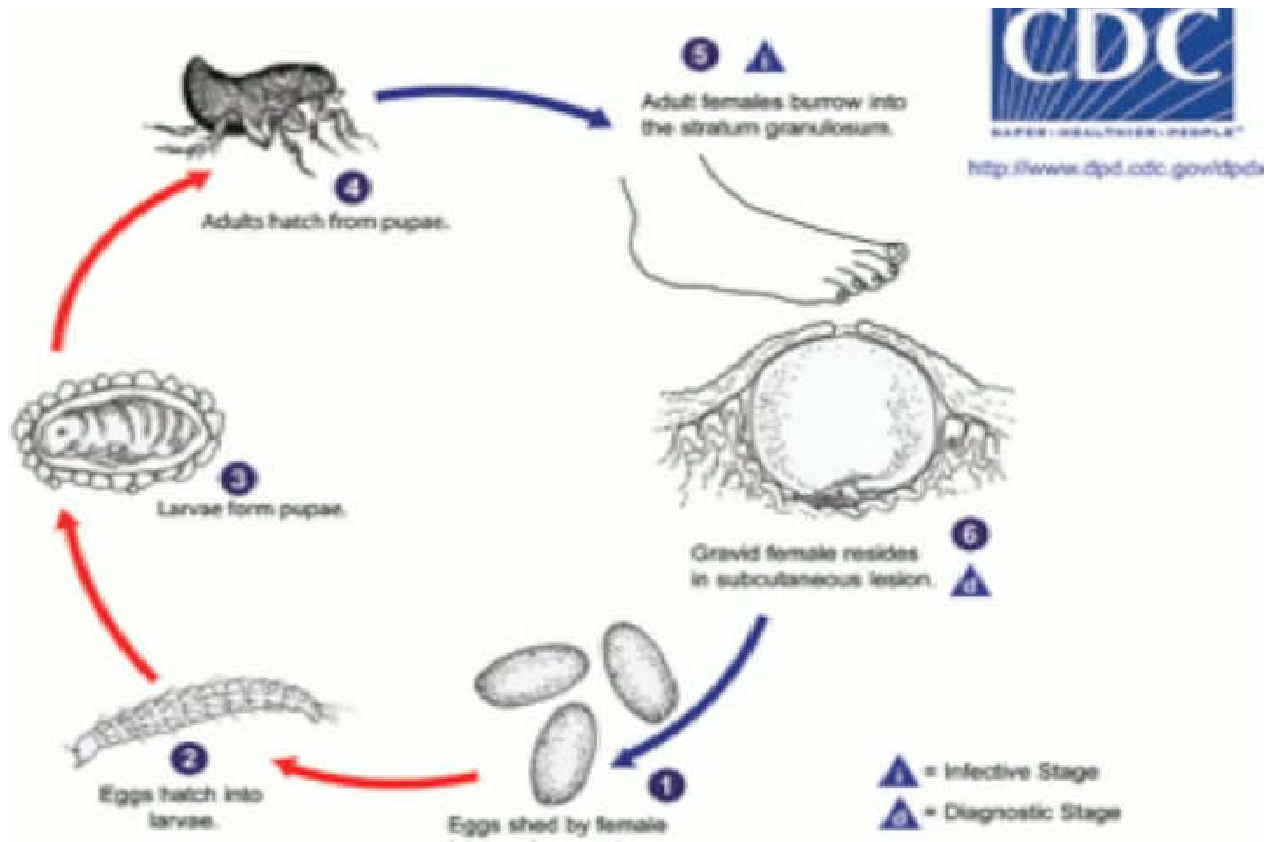
Vector-borne diseases

Vector related diseases include malaria, trypanosomiasis, onchocerciasis, lymphatic filariasis, dengue and ectoparasites (fleas, ticks, lice), etc. Many of these diseases cross the fence line and can be significant sources of problems within the workforce and the community. Addressing these diseases at the work site AND community level is necessary in order to mitigate their impacts and the risks they pose to a company since workers often move between the workplace and community, thereby rendering useless a workplace-only program.

Vectors/Mosquitoes

Either as part of the larger environmental and social assessment of the project, or in a targeted health impact assessment, if the assessment is taking place in a tropical or semi-tropical environment that has a significant burden of vector-borne diseases, it is essential that someone on the assessment team has a working knowledge of entomology and vector-borne disease biology. Specific detailed local knowledge can be accessed by interfacing with national in-country entomology/vector borne disease control experts as well.



	Risks	Key Questions	Response
Assessment of mosquito-borne diseases	• High case load on workplace clinics or benefits programs thereby increasing costs e.g. one case of malaria will typically produce five additional cases by increasing the reservoir pool of infectives for the mosquitoes that spread the disease	What are the major mosquito-borne diseases at the site/in the community?	
	• Increased worker absenteeism	-Malaria?	
	• Decreased productivity of workers suffering from malaria i.e. presenteeism issues	-Dengue?	
		-Lymphatic Filariasis (LF)?	
		Is anything known about the key mosquito vectors in the areas of interest?	
		When are people being bitten-day and/or night?	
		Who is being bitten-people and/or animals?	
		Are more people being bitten inside or outside?	
		Do workers and community members have access to information and education about how to prevent malaria, dengue or other endemic vector-borne diseases in their areas?	
Determine scope	• Hard to know where to 'draw the line' in terms of which communities to work in • Programs that work well inside the fence line are more costly and complex at the community level	What communities are contiguous to our work sites?	
	• Company must consider and align its community control efforts with host country programs	In which communities do our workers live?	
		How far are the communities from our work site(s)?	
		What methods are we employing inside our fenceline and are they appropriate/cost beneficial for expansion to the community?	
		What is the country national control plan, if any?	

Technical note: Anopheles larvae: (malaria and filariasis vector) swim parallel to the water surface and are usually found in open, clean water bodies (e.g. puddles) that contain some vegetation they can feed on (see Figure1). Anopheles mosquitoes are crepuscular (active at dusk or dawn) or nocturnal (active at night). Only female mosquitoes take blood meals (and thus transmit malaria) that are used to support the development of eggs.

Culex (e.g. West Nile virus, Japanese encephalitis, sometimes LF) and Aedes larvae (e.g. dengue, yellow fever) swim in an angle to the water surface (see Figure 1). Culex mosquitoes prefer to attack at dusk and after dark and Aedes mosquitoes bite at daytime. Both species prefer small bodies of still water full of organic matter (usually man made) as breeding sites, such as tin cans, bird baths or rain barrels.

Figure 1 – Difference in swimming position

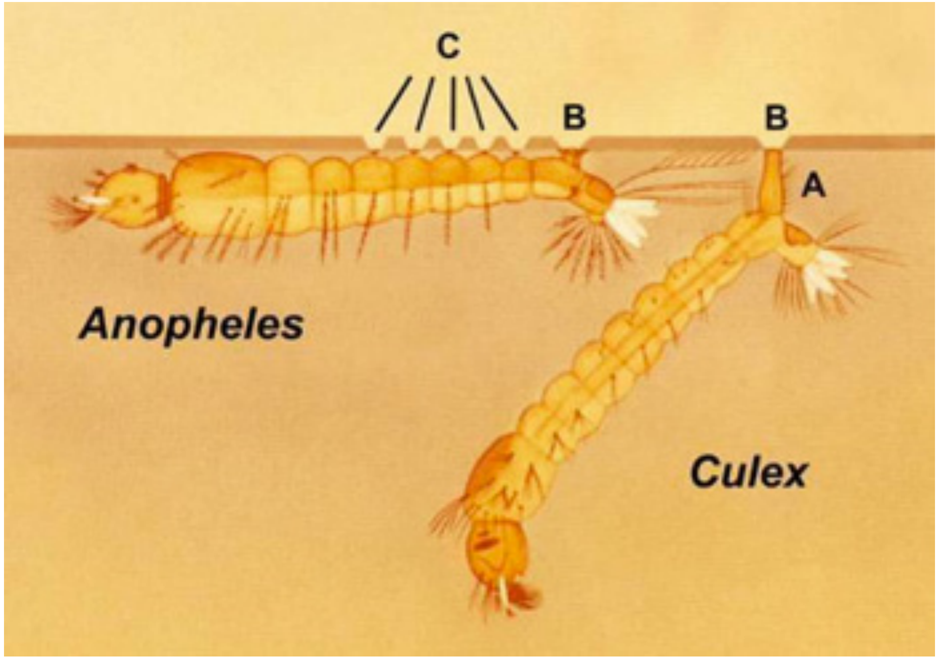


Figure 2 – Culex larvae

(Source: CDC Public Health Image Library)

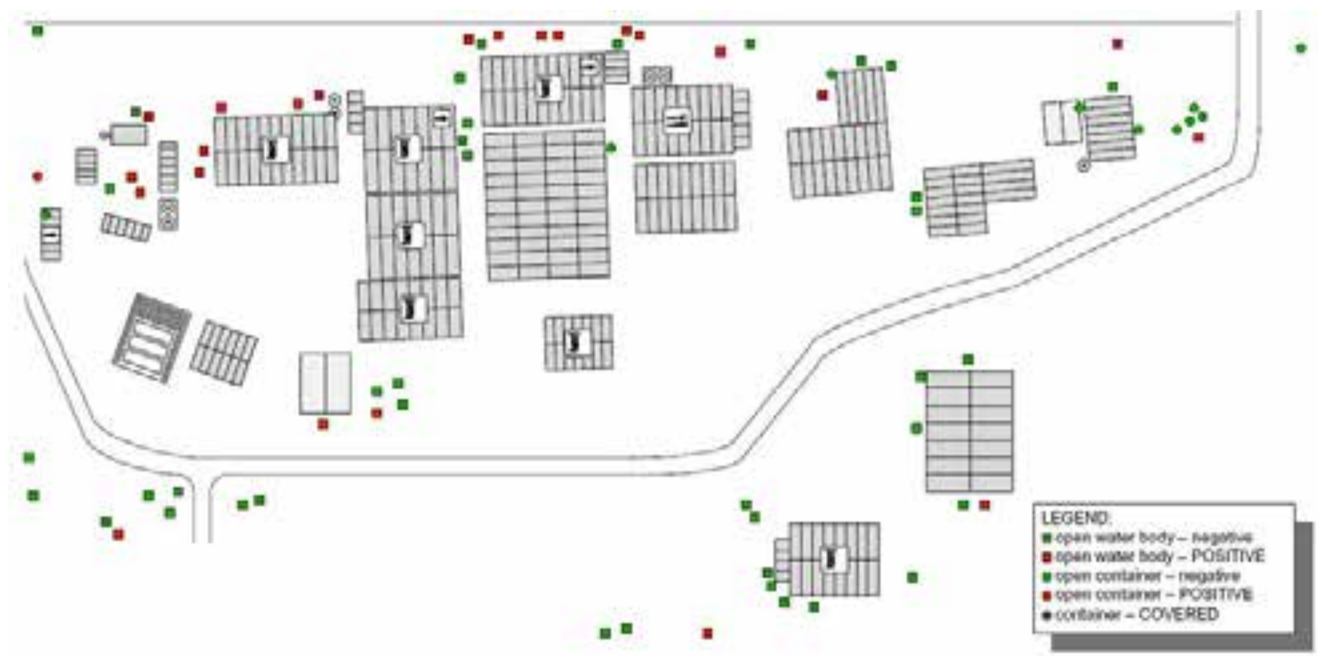
Mitigation and management

Action Area	Action to Undertake	What can be done?
Larval Survey	Prepare a ground plot of area of interest for open bodies of water	· Systematically screen area of interest for open containers
		· Produce a plot schema (See Figure 3 below for an example)
	Take water samples:	· Are larvae present in the water samples?
	An open water bottle may be used to detect larvae in large water bodies. A 'dipping' device can be made from a stick and an empty clear plastic drink container.	
	Mark the ground plot with container and larval data	Does the ground plot include:
		· whether it is an open container or an open water body (i.e. puddle)?
		· whether each container/body of water contained any mosquito larvae?
		(see Figure 4 for an example)
Estimating risk	1 of the 3 indexes has been used to estimate risk of mosquito-borne disease:	· Calculate risk, based on one of the 3 indices
	· house index- the percentage of houses infected with larvae (a house is "one unit" of accommodation and the surrounding premises, unrelated to the actual number of household residents)	· Is there increase risk of disease transmission? (A greater than 5% house, container or Breteau index indicates a potential increased risk of disease transmission)
	· container index- the percentage of water-holding containers infested with larvae	
	· Breteau index- the number of positive containers per 100 houses inspected	
Management of breeding sites*	Eliminating	· Open containers that are actually improperly disposed trash have been eliminated
	Finding and filling	· Puddles have been filled
	Draining	· Larger standing bodies of water have been drained
	Covering	· Screens or covers have been placed on open containers that have a function, such as water storage/catchment containers

*Scientific evidence indicates that up to 95% malaria control can be obtained by environmental management of surface water and breeding sites.

Figure 3

Figure 4



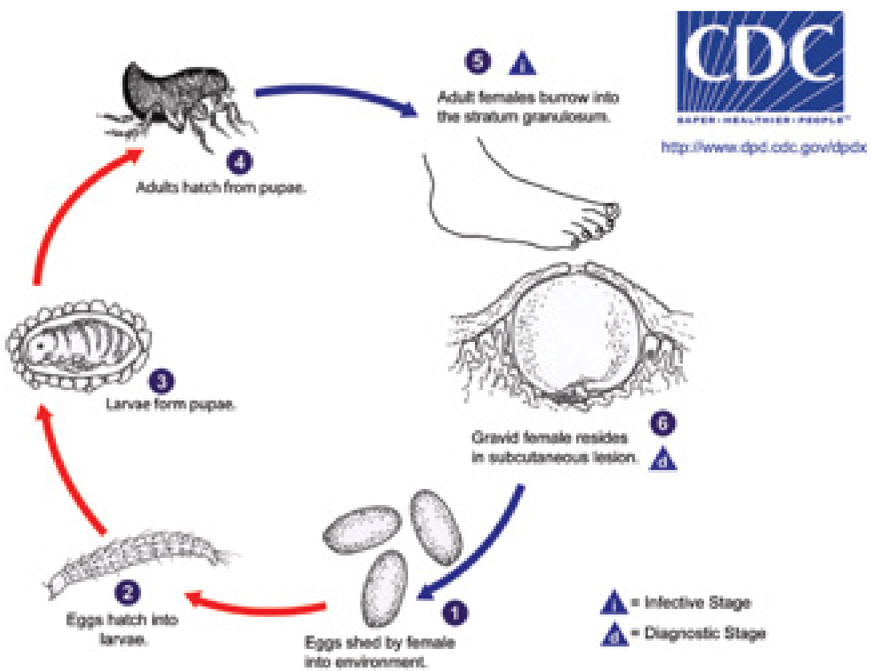
Ectoparasites

Skin diseases, including those caused by ectoparasites are one of the top five presentations to internal/onsite project medical departments, particularly if workers are rotating back and forth from community to worksite. Skin diagnoses are common and usually accurately made by community health workers and nursing staff; therefore, the 'burden of disease" can be easily established.

Source: CDC - Emerging Infectious Diseases • Vol. 9, No. 8, August 2003

	Risks	Key Questions	Responce
Assessment of ectoparasites	· Sand fleas or jiggers/chigoes burrow into the skin of humans and can cause infections	Is it a rural setting?	
	· Dog and human fleas are usually nuisance fleas, but bites can become infected	Are dogs and cats present in the community?	
	· Fleas breed close to the resting and sleeping places of those who they feed on (animals and humans), in dust, dirt, rubbish, cracks in floors or walls, carpets, animal burrows and birds' nests.	How are dogs managed and controlled in terms of parasite and hygiene management?	
	· High humidity is required for development	Are there any veterinary measures being undertaken in the community to treat dogs/cats? Livestock?	
	· Domestic animals are a significant source of the problem	Are skin diseases common in the community? Consult work or community clinics.	
	· Humans and their ectoparasites often live 'happily together' so community members may not spontaneously offer information so one must question	Do people have access to affordable insecticides/ products to control ectoparasites?	
	·	Do workers and community members have access to information and education about how to prevent ectoparasite infestations and proper treatment?	

Technical note: Fleas have been involved in devastating epidemics of plague throughout the world. Larvae of the so-called “chigoe flea,” (also known as jigger, nigua, chica, pico, cique, or suthi) Tunga penetrans, develop in sandy soil which explains another common name, “sand flea.” Female T. penetrans infect people by penetrating into tender flesh between toes or into the soles of the feet. There, the 1-mm long females become embedded, begin to suck blood, and eventually develop eggs. As they do, their body swells about 80-fold, reaching the size of a pea and causing intense pain. Sites of infestation may become infected with bacteria and, if untreated, may eventually require amputation. Tunga penetrans burrows under the skin of humans, unlike other fleas which are ectoparasitic, meaning on the surface of the skin. The females remain embedded in the host tissue during engorgement and egg-production. The fleas are usually found between the toes or under toe nails, and humans acquire the infection when walking barefoot in tropical and subtropical regions. Adult fleas are fully developed within 1–2 weeks but only emerge from their cocoons after receiving a stimulus, such as the vibrations caused by movement of the host. In vacant houses they may survive in the cocoons for up to a year. People moving into a vacant house can cause many fleas to emerge simultaneously from the cocoons and attack people or animals in large numbers. Under optimal conditions the development from egg to adult takes 2–3 weeks.




Eggs extracted from the foot of a patient from Guyana. Source: CDC


Mound of eggs next to crusted nodule. Source: DermAtlas

Mitigation and management

Action Area	Action to Undertake	What can be done?	Status t
Management in housing/ structures	Fleas and their eggs, larvae and cocoons can be effectively removed by keeping living areas well swept and floors washed.	When new people enter housing/structures that have been vacant for a year or less, are the floors swept and washed with detergents or insecticides?	Completed (when)
		· Clean floors, mop with Clorox solution	In Progress (date to be finished)
		· Areas under beds completely cleaned out and mopped	Planned and budgeted (when and how much)
			Not planned
			Not applicable
			Yes/No
	Heavy infestations with fleas are recognized by marks on clothing and bedding of undigested blood ejected by the fleas.	· Is bedding and clothing inspected and checked for signs of fleas?	Completed (when)
	·	· Is bedding and clothing washed with Clorox?	In Progress (date to be finished)
		· Are mattresses routinely aired in the sunshine?	Planned and budgeted (when and how much)
			Not planned
			Not applicable
			Yes/No
Preventing infestations	Heavy infestations can be controlled by spraying and dusting (See Table 1 below for insecticides and application methods effective against fleas)	· Spraying or dusting with insecticides into cracks and crevices, corners of rooms and areas where fleas and their larvae are likely to occur	Completed (when)
		· Has there been particular attention to spraying where the dogs lie down?	In Progress (date to be finished)
		· Spray under the living quarters and the posts supporting the buildings	Planned and budgeted (when and how much)
			Not planned
			Not applicable
			Yes/No

Personal protection	Use of insecticides and appropriate clothing	• Is DEET available to be applied to skin and clothing?	Completed (when)
		• Is longer lasting protection obtained by using insecticide impregnated clothing?	In Progress (date to be finished)
		• Do people wear closed toed shoes to help prevent chigoes bites?	Planned and budgeted (when and how much)
			Not planned
			Not applicable
			Yes/No
Treatment of animals	Regular checking for fleas in the hair around the neck or on the belly of dogs and other pets.	• Are dogs/cats checked regularly for fleas?	Completed (when)
		• Is treatment in the form of dusts, sprays, dips or shampoos to the fur available and used?	In Progress (date to be finished)
		• Use plastic flea collars for pets (typically effective for 3-5 months at a time)	Planned and budgeted (when and how much)
			Not planned
			Not applicable
			Yes/No

Residual spray:	Pesticide power: (dust)
malathion (2%)	malathion (2–5%),
diazinon (0.5%),	carbaryl (2–5%),
propoxur (1.0%),	propoxur (1%),
dichlorvos (0.5–1.0%),	bendiocarb (1%),
fenchlorvos (2%),	permethrin (0.5–1.0%),
bendiocarb (0.24%),	cyfluthrin (0.1%),
natural pyrethrins (0.2%),	deltamethrin (0.05%),
permethrin (0.125%),	temephos (2%),
deltamethrin (0.025%),	pirimiphos methyl (2%),
cyfluthrin (0.04%),	diazinon (2%),
pirimiphos methyl (1%)	fenthion (2%),
	fenitrothion (2%),
	jodfenphos (5%),
	(+)-phenothrin (0.3–0.4%)
Shampoo:	Fumigant canister:
propoxur (0.1%),	propoxur,
(+)-phenothrin (0.4%)	dichlorvos,
	cyfluthrin,
	permethrin,
	deltamethrin,
	(+)-phenothrin
Flea collar for dogs:	Repellent diethyl-toluamide (deet), dimethyl phthalate, benzyl benzoate
dichlorvos (20%),	
propoxur (10%),	
propetamphos,	
diazinon	

Source: WHO Vector Control 1997

Additional Resources

To reference the complete modules on vector-borne diseases, see the IFC/NewField's series of rapid assessment health modules.

Vector Control. Methods for use by individuals and communities. Prepared by Jan A. Rozendaal, WHO, 1997

Malaria:
Vector Control
Diagnosis and treatment
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Canine Vector-borne diseases