practices?

- Does the community have a bushmeat market or involvement in other wildlife trade?
- Does the community engage in subsistence hunting?
- Does the community practice traditional activities that could facilitate the spread of communicable diseases (e.g., burial practices)?

#### 11. Community Food Supply

Will the project be feeding its workers?

The presence of a large-scale project during both construction and operations could put increased demands on local food suppliers. As a result, prices could rise and make locals look to bushmeat and forest products to supplement their food supplies.

- What are the local sources of agricultural goods?
- What are the local sources of protein?
- Are there sufficient sources of both to accommodate the increased demand of the project?
- What will be the sources of the project’s food?
Table 4 provides a cross-walk of where information from this analysis could be added to an ESIA or an HIA.

**Table 4**

<table>
<thead>
<tr>
<th>Analysis Area</th>
<th>ESIA Section</th>
<th>HIA Section</th>
<th>New Analysis Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worker Health</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living Quarters</td>
<td>Project Description</td>
<td>Respiratory and Housing</td>
<td>Compliance with International Best Practices(^2) or local requirements for housing</td>
</tr>
<tr>
<td>Canteen – Food safety/security</td>
<td>-</td>
<td>Food &amp; Nutrition</td>
<td>Compliance with International Best Practices or local requirements for food.</td>
</tr>
<tr>
<td>Food Management (storage and disposal)</td>
<td>Waste Management or Terrestrial Biological Resources</td>
<td>Food &amp; Nutrition/Vector-Related Impacts/Soil, Water, &amp; Sanitation</td>
<td>Adequacy of food protection to prevent contamination and not attract pests (animals and insects)</td>
</tr>
<tr>
<td>On-site Clinic</td>
<td>-</td>
<td>-</td>
<td>Evaluate the adequacy of the clinic and community infrastructure to identify and address outbreaks</td>
</tr>
<tr>
<td>Waste Management</td>
<td>Hazards and Public Safety or Waste Management</td>
<td>Vector-Related Impacts/Soil, Water, &amp; Sanitation</td>
<td>Adequacy of waste management to prevent attracting pests (animals and insects)</td>
</tr>
<tr>
<td>Water Management</td>
<td>Water Resources/Waste Management</td>
<td>Soil, Water, &amp; Sanitation</td>
<td>Compliance with International Best Practices or local requirements for water and waste management Adequacy of protection of water resources to prevent contamination from animals, not provide vector habitat, and not attract animals</td>
</tr>
<tr>
<td><strong>Biodiversity/Wildlife Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildlife Endemic Zoonotic Diseases</td>
<td>Terrestrial Biological Resources</td>
<td>Community Profile – Communicable Diseases/Veterinary Medicine</td>
<td>Are local wildlife species present that are known to harbor zoonotic pathogens of concern?</td>
</tr>
<tr>
<td>Biodiversity Management: Wildlife Population as a Result of Habitat Changes</td>
<td>Terrestrial Biological Resources</td>
<td>Veterinary Medicine</td>
<td>How changes in habitat and biodiversity can change wildlife dynamics and increase/decrease wildlife communities and/or populations that may harbor zoonotic pathogens of concern to humans</td>
</tr>
<tr>
<td>Biodiversity Management: Bushmeat Policy</td>
<td>Terrestrial Biological Resources – Management and Mitigations</td>
<td>-</td>
<td>Bushmeat hunting can increase exposure to zoonotic pathogens</td>
</tr>
<tr>
<td><strong>Community Health</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Clinic</td>
<td>Socioeconomics, Utilities and Infrastructure,</td>
<td>Health Services, Infrastructure, &amp; Capacity</td>
<td>Evaluate the adequacy of the clinic and community infrastructures to identify and address outbreaks</td>
</tr>
</tbody>
</table>

\(^2\) e.g., guidance from the IFC: [http://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf](http://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf)
Cumulative impacts are those that could result from the additive effects from past, existing, and reasonably foreseeable projects. These types of impacts are often difficult to evaluate because they require looking beyond the boundaries of the project and examining both historical context and potential future projects in the region. Cumulative impacts could occur that would be associated with increasing the potential exposure to zoonotic pathogens:

1. If the combination of existing and new projects sufficiently change the habitat such that it favors species that host pathogens of concern. If wildlife habitat is removed completely, then many species would not survive; however, other species may become established and/or become more abundant (e.g. many rodent species thrive in human habitats).
2. If the existing community infrastructure is already stressed or inadequate, the addition of one new project may or may not add further stress, but if multiple projects are planned for the same general area, the community infrastructure could be stressed to the point that systems begin to break down.

**Action Plan**

Preventing or minimizing exposure to emerging or existing infectious pathogens of zoonotic origin should be addressed at multiple levels. Appendix B includes representative mitigation measures that could be included in an action plan.

At a company/community/regional level, mitigation measures should focus on:
- Maintaining intact habitats and preserving biodiversity
- Educating and institutionalizing general public health measures to prevent infectious disease transmission and outbreaks
- Preparing for disease outbreaks

Preparing for disease outbreaks not only involves having an outbreak plan, but also establishing and maintaining communication networks with health care providers, local governments, NGOs, and other companies and industry groups. This may take the form of joint simulations, meetings, phone networks, designated points of contact and trigger points, and standing task forces, among other approaches.

For individuals, mitigation measures should focus on preventing direct or indirect contact with wildlife or their excreta by:
- Not creating habitat or food sources for wildlife or pests where people live and work
- Limiting or preventing contact with wildlife or their excreta
- Institutionalizing basic public health control measures to minimize the transmission of pathogens
• Educating individuals to safeguard against pathogen transmission

Figures 4 and 5 provide frameworks to use in formulating prevention/mitigation strategies.

While preventing exposure is preferable, all action plans should have a preparedness plan for disease outbreaks. The Ebola outbreak provided examples of actions that facilities can take to limit transmission during an outbreak such as:

• Installing hand-washing facilities with potable water and soap at the entry point to all camps, offices, canteens, and residential areas, and educating the workforce to use them
• Installing temperature screening devices at the entrance of camps
• Ensuring safe handling of healthcare waste and dead bodies for infection control
• Providing accurate evidence-based information about diseases to dispel rumors

General use of hand-washing facilities can reduce transmission of multiple communicable diseases. Temperature monitoring during the Ebola epidemic identified other febrile diseases.
Figure 4: Practices *Individuals* Can Take to Reduce the Potential for Zoonotic Disease Transmission Risk

**Transmission Routes**

- **Blood**
- **Saliva**
- **Urine/Feces**

**Fomite/skin**
- Bites, scratches and cuts while butchering

**Food**
- Bitten fruits, contaminated stored grains and undercooked meats

**Water**
- Shared water and open water sources

**Air**
- Aerosols

**Transmission Prevention**
- Avoid eating bitten fruit
- Avoid contact with sick or dead animals
- Practice good hygiene
- Wash cuts and scratches with soap
- Cook all meat at 56°C
- Wash fruit before eating
- Drink treated water
- Cover mouth and nose (using a mask or respirator) in risk areas (e.g. caves, mines, storage areas)

**INFECTED ANIMAL**
- Blood
- Saliva
- Urine/Feces

**HUMAN DISEASE**
Figure 5: Practices Companies Can Take to Mitigate the Potential for Zoonotic Disease Transmission

**Preventative Measures**
- Protect animal habitat
- Livestock in biosecure enclosure

**Transmission Routes**
- Blood
- Saliva
- Urine/Feces

**Transmission Prevention**
- Prohibit hunting concessions
- Protect food storage
- Protect water sources
- Manage waste; Housing to exclude bats & rodents

**Fomite/skin**
- Bites, scratches and cuts while butchering

**Food**
- Bitten fruits, contaminated stored grains and undercooked meats

**Water**
- Shared water and open water sources

**Air**
- Aerosols

**Transmission Prevention**
- Provide vaccinations
- Treat drinking water
Monitoring and Evaluation
Monitoring and evaluation (M&E) of any mitigation strategies should be implemented. Key performance indicators used could be structural, process, and outcome based.

Structural
- Staff housing characteristics (adequate and appropriate space per individual, sanitation, food storage)
- Landfill characteristics (adequate size; appropriate cover to discourage pests; appropriate and adequate runoff control; appropriate distance from housing, village, and other human-used facilities)
- Waste bins (covered and secure to prevent raiding by wildlife, and emptied regularly)
- Reduction or elimination of open water (gutters, ditches, water containers, etc.)
- Facility structure characteristics (measures to discourage bat roosting and rodent invasion)

Process
- Implementation of Biodiversity Monitoring Plan and establishment and enforcement of policies on bushmeat and other wildlife trade
- Implementation of integrated pest management to reduce animal pest and insect abundance, including implementation of appropriate waste management procedures to prevent attracting insects and vermin
- Implementation of food – procurement, safety/security, handling, and disposal – procedures to eliminate potential contamination by pests
- Operational disease monitoring, surveillance, and reporting plan
- Operational disease outbreak plan that is evaluated annually
- Compliance with local and national health reporting requirements, consistent with the World Health Organization International Health Regulations

Outcome
- Maintenance of intact habitats and biodiversity around the facility
- Number of infectious disease events or outbreaks
- Number of pests trapped or frequency of pests observed
- Number of adverse wildlife encounters (e.g. bites, scratches)
- Amount of on-site hunting
- Number of occurrences of bushmeat procurement
- Amount of bushmeat and animal products destined for wildlife trade found in company vehicles or at exit gates
Table A-1 provides an example of the types of information that should be assessed to identify wildlife pathogens that have been identified in and around the project area, potential pathogens associated with wildlife endemic to the project area, and the corresponding transmission pathways of infection associated with these pathogens.

These types of country-level tables can be generated with disease data from WHO Global Health Observatory (http://www.who.int/gho/en/) and Pandemic and Epidemic Disease Reports (http://www.who.int/csr/disease/en/), FAO Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (http://www.fao.org/ag/againfo/programmes/en/empres/home.asp), OIE World Animal Health Information Database for OIE-Listed Diseases (http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home), and select non-listed diseases reported in wildlife (http://www.oie.int/wahis_2/public/wahidwild.php), and may be supplemented by a tool on HealthMap (http://www.healthmap.org/en/). Species range information may also be available via the IUCN Red List of Threatened Species (http://www.iucnredlist.org/) and the Map of Life (https://www.mol.org/). Otherwise, a literature search will have to be conducted by country, pathogen, and research databases (e.g. Olival et al. in review, EcoHealth Alliance).

The presence of these types of pathogens could be incorporated into a company’s risk assessment program.

Table A-1. Examples of Known Zoonotic and Vector-Borne Viruses of Concern

This table is designed as a first level “Hazard Identification” element.

<table>
<thead>
<tr>
<th>Virus</th>
<th>Transmission Pathway</th>
<th>Examples of Known Species Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marburg Virus</strong></td>
<td>Direct contact with infected animal</td>
<td>Franquet’s epauletted fruit bat (<em>Epomops franqueti</em>), Hammer-headed bat (<em>Hypsiphractus montrosus</em>), Egyptian fruit bat (<em>Rousettus aegyptiacus</em>), Great long-fingered bat (<em>Miniopterus inflatus</em>)</td>
</tr>
<tr>
<td><strong>West Nile Virus</strong></td>
<td>Vector-borne</td>
<td><em>Straw-coloured fruit bat</em> (<em>Eidolon helvum</em>), humans</td>
</tr>
</tbody>
</table>
| **Ebola Virus**  | Direct contact with infected animals  | Bats: *Straw-coloured fruit bat* (*Eidolon helvum*), Franquet’s epauletted fruit bat (*Epomops franqueti*), Hammer-headed fruit bat (*Hypsiphractus montrosus*), Peter’s dwarf epauletted fruit bat (*Micropteropus pusillus*), Little collared fruit bat (*Myonycteris torquata*), Egyptian fruit bat (*Rousettus aegyptiacus*)  
Non-human primates: Gorilla (*Gorilla gorilla*), Chimpanzee (*Pan troglodytes*)  
Humans |
| **Chikungunya Virus**| Vector-borne                     | Bats: Egyptian fruit bat (*Rousettus aegyptiacus*), Cape Leaf-nosed bat or Sundevall’s roundleaf bat or Common African Leaf-nosed Bat (*Hipposideros caffer*)  
Rodents: Natal multimammate mouse (*Mastomys natalensis*)  
Humans |
<table>
<thead>
<tr>
<th>Virus</th>
<th>Transmission Pathway</th>
<th>Examples of Known Species Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simian immunodeficiency virus (SIV)</td>
<td>Direct contact with infected animals</td>
<td>Non-human primates: <em>Cercopithecus</em> spp., <em>Lophocebus albigena</em>, <em>Drill</em> (<em>Mandrillus leucophaeus</em>), <em>Mandrill</em> (<em>Mandrillus sphinx</em>), <em>Guerza</em> (<em>Colobus guereza</em>), <em>Chimpanzee</em> (<em>Pan troglodytes</em>)</td>
</tr>
<tr>
<td>Monkeypox Virus</td>
<td>Direct contact with infected animals</td>
<td>Non-human primates: <em>Cercopithecus</em> spp., Rodents: Northern giant pouch rat (<em>Cricetomys</em> spp.),</td>
</tr>
</tbody>
</table>

*Table includes examples of known zoonotic pathogens in mammals and birds as documented in the scientific literature (2000-2011).*
**APPENDIX B: Example Preventative Mitigation Measures**

Table A-2 presents examples of preventative mitigation measures that can be implemented for a large project within a community in a rural setting. It is not meant to serve as a template, but rather to illustrate some of the actions that can be taken.

C&C = Company and Contractor Health Plan  
PACs = Potentially Affected Communities

**Timing:**

<table>
<thead>
<tr>
<th>Timing</th>
<th>Action Plan</th>
<th>Responsibility</th>
<th>Collaborating Agency or Organization</th>
<th>Indicators</th>
<th>Surveillance Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predesign (PD)</td>
<td>Design (D)</td>
<td>Construction (C)</td>
<td>Operations (O)</td>
<td>Decommissioning (DC)</td>
<td></td>
</tr>
</tbody>
</table>

**Emerging Zoonotic Disease Transmission**

**Risk: Direct contact with infected animals (Direct contact with infected animals can occur while working outdoors, in adits or caves, in agricultural settings, in locations where food or waste is stored)**

<table>
<thead>
<tr>
<th>Action</th>
<th>Responsibility</th>
<th>Collaborating Agency or Organization</th>
<th>Indicators</th>
<th>Surveillance Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute a no-bushmeat-hunting policy within the concession if possible. Otherwise discourage bushmeat hunting and enforce local bushmeat regulations in areas of company control.</td>
<td>Company</td>
<td>Local environment department</td>
<td>Presence/absence of on-site poaching, # of confiscations</td>
<td>Company security or Community Relations Department</td>
</tr>
<tr>
<td>Train workers about issues associated with bushmeat hunting – in particular species and their associated diseases – and discourage the purchasing of bushmeat</td>
<td>Company education department</td>
<td>Local environment department</td>
<td>Presence/absence of on-site poaching, # of confiscations</td>
<td>Company security or Community Relations Department</td>
</tr>
</tbody>
</table>

3 There may be instances where the responsibility is the company’s, but partnering with agencies within government or with NGOs can make training and capacity building more effective.
<table>
<thead>
<tr>
<th>Timing</th>
<th>Action Plan</th>
<th>Responsibility</th>
<th>Collaborating Agency or Organization</th>
<th>Indicators</th>
<th>Surveillance Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>C→DC</td>
<td>X</td>
<td>Company health and environment department</td>
<td>Local environment department</td>
<td>Number of workers that use PPE when operating in areas with known concentrations of rodents or bats</td>
<td></td>
</tr>
<tr>
<td>C→DC</td>
<td>X</td>
<td>Company education department</td>
<td>Local environment department/health department</td>
<td>Number of workers trained; number of adverse encounters</td>
<td>Incidence recorded at company clinic</td>
</tr>
<tr>
<td>D→O</td>
<td>X</td>
<td>Company</td>
<td>Local environmental department</td>
<td>Length of linear corridor</td>
<td>Annual mapping</td>
</tr>
<tr>
<td>D→DC</td>
<td>X</td>
<td>Company</td>
<td>Local environmental department</td>
<td>Species counts</td>
<td>Semi-annual inventories</td>
</tr>
<tr>
<td>C→O</td>
<td>X</td>
<td>Company</td>
<td>Local environment department/health department</td>
<td>Presence/absence of pests; crop destruction</td>
<td>Company environmental audit</td>
</tr>
<tr>
<td>C→DC</td>
<td>X</td>
<td>Company education department</td>
<td>Local environment department</td>
<td>Number of people trained</td>
<td></td>
</tr>
<tr>
<td>C→DC</td>
<td>X</td>
<td>Company education department</td>
<td>Local environment department/health department</td>
<td>Number of locals trained; number of adverse encounters at local clinic</td>
<td>Incidents recorded at local clinic</td>
</tr>
<tr>
<td>C→DC</td>
<td>X</td>
<td>Company environment department</td>
<td>Local environment department/health department</td>
<td>Number of reports</td>
<td>Worker/community reporting</td>
</tr>
<tr>
<td>Action Plan</td>
<td>Responsibility</td>
<td>Collaborating Agency or Organization</td>
<td>Indicators</td>
<td>Surveillance Method</td>
<td></td>
</tr>
<tr>
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<td>------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Conduct educational campaign about wildlife conflict mitigation &amp; domestic animal biosecurity</strong>&lt;br&gt;Review food safety and security procedures</td>
<td>C→DC</td>
<td>x</td>
<td>Company education department</td>
<td>Local natural resource department</td>
<td>Number of people trained</td>
</tr>
<tr>
<td><strong>Risk: Indirect contact with infected animals (Indirect contact can occur through consumption of food or liquids that have been contaminated with animal excreta or from insect vectors)</strong>&lt;br&gt;Review food storage methods and protections</td>
<td>D→O</td>
<td>X</td>
<td>Company</td>
<td>Local environment department/health department</td>
<td>Presence/absences of pest prevention measures</td>
</tr>
<tr>
<td>Review waste disposal and management</td>
<td>D→O</td>
<td>X</td>
<td>Company</td>
<td>Local environment department/health department</td>
<td>Daily cover, pest control</td>
</tr>
<tr>
<td>Review housing design to ensure adequate measures exist not to promote or facilitate infectious disease transmission</td>
<td>D→DC</td>
<td>X</td>
<td>Company, engineering design</td>
<td>Local health department</td>
<td>Occupants per room, food storage, sanitation</td>
</tr>
<tr>
<td><strong>Conduct health education programs for project workers regarding infectious diseases transmission</strong>&lt;br&gt;Conduct health education programs for project workers regarding food safety</td>
<td>C→DC</td>
<td>X</td>
<td>Company health or education department</td>
<td>District health officer</td>
<td>Number of workers trained</td>
</tr>
<tr>
<td>Assist with providing food sanitation awareness materials to local district environmental sanitation officers for educational sessions with food handlers and slaughterhouses, particularly vendors who sell food to project workers</td>
<td>C→O</td>
<td>x</td>
<td>Company health or education department</td>
<td>Local environmental health department</td>
<td>Food handler practices</td>
</tr>
<tr>
<td>Timing</td>
<td>Action Plan</td>
<td>Responsibility</td>
<td>Collaborating Agency or Organization</td>
<td>Indicators</td>
<td>Surveillance Method</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>----------------</td>
<td>--------------------------------------</td>
<td>------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>C → DC</td>
<td>X x</td>
<td>Company</td>
<td>Country health services: vector-control division</td>
<td>Entomological infection rate/parasite prevalence rates in children</td>
<td>Review survey reports</td>
</tr>
</tbody>
</table>

**Implement an entomological survey program for insect vectors at the facility and in the PACs**

**Risk:** Changes to the surrounding communities due to the presence of a facility that could increase contact with wildlife (direct contact) and/or result in increased transmission of infectious diseases that occur locally (amplification)

<table>
<thead>
<tr>
<th>Action Plan</th>
<th>Responsibility</th>
<th>Collaborating Agency or Organization</th>
<th>Indicators</th>
<th>Surveillance Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>D → DC</td>
<td>X x</td>
<td>Company engineer/planner</td>
<td>Local environmental health and planning departments</td>
<td>Local spatial plan in place</td>
</tr>
<tr>
<td>D → DC</td>
<td>X x</td>
<td>Company engineer/planner</td>
<td>Local environmental health, infrastructure, and utilities departments</td>
<td>Number of plans developed and implemented</td>
</tr>
<tr>
<td>D → DC</td>
<td>X x</td>
<td>Company engineer/planner</td>
<td>Local environmental health department</td>
<td>Number of meetings/workshops</td>
</tr>
<tr>
<td>D → DC</td>
<td>X x</td>
<td>Company environmental health officer</td>
<td>Local environmental health department</td>
<td>Number of meetings and level of support</td>
</tr>
<tr>
<td>D → DC</td>
<td>X x</td>
<td>Company environmental health officer</td>
<td>Local environmental health department</td>
<td>Number of boreholes that are compliant</td>
</tr>
<tr>
<td>Timing</td>
<td>Action Plan</td>
<td>Responsibility</td>
<td>Collaborating Agency or Organization</td>
<td>Indicators</td>
</tr>
<tr>
<td>--------</td>
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<td>--------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>C &amp; C PACs</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Collaborate with local waste management services to develop non-hazardous waste management plans for local communities that can include:**
- Sufficient garbage cans and dumpsters
- Garbage stored in rodent-proof containers
- Sanitary and solid waste collected daily and covered daily with a solid layer of soil (15 to 30 cm)
- Appropriate container program to avoid waterborne insect breeding
- Prohibit moving large quantities of foodstuffs to animal farmers to avoid generating rodent or reptile habitat

| D→DC  | x  | Company environmental health officer | Local environmental health department | Number of plans in place and implemented | Site assessment |

**Support the training of local community health personnel in infectious disease surveillance and outbreak response**

| D→DC  | x  | Company health officer | Local health department | Number of people trained; Presence/absence of plan | Presence of a functioning disease surveillance program |

**Support improvement of local market biosecurity measures**

| D→DC  | x  | Company health officer | Local health department | Improved biosecurity measures |

**Support local land-use planning and manage project-induced population influx to preserve areas of intact habitat**

| PD→O  | X  | Company corporate social responsibility officer | Local planning department | Presence/absence of intact habitats and their size | Identify intact habitat and then track their integrity |
Selected Reference List for Taxonomic Groups and their Pathogens

**Bats**


Quan P.-L. *et al.* (2013). “Bats are a major natural reservoir for hepaciviruses and pegiviruses.” *Proceedings of the National Academy of Sciences*, doi:10.1073/pnas.130307110


**Rodents**


**Non-Human Primates**


**Additional Guidance Resources**


World Health Organization HealthCare Waste Management website:

