



A Guide to
Malaria
Management
Programmes

in the oil and gas industry





A Pocket Guide to
**Malaria
Management
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This *Pocket Guide* is a ‘quick-reference’ supplement to the OGP/IPIECA publication entitled *A Guide to Malaria Management Programmes* which is available from OGP/IPIECA, both in print and on CD-ROM. It provides a brief overview of activities and responses to frequently asked questions related to malaria for the oil and gas industry.



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Purpose of this Guide

This *Guide* outlines and describes the scientific concepts, rationale and value of Malaria Management Programmes (MMPs) for the oil and gas industry. The *Guide* provides a broad overview of MMPs, and templates such as implementation checklists and audit protocols that might typically form part of key activities when implementing MMPs in the oil and gas industry.

Experience within the oil and gas industry suggests that health is one of the key issues for both the project workforce and the host country. Health impacts can potentially occur within defined project geographical boundaries and across surrounding communities. The possibility of impacts is particularly true for an issue like malaria that involves a complex interaction between biological and environmental variables and social and behavioural practices. The oil and gas industry operates across a myriad of countries and cultures that form part of this interaction. Typically, the focus on malaria impacts is centred on Sub-Saharan Africa (SSA), however, malaria transmission occurs globally. Regardless of geographical location, the industry operates in an atmosphere of heightened expectations, particularly related to health, social and environmental practices. When present, malaria can be more than a health management problem; it is increasingly recognized as an

issue that can transcend company medical support systems and significantly affect environment, safety and human resources activities. The management of malaria is therefore a potential concern throughout the supply chain of global exploration, production, refining, distribution and marketing.

This *Guide* attempts to build on successful industry practices. However, experience at both the international health level, and from a private sector perspective, indicates that malaria management is both complex and difficult. There is no unique set of strategies or set of programmes that will work in all situations or geographical locations. The only constant feature of both the biology and human medical science of malaria is change and evolution. However, there are reasonably well-understood principles that can be utilized in virtually all situations that the oil and gas industry is likely to encounter. This *Guide* presents and analyses these principles and illustrates how they can be applied systematically within the context of worldwide oil and gas operations. A series of linked technical appendices is provided on the attached CD-ROM so that readers who want greater scientific explanation and technical back-up will have a readily available source of information. For completeness, a glossary is provided.

The overall situation: global burden of malaria

Malaria is not a newly emerging disease. There is an extremely long history of human and malaria parasite interaction spanning over 10,000 years. Malaria parasite populations experienced rapid growth in Africa and spread worldwide following human population growth, migration and agricultural development. Similarly, malaria morbidity, mortality and disability have changed and evolved over time and geography.

Human malaria risk has fallen from 53 per cent to 27 per cent of the Earth's land surface. Sub-Saharan Africa (SSA) accounts for 59 per cent of the global clinical malaria cases, Southeast Asia accounts for 38 per cent and Latin America accounts for 3 per cent. The Western Pacific region (which includes China) has less than a 1 per cent burden, despite a large population, because of marked reduction in transmission across China since 1975. The World Health Organization (WHO) estimates that on a worldwide basis, there are 300–500 million clinical episodes per year.

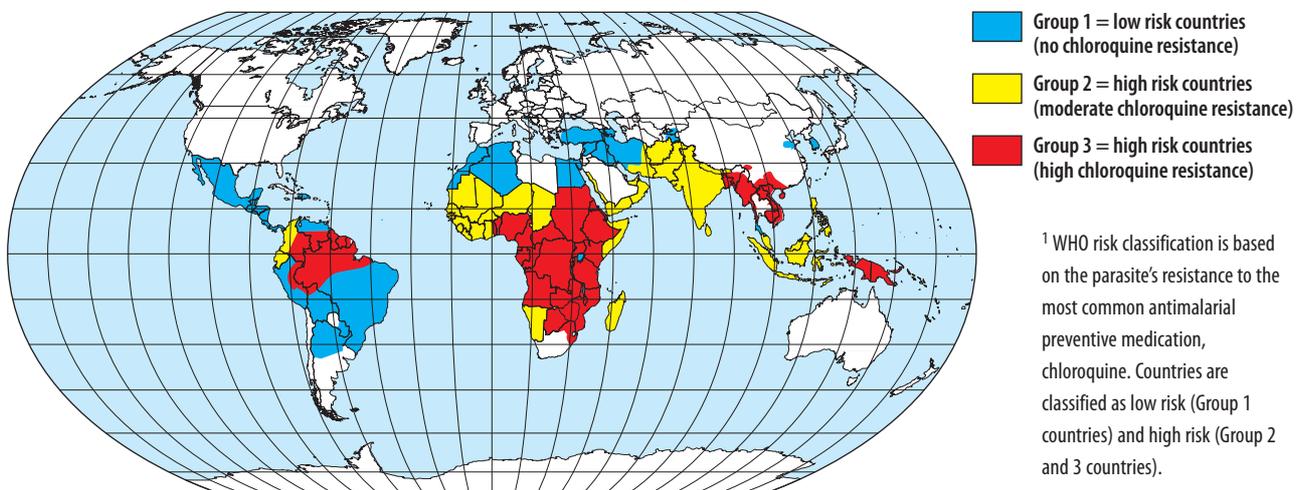
While there has been a contraction in the geographical limits of all-cause malaria transmission, the gains have been in areas that had relatively low underlying levels of malaria endemicity. Endemicity is defined as the probable presence of malaria transmission. In

contrast, there were minimal effects in those geographical areas that are characterized by high levels of malaria endemicity. These observations are consistent with the documented evidence that controlling malaria across large geographical areas becomes progressively more difficult as a function of increasing intensity of malaria transmission.

In many geographical areas, particularly in sub-Saharan Africa, there is intense but stable year-round transmission. Therefore, MMP strategies that are highly successful in a geographical setting of low transmission may fail in areas characterized by entrenched, high-level transmission. Further complicating the situation is a significant movement of populations from rural to urban settings. For example, in sub-Saharan Africa, urban cities are growing by approximately 10 per cent per year. Urban malaria has different transmission characteristics due to the unique ecosystem of the city environment.

For many companies, operations exist simultaneously across virtually all geographical settings; therefore it should be anticipated that a variety of malaria management strategies would be required. Refer to [Appendix A](#) for a brief history of the evolution of malaria distribution and impacts.

Figure 1: Global malaria risk, as classified by the World Health Organization (WHO) ¹



Key factors to promote success: role of senior management

For industry, one of the most important insights in malaria management is simply recognizing that malaria is a key business issue that cuts across multiple staff and line functions. Because malaria management potentially requires a large effort, a prominent leadership role by senior management becomes an essential initial activity (see Box 1). While the development of an effective MMP is a highly technical undertaking, the articulation of a 'vision' involving the importance of malaria related issues becomes one of the most important first steps.

MMPs are multi-dimensional issues affecting numerous stakeholders both inside and outside the company. Malaria impacts, either positive or negative, are potentially visible at the in-country staff level and even at national and international levels. Corporate Social Responsibility (CSR) efforts, along with company reputation, can be impacted by malaria. MMPs offer a significant opportunity for a 'win-win' scenario for both the

Box 1: The role of senior management

Senior management is in a key position to:

- articulate corporate objectives;
- translate these objectives into performance expectations;
- require development of a system for performance monitoring;
- hold all levels of management accountable for performance; and
- provide the necessary resources, both financial and technical.

company and the host country: an effective programme can significantly enhance operating efficiency and safety while providing a clear positive benefit for the host country at multiple levels.

What are Malaria Management Programmes (MMPs)?

Malaria is a disease that involves the interaction of a parasite, a vector and a host. A vector is defined as an organism that carries and transfers a microorganism from one host to another. For malaria, the host includes both humans and other mammals. MMPs are multi-disciplinary, integrated efforts that combine expertise and strategies in human and vector biology, environmental management, clinical medicine and community level interactions to protect people from malaria. The long history of efforts to

manage malaria illustrates that this disease demonstrates remarkable resilience in human populations despite enormous efforts to eradicate it. In order to realistically develop and implement MMPs, it is necessary to construct a basic scientific framework that captures the underlying biology, pathophysiology (how humans respond to malaria infection) and epidemiology of malaria infection. This fundamental framework is generally built around the principles of primary, secondary and tertiary prevention.

Malaria Management Programmes— levels of prevention

For MMPs, the levels of prevention can be specifically defined (see Figure 2) so that an integrated programme can be developed systematically.

- Primary prevention is considered to be **eradication** and is focused on vector control strategies.
- Secondary prevention is **controlling and reducing risks**. Secondary prevention strategies cover the full range of personal protection (including chemoprophylaxis and repellants) and behaviour modification measures.
- Tertiary prevention is **treatment of disease** in order to prevent impairment and subsequent disability or death.

Primary prevention of transmissible vector-borne diseases

(See also [Appendix B](#))

Malaria is a parasitic disease of microorganisms that belong to the genus *Plasmodium*. While there are more than 100 species of *Plasmodium* that can infect many birds, reptiles and mammals, there are only four species of *Plasmodium* that typically infect humans:

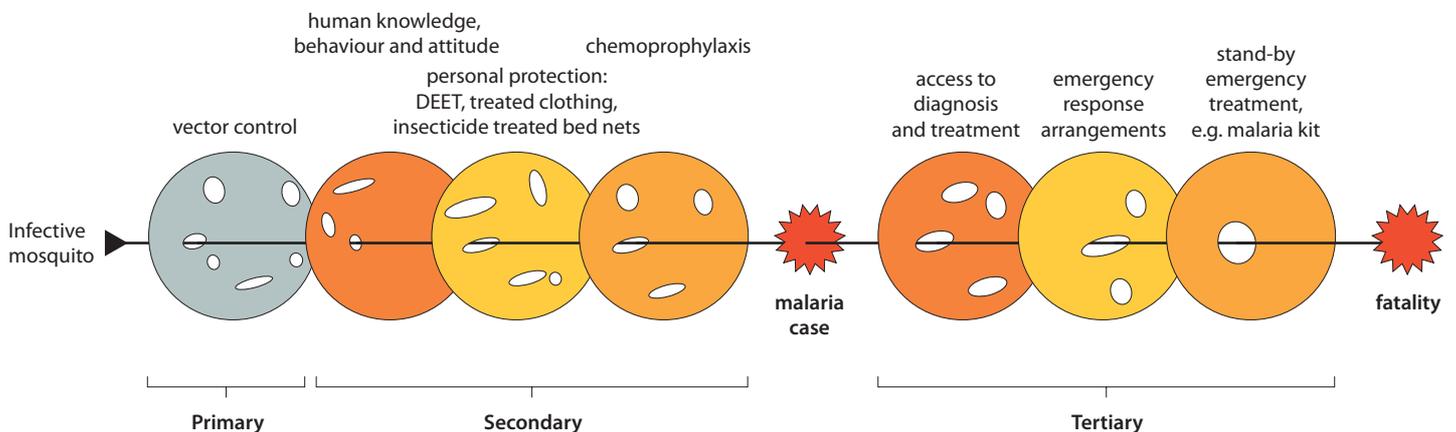
- *Plasmodium falciparum*—found worldwide in tropical and subtropical areas and is the predominant species causing severe and potentially fatal disease;
- *Plasmodium vivax*—found in Asia, Latin America, and a few areas of Africa. Because of Asian population densities, this is the most prevalent form of malaria worldwide;
- *Plasmodium ovale*—found primarily in West Africa and islands of the western Pacific. This form of malaria is similar to *vivax*;
- *Plasmodium malariae*—found worldwide and can produce a long-lasting and chronic infection with an extremely long duration.

Life cycle of malaria

The female *Anopheles* mosquito is the key vector for transmitting malaria parasites to humans because they require blood meals as a source of protein for the production of eggs. Two critical factors are:

- a source of blood meals; and
- the feeding and resting behaviour pattern of the mosquito (dusk or dawn versus nocturnal (night time), as well as the primary location of feeding and post-feeding resting, i.e. indoors versus outdoors).

Figure 2 Defences against malaria



Malaria management programmes—levels of prevention

Feeding and resting behaviours have a significant impact on both the overall vector efficiency and the analysis of potential control measures, e.g. insecticide treated bednets (nocturnal, inside biting), indoor residual spraying (indoor resting), or source reduction (outside biting and resting).

Pathophysiology

The period of time between the infective bite and clinically experienced symptoms (incubation period) typically ranges from 7–30 days depending on the infective species (see [Appendix B](#)). The delay between infective bite and symptoms can cause diagnostic problems and place expatriate workers at significant risk since they or their physician might not recognize that a new fever could be malaria, particularly if they are no longer in a malarial area.

After multiple malaria infections, an individual develops partial protective immunity. This individual does not have full immunity but rather is described as ‘**semi-immune**.’ Semi-immune individuals can still be infected by the malaria parasite but are less likely to develop severe disease and generally lack the usual malaria symptoms commonly associated with typical clinical disease. Expatriates, regardless of home country location, are usually considered as ‘**non-immune**’, since they lack sufficient protective immunity.

The development of acquired immunity tends to be location specific and usually results from long-term childhood exposure. An adult individual from one malaria endemic region may not be protected in a country that has a different spectrum and intensity of malaria. In order to maintain effective levels of acquired immunity, an adult individual must be constantly exposed to malaria. As an example, an employee whose home country is in a malarial area and who has been considered semi-immune will rapidly lose this immunity



without continuous immune (infected bite) stimulation, e.g. when on long-term expatriate assignment to a non-malarial area.

Vector epidemiology

For oil and gas operations, the shift from rural to urban setting is critical for MMPs. It is quite likely that there will be operations in both urban and rural settings with frequent interaction between the two. Major oil and gas operations, including offshore platform settings, generally require some level of urban-centred technical and staff support. Therefore, the urban environment is important for the industry since it is probable that large numbers of technical staff will transit through locations, e.g. airports, that are located in areas impacted by malaria. ‘Airport malaria’, defined as malaria acquired through the bite of an infected mosquito by an individual without exposure to the vector in its natural habitat, has been frequently reported and is expected to increase. A similar transmission problem could even impact offshore platform crews since ships and helicopters can readily transport the mosquito vectors. In addition, continuous work operations also increase the exposure of individuals to nocturnal vectors. Finally, human knowledge, attitudes, beliefs and practices regarding malaria are important.

Malaria management programmes—levels of prevention

Urban malaria epidemiology

It is not well known if all of the standard malaria prevention, management and control strategies can be effectively transferred to urban settings. While there is some evidence that anopheline species are adapting to urban aquatic habitats (e.g. water-filled domestic containers, back yard gardens), there is concern that misdiagnosis and subsequent inappropriate treatment of malaria is occurring.

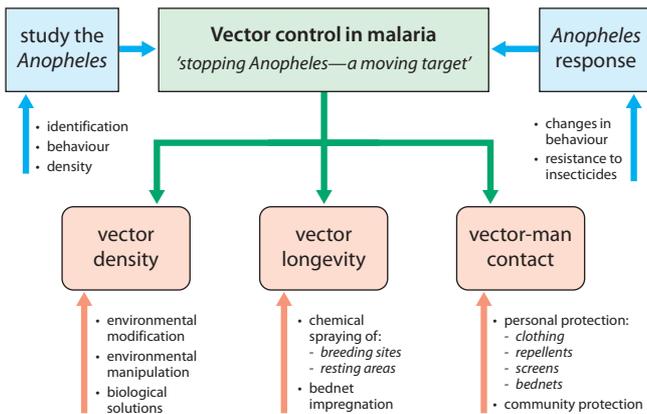
All fevers cannot be presumptively assumed to be malaria in an urban setting. The typical clinical protocols that are employed in the countryside may not be valid in the city. Research has shown that 50–70 per cent of the fevers in an urban setting are not laboratory proven malaria despite an initial clinical (non-laboratory) diagnosis to the contrary. Within an urban context, the cost-effectiveness of standard vector control strategies is also unknown.



Malaria 'fogging' in Kuala Lumpur, Malaysia

Primary prevention: vector control

Figure 3: Using vector control to reduce malaria transmission



The general goal of vector control is to reduce malaria transmission by:

- i) decreasing the contact between humans and the relevant vectors;
- ii) reducing the vector population density; and
- iii) changing vector longevity.

The three basic strategies that are directed towards different links in the overall transmission chain are summarized in Box 2.

Indoor residual spraying (IRS)

The main purpose of IRS is to reduce the survival of malaria vectors entering houses. It is of little use for control of malaria vectors that rest outdoors, particularly if they also bite outdoors and do not enter the sprayed structure. Similarly, larval control depends upon extremely high coverage since even a few temporary breeding sites may be sufficient to maintain high transmission levels.

Insecticide treated nets (ITNs)

As ITN coverage increases, there is an overall reduction on the vector population; hence the effect on the community is greater than the

Box 2: Three strategies for vector control

1. Reduction of **human-vector contact** by:
 - the use of bednets;
 - improvements in housing (screening windows, eaves and doors);
 - repellants for skin and/or clothing;
 - insecticide dispensers (mosquito coils, plug-ins); and
 - room preparation (spraying curtains, under bed, etc.).
2. Vector density reduction (treatment of vector breeding places).
Most anophelines cannot fly more than 4 km from their breeding sites, and generally remain within 2 km. **Larval control** is critical and directed towards:
 - source reduction by environmental management, i.e. drainage, flushing, filling and altering river and lake margins so that they are unsuitable for anopheline breeding;
 - larviciding using both chemical insecticides and those of biological origin, generally administered in cycles, which may vary between 2 and 10 weeks;
 - biological control using predators such as larvivorous fish;
 - space spraying of insecticides for rapid reduction of vector density: there are significant limitations to this method including difficulty of night time application and poor penetration of fogs into the daytime resting places of the vectors.

Any larvicidal strategy must also consider potential environmental impacts.
3. Decrease **adult** vector longevity by:
 - indoor residual spraying (IRS) for indoor resting mosquitoes; and
 - community-wide use of insecticide treated nets (ITNs), particularly for ages 0 to 5.

sum of the individual protection. ITN community outreach programmes sponsored by a project, while complex, are still likely to be simpler to support and maintain than a community-wide IRS effort.

Space spraying

Space spraying is the most rapid method in areas of high population density, however it is an emergency control method and unlikely to be the main vector control strategy due to the known limitations of this technique and the rapid recovery of the vector population.

A night-time fogging campaign (e.g. between 22:00 and 04:00) will have the greatest impact on nocturnal indoor feeding and resting mosquitoes.

Secondary and tertiary prevention of transmissible vector-borne diseases

(See also [Appendix C](#))

Secondary prevention

Secondary prevention involves controlling and reducing individual risks by using the full range of personal protection and behaviour modification measures. These measures are divided into a four-level pyramid of prevention often known as the ‘A-B-C-D strategy’ (Box 3):

Box 3: Secondary prevention—the A-B-C-D strategy

- A** for **awareness and education** of the risk of malaria. It requires:
 - a relationship between patient and physician;
 - understanding of prevention strategies; and
 - awareness pre-travel, during travel and post travel.
- B** for **bites—use of personal protection measures**. It requires:
 - an understanding of Anopheles behaviour, i.e. feeding and resting;
 - wearing of proper clothing, e.g. long-sleeved shirts, long pants, socks and shoes;
 - use of appropriate repellents, especially at twilight and on neck, face and ankles;
 - use of permethrin on clothes and bed nets; and
 - preparation of the room for sleeping.
- C** for **compliance with chemoprophylaxis**.
- D** for **prompt diagnosis** of malaria and securing early **treatment**.

In preparation for travel overseas some companies have established a ‘malaria visa’ programme. The malaria visa approach requires that an individual perform specific educational, behavioural (for example, spraying clothing with insecticide, obtaining repellents, spraying bed nets with insecticide), and chemoprophylaxis (use of a specific medication in order to prevent development of malaria) activities before permission is given to enter a malarious area on company business. This strategy is potentially quite effective for short-term assignments and for individuals who are transiting known malarious areas. The malaria visa strategy can be effectively combined with

other primary prevention vector control efforts. An example of a malaria programme implementation checklist is included in [Appendix D](#).

‘A’ for awareness and education

As part of a secondary prevention programme, companies often provide workers who are going to travel or reside in potentially malarious areas with consistent, standardized educational materials and instructions before travel to malaria risk areas. To be effective, this instruction typically needs regular reinforcement while working in the malaria risk area.

‘B’ for bites—personal protection measures

Bite prevention at the individual level is based on creating a physical and/or chemical barrier between the person and the vector. The effectiveness of these measures is shown in Table 1.

Table 1 Effectiveness of barriers

Prevention measures	Effectiveness (at typical compliance levels)
Use of impregnated bed nets	Reduces transmission by 68–95%
Permethrin treated clothing	Reduces likelihood of infection by 24–97%
Permethrin impregnated clothes in combination with use of N,N,-diethyl-3-methylbenzamide (DEET) insect repellent	Reduces bites by up to 99%
Long sleeve shirts and trousers	Reduces likelihood of infection by up to 62%
Chemoprophylaxis	Reduces likelihood of infection by up to 93%
Use of DEET on exposed skin	Reduces likelihood of infection by up to 45%
Vector control measures, including all of the above, plus residual insecticide spraying, space spraying, elimination of breeding sites, larviciding, biological control and the use of air-conditioning, where feasible.	If 100% use was feasible, this package of measures would virtually eliminate malaria risk

Secondary and tertiary prevention of transmissible vector-borne diseases

Table 2: Effectiveness of commercially available repellants

Insect repellent	Duration of coverage
23.8% DEET	301.5 minutes
Picaridin (KBR-3023) 9.3%	120 minutes
Soybean-oil based	94.6 minutes
IR3535	22.9 minutes
Citronella based products, 'skin-so-soft'	Less than 20 minutes

The overwhelming medical consensus on bite prevention is to strongly recommend: (1) insecticide (permethrin or deltamethrin) impregnated mosquito nets; (2) permethrin treatment of clothing; (3) wearing of long-sleeved shirts and trousers; and (4) use of repellants for exposed skin (e.g. DEET or Picaridin).

A variety of skin repellants are commercially available. These products vary significantly in their effectiveness (see Table 2). There are marked differences in the duration of activity for each product. Every product requires reapplication; however, some products are far more long-lasting than others. In general, the various DEET products are the most effective.

'C' for compliance with chemoprophylaxis

Chemoprophylaxis involves taking a specific medication in order to prevent development of malaria. Each medication has its own spectrum of side-effects, dosage schedule of administration and indications and contra-indications. Drug branding, marketing and advisory guidelines are typically produced on a target country basis, since resistance profiles are constantly changing for the medications. The most current guidelines for the target country should always be consulted. In addition, appropriate local medical experts can also be consulted. Regardless of the medication, the key concept

is compliance with both the medication AND personal protection measures.

Drug-based prevention strategies are based on two key concepts:

- prevention of infection—also known as causal prophylaxis; and
- prevention of illness—known as suppressive prophylaxis.

These strategies work by killing the parasites as they differentiate and develop in either the liver and/or the red blood cell. [Appendix C](#) discusses the malaria life cycle and presents the underlying theory for these drug-based strategies. As with all drug treatment regimes, malaria chemoprophylaxis is a balance between risk and benefit. Medications all have potential adverse effects, individual tolerability issues and cost considerations. Many individuals purchase 'black market medications' that may be cheaper but are often 'fakes' containing no active ingredient or lacking appropriate pharmacological potency. Even if using established brand name drugs from reputable suppliers it is critical to understand that no chemoprophylaxis regime is 100 per cent efficacious because of:

- unpredictable drug absorption;
- variable therapeutic plasma levels being reached due to individual genetic differences in metabolism; and
- the presence of drug resistant parasites.



PhotoLink/Getty Images

Secondary and tertiary prevention of transmissible vector-borne diseases



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The full range of secondary prevention strategies should be considered for all non-immune individuals. For semi-immune individuals, the situation is more complex. Chemoprophylaxis is often considered for:

- infants under three years of age;
- semi-immune pregnant women;
- semi-immune people who have left their endemic malaria area for more than 6–12 months, becoming non-immune, and returning to an endemic malaria area; and
- other vulnerable groups (e.g. people with immunosuppression).

It cannot be assumed that someone from a malaria endemic country is semi-immune since partial immunity can only be acquired by significant and continuous exposure to the same malaria species from childhood onwards. Therefore, individuals transferring between different malarious areas may need additional medical consideration. Chemoprophylaxis alone does not provide absolute protection; therefore, providing the full range of secondary prevention strategies is an important consideration.

Finally, with regard to compliance, it is important to note that the provision of antimalarials to employees in the field does not obviate the risk of contracting malaria. While in some cases this is due to poor absorption and/or variable therapeutic plasma levels, as

noted above, in some cases this is due to a small percentage of non-compliant individuals who do not take, or do not consistently take, the prescribed medication.

Compliance drug testing regimes, using urine testing for medication metabolites, have been implemented by some companies in the oil and gas industry as part of an overall Malaria Management Programme. These tests form part of contractual arrangements between employer and employee and where required for non-immune expatriate staff will likely also be required for contract staff; individuals testing negative for metabolites are first counselled and transferred to a 'frequent test pool'. Should the problem persist, the individual will be investigated further to determine the cause of the problem and if necessary may be transferred to a non-malarial area.

'D' for prompt diagnosis and early treatment

Malaria is a true medical emergency that requires rapid diagnosis and treatment, as infected individuals can rapidly deteriorate over a 24-hour period. Ninety per cent of cases of all malaria are associated with:

- inappropriate chemoprophylaxis, e.g. the wrong drug and/or dosage; or
- no chemoprophylaxis.



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Secondary and tertiary prevention of transmissible vector-borne diseases



In two-thirds of tropical travellers who die of malaria, either treatment is delayed or the diagnosis is simply missed. In most cases the individuals concerned never took chemoprophylaxis in the first place, so a common recommendation is to assume that every traveller with fever or unexplained flu-like illness has life threatening malaria. This recommendation will obviously produce 'false-positives' and subsequent over-diagnosis of malaria; however, the medical rationale is that 'false-negatives' are potentially at substantial risk for a fatal outcome due to missed diagnosis. This overriding concern related to delay in diagnosis has led to the development of:

- rapid diagnostic tests (RDTs); and
- stand-by emergency treatment (SBT) kits.

When the test kit is well maintained, some RDT products can achieve a sensitivity (the ability to detect a 'positive') for *P. falciparum* similar to that obtained by microscopy. RDTs can be damaged by exposure to high temperature extremes (heat or cold). If transport and storage within conditions specified by the manufacturer are not met, the sensitivity of the RDTs may be impaired and shelf life reduced.

Coartem® (artemether/lumefantrine), is a new, life-saving malaria treatment that is included in most SBT kits. Even where RDTs

do not indicate malaria, travellers are encouraged to take Coartem® as a precaution. Coartem® is now included in the World Health Organization (WHO) Model List of Essential Medicines, and is being distributed through the WHO as part of the worldwide Roll Back Malaria initiative.

Tertiary prevention

Some oil and gas companies have developed RDT and SBT kits as part of their MMP efforts. These kits represent tertiary prevention and are not a substitute for developing a comprehensive MMP that includes appropriate primary and secondary prevention. The essential features of comprehensive MMPs involve systematic evaluation and institution of primary and secondary prevention strategies so that an adequate and defensible wall of prevention is constructed and maintained.

Benefits of an MMP

A well-executed MMP can prevent morbidity and mortality in the workforce. MMPs send an important and positive message to the entire

workforce (including semi-immune nationals), surrounding communities and other national and international stakeholders.

Box 4: Benefits of a Malaria Management Programme

- Protecting the health of the workforce
- Demonstrating commitment of senior management to a key health issue
- Defining roles and responsibilities between companies, contractors and host governments
- Establishing an accurate and appropriate baseline of a key disease for future comparison during the development, operation and eventual closure of a project
- Demonstrating the potential improvement in the malaria burden in surrounding communities
- Identifying and documenting key environmental features that relate to vector habitat and subsequent control
- Documenting baseline environmental conditions relevant to vector control
- Developing and enhancing local, provincial and national capacity for malaria control
- Providing a positive framework/opportunity for stakeholder input, involvement and trust building
- Enhancing the companies profile amongst NGOs, international institutions, including multi-lateral development and financial institutions
- Potentially contributing to host community's health systems capacity, infrastructure, and development

When to develop and implement an MMP

If a company is considering business opportunities in malarious settings then, it is critical to consider development of an appropriate MMP for all phases of the business activity. Programme development and complexity should reflect an accurate understanding of malaria risks for company personnel and even surrounding communities. Many companies may wish to develop a standardized set of

secondary and tertiary prevention practices and procedures for any work in malarious areas, e.g. malaria visa process. In addition to their own workforces, these standard practices and procedures may cover a variety of contractors and suppliers. Overall, an integrated approach, using primary, secondary and tertiary prevention, is likely to have the greatest chance of success.

Integrating an MMP with other impact assessment and outreach programmes

Malaria is a multi-dimensional disease; therefore, a complex skill set is essential for programme development and management. Construction of each level of the wall of prevention requires a diverse team of specialized professionals. If a proposed business activity is in a malarious area, then the accurate and detailed assessment of malaria risk is indicated. Experience indicates that environmental scientists, sociologists, medical professionals, vector biologists, education trainers and community development specialists may be necessary. Malaria risks and impacts should also be considered in carrying out health, social and environmental impact assessments. The OGP/IPIECA *Guide to Health Impact Assessments in the oil and gas industry* specifically discusses the need to consider

vector-related diseases like malaria as part of the impact assessment process. Integration with company HSE management and health risk assessment processes is also important. Malaria-related issues could be a significant area of activity for both social and environmental assessments. Because of both the importance and complexity of MMP issues, many companies in the oil and gas industry have developed stand-alone multi-disciplinary integrated teams of specialists for programme development and implementation. Often the 'lessons learned' from MMPs in large projects, e.g. oil field development and pipelines, are directly transferable to both other key business partners and internally to other locations of a companies' worldwide business activity.

National and international stakeholder consultation

Malaria-related issues have a large and well-organized set of international stakeholders. These stakeholders include, NGOs, academic institutions, multi-lateral development and funding agencies and institutions purely created for malaria prevention, management and control. In addition, some level of local, provincial and national malaria control efforts will be encountered at the host country level. In many situations, co-ordination and communication with all of these international and national stakeholders is a daunting task. Nevertheless, because of the potential for significant benefit or inadvertent adverse impacts, e.g. duplication of efforts, unmet and unanticipated community level expectations that could be produced, it is important to

carefully consider the multi-level social and community ramifications of any comprehensive malaria management programme.



National and international stakeholder consultation

It has become apparent that significant advances in the medical and environmental control areas have not necessarily translated into success at the individual, community and health systems levels. There is a significant gap between intervention efficacy and effectiveness at the community level in a developing country setting. Increasingly, the oil and gas industry faces the need to understand community level health, social and environmental concerns in order to receive and maintain a 'license to operate.' MMP is a particularly difficult set of issues because the biology of the disease is not easily confined within the boundaries of a proposed project and invariably, in a large project, overlaps into adjacent communities. The oil and gas industry

is increasingly asked to address problems that traditionally are 'outside the fence line' and historically considered responsibilities of the host government. In a given project setting, comprehensive secondary and tertiary prevention strategies may be adequate for the project; however, it is quite likely that other international and national stakeholders will request a more active outreach role in all levels of prevention management and control, particularly in vector control efforts. In order to realistically understand these expectations, careful, close and early consultation during project formation and development stages with key national and international stakeholders is advisable.

Putting it all together: the MMP process

There is no single MMP process that will necessarily be appropriate in all the diverse situations confronting the oil and gas industry. However, there are a series of systematic steps that can be used in order to determine what type of MMP is appropriate in a particular situation. Many companies in the oil and gas industry already have a general approach for developing MMPs. Similarly, many international agencies and national governments have published detailed guidelines covering malaria diagnosis and treatment at both an individual and community level. Because both diagnostic testing and available medications and treatment protocols are constantly evolving, the most currently available guidelines should always be consulted.

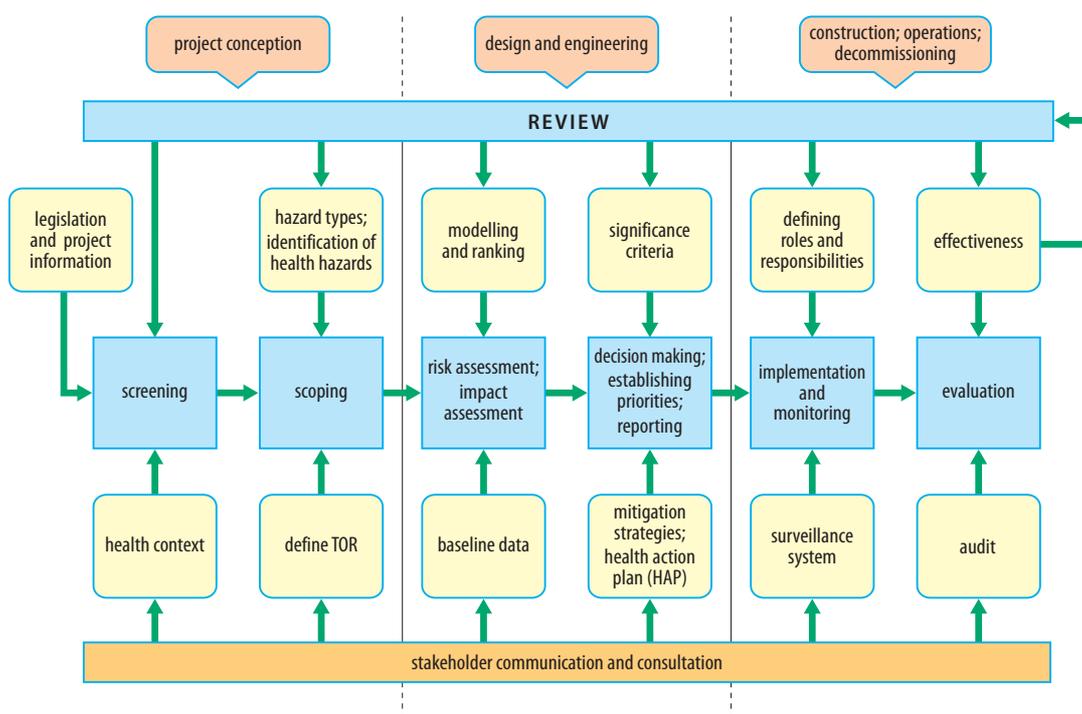
While the science of malaria is constantly changing, an overall management framework is reasonably well established and can be used in almost all situations confronting the oil and gas industry. This structure consists of a sequence of common elements that frames the MMP

process and is illustrated in Figure 4. The process is modelled after the general framework used in the suite of environmental, social and health impact assessments (see Box 5).

Box 5: Framework for social and health impact assessments

- **Screening**—determine if a proposed business activity is going to take place within a potentially malarious environment
- **Scoping**—outline the range and types of malaria problems that could be encountered
- **Planning including resourcing, cost and time management**—consider the types of resources, activities costs and level of effort that may be required
- **Stakeholder consultation**—co-ordinate, communicate and exchange information at the local, provincial, national and international level
- **Risk assessment**—investigate, appraise and qualitatively or quantitatively rank the impacts positive or negative that could be produced
- **Decision making**—establish priorities
- **Mitigation strategy**—develop a written mitigation action plan (MMP programme)
- **Implementation and monitoring**—define roles and responsibilities

Figure 4: The MMP process



Putting it all together: the MMP process

Screening

The geographical settings where malaria transmission exists are reasonably well known. Therefore, if a business activity is likely to either be centred in or transit through a malarious area then, malaria should be considered as a potential health concern. A description of the proposed business activity covering location, size, workforce, surrounding communities, and operations is essential. This initial review will help determine the need and level of MMP that may be required. Not all business activities require comprehensive MMPs. In many situations, companies have developed a 'malaria visa' programme that is based on secondary and tertiary prevention strategies incorporated into the 'A-B-C-D' programme discussed in earlier sections of this *Guide*. Based on the initial screening, implementation of a malaria visa programme may be sufficient for the workforce. However, it is important to understand that this programme is internally workforce focused and not fully transferable to the large number of semi-immune individuals who may be living in communities adjacent to the proposed business activity.

Scoping

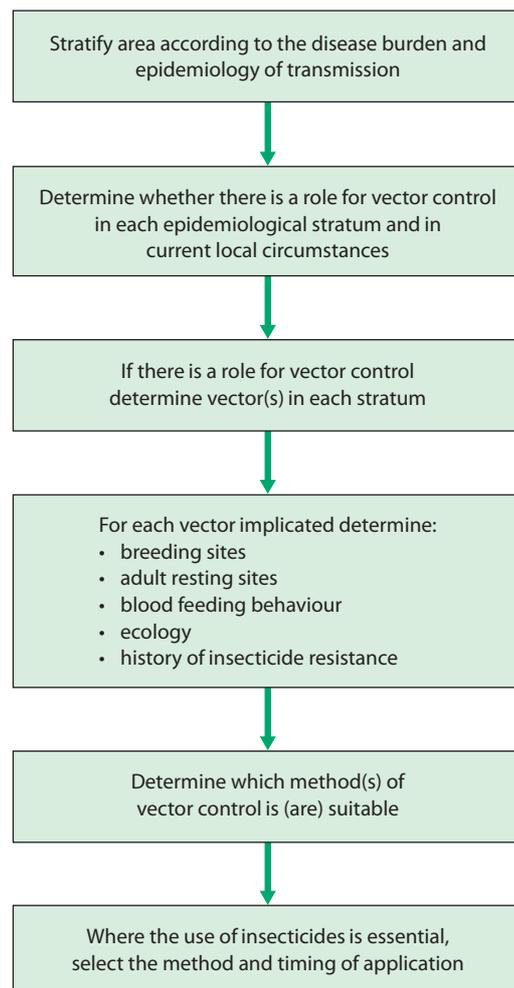
Scoping is generally a process for outlining the range and types of hazards and potential beneficial impacts. The overall types and categories of questions that must be addressed are defined at this stage. At the scoping stage the overall types of questions include:

- defining the type and endemicity level of malaria, e.g. dominant *Plasmodium* parasite, and whether it is stable or unstable;
- considering whether different strategies will be required depending upon the phase of the project, i.e. construction, operation, decommissioning;
- defining the at-risk population including construction workers, contractors,

nationals, and community residents. If primary prevention vector control strategies are deemed critical, then a general series of sequential questions should be considered. The overall process for this effort is shown in Figure 5.

The output of the scoping exercise can also be used as a basis for formally developing a set of terms of reference (TOR). Either internal or external consultants, or a combination of both, can use the TOR.

Figure 5: Decision-making process (Najera, 2002)



Putting it all together: the MMP process

Planning including resourcing, cost and time management

After the general scope has been determined, the planning process can begin. It is critical to identify at the outset the types of resources that may be required. Resourcing issues require careful consideration since multi-level, integrated MMPs draw expertise across many disciplines. While many oil and gas companies have large and sophisticated medical, environmental and safety departments, it is quite likely that some level of outside specialty expertise will still need to be considered, particularly related to the implementation of primary vector control strategies. For large projects, even secondary prevention strategies require significant levels of active on-site clinical medical support for accurate diagnosis and treatment. If the proposed business activity does not require an on-site medical function, it may still be advisable to identify appropriate local resources, including medical practitioners and hospitals with appropriate malaria expertise and diagnostic equipment.

Implementing an MMP is potentially an expensive undertaking and may require a significant level of staffing. The level of staffing is a function of the goals that the programme wishes to achieve and the underlying level of malaria transmission. Many programmes have overall global objectives that include achieving a zero fatality rate while minimizing the risk of contracting malaria to the lowest practicable level. Potentially, these goals can be achieved but an intense, integrated and sustained effort using a variety of primary, secondary and tertiary strategies is likely to be needed.

Stakeholder consultation

Stakeholder communication and consultation is a process of mutual dialogue and information exchange between the project and the key stakeholders. Stakeholders should be systemati-



Keith Brofsky/Getty Images

cally identified and defined since it is quite likely that there will be multiple levels of groups and organizations that will be both interested, active and operating within the overall sphere of the business activity. Malaria is a disease that has attracted worldwide attention in virtually all areas where transmission is found. Therefore, it is highly likely that any proposed project in a known malarious area will already be subject to some level of NGO, national or international intervention control effort. Given this reality, the opportunity for miscommunication and duplication of effort is significant. Therefore, a malaria stakeholder communication programme is often considered as early as possible in the overall business development cycle. This effort should be carefully planned and coordinated in a fashion that is consistent with and responsive to overall business objectives.

Risk assessment

Risk assessment is the process that investigates, appraises and qualitatively or quantitatively ranks the impacts, positive or negative, that could be produced by a given activity. Many oil and gas companies have internal risk assessment procedures and protocols covering health,

Putting it all together: the MMP process



environmental, social and safety aspects of a proposed new business project. These processes can be applied to MMP efforts. In a given geographical location, it is important to understand the specific biology, pathophysiology, and epidemiology of malaria that may be encountered. The level of malaria risk will vary substantially both by geographical location and complexity of proposed project. An oil field development and pipeline is likely to require substantially more investigation and programme development than opening a small marketing office or retail store. The risk assessment process can capture these differences and provide an appropriate way to rank impacts so that they can be address in a priority fashion.

Two important considerations in the risk assessment process are the evaluation of existing data and determination of the need for new baseline information. Existing sources of information must be carefully reviewed for accuracy, relevance and completeness. All fevers are actually not malaria even though in rural malarious areas fever is 'presumptively assumed' to be malaria and treated accordingly. Many studies have documented that malaria is frequently misdiagnosed. If there is a concern that the project will impact the existing transmission pattern and burden of malaria, then careful consideration should be given to determine whether a new data collection effort

is indicated. As previously discussed, the profile of malaria in urban and peri-urban settings is quite different than the intensity usually seen in a rural environment. If new data is deemed necessary, then a series of carefully defined study questions should be developed. These study questions are likely to cover vector species, habitat, and density in addition to objective burden of disease.

The ranking of potential impacts can be considered from an individual environmental, medical and sociological perspective or as an integrated exercise. Since malaria is a disease that operates at many levels, it may be more efficient and meaningful to develop an integrated impacts ranking that considers not only health but also social and environmental effects. The degree of detail and sophistication of the ranking exercise is project specific. The literature on community level impacts of malaria is vast and varies significantly across different global locations. Impacts and effects observed in sub-Saharan Africa should not be assumed to be fully relevant for Asia or South America. For a large project, that is expected to last for many years, risk assessments frequently consider both the workforce and the surrounding community.

Decision making

Decision making establishes priorities and begins the process of developing and dedicating appropriate resources. For episodic or small-scale business activities the implementation of existing standard practices may be entirely sufficient, e.g. a malaria visa programme. For large, long-term projects, many companies have established dedicated multi-disciplinary malaria management teams in order to simultaneously manage both internal and external malaria issues. Senior management support, both at the project and corporate level, is essential since sustainable MMP programmes are neither simple nor inexpensive.

Putting it all together: the MMP process

Mitigation

The written MMP is the mitigation plan. This plan specifies how high and how thick the ‘wall of prevention’ is constructed. The MMP is not a static exercise but a ‘living document’ that will evolve and change over time. The programme is likely to be a combination of both internal workforce and external community needs. Many of the most important concerns and controversies surround the key vector control strategies of insecticide application, IRS, space spraying, ITNs, and larviciding. Finally, emergency response and planning should also be performed since there is no 100 per cent effective MMP programme and, in some situations, immediate treatment and or evacuation may be indicated.

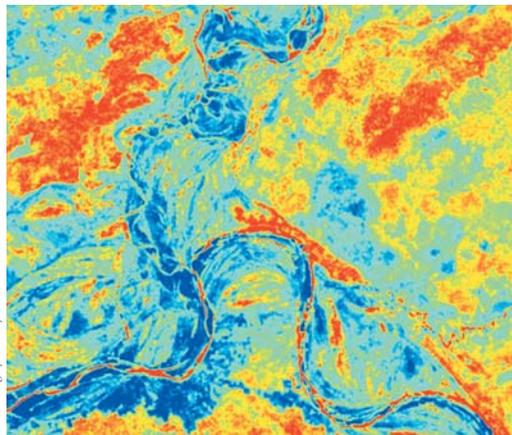
Implementation and monitoring

For comprehensive MMPs, one of the most critical aspects of the implementation plan is the division of responsibilities and timescales between the project and the host government at local, regional and national levels. Roles and responsibilities should be defined and clearly understood, particularly if the MMP efforts are going to extend outside the project boundaries. Therefore, an analysis of local, regional and national malaria infrastructure and

management capacity is critical. Building the environmental, medical and social capacity and sustainability required for an integrated approach to malaria are neither simple nor cheap. Many malaria programmes initially succeed only to fail at a later date, as primary prevention vector control strategies are not properly maintained. Long-term planning and commitment is essential since sustainable capacity development is a long and slow process. The role of contractors becomes quite important since much of the day-to-day activity is performed by rotating contractors, particularly during the construction phase of a project. Contractor roles and responsibilities can be assigned and specified during the initial scope of work contract process.

Ongoing staffing levels will also require attention and consideration since MMP is not a static process. It should be reasonably anticipated that unexpected swings in weather and human migration patterns and activities will occur. Both of these events can have profound impacts on malaria transmission within the workforce and external communities.

Development of a monitoring system for the overall MMP effort is a critical component. A monitoring system is designed to document how the programme is affecting malaria transmission. A variety of indicators can be developed for this purpose. Similarly, standard medical outcome indicators can be developed covering diagnosis and treatment, e.g. suspected, probable, confirmed and fatal malaria cases. These medical data are important because it provides an early detection system for changes, negative or positive, in malaria transmission. A sample malaria case investigation form is included as [Appendix E](#) to this Guide.



Landsat imagery courtesy of ExxonMobil

Left: satellite imagery can be used to predict the distribution of the main vectors of malaria—landscape epidemiology is a critical feature that can be used for the development of MMP programmes.

Putting it all together: the MMP process

Finally, early detection is not the same thing as early warning. Malaria Early Warning Systems (MEWS) require a different level of monitoring, planning and development and are usually considered to be a national government project. However, because of the high levels of technological expertise, particularly regarding RS/GIS techniques, that are resident in many oil and gas companies, collaboration or technology transfer may be entirely appropriate (refer to [Appendix B](#) for additional details).

Evaluation

Evaluation and verification of performance and effectiveness is one of the most important steps in an MMP programme. A system for determining that implementation has been accomplished and is achieving the desired results should be considered. Within the implementation and monitoring plan a system of outcome indicators is typically specified. Auditing against these indicators can be readily performed. Contractor performance should also be verified and assessed for effectiveness and compliance. If the MMP is actively cooperating with host country programmes, these efforts should also be independently assessed against previously established outcome indicators.

A variety of audit systems for health programmes have been developed. General audits often cover:

- medical records and reports;
- facility inspections for vector control evaluation;
- knowledge, attitude and practices (KAP) assessments;
- training records—topics, attendances and feedback;
- health care programme reviews and audits;
- emergency drills; and
- incident investigations.

Audits should be considered at regular intervals because large projects are constantly changing, for example:

- new company activities (e.g. work near swamps, jungles, etc.);
- new projects in potentially exposed geographic locations;
- modifications in work schedule (e.g. night shifts);
- changing contractual requirements;
- new scientific discoveries (e.g. medications, resistance);
- international and government advisory recommendations concerning malaria resistance to medication.

An example of an audit form is included in [Appendix F](#) of this *Guide*.

Glossary

A-B-C-D	A simple way to remember the key steps needed to protect people from malaria: Awareness - Bite prevention - Chemoprophylaxis - Diagnosis	Infective bite	A mosquito bite that introduces malaria parasites into the bitten host
Anopheles	Category (i.e. genus) of mosquito—some female species of Anopheles are capable of transmitting malaria to humans and animals	IPIECA	International Petroleum Industry Environmental Conservation Association
Burden	Size of a health problem in an area, measured by cost, mortality, morbidity, or other indicators	IRS	Indoor Residual Spraying—treatment of houses where people spend night-time hours, by spraying insecticides that have a residual efficacy, i.e. they continue to affect mosquitoes for several months
Chemoprophylaxis	A method of attempting to prevent malaria by taking various drugs prior to, during, and after exposure to malaria	ITNs	Insecticide Treated bed Nets
Coartem®	A new, life-saving malaria treatment (artemether/lumefantrine)	Malaria	A parasitic disease that kills two million people per year around the world
DEET	An insecticide (N,N,-diethyl-3-methylbenzamide) for use on exposed skin to repel mosquitoes	Malarone	Brand name of atavaquine-proguanil, a drug used to prevent and treat malaria
Disability	A physical or mental impairment that substantially limits one or more major life activities	Mefloquine	A drug used to prevent malaria that goes under the brand name of Lariam
E&P	Exploration and Production	MEWS	Malaria Early Warning System—a system for predicting malaria epidemics based on satellite data
Endemic	Describes a disease that is localized to a particular geographical region	MMP	Malaria Management Programme
Endemicity	The probable presence of malaria transmission	Morbidity	Proportion of the population who have a particular disease
Entomologist	An expert on insects, such as Anopheles mosquitoes	Mortality	Proportion of a population who have died from a particular disease
Epidemic	A sudden increase in the frequency of malaria that significantly exceeds the seasonal variation normally observed in a given area	NGO	Non-Governmental Organization
Epidemiology	The study of the incidence, distribution, and control of disease in a population	Nocturnal	Term describing Anopheles mosquitoes that are active at night
Host	The human or animal in which the malaria parasite lives outside of the mosquito	Non-immune	A person with no immunity to malaria
Immunity	Protection generated by the body's immune system in response to previous malaria attacks resulting in ability to control or lessen a malaria attack	OGP	International Association of Oil and Gas Producers
Incubation period	The interval of time between infection by a malaria parasite and the onset of the first symptoms of the illness. Incubation periods for malaria can range from 7 to 40 days depending on the species	Parasite	A microorganism, such as Plasmodium, that lives, grows and feeds in a different organism while contributing nothing to the survival of its host
		Pathogen	Parasites (including those causing malaria), bacteria, viruses or fungi that can cause disease
		Pathophysiology	The functional changes in humans resulting from infection by malaria parasites
		Perennial transmission	Situation whereby malaria is spread throughout the year
		Peri-urban	The area immediately surrounding an urban or city area

Glossary

Permethrin	An insecticide effective in treating clothes to repel and kill mosquitoes	SBT	Stand-By emergency Treatment kits: these kits typically consist of two parts: (1) a Rapid Diagnosis Test; and (2) malaria treatment medication such as Coartem; these kits enable personnel to self-test for malaria and take medication to cure the disease.
Plasmodium	The category (i.e. genus) of the parasite that causes malaria. The genus includes four species that infect humans: <i>Plasmodium falciparum</i> , <i>Plasmodium vivax</i> , <i>Plasmodium ovale</i> and <i>Plasmodium malariae</i> . <i>P. falciparum</i> is the fatal form. <i>P. vivax</i> and <i>P. falciparum</i> are the species most commonly encountered by the oil and gas industry.	Space spraying	The widespread spraying of insecticide (often called fogging) from vehicles or aircraft to kill mosquitoes
Prophylactic drugs	Medication taken to prevent malaria	SSA	Sub-Saharan Africa
RDT	Rapid Diagnostic Tests—these tests for malaria are often included in stand-by emergency treatment kits to enable subjects to self-test for the presence of malaria in their own blood.	TOR	Terms of Reference
Risk	The product of the chance that a specific undesired event will occur and the severity of the consequences of the event: Risk = (Probability) x (Consequence)	Vector	An organism (e.g. female Anopheles mosquito) that transmits an infectious agent (e.g. malaria parasites) from one host to another (e.g. humans)
RS/GIS	Remote Sensing/Geographical Information System	Vector-borne diseases	Diseases (e.g. malaria) that are transmitted from one host to another (e.g. humans) via an organism known as a vector (e.g. female Anopheles mosquito)
		Vector control	Process of eliminating mosquitoes that can transmit malaria
		WHO	World Health Organization

List of Appendices

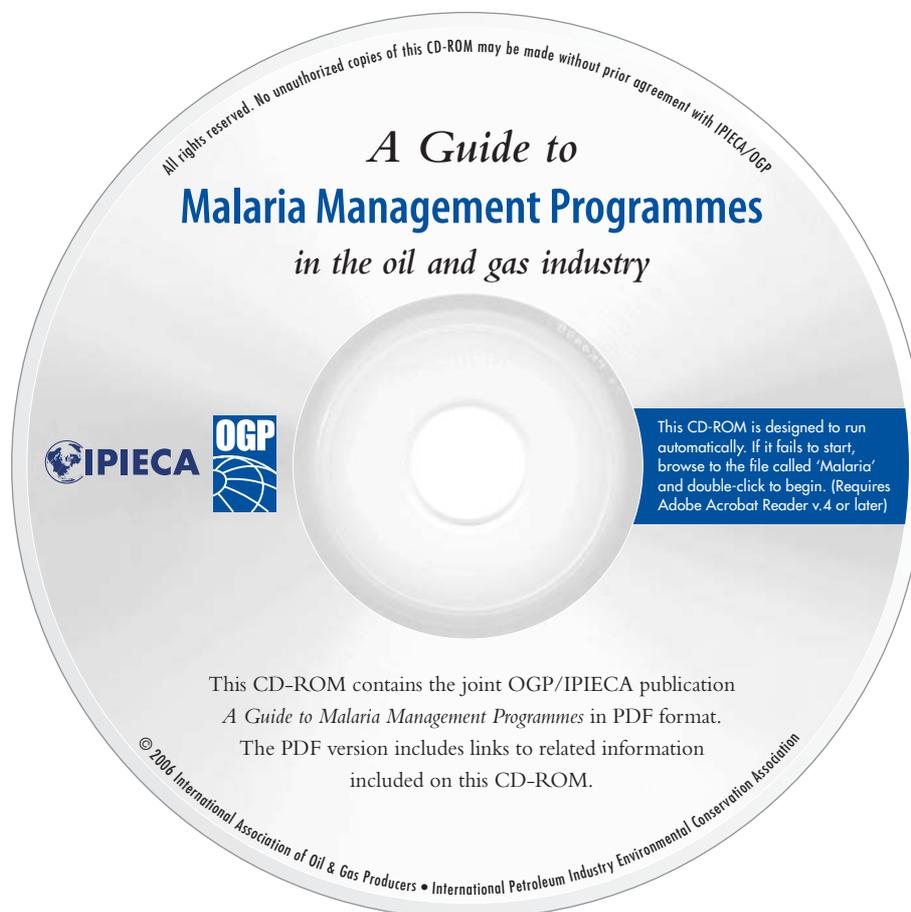
- Appendix A: [Brief History of the Evolution of Malaria Distribution and Impacts](#)
- Appendix B: [Primary Prevention of Transmissible Vector-Borne Diseases](#)
- Appendix C: [Secondary and Tertiary Prevention of Transmissible Vector-Borne Diseases](#)
- Appendix D: [Malaria Programme Implementation Checklist](#)
- Appendix E: [Malaria Case Investigation Form](#)
- Appendix F: [Audit Form](#)

A 'Guide to Malaria Management Programmes' on CD-ROM

This document is also included on the attached CD-ROM in PDF format[†]. The file includes links to the associated Appendices which are also included on the CD-ROM. The links are represented in this printed version by the [blue underlined text](#).

[†]Requires Acrobat Reader™ — available from the Adobe website: www.adobe.com/products/acrobat/readstep2.html

* Web browser and Internet connection required



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International Association of Oil & Gas Producers (OGP)

OGP represents the upstream oil and gas industry before international organizations including the International Maritime Organization, the United Nations Environment Programme (UNEP) Regional Seas Conventions and other groups under the UN umbrella. At the regional level, OGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is OGP's role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

International Petroleum Industry Environmental Conservation Association (IPIECA)

The International Petroleum Industry Environmental Conservation Association (IPIECA) is comprised of oil and gas companies and associations from around the world. Founded in 1974 following the establishment of the United Nations Environment Programme (UNEP), IPIECA provides one of the industry's principal channels of communication with the United Nations. IPIECA is the single global association representing both the upstream and downstream oil and gas industry on key global environmental and social issues including: oil spill preparedness and response; global climate change; health; fuel quality; biodiversity; social responsibility and sustainability reporting.

