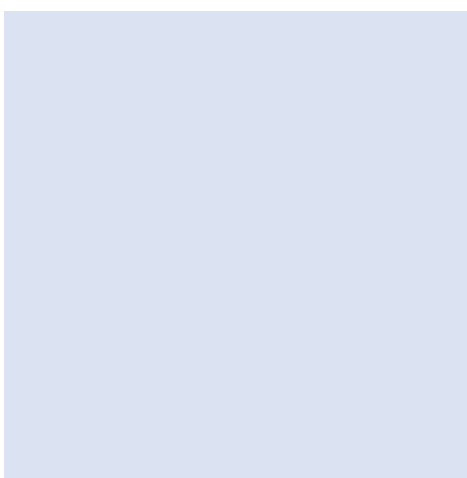


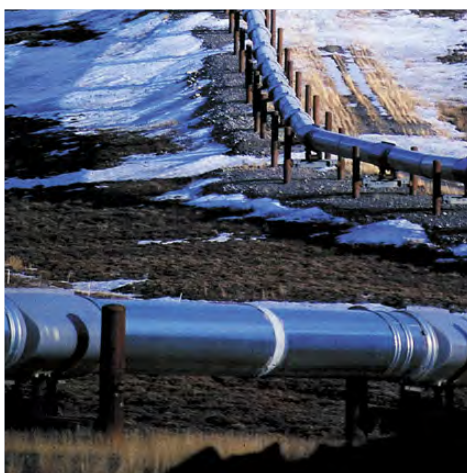
Health impact assessment

A guide for the oil and gas industry



THE GLOBAL OIL AND GAS INDUSTRY ASSOCIATION FOR ENVIRONMENTAL AND SOCIAL ISSUES

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Executive summary

OVERVIEW: THE IMPORTANCE AND VALUE OF HEALTH IMPACT ASSESSMENTS

Oil and gas companies need to consider and understand the potential public health impacts of their projects and operations in order to define their responsibilities with regard to local communities and host governments.

A health impact assessment (HIA) is a structured planning and decision-making process for analysing the potential positive and negative impacts of programmes, projects, and policies on public health. These can then be addressed in a timely and appropriate manner to achieve positive outcomes and cost benefits while also enhancing sustainability.

This guide defines and outlines the purpose and value of health impact assessments within the oil and gas industry, and details a six-step HIA implementation process. It revises and updates the 2005 guide, and includes 'lessons learned' and new HIA developments.

The guidance is intended as a technical resource for both subject matter experts and project staff who work on the potential health impacts of oil and gas projects.

INTRODUCTION

The introduction explains the purpose of the document, which is to create a common understanding of the basic concerns, principles and practices of HIA for the oil and gas industry that would be relevant across a diversity of potential upstream, midstream and downstream projects.

WHAT IS HIA?

While exploring the core principles of HIA, this section locates the process within the broader context of national requirements, international standards and the concerns of financial institutions. It also reviews the benefits and limits of the assessment, looks at HIAs both as stand-alone processes and components of broader environmental, social and health impact assessments (ESHIA), and outlines the different types of HIAs.

STRATEGIC HEALTH IMPACT ASSESSMENT (SHIA)

Strategic health impact assessment (sHIA) is a structured process to strengthen the role of health issues in strategic decision making and planning. Focusing on decision making, sHIA provides a technical document and a strategic engagement process that can inform industry strategic planning across multiple projects over a large geographical area. Often driven by governments and international financial institutions, the sHIA process enables industry to plan for, and manage, the human health impacts resulting from decisions made across a range of levels, from regional to global. This strategic process can create a platform for engagement with government or regulatory authorities and communities about human health-related issues identified during the project planning.

Three core principles for conducting sHIAs inform the process, and its outcomes and outputs: scale (of impacts); collaboration; and timing. Outcomes of a sHIA are: a technical report about strategic health impacts; improved definition of relationships with stakeholders; indicators for ongoing project planning and assessment; and monitoring and evaluation.

PROJECT HEALTH IMPACT ASSESSMENT

Once the decision has been taken to conduct an HIA, it is vital to consider the level of effort needed to adequately characterize potential project risks. While there is no consistent or agreed terminology to describe the required intensity of effort, this Guide defines three key types of HIA: **desktop**; **rapid appraisal**; and **comprehensive**.

The type of HIA that is considered triggers different approaches to baseline data collection and stakeholder engagement.

A **desktop HIA** is a qualitative assessment most appropriate for projects with few anticipated health impacts. It will usually be completed in 2 to 4 weeks, but may take longer if baseline data gathering is difficult. Typically the HIA team will not pursue extensive external stakeholder engagement, but any related data collected should be documented. Internal business stakeholders and close communication are critical. Desktop HIAs are often

implemented by company staff as an internal 'exercise' and are not made public.

A **rapid appraisal HIA** is site-specific and uses health information that is already available or potentially accessible without conducting new field survey work. Data sources for a rapid appraisal may include: peer-reviewed scientific literature; NGOs' reports and data; and local, provincial and national health department databases. In addition, if the current project under consideration is an expansion scenario, information from previous impact assessments should be consulted.

A **comprehensive HIA** is defined by its collection of new field study data to address data gaps identified during scoping. It may be appropriate for large, complex projects involving some or all of the following: local community resettlement; potential for project-induced in-migration; major disruption of livelihoods; significant impact for key social determinants of health; information gaps related to a well-known aspect of a project; greenfield oil or gas developments.

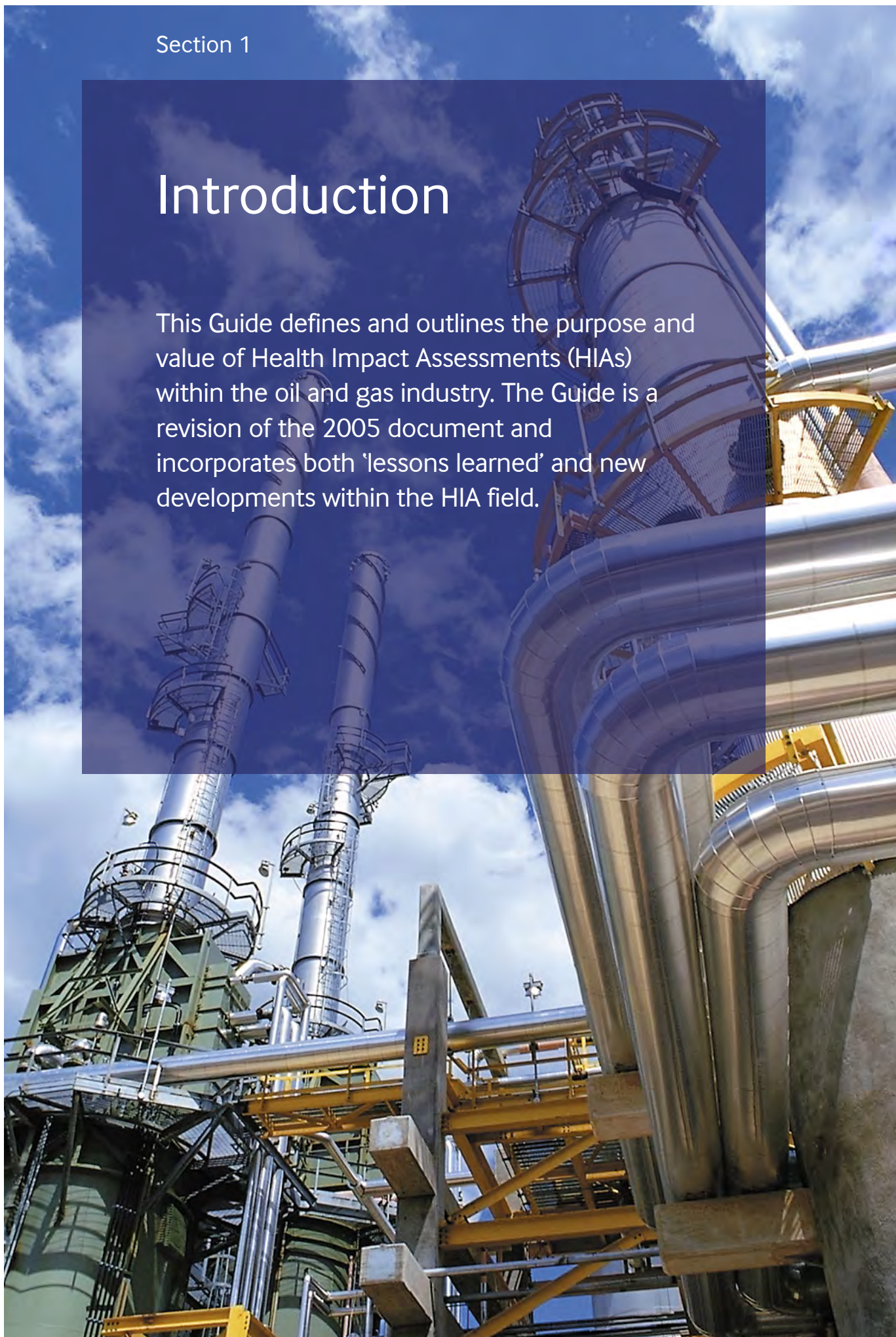
CRITICAL STEPS IN THE HIA PROCESS

The largest section of the guide describes six critical steps for the practical implementation of HIAs:

1. **Screening** is a preliminary evaluation of whether a project poses significant health questions, and helps determine whether an HIA is needed. All screening discussions should answer the basic question: Is an HIA appropriate and/or needed for this project?
2. **Scoping** underpins the HIA process. It is an early, open identification of likely significant impacts requiring investigation, and can also facilitate identification and assessment of alternative project designs/sites, the gathering of local knowledge of site and surroundings, and the preparation of a plan for public involvement. Scoping results are frequently used to prepare HIA terms of reference—providing focus when time and resources are usually limited—and to decide whether the HIA will be a stand-alone document or part of an overall ESHIA.
3. Collecting and reporting **baseline** data is a critical analytic task for the HIA. The scoping analysis and use of the systematic methodology, such as the environmental health area framework, should help guide and inform the data collection process. Initially, a large amount of data can be collected using published sources, e.g. peer-reviewed scientific papers, 'grey literature' produced by the host country Ministry of Health, etc. Stakeholder input and local knowledge are critical and should be obtained and coordinated with the ESHIA team.
4. **Impact assessment:** after screening, scoping and baseline analysis, the HIA team should rate and rank the potential health impacts, their relative importance and at what level they are expected to occur. Impacts can occur singly or in combination at various levels, i.e. individual, household, community/village, regional and national. The assessment needs to consider the advantages and disadvantages of concentrating on one level versus another. It may be difficult to develop the database necessary to assess all levels or key units simultaneously. Clearly defining the unit of assessment is critical since it can help to focus studies and concentrate resources as well as facilitate understanding of the linkages that exist between the different levels.
5. **Mitigation and enhancement** are measures that aim to avoid, minimize, eliminate or remedy an adverse effect, or maximize a potential benefit. Outcomes of the impact assessment step can be used to both prioritize health impacts to be mitigated and to identify opportunities for enhancing health benefits. The mitigation development process should reassess the effectiveness of the selected mitigation measures. Even companies with strong reputations can lose credibility when mitigations fail to prevent or reduce health impacts and enhance positive impacts associated with a project.
6. **Monitoring and evaluation** help to determine whether the selected mitigation strategies have been implemented and are effective. Monitoring is the ongoing, methodical collection of data that provides early indication of progress toward the desired goals. Evaluation is periodic and primarily focused on measuring long-term results and overall effectiveness of the actions implemented. Effective management, monitoring and evaluation depend on the identification of key performance indicators.

Introduction

This Guide defines and outlines the purpose and value of Health Impact Assessments (HIAs) within the oil and gas industry. The Guide is a revision of the 2005 document and incorporates both 'lessons learned' and new developments within the HIA field.



Introduction

PURPOSE OF THIS GUIDE

HIA is a useful and beneficial tool for business, communities and host country decision makers. Experience within the oil and gas industry suggests that health is a critical issue, both for the project workforce and the surrounding communities, as well as being a key component of project sustainability. The oil and gas industry faces a complex agenda that increasingly requires an evaluation of health, social, human rights and environmental impacts throughout its operations. This concern is often present and felt in all phases of upstream, midstream and downstream activity, i.e. exploration, production, refining and marketing activities.

Historically, impact analysis has focused primarily on environmental assessment and compliance; however, over the past several years, the industry's 'licence to operate' has expanded to encompass both environmental and social performance. While health and safety issues have always received the highest priority for any project, the traditional focus was on worker health and safety within the geographical boundaries of a proposed project. The importance of HIA and public health has been rapidly absorbed by the oil and gas industry, and these are Tier 1 (Health Management System) KPIs for IOGP members. Within the context of environmental and social issues, the oil and gas industry is increasingly asked to address problems that are considered to be 'outside the fence line' and not directly tied to a specific oil and gas project, i.e. problems that are considered responsibilities of the host government. There is a difference between the potential health consequences of a project or production activity and the general voluntary health promotion outreach activities supported by the companies. For example, many companies have a variety of local community health initiatives that are not directly related to mitigating potential negative project-related impacts. These voluntary contributions include vaccination support, local health staff training, scholarships, etc. The potential 'blurring' of the line between inside and outside the fence line has led some companies to consider the role and benefit of a 'strategic HIA' in

addition to the execution of a project-specific HIA. Strategic HIA (sHIA) is a new and evolving concept that is a parallel exercise to: (i) the strategic environment assessment (SEA) for public plans and programmes; and (ii) the assessment of cumulative impacts for multiple projects that often coexist in the same general geographical area, e.g. large offshore gas and oil development blocks with significant onshore processing and support facilities. The sHIA provides a potential opportunity for companies to consider a higher-level perspective on large, complex developments, (e.g. onshore LNG projects), and to establish relationships with multiple stakeholders, such as the national health authorities. Oil and gas companies need to understand and consider the potential public health impact of their activities and projects on both local communities and the host government in order to understand, define and address their responsibilities appropriately.

The practice of HIA has gained substantial traction within the oil and gas industry over the past 10 years, and many companies have developed their own internal HIA guidelines and execution procedures. HIA can be a separate process or can be integrated with the other components to become an environmental, social and health impact assessment (ESHIA), but the underlying principles remain the same. This HIA Guide is useful whether the HIA is part of an integrated assessment or is presented as a stand-alone report. Hence, this guidance is designed to present many of the common practices and procedures that are occurring across the industry regardless of the final report format. The purpose of this guidance document is to create a common understanding of the basic concerns, principles and practices of HIA for the oil and gas industry that would be relevant across a diversity of potential upstream, midstream and downstream projects.

What is HIA?

This section provides an overview of the core principles of an HIA, and looks at the need to consider national requirements and international standards. The benefits and limitations of HIA are discussed, and other types of health studies are introduced. The section closes with a summary of the steps needed to conduct an integrated environmental, safety and health impact assessment (ESHIA).

What is HIA?

CORE PRINCIPLES

HIA is a structured planning and decision-making process for analysing the potential positive and negative impacts of programmes, projects and policies on public health. The HIA process is designed to:

- provide a systematic methodology and process of how a project, policy or programme is potentially generating human health impacts;
- predict the consequences (positive, negative or both) and distribution of these impacts across potentially affected communities, including vulnerable individuals or groups;
- identify positive health effects while prioritizing the prevention of potential negative health effects;
- be multidisciplinary in approach and use information from many different health providers, disciplines and allied technical fields, e.g. environmental, socio-economics and human rights;
- facilitate discussions across decision makers and key stakeholders; and
- generate detailed baseline information that can be used to develop key performance indicators for future monitoring and evaluation.

A comprehensive HIA is a participative and interactive process with a broad range of stakeholders at every level within the host society. In addition, health analysis is increasingly considered by national and international stakeholders (e.g. non-governmental organizations (NGOs) and financial institutions) as an essential part of the overall impact assessment process. HIA can be used at any stage of the industry life cycle, whether this is new country entry, exploration and development, production, modification of an existing activity or closure of previous projects.

HIA makes recommendations to avoid or mitigate negative impacts and enhance health opportunities as a core aspect of the oil/gas project design. The HIA can

also assist in the planning process for health and social outreach programmes that extend beyond the fence line and into surrounding communities, e.g. capacity and institution building, health infrastructure support, information education and communication, vocational training, safe water projects and small-scale business (trade markets) infrastructure support. All of these programmes can provide positive and important health benefits, both in terms of strengthening public health services and enhancing household-level health outcomes, the latter being strongly associated with improved income generation.

HIA seeks to identify and estimate lasting or significant changes resulting from different actions on the health of a defined population. These changes can be positive or negative, intended or not, single or cumulative. Furthermore, the range of changes may or may not be evenly distributed across the population. The potential for uneven differences is a major concern for many impact assessment practitioners (including health) and is generally referred to as the 'assessment of equity'. The management and mitigation of potential health impacts is discussed in later sections of this guidance. The integration and alignment of impact management across health, environment, social and human rights is extremely important.

NATIONAL REQUIREMENTS AND INTERNATIONAL STANDARDS

The HIA team should carefully evaluate and understand host government rules and requirements covering health. In any given setting, there is a range of regulations and standards addressing health issues that should be considered during the development and execution of an HIA. National laws regarding health can be extremely variable and are often included in the regulatory framework review typically addressed by the environmental and social impact assessment process,

e.g. with regard to land use, housing, and water and sanitation systems. Most countries have labour and workplace health and safety rules; however, these requirements are more commonly considered by 'inside the fence line' evaluations. In terms of community health, communicable disease reporting requirements are extremely important, particularly as the number of serious emerging infectious diseases continues to increase worldwide. Relatively few countries require a formal stand-alone HIA or its equivalent; however, host country and lender (financial institutions) requirements often trigger a formal and detailed health impact analysis above and beyond the level customarily considered in the environmental and social assessment. Many oil and gas companies have internal impact assessment guidelines and requirements. In addition, IPIECA has developed a number of human rights guidance documents that consider the role of health and well-being within this context, i.e. the 'right to health.' Since the first edition of this IPIECA-IOGP HIA Guide was written in 2005, the number of member companies that require some level of community health impact assessment has increased.

INTERNATIONAL FINANCIAL INSTITUTIONS (IFIs) AND THEIR ROLE IN HIA

IFIs are financial institutions that are established across more than one country and are subject to international law. IFIs include the World Bank Group (WBG), European Investment Bank, Asian Development Bank, Asian Infrastructure Investment Bank, European Bank for Reconstruction and Development, Development Bank of Latin America, African Development Bank and the Islamic Development Bank. These institutions have global reach and are critical partners for both host countries and oil and gas companies. One of the most influential IFIs is the World Bank Group. Within the WBG, the International Finance Corporation (IFC) is one of the most important actors in terms of impact assessment, particularly for private companies. The IFC is the largest global development institution focused exclusively on the private sector. The IFC has developed a series of eight Performance Standards (PS) that are 'directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.' The PS were revised and updated in 2012 and cover a range of social, environmental and



health and safety performance areas. Performance Standard 4, *Community Health, Safety and Security* and its associated 'Guidance Notes' directly address community health. Many oil and gas companies have modelled their own impact assessment processes to be aligned with the IFC Standards.

Private sector financial institutions have also embraced the need for benchmarking environmental, social and health project risks, and have developed a risk management framework known as the Equator Principles (EP). The EP are used for determining, assessing and managing environmental, social and health risks in project financing. The EP have adopted the IFC PS and IFC *Environmental Health, and Safety Guidelines (EHS) Guidelines* and applied them globally, to all industry sectors, including oil and gas.

BENEFITS OF PERFORMING HIA

Many oil and gas projects occur on a large scale and in diverse locations across the globe. The potential for health impacts is affected by a combination of local environmental, cultural and social living conditions. The HIA is a tool that helps decision makers and stakeholders to maximize the potential benefits for communities and minimize potential impacts that may be triggered by the project. The HIA can be a vehicle for documenting and delineating the roles, responsibilities and issues that are relevant for the host government, local communities and the project sponsor. The HIA can assist in understanding the wider health issues and trends that may already be occurring in the host country or community.

A well-executed HIA can prevent new project delays by anticipating, soliciting and appropriately incorporating stakeholder concerns and suggestions into the overall project design. Similarly, existing operations can also benefit by the timely assessment and evaluation of a broad range of impacts. One of the key benefits of the HIA process for stakeholders is to enhance the awareness that health is a relevant and significant cross-cutting issue. Additional benefits include:

- Identifying factors, positive or negative, that otherwise may not have been adequately assessed. This process allows for timely project design and modifications in a cost-effective manner.
- Quantifying the positive and negative impacts more precisely than would have otherwise been done.
- Clarifying the potential elements of project trade-offs. The HIA can become an effective risk management tool for all stakeholders.
- Describing the potential interactions and relationships among the different environmental health areas and sectors.
- Allowing a clearer analysis of potential mitigation strategies for negative effects or enhancement of positive benefits.
- Making the overall project decision process more transparent for key stakeholders.
- Providing a structured environment for stakeholder input and engagement in both new projects and existing operations. This allows for early input into the overall decision-making processes.
- Building consensus within stakeholder communities so that mutual trust is developed and enhanced during all phases of project development, construction, operations and decommissioning.
- Securing funding from IFIs.
- Specifying responsibilities between the project sponsors and the host government.
- Establishing an accurate and appropriate baseline for future comparison during the development, operation and eventual closure of a project.
- Enhancing project benefits, as HIA can help to provide the basis for large- and small-scale investment and development plans in the health sector and other areas (for example, education) for the benefit of the overall community.
- Contributing to overall health systems capacity, infrastructure and development including preservation of traditional medicine, local health providers and culturally important practices.

LIMITATIONS

This Guide does not focus on 'inside the fence line' occupational health issues that are typically covered by both host country's rules and regulations and internal company policies and procedures. The oil and gas industry is a leader in occupational health and safety, and a range of IPIECA-IOGP publications are available which cover a wide variety of workplace issues. This guidance document addresses workplace 'cross-over' issues that could potentially affect household- and community-level health outcomes; examples include emerging infectious diseases and changes in the level of non-communicable diseases. In general, the Guide focuses on projects as opposed to general policy or programme impact assessment.

AUDIENCE FOR THIS GUIDE

The Guide is intended as a technical resource for both subject matter experts and project staff who work on the potential health impacts of oil and gas projects. Experience with the first edition of this Guide indicates that there are a variety of internal business stakeholders who want to understand and participate in the HIA process, including:

- project managers;
- environmental, social, human rights and health advisers;
- communications and external affairs personnel;
- HSE managers;
- construction and facilities managers;
- design engineers; and
- security professionals.

Many company decision makers are unfamiliar with HIA and its close alignment and potential integration with the environmental and social impact assessment process. This Guide provides core technical information and insight into the benefits of conducting an appropriate, focused and integrated HIA. In addition, external stakeholders (e.g. host country officials and international financial institutions), including potentially affected communities can use this guidance as both an information source and as a mechanism for actively participating in the HIA process.

THE ESHIA PROCESS AND OTHER IMPACT ASSESSMENTS

Human health outcomes are embedded in a myriad of economic, social and personal issues. Theoretically, there are potential benefits and synergies that could be derived by using a multidisciplinary team that utilizes a single impact assessment approach integrating environmental, social, human rights and health components. The resulting ESHIA could be fully integrated and:

- avoid duplications;
- minimize overlaps;
- efficiently and cost-effectively obtain baseline information;
- have a unified risk ranking system so that environmental, social, human rights and health impacts could be systematically rated and ranked using a common risk matrix;
- better assess the pathways between environmental exposure and health outcomes; and
- develop a unified risk registry with an integrated monitoring and surveillance system.



The overlap across the different ESHIA disciplines is illustrated in Figure 1.

In general, the different disciplines (environmental, social, human rights and health) all use a similar sequential impact assessment process. While an integrated impact assessment is theoretically ideal, there are many situations when a stand-alone HIA is created and is a preferred option. In many circumstances, there will be an overlap across the potential social, health and environmental impact areas. However, many projects, particularly those that are large and have diverse linear features (e.g. pipelines, power transmission corridors, canals and significant new-road developments), may impact communities and geographical areas in ways that are specific to health.

For example, long-haul truckers are considered an important 'vector' for HIV/AIDS transmission, and changes in land use and/or in-migration may trigger new disease emergence (emerging infectious diseases). These geographic areas or communities may not match potentially affected areas identified in the social or environmental component of the ESHIA. The epidemiology of disease transmission is generally not considered during the social impact assessment (SIA) and may be evaluated in the environmental impact assessment (EIA) only in relation to wildlife and habitat issues. Project-induced in-migration is likely to be considered differently by environmental, social, human rights and health professionals. Flexibility is critical as the overall impact assessment, whether integrated or stand-alone, should be fit for the intended purpose.

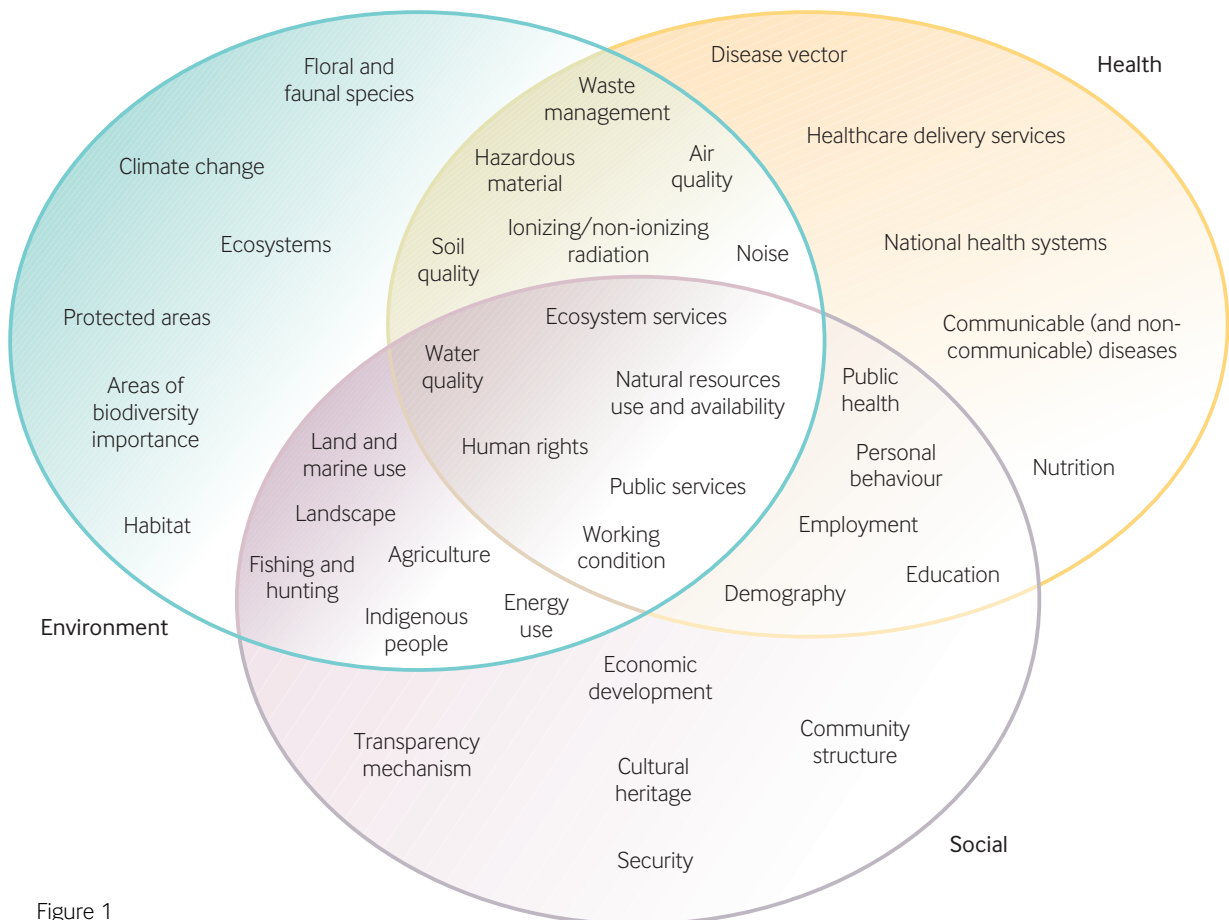


Figure 1
Key environmental, social and health issues
and their interrelationships

Source: eni E&P Standard Doc. No. 1.3.1.47, *Environmental, Social and Health Impact Assessment*, 2010

Whether stand-alone or integrated, the HIA process can work synergistically within the ESHIA process. For example, baseline environmental health data such as water and sanitation service levels in communities and contaminant levels in media (i.e. soil, water, air, subsistence foods) collected by the environmental team is utilized in the HIA, thus avoiding duplication of efforts. Typically, there are environmental and social studies that generate data, which can be fed directly into the HIA. These interdependencies are extremely important and are shown in Appendix 1. Survey efforts should also be coordinated to avoid survey fatigue among residents.

OTHER HEALTH STUDIES

As part of the project evaluation process, company health professionals are often tasked with performing three different types of assessments that can provide critical input into the HIA:

- health risk assessment (HRA)
- health needs assessment (HNA)
- health facility assessment (HFA)

Health risk assessments classically address 'inside the fence line' issues that focus on the workforce. These assessments include the quantitative calculation of incremental individual exposure risk to hazardous materials in the environment or the assessment of exposure risks encountered while working at the project facility, such as chemical exposures, cold and heat exposures, or safety hazards. There are cross-over considerations when workers act as transmission agents for potentially hazardous exposures (e.g. to chemicals or infectious diseases) and transmit the exposure effects from the worksite to their homes. These situations are typically evaluated as part of an industrial hygiene/safety review and should be carefully considered by the HIA team.

Health needs assessments (HNAs) involve a systematic review of the health issues faced by a population, and lead to agreed priorities, strategy identification/selection and resource allocation that may concur to improve health and reduce inequalities.

Health facility assessments (HFAs) function primarily as a means of documenting the existing level of clinical (including hospital and emergency healthcare) services that are available, both in the host communities and the country as a whole.



THE HIA PROCESS, INCLUDING TYPES OF HIAs

The steps necessary to conduct an integrated ESHIA are illustrated in Figure 2. The sequence of basic steps, e.g. screening, scoping, baseline, impact assessment, mitigation planning and monitoring, is identical for a stand-alone HIA. Stakeholder communication and consultation is critical during all phases of the HIA. Stakeholders (both internal and external) should have an opportunity for input throughout the entire process.

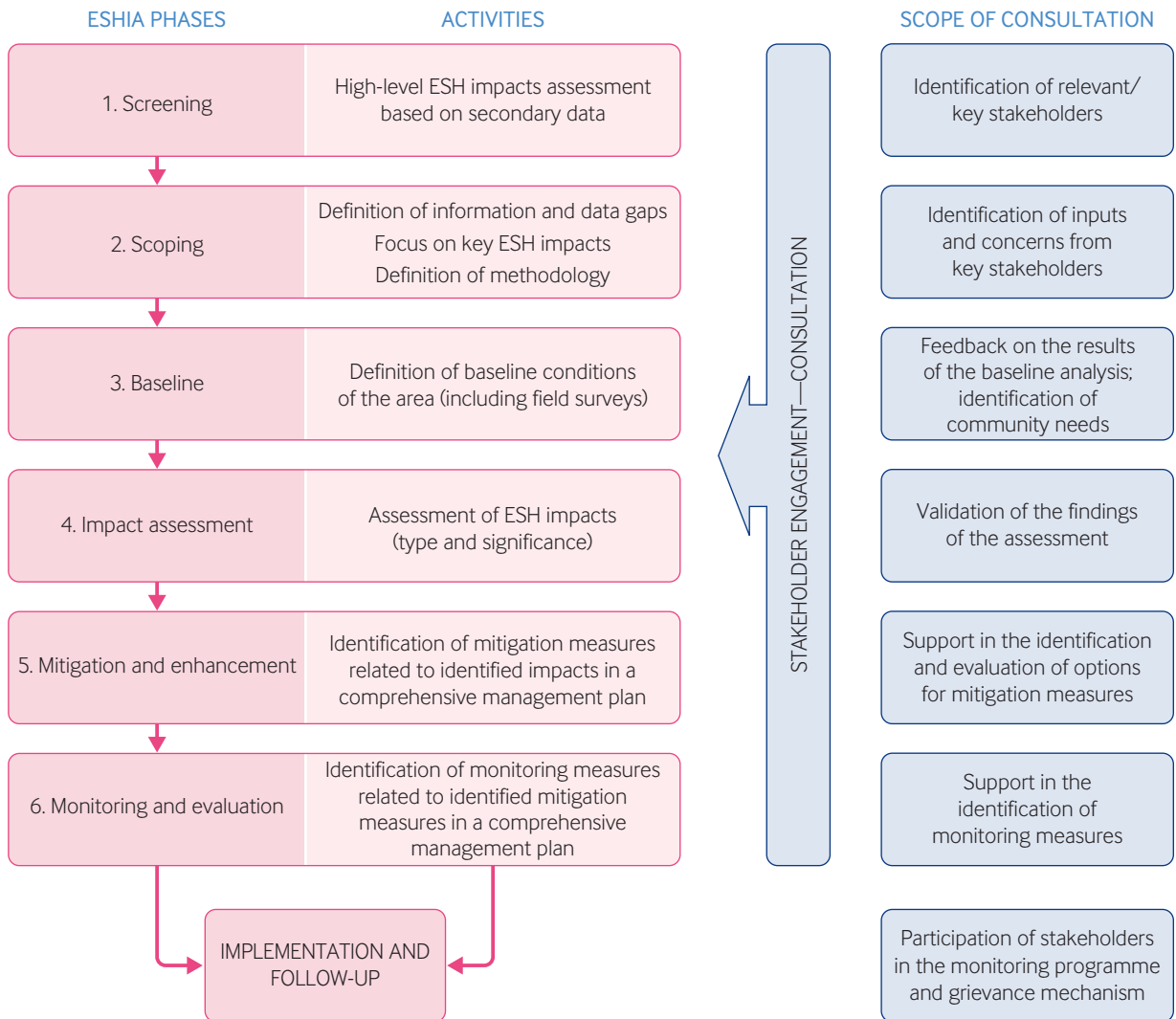


Figure 2
Critical activities that inform each step of the HIA process are illustrated as arrows directed toward the key decision making steps of the HIA process.

Source: eni E&P Standard Doc. No. 1.3.1.47, *Environmental, Social and Health Impact Assessment, 2010*

Strategic health impact assessment (sHIA)

A strategic health impact assessment can be defined as 'a structured process to strengthen the role of health issues in strategic decision making and planning'. Crucially, because of its focus on decision making, sHIA provides a technical document and a strategic engagement process that can inform industry strategic planning across multiple projects over a large geographical area.



Strategic health impact assessment (sHIA)

INTRODUCTION TO sHIA

Strategic health impact assessment can be defined as ‘a structured process to strengthen the role of health issues in strategic decision making and planning’. Crucially, because of its focus on decision making, sHIA provides a technical document and a strategic engagement process that can inform industry strategic planning across multiple projects over a large geographical area.

When there is potential for (i) large-scale industry activity in a new geographical area and/or (ii) a number of separate projects carried out by multiple organizations in a large geographic region, conducting a sHIA may be an important option to consider. Potential examples include oil sands activities in Canada, oil and gas exploration and development in Greenland and Mozambique, and large onshore and offshore development in Ghana. Multiple projects, typically conducted by different developers, have the potential to lead to a myriad of health impacts across a large geographical area, i.e. at provincial, regional and

potentially national scales. Impacts, both positive and/or negative, on a large geographical scale, may be beyond the scope of single project assessments, and it may not be possible to assess, mitigate and effectively manage such impacts without significant and ongoing involvement by the host country government. Strategic environmental assessments (SEA) offer a potential template for a similar strategic health assessment. Similarly, integration of health into an ongoing SEA process could be considered. For example, the World Bank has recognized SEA as a key means of integrating environmental and social considerations into policies, plans and programmes, particularly for sector decision making, reform and sustainable development. The World Bank has written that ‘SEA is a family of approaches that lie on a continuum. At one end, the focus is on impact analysis, at the other end, on institutional assessment. SEA incorporates environmental considerations across different levels of strategic decision-making: plan, program, and policy.’ A similar perspective can be utilized for health, either as part of an integrated strategic assessment or, in some situations, as a stand-alone sHIA.



Section 3

Strategic health impact assessment (sHIA)

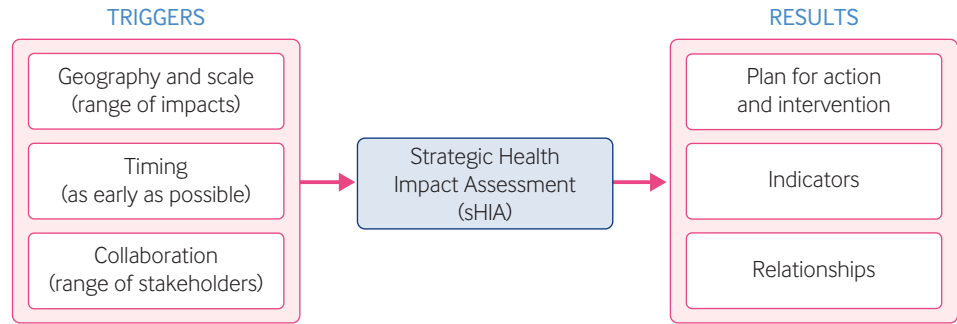


Figure 3
Triggers/dimensions
of sHIA and its results

sHIA ACTORS

While governments and International Financial Institutions could be major drivers of the sHIA process, the sHIA approach allows for industry to plan for, and manage, the human health impacts of a range of decisions including macro-business models and approaches at a global and regional level. This strategic process can lay the platform for engaging with government or regulatory authorities and communities about issues influencing human health that have been identified through the project planning process.

sHIA PRINCIPLES

There are three core principles for conducting sHIAs that inform the process as well as the results (see Figure 3). The core dimensions underpinning these principles are scale (of impacts), timing and collaboration.

Correspondingly, the outputs of a sHIA are: (i) a technical report about strategic health impacts; (ii) improved definition of relationships with stakeholders; (iii) indicators for ongoing project planning and assessment; and (iv) monitoring and evaluation. These outcomes are discussed, and compared and contrasted to a more typical project HIA.

Geography and scale (range of impacts/new area)

sHIAs are concerned with large geographic areas, e.g. national and regional. Strategic decisions at a large scale are concerned with potential health impacts of multiple similar projects, e.g. development of multiple offshore platforms feeding different and geographically dispersed onshore LNG plants. Similar to the process considered by the cumulative impacts assessment, the analysis also includes other non-project related development activities and government priorities occurring in the region, e.g. transport infrastructure, schools, markets, etc.



Section 3

Strategic health impact assessment (sHIA)

Collaboration (range of stakeholders)

Strategic problems require discussion and collaboration across a large and diverse set of stakeholders. sHIAs provide the opportunity to proactively engage with a wide range of stakeholders, including other companies who are operating, or plan to operate, in the same general geography, at an early stage of project planning and development.

Timing (as early as possible)

sHIAs should occur at the earliest point of planning for industry activity where ideas and options about multiple activities at scale are forming. The purpose of a sHIA is to identify and assess the range of potential health impacts at a large scale and from multiple activities before the traditional planning for individual activities begins. Once a trigger has been established—in terms of need for a sHIA to address a problem—a sHIA can be rapidly initiated.

Results

The principle results from a sHIA include:

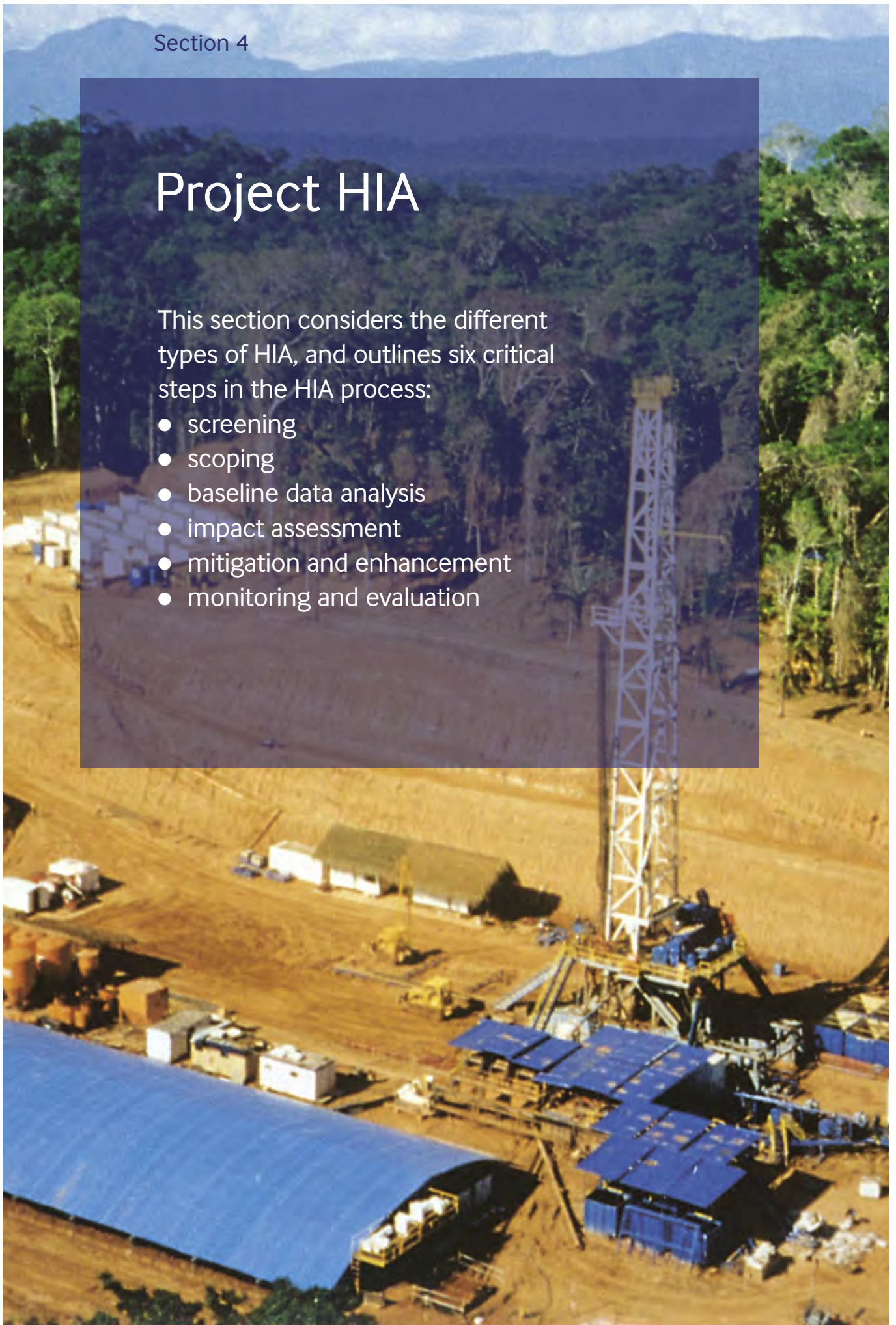
- Decisions are made about planning for actions and interventions based on the size and type of health impacts in new regions where industry will operate.
- Development of broad national or regional-level indicators that can be used for monitoring, e.g. population morbidity and mortality indicators.
- Strategic relationships allow implementation of effective interventions.

Finally, the sHIA planned interventions should lead to reduced impact on, and even improve, health in communities which can be measured through reduction in morbidity and mortality numbers.

Project HIA

This section considers the different types of HIA, and outlines six critical steps in the HIA process:

- screening
- scoping
- baseline data analysis
- impact assessment
- mitigation and enhancement
- monitoring and evaluation



Project HIA

TYPES OF HIA

If a decision is made to conduct an HIA, it is extremely important to consider the level of effort needed to adequately characterize potential project risks. HIA practitioners often refer to different types of HIAs in terms of the intensity of effort that will be required, particularly in relation to the collection of new community-level data, as well as the overall time needed to complete a document. At present, no consistent terminology is used to distinguish one type of HIA from another. In this Guide, the key terms used to describe the different types of HIAs are:

- 'desktop';
- 'rapid appraisal'; and
- 'comprehensive'.

The type of HIA that is considered triggers different approaches to baseline data collection and stakeholder engagement.

Desktop HIA

The desktop HIA is a qualitative assessment and is most appropriate for projects with few anticipated health impacts. The desktop HIA ideally requires 2 to 4 weeks but may require longer if baseline data are difficult to obtain. The HIA team typically does not pursue extensive external stakeholder engagement. However, any external stakeholder input that is collected should be documented. Close communication with internal business stakeholders is critical. Many desktop HIAs are performed by internal company staff as an internal 'exercise' and are not released for public review or comment. In a desktop analysis, the following elements should be covered:

- project background;
- internal company standards and guidance for impact assessments;

- legislative/regulatory review;
- scope of the HIA;
- brief project description including:
 - (i) location;
 - (ii) site access (are new transport features needed?);
 - (iii) timing/schedule;
 - (vi) type of project activity; and
 - (v) the number of persons involved in the project activity;
- potentially impacted areas (geography);
- potentially affected communities (if any);
- community and/or external stakeholder concerns or comments;
- brief baseline analysis and preliminary identification of whether critical data gaps are present;
- impact analysis based on the standard environmental health area (EHA) categories;
- mitigation analysis (if required, or if none, why not?); and
- monitoring and evaluation analysis (if required, or if none, why not?) .

Rapid appraisal HIA

A rapid appraisal HIA is considered to be a site-specific HIA that uses health information that is already available or potentially accessible without conducting new field survey work.

Data sources for a rapid appraisal may include: peer-reviewed scientific literature; NGO reports and data; and local, provincial and national health department databases. In addition, if the current project under consideration is an expansion scenario, information from previous impact assessments should be consulted.

Comprehensive HIA

The hallmark of the comprehensive HIA is new field study data. Field studies address data-gaps identified during the scoping process. A comprehensive HIA may be appropriate for large, complex projects that involve:

- resettlement of existing communities;
- significant potential for project-induced in-migration;
- major disruption of livelihoods;
- significant impact on key social determinants of health;
- information gaps related to a well-known aspect of a project; and
- large greenfield development, i.e. no previous oil or gas projects.

Field data collection typically consists of a combination of: (i) household level health-questionnaire surveys;

(ii) key informant interviews with health workers and other community leaders/stakeholders; (iii) focus group discussions (FGDs), especially with vulnerable groups, such as women, elders, disabled persons, etc.; and (iv) biomedical data, e.g. haemoglobin determination, malaria prevalence surveys, anthropometric surveys, etc. If an integrated environmental, social and health study is foreseen, survey administration should be aligned with the timing of environmental and social surveys, and coordinated through the ESHIA team in order to avoid survey fatigue among community members and to make optimal use of project resources.

A summary of the levels and characteristics of the different types of HIAs is shown in Table 1.

Table 1 Levels and characteristics of the different types of HIAs

TYPE OF HIA	CHARACTERISTICS
Desktop HIA	<ul style="list-style-type: none"> ● Broad overview ● Analysis of existing and accessible data ● No new data collection. Usually takes an experienced assessor 2–3 weeks to perform the appropriate literature searches, analysis and write-up
Rapid appraisal HIA	<ul style="list-style-type: none"> ● Provide more detailed information of possible health impacts ● Analysis of existing data ● Stakeholder and key informant analysis ● No new data collection ● Typically takes a team of two experienced assessors 10–14 days in the field, followed by 4–8 weeks of analysis and document preparation, with literature (desktop) searches performed prior to the field work
Comprehensive HIA	<ul style="list-style-type: none"> ● Provide a comprehensive assessment of potential health impacts ● Robust definition of impacts ● New data collection ● Participatory approaches involving stakeholders and key informants ● Requires approximately 2–4 weeks of fieldwork. Community survey may require a long pre-work coordination time and its feasibility is highly dependent on local climate and accessibility.

While no formal algorithm is used to select the level of HIA, Figure 4 suggests key factors for consideration and a schematic for decision making.

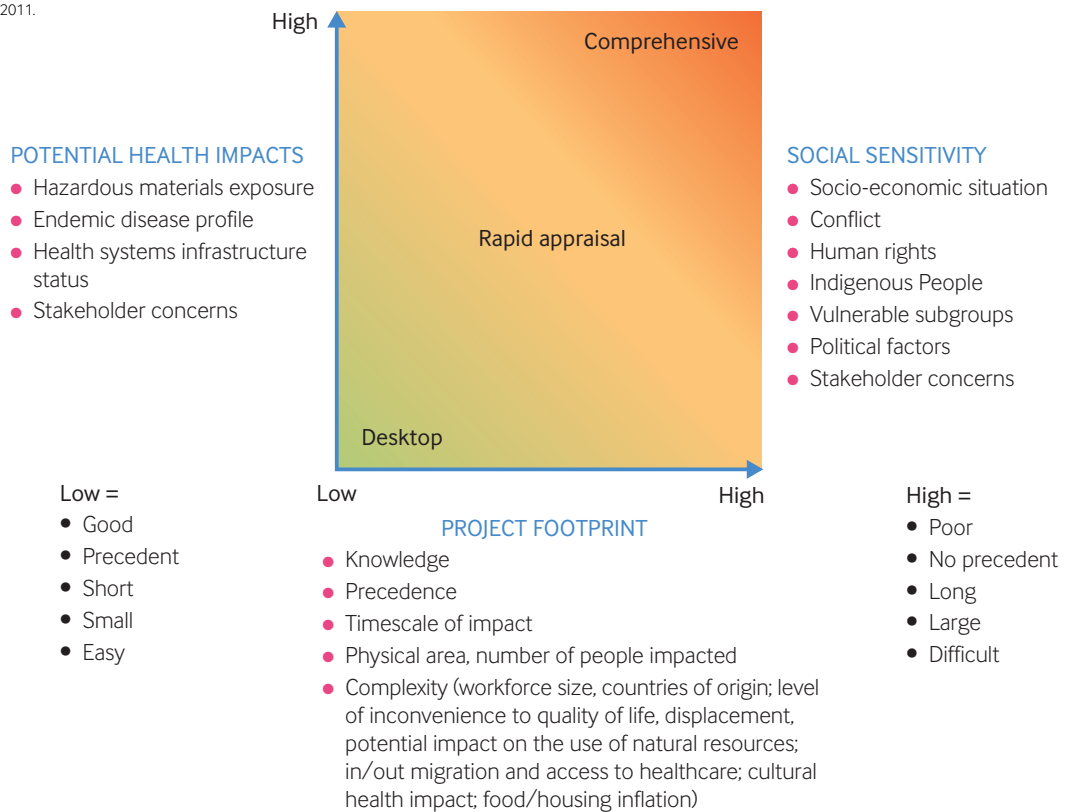
The potential health impacts axis considers health issues in the proposed project location, such as:

- exposure to hazardous materials—considers facility operation, and potential exposures to physical (including noise and illumination), biological and chemical hazards, particularly potential impacts on subsistence resources through emissions, or avoidance of an area due to noise or other physical hazard;
- resettlement, relocation, influx—considers whether or not the project will require the need for changes in the existing community configuration and social structures;

- endemic disease profile—considers the likelihood of sexually transmitted infections including HIV/AIDS, communicable respiratory diseases including tuberculosis, and other emerging infectious diseases, etc.;
- health systems and infrastructure—considers status of existing public health infrastructure and potential effects on direct clinical care services and resources;
- stakeholder concerns—considers critical community issues, such as impacts on subsistence harvest, water quality, crime rates, increased road traffic and accidents, noise, dust, etc.; and
- social sensitivity—considers whether or not the project will significantly alter existing cultural, community, and household social relationships.

Figure 4
Selecting an HIA type

Source: adapted from State of Alaska (2011), *Technical Guidance for HIA in Alaska* (Alaska HIA Toolkit), 2011.





The social sensitivity axis gives special focus to some of the social determinants of health such as gender, ethnicity, cultural cohesion, physical or mental distress due to cultural change, education levels, poverty or economic disadvantage, and dependence on unique natural resources. These topics are usually addressed in the social impact analysis, so it is extremely important that the HIA team understands the SIA approach to social analysis.

The project footprint axis applies to:

- the physical area, and number of communities affected by construction, operation and decommissioning: the health-specific project footprint may extend beyond the immediate physical footprint, and a useful technique may be to organize potentially impacted communities into geographic 'zones of impact' (e.g. 'Zone 1' representing the most impacted proximate communities; 'Zone 2' representing potentially impacted but geographically distant communities, and 'Zone 3' representing those with a low likelihood of potential impact);
- inconveniences to the population's quality of life such as dust, noise and transportation congestion;
- changes in access to services (e.g. health clinics) or livelihood activities due to re-routing of roads, re-routing or damming of rivers, and positioning of construction camps;

- impacts on natural resources used by the communities for subsistence, such as hunting and fishing, foraging, and water supplies for drinking;
- physical displacement (resettlement or relocation of individuals or communities increases the project footprint);
- impact on community transportation infrastructure, such as road improvements resulting in potential positive and negative changes in the flow of goods and services, such as alcohol and drugs (negative) and delivery/restocking of medication (positive);
- potential of the project to lead to local violence or other significant disruptions of community cohesion;
- Indigenous Peoples' cultural health practices and access to health infrastructure and services; and
- distortion of local prices, especially of food, property and energy.

CRITICAL STEPS IN THE HIA PROCESS

Step 1: Screening

Screening is a preliminary evaluation to decide whether a project poses any significant health questions, and helps to determine whether an HIA is needed. All screening discussions should attempt to answer the basic question: *'Is an HIA appropriate and/or needed for this project?'*

A description and general knowledge of the project, covering location, size, workforce, surrounding communities, operations and likely exposures, is essential. This initial review will determine whether an HIA may be appropriate, and provides an indication of its potential complexity.

Table 2 Steps for screening

Source: adapted from State of Alaska (2011), *Technical Guidance for HIA in Alaska* ('Alaska HIA Toolkit').

1. Assemble the team		
2. Identify legislative and relevant corporate requirements		
3. Gather and review relevant project information		
4. Evaluate health context		
<i>a. Location</i>	<i>b. Influx</i>	<i>c. Culture/socio-economic</i>
<ul style="list-style-type: none"> ● Rural ● Urban ● Peri-urban 	<ul style="list-style-type: none"> ● Temporary ● Permanent ● Countries or locations of origins 	<ul style="list-style-type: none"> ● Social structure <ul style="list-style-type: none"> ● tribal/clan ● Level of wage/cash economy <ul style="list-style-type: none"> ● subsistence agriculture
5. Review project design		
<ul style="list-style-type: none"> ● Water bodies ● Waste management ● Roadways, pipelines ● Construction camps ● Operation facilities ● Source of potential exposure ● Transmission-line corridors 		
6. Review the possible health impacts using environmental health areas (refer to Table 4 on page 28)		
7. Identify potentially health impacted geographic areas and potentially affected communities		
8. Identify key stakeholders		
9. Determine whether an HIA is needed		

Step 2: Scoping

Scoping is an early and open activity to identify the impacts that are most likely to be significant and require investigation during the HIA work. It may also be used to:

- identify alternative project designs/sites to be assessed;
- obtain local knowledge of site and surroundings; and
- prepare a plan for public involvement.

The results of scoping are frequently used to prepare the terms of reference for the HIA. A decision should be made whether the HIA will be a stand-alone document or part of an overall ESHIA. Scoping is one of the main foundations of an HIA. If scoping is carried out well, the HIA process has a significantly higher chance of proceeding smoothly and efficiently; if carried out poorly, it is likely that important information will be missed, leading to unnecessary delays and costs.

Scoping defines the limits of what is included in the HIA and what it is not necessary to include. This is important because time and resources are limited when undertaking a HIA and it is necessary to invest them in addressing the most important and relevant baseline aspects and potential impacts (Table 3).

Scoping also starts the process of understanding the regulations and standards that are pertinent to the project and its setting. This is important since these will have considerable influence on the health performance standards and the significance criteria that will be used in assessing impacts.

The scoping process:

- gives a clear focus for which health issues will be addressed in the HIA;
- considers the range of direct, indirect and cumulative impacts on health issues;
- identifies major external stakeholders and their likely issues and concerns;
- starts the process of understanding applicable host country regulations and standards and their potential impact on the design of the HIA;
- determines whether compliance with IFC Performance Standards will be required;
- considers the relevant company regulations and standards, especially if the host country has a weak legal and regulatory system;
- makes a provisional identification of the issues and potential impacts;
- considers what baseline information is required and how to get it; and
- describes the impact assessment ranking and rating methods to be used.

Table 3 Steps for scoping

1. Set the geographical time and population boundaries for the assessment		
2. Determine the HIA approach		
<i>a. Comprehensive</i>	<i>b. Rapid appraisal</i>	<i>c. Desktop</i>
<ul style="list-style-type: none"> ● Significant influx concern ● Resettlement/relocation ● Key social determinants of health (SDH), e.g. income, employment ● Significant construction activity ● New linear features, including transportation ● Large project in rural setting ● Potential subsistence impacts ● Community perceptions 	<ul style="list-style-type: none"> ● No new data collection anticipated within communities of concern ● Existing data source review 	<ul style="list-style-type: none"> ● Limited review

Important technical considerations during scoping are:

- defining potentially impacted (affected) communities (PICs) and vulnerable populations;
- considering the potential extent and magnitude of project induced in-migration;
- considering impacts across a suite of defined EHAs;
- considering the availability of specific health defined key performance indicators (KPIs); and
- assessing potential partners including the viability of community participatory epidemiology.

Potentially impacted communities and populations

During the scoping process, the HIA team should define the PICs and be careful to identify vulnerable subgroups within these communities. Potentially impacted populations may be grouped by variables such as age, sex, ethnic group, education, income level and even disease status (e.g. people living with HIV/AIDS).

Population groups will differ in their vulnerability to health hazards. For instance, research has shown that, in developed countries, chronic disease disproportionately affects women and minority groups. In developing countries, chronic disease rates have been rising rapidly, most likely due to a complex mix of social, economic and behavioural factors. Children are often more susceptible to communicable disease due to their lack of immunity. In addition, it should be noted that the composition of a community may change during the project's life cycle. For instance, during a construction phase of a project, there may be a greater proportion of adult men than during other project phases.

A set of clear criteria often allows PICs to be identified in a systematic way and facilitates the development of zones of impact for the project. Some sample criteria are communities with:

- close geographic proximity to the project;
- potential changes to water sources and quantities;
- locations in projected release areas for contaminants of concern (e.g. plume);
- high likelihood of influx, resettlement or relocation;
- intense workforce recruitment potential;
- high likelihood for change in key subsistence resources;
- high likelihood for change in transportation infrastructure;

- potential for economic change, including regional staging centres, e.g. port facilities or regional transportation hubs;
- existing large burden of diseases or health problems; and
- existing high level of exposure to an environmental hazard.

Project-induced in-migration (influx)

Project-induced in-migration (also generically known as 'influx') is a critical consideration for the overall impact assessment effort. The IFC has studied project-induced in-migration associated with large development projects, although these studies have largely been performed in rural environments in developing country settings.

According to the IFC, influx associated with economic opportunity is a common phenomenon and involves the movement of people into an area in anticipation of, or in response to, economic opportunities associated with the development and/or operation of a new project. While primary employment is a critical driver, a wide range of project-related economic opportunities serve to draw people into a project area, particularly in close proximity to large workforce housing developments. As noted by the IFC, this in-migration may ultimately benefit trade, employment, infrastructure and services in the project area; however, there can also be negative consequences for host communities in terms of environmental, social and health issues. The US Agency for International



Development (USAID) has developed an analysis and audit checklist of emerging infectious diseases (EID) that can be triggered by significant project-induced in-migration. More information on this critical topic is presented in Appendix 2.

The positive and negative impacts of influx are not solely driven by the magnitude of in/out migration (i.e. the 'rate of influx'). The overall footprint, duration and sustainability of in-migration, along with the resilience and absorptive capacity of the affected area, all determine the significance of the consequences of in-migration for a given project.

HIA experience in international developing country settings indicates that influx impacts are not evenly distributed across a defined study area, hence the population growth rate and distribution cannot be reliably assumed a priori. From an HIA perspective, influx is a significant potential source of impacts; however, HIA experience indicates that the 'health issues' are largely, but not exclusively, focused on the construction period.

Environmental health areas (EHAs)

Given the broad definition of 'health', HIAs can potentially have extremely wide scope and latitude. The underlying philosophical model of the HIA often drives the scope of the HIA. The two traditional models of health are biomedical and social or socio-environmental. The biomedical model of health focuses on disease and illness, and related causal mechanisms. In contrast, the socio-environmental model tends to focus on the broader factors or determinants that shape and influence health and well-being. Health determinants are personal, social, cultural, economic and environmental factors that influence the health status of individuals or defined populations. Examples include age, sex, genetic factors, air, water, housing conditions, income, employment and education.

An additional perspective known as 'ecosystem services' has also been gaining traction, particularly with EIA practitioners. The perspective received a substantial boost as the 2012 IFC Performance Standards update included specific language regarding ecosystem services in Performance Standard 6, *Biodiversity Conservation and Sustainable Management of Living Resources*. An ecosystems framework that includes health considerations is presented in Appendix 3.

There is a continuous effort to link biomedical and socio-environmental models and ecosystem services. Policy-level HIA tends to utilize a broadly defined socio-environmental model where significant emphasis is placed on determinants of community health such as poverty and income. In contrast, project level HIA is often more narrowly focused on specific health outcomes, for example potential project-attributable changes in disease-specific rates for, say, malaria or sexually transmitted infections (STIs). According to the IFC, ecosystem services include:

- provisioning services: e.g. food, fresh water, timber, fibres, medicinal plants;
- regulating services: e.g. surface water purification, carbon storage, climate regulation, protection from natural hazards;
- cultural services: e.g. natural areas that are sacred sites, or important for recreation, aesthetic enjoyment; and
- supporting services: e.g. soil formation, nutrient cycling, primary production.

The World Bank has developed the scope of HIA for sub-Saharan Africa and other low human development index (HDI) settings within the context of environmental health. The 'environmental health' perspective encompasses the 'human living environment' and emphasizes primary prevention through interventions in housing, sanitation, solid waste control, water, food, transportation and communication. The 'environmental health' approach overlaps with some of the ecosystem services concepts, e.g. food, water. The World Bank approach and scope emphasizes the potential linkages between infrastructure-related activities and overall environmental health. Sectors defined by the World Bank are: housing; water and food; transportation; and communication and information management. This integration of health and infrastructure is compatible with the design and execution of large, capital intensive oil and gas projects in low HDI settings.

The environmental health perspective represents a shift from a disease-specific focus (e.g. malaria) toward an examination of the relationships between overall disease burden and infrastructure impacts. For example, the assessment of potential malaria impacts is an important consideration for many projects, and malaria management has an extremely strong environmental component. The first edition of the IPIECA-IOGP HIA Guide generally promoted the EHA framework that was also utilized by the IFC 'HIA Toolkit' (2009). The EHA framework has 12 specific defined areas (Table 4).

Many oil and gas projects are undertaken in settings where there is an extremely high underlying burden of vector-borne, zoonotic diseases, respiratory illnesses

and STIs. Hence, the EHA methodology provides several areas for discrete, focused consideration. The EHA framework can be aligned with an ecosystems services strategy as illustrated in Table 5.

Regardless of whether EHAs, the ecosystem services framework, or determinants of health are utilized, the critical objective is that the HIA utilizes a systematic methodology that is compatible with environmental, social and human rights impact assessment strategies. This focus on compatibility is important to ensure that the HIA is viewed as an integral and essential part of the overall impact assessment process, regardless of whether the HIA is a stand-alone report or part of an ESHIA.

Table 4 Defined environmental health areas

ENVIRONMENTAL HEALTH AREAS (EHAs)

Vector-related diseases (VRDs): malaria, schistosomiasis, dengue, Japanese encephalitis, lymphatic filariasis, etc.
Housing and respiratory issues: acute respiratory infections (bacterial and viral), pneumonia, tuberculosis, respiratory effects from housing, overcrowding and inflation of housing prices.
Veterinary medicine/zoonotic diseases, including zoonotic emerging infectious diseases, e.g. brucellosis, rabies, Ebola.
Sexually transmitted infections: HIV/AIDS, syphilis, gonorrhoea, chlamydia, hepatitis B.
Diseases related to soil, water, sanitation and waste: giardiasis, worms, etc.
Food and nutrition-related issues: stunted growth, wasting, anaemia, micronutrient diseases (including folate, vitamin A, iron and iodine deficiencies), changes in agricultural practices, gastroenteritis (bacterial and viral) and issues relating to inflation of food prices.
Accidents and injuries: traffic-related accidents, spills and releases, construction (home- and project-related) and drowning.
Exposure to potentially hazardous materials: pesticides, fertilizers, road dust, air pollution (indoor and outdoor, related to vehicles, cooking, heating or other forms of combustion and incineration), landfill waste or incineration ash, any other project-related solvents, paints, oils or cleaning agents and their by-products.
Psychosocial effects (social determinants of health): resettlement/relocation, violence, security concerns, substance misuse (e.g. drugs, alcohol, smoking), depression and changes to social cohesion.
Cultural health practices: role of traditional medical providers, indigenous medicines and unique cultural health practices. Understanding cultural practices and beliefs inside and outside communities that are health lowering and enhancing.
Health services infrastructure and capacity including programme management delivery: physical infrastructure, staffing levels and competencies, technical capabilities of health-care facilities at district levels, systems for delivering and managing health programmes, coordinating the project to existing national and provincial health programmes (for example, TB, HIV and AIDS) and future development plans.
Non-communicable diseases: e.g. hypertension, diabetes, stroke and cardiovascular disorders.

Table 5 Identifying the drivers of ecosystem change likely to be associated with the project

ECOSYSTEM CHANGE	DRIVER EXAMPLE	ECOSYSTEM SERVICE CATEGORIES IMPACTED	ENVIRONMENTAL HEALTH AREAS IMPACTED
Change in local land use and cover	Changes in wildlife migration patterns and habitat use, land availability for hunting, and/or agriculture, disease vector and host/reservoir habit, availability of medicinal plants, culturally significant locations for traditional healing practices	Provisioning, regulating, cultural, supporting	Food and nutrition issues, VRDs, zoonotic disease, accident and injury, cultural health practices
Harvest and resources consumption	Changes in availability of subsistence fish and wildlife species, water availability	Provisioning, regulating, cultural, supporting	Food and nutrition issues, water and sanitation (WATSAN) diseases
Pollution	Changes in water quality, water resources pattern	Provisioning, regulating, cultural, supporting	Exposure to potential hazardous materials, food and nutrition issues, WATSAN diseases
Introduction of invasive species	Changes in wildlife migration pattern and habitat use, land availability for hunting and/or agriculture, disease vector and host/reservoir habit, availability of medicinal plants, etc.	Provisioning, regulating, supporting	Food and nutrition issues, VRDs, zoonotic disease, accident and injury, cultural health practices
Demographic change	In-migration, resettlement	Provision, regulating	Housing and respiratory issues, WATSAN diseases, food and nutrition issues
Economic changes	Decreased dependency on water purification and waste treatment, soil quality and diseases regulation, and harvest and resources ecosystem services	Regulating	Accidents and injuries, VRDs, zoonotic diseases, WATSAN diseases
Socio-political, cultural, religious change	Decreased use of medicinal plants, traditional healing practices	Provisioning, cultural	Cultural health practices
Scientific and technological change	Decreased dependence on water purification and waste treatment, soil quality and diseases regulation, ecosystem services, increased efficiency of agriculture practices	Provisioning, regulating	WATSAN diseases, STIs, food and nutrition issues

Considering the availability of health KPIs

During scoping, the need for monitoring and evaluation (M&E) of potential health impacts should be considered. This can potentially help to identify high-priority health impacts specifically related to the project. These impacts will need to be considered within the context of available baseline data and future monitoring. For example, scoping may identify that increases in road traffic accidents and injuries might have a potential impact due to increased project-related vehicular traffic. Understanding the baseline level of traffic (e.g. vehicle counts, etc.) including the current level of accidents and injuries becomes an important piece of baseline data. Future monitoring may follow the subsequent changes in underlying road traffic volume including accident and injury rates. The number of road traffic accidents per vehicle kilometre travelled is an example of a key performance indicator.

KPIs are used to evaluate impacts throughout construction and operations. KPIs should be measurable and, ideally, easy to monitor on a regular basis. Most companies rely on the Global Reporting Initiative¹ to develop their annual sustainability reports and their Communication on Progress (COP) for the UN Global Compact². An experienced HIA team will use the scoping period to consider which KPIs are appropriate for future monitoring in a manner consistent with the company's already-existing commitments and reporting mechanisms.

Assessing potential partners

The impact assessment team should evaluate potential host country health partners who could be involved with the assessment process. Ministry of Health authorities will almost always be involved as well as health officials at the village, district, provincial, regional and national levels. Each entity has unique information about the project, the local environment, and cultural and traditional practices important for completing the HIA and other assessments.

Step 3: Baseline data collection and reporting

Collecting and reporting baseline data is a critical analytical task for the HIA. The scoping analysis and use of the systematic methodology, such as EHA framework, should help to guide and inform the data collection process. Initially, a large amount of data can be collected using published sources, e.g. peer-reviewed scientific papers, 'grey literature' produced by the host country Ministry of Health, etc. Stakeholder input and local knowledge are critical, and should be obtained and coordinated with the ESHIA team (Table 6).

The baseline literature review is likely to reveal whether there are key data gaps that should be addressed through the collection of baseline field data (e.g. anthropometric and disease-specific (e.g. malaria prevalence) surveys. The data collection efforts should match the complexity and practical needs of the HIA, and should not be allowed to devolve into an academic exercise, i.e. the field effort should be 'fit for purpose.' It

Table 6 Steps for baseline data collection

1. Systematic literature review (e.g. by environmental health area)
2. Evaluation of existing country survey and research data <ul style="list-style-type: none"> • Data validation • Statistical analysis
3. Evaluation of data from key stakeholders; traditional and local knowledge
4. Evaluation of health data from existing project workers

¹ Global Reporting Initiative (GRI): www.globalreporting.org

² UN Global Compact: www.unglobalcompact.org

is important to always think about why data needs to be collected, how it is relevant to the project, and how it relates to the overall final analysis of a project.

Before new data are collected, a series of relevant study questions should be carefully formulated. Data should be collected in a culturally sensitive and ethical manner with a clear understanding of how it will be utilized in the HIA (for example in impact clarification or characterization, or for baseline definition for subsequent monitoring activities). Formal ethical review and/or Institutional Review Board (IRB) approval from the host country Ministry of Health is typically required before fieldwork can begin.

There are a wide variety of evidence and data collection methods that can be selectively employed, including:

- focused stakeholder interviews and discussions;
- key informant questionnaires and surveys of knowledge, attitudes, beliefs and practices;
- objective health screening surveys for certain diseases or conditions, e.g. malaria, micronutritional deficiencies and disease-specific surveys including consideration of seasonality (e.g. wet versus dry) as this can be a critical confounding problem;
- health needs assessment;
- demographic and health surveys; and
- food consumption and nutrition surveys.

The overall data establishes the baseline from which estimated and actual project impacts on the community can be measured. Interdependencies with other project functions exist and may provide critical sources of baseline health data, e.g. hydrogeology, traffic and influx studies. Interdependencies across the impact assessment disciplines are quite common. Appendix 1 identifies these interdependencies as a function of EHA. Table 7 (below) illustrates some of the standard baseline data that are typically collected across environmental, social and health disciplines.

Health status indicators

Once health statistics are collected, careful attention should be given to what the statistics actually represent. There is often confusion regarding key public health terminology and definitions, e.g. incidence versus prevalence rates. For example, incidence and prevalence rates are two commonly used measures of disease frequency. A disease incidence rate refers to the rate at which new cases of disease occur in a population during a specified time period, whereas a disease prevalence rate refers to the proportion of the population that has the disease at a given point in time or over a specified time period. Appendix 5 presents a brief glossary of important public health terminology.

Table 7 Some of the standard baseline data that are typically collected across environmental, social and health disciplines

Source: eni E&P Standard Doc. No. 1.3.1.47, *Environmental, Social and Health Impact Assessment, 2010*

ENVIRONMENTAL	SOCIAL	HEALTH
<ul style="list-style-type: none"> ● Atmosphere ● Water ● Soil and subsoil ● Oceans, seas and coasts ● Biodiversity ● Services ● Waste ● Energy 	<ul style="list-style-type: none"> ● History and culture ● Demography and social determinants ● Gender issues ● Welfare ● Facilities ● Political and institutional framework ● Transparency and corruption ● National and local economy ● Cooperation ● Human rights 	<ul style="list-style-type: none"> ● National health concern ● Burden of diseases ● Morbidity, mortality and disability ● Community health determinants (risk factors) ● Responsiveness of public health systems ● Responsiveness of private health providers/traditional healers

Health statistics should be analysed and presented in a way that describes community health status in context. Comparative analysis evaluates data on affected communities relative to reference communities and regional and national statistics. Trends analysis consists of quantitative presentation of health indicators over time (including graphical presentations), as well as discussion of potential causes that may have influenced the trends seen in the data (for example, a significant change in a disease rate may be caused by a change in case definitions, changes in healthcare access, changes in surveillance/collection/reporting system, etc.).

Data quality and relevance will be an important consideration in the health baseline assessment. Not only is it important to have accurate and valid information to correctly characterize the current situation of the area, it is also critical for subsequent assessments that the information is well specified and clearly defined.

Potential data quality problems may include: inaccurate or incomplete information; definitional problems; rate or ratio calculations that differ from international standards; poorly documented information sources; disease classification errors; definitional changes of disease classification; and biases in the system that might lead to over- or under-classification of certain diseases. When collecting data, the assessor should evaluate the quality of data. For example, any unusual aspects of the data should be noted (e.g. extreme variation by month in the recorded numbers of deaths or births). The assessor should also collect information about the data sources and collection methods as part of the quality evaluation.

Environmental factors

Although the main focus of the health baseline is to describe health status, it is important to identify environmental factors that influence the exposure of communities and potentially vulnerable subpopulations to health hazards/issues. Current hazardous environmental health factors should be identified, along with other factors that are likely to be associated with future project stages. Most oil and gas projects have distinct phases, i.e. front-end engineering design (FEED), early works construction, major construction, operations and decommissioning. Potential hazards and exposures are unlikely to be static and are likely to change over the different project phases.



Direct human health hazards from oil and gas development projects may be related to the potential contamination of environmental media, e.g. air, water, soil and biota, and subsequent human contact with those media. Establishing direct links between environmental exposures and human health outcomes is often very problematic for a number of reasons. For example, there are often long latencies between environmental exposures and disease (such as cancer). Instead, environmental health indicators, i.e. direct measures of environmental determinants of health, are often used to assess the status of environmental health factors.

Social factors

There is an extremely important set of baseline household level social data that is strongly tied to health performance, e.g. income, consumption expenditure, costs of housing, food, fuel and household educational attainment, etc. Household and community-level demography, e.g. household size, age pyramids and structure, number of living/sleeping rooms, occupation, education, etc. is utilized by both social and health impact assessors. The HIA team should collaborate and align with the social team in order to efficiently review and understand key baseline social data and avoid duplicate data collection.

Health system: infrastructure, human resources, programmes and policies

As part of the health baseline assessment, the local health support systems, agencies, supply chains (especially for medications) and infrastructure are considered. An assessment of the healthcare delivery system is critical, and requires more than just performing a physical facility review and equipment inventory. In a developing country context, experience indicates that carefully reviewing local staffing levels and qualifications is essential. Knowledgeable and experienced health professionals should perform this ground-truthing assessment. Example questions assessing a community’s current health system capacity might include:

- Are health services in line with national policies/programmes and accessible to the various population groups in a community?
- Do healthcare diagnostic facilities exist? If so, are they functional and quality controlled?
- Do healthcare centres have safe water supplies, functional equipment, and effective waste management systems?
- Are there adequate supplies of essential drugs? Are stock-outs common?
- Are health statistics routinely collected and shared between local and regional health facilities and agencies?
- Are diagnoses (e.g. using rapid diagnostic testing kits) subject to laboratory confirmation?
- Which governmental bodies have jurisdiction over water supply, sanitation, etc. and what bodies have control over regulatory requirements?

Interpreting baseline data and reporting

Merely reporting factual baseline information is rarely enough to allow impacts to be assessed and decisions to be made. The meaning of what has been observed and measured should also be interpreted. For example, clinical diagnoses of malaria should be interpreted cautiously, as experienced and peer-reviewed studies have clearly demonstrated that malaria prevalence can be grossly overestimated in the absence of objective testing. Interpretation provides a bridge between factual baseline data and being able to assess the significance of impacts.

The baseline ‘chapter’ is an integral part of the HIA and is often the longest and most time-consuming section to prepare and write. In some instances, the baseline data collection exercise may result in development of a separate stand-alone report that is issued by the project. In reporting the baseline, it is essential to identify critical data gaps in knowledge or areas of uncertainty. Certain data gaps may need to be addressed by additional studies or as part of the implementation of the HIA findings.

Step 4: Impact assessment

After screening, scoping and baseline analysis, the HIA team should rate and rank the potential health impacts, their relative importance and at what level they are expected to occur (Table 8). Impacts can occur singly or in combination at various levels, i.e. individual, household, community/village, regional and national. The assessment needs to consider the advantages and disadvantages of concentrating on one level versus

Table 8: Impact assessment

Impact assessment	1. Detailed description <ul style="list-style-type: none"> ● Use of map to brainstorm to identify risks 	<ul style="list-style-type: none"> ● Extent ● Magnitude ● Frequency
	2. Assess impact significance <ul style="list-style-type: none"> ● Perception of risks by potential affected communities ● Nature—direct, indirect or cumulative ● Timing and duration 	
	3. Risk ranking <ul style="list-style-type: none"> ● Severity ● Probability 	

another. It may be difficult to develop the database necessary to assess all levels or key units simultaneously. Clearly defining the unit of assessment is critical since it can help to focus studies and concentrate resources as well as facilitate understanding of the linkages that exist between the different levels.

As part of the impact assessment process it is important to consider the strength of cause-and-effect relationships and to assess, either qualitatively or semi-quantitatively, the likelihood of potential impacts. One of the benefits of the process is that it can facilitate the ranking of impacts so that they can be addressed in a priority fashion. Many companies perform an 'assessment' of the defined impacts using a severity (consequence)–probability (likelihood) matrix. The definitions of severity and probability are company specific. If the health impact rating process employs the same internal company system utilized for environmental and social, critical internal and external stakeholders can evaluate the full suite of impacts within a uniform framework.

In general, impacts exist in two broad categories: (i) those that are within a project span of direct control and are therefore amenable to technical (engineering) and managerial control by a project; and (ii) those that are external to immediate project control and often require (a) actions by contractors and subcontractors and/or (b) host government involvement and participation. For example, a project is directly responsible for worker activity on-site; however, when workers are off duty and away from the site, a project has little or no control over personal behaviours. While this manageability is considered within the risk dimension analysis, it is more crucial in the development of mitigation roles and responsibilities.

Dimensions of health impacts

Each potential health impact has several different dimensions, and most companies have defined the dimensions relevant for them. These might include:

- **Nature:** direct, indirect or cumulative, defined as:
 - *Direct*—caused by an action and occurring at the same time and place.
A direct effect demonstrates a specific cause-and-effect relationship. For example, the presence of a project vehicle that subsequently has an accident on a roadway in a local community would be a direct cause-and-effect situation.

- *Indirect*—caused by an action and occurring later in time or farther removed in distance, but still reasonably foreseeable

Indirect effects can be of equal or greater significance than the more observable direct impacts that are related to accidents, injuries or sudden releases of potentially hazardous materials. Indirect effects can include increases in community rates of certain communicable diseases that are associated with significant project-induced in-migration into local communities by job seekers. In this situation, the presence of a large project can lead to construction job seekers and service workers moving into local communities, which can significantly alter the spread and transmission of many diseases like influenza and sexually transmitted infections (STIs).

- *Cumulative*—caused by an incremental impact of an action when added to other past, present and reasonably foreseeable future actions. Impacts may be minor but collectively significant over a period of time.

Cumulative effects analysis is complex and often difficult to perform because the effects:

- i. may arise on a human receptor at any scale;
- ii. are triggered by multiple causes, e.g. interaction of multiple health issues on one receptor (individual); and
- iii. are generated by multiple impact pathways, e.g. air quality impacts attributable to multiple projects such that overall levels of individual pollutants increase incrementally, with subsequent changes in disease outcomes such as asthma. Hence, the cumulative effects of an activity/intervention may be either:
 - (a) additive—incremental accumulation; or
 - (b) synergistic—produced by the interaction or combination of effects in the past, present and reasonably foreseeable future.

- **Timing and duration:** when (in the project phase), i.e. construction, operations, decommissioning; and how long, i.e. days, weeks, months, years, etc.
- **Frequency:** the overall rate of occurrence within the defined time duration.
- **Extent:** localities most likely to experience the projected impact (local, parish, regional).

- **Magnitude:** intensity, particularly with regard to existing baseline conditions.
- **Significance:** perception of risks by a potentially affected community.
- **Manageability or ability to influence risk responses** ('proactive' or 'reactive'):
 - *High*—within the control of the project management team. Can control probability or impact (or both).
 - *Medium*—within the influence of the project management team. Can influence probability or impact (or both).
 - *Low*—outside the influence of the project management team. Can only influence impact.

The impact assessment process rates and ranks potential project impacts. HIAs typically use a standard impact assessment methodology that includes:

- identification of potential health impacts;
- description of the issue and impact;
- risk analysis of the defined impacts, which considers the importance of potential health impacts based on a severity (consequence) and probability (likelihood) risk matrix; and
- impact ranking, which can be performed using a severity–probability matrix.

While a 'limitless' number of potential impacts, positive and/or negative, can be imagined, experience indicates that defining a realistic set of impacts based on a pre-defined systematic framework such as EHAs is likely to capture the most important impact issues. Table 9 illustrates a generic set of potential impacts by EHA.

Table 9 An illustrative example of potential impacts by EHA

ENVIRONMENTAL HEALTH AREA AND ASSOCIATED IMPACTS

<p>Vector-related disease—malaria, leishmaniasis and ectoparasites, etc.</p> <ul style="list-style-type: none"> ● Although incidence of malaria is currently low, 80% of the country's territory is receptive to infection. Active infections are currently reported in 23 districts of the country. Third-country national (TCN) imported malaria is a concern without rigorous screening for TCN workforce entering the country. ● Leishmaniasis, <i>Yersinia pestis</i> and tularemia are endemic in the country, with most cases occurring in rural areas. Project alteration of host habitat could impact the ecology of these diseases and thus transmission to humans. ● Scabies, a contagious skin rash caused by mites, is common in children in the country but outbreaks are also common among adults in institutional/camp settings.
<p>Housing and respiratory issues—acute respiratory infections (ARI) (bacterial and viral), pneumonias, tuberculosis; respiratory effects from housing, overcrowding, housing inflation</p> <ul style="list-style-type: none"> ● There will be a large rotating national workforce housed in project camps across the country; communicable respiratory diseases are a significant concern; these include tuberculosis (TB), influenza and acute upper and lower respiratory infections. The country has a high burden of TB including MDR-TB so this disease is of particular concern.
<p>Zoonotic diseases—animal to human disease transmission; potential disease distributions secondary to changes in animal migration patterns due to project-related activities or infrastructure, emerging infectious diseases (See Appendix 2)</p> <ul style="list-style-type: none"> ● Ebola, brucellosis, anthrax, rabies, echinococcus, and foot-and-mouth disease all occur within the project area.
<p>Sexually transmitted infections—HIV/AIDS, syphilis, gonorrhoea, chlamydia, hepatitis B</p> <ul style="list-style-type: none"> ● The project camps will be open allowing interaction with the local population. ● Long-haul truck drivers transporting materials/goods to the project camps from major cities are a potential concern. ● HIV transmission is currently on the rise in the country.

Continued ...

Table 9 Examples of potential impacts by EHA (continued)

ENVIRONMENTAL HEALTH AREA AND ASSOCIATED IMPACTS

<p>Soil, water, sanitation and waste-related diseases—e.g. giardia, hook and pin worms, etc.</p> <ul style="list-style-type: none"> ● WATSAN diseases are likely to be high among PICs as sewage and waste disposal infrastructure utilities are lacking. ● Abstraction of surface and/or groundwater could adversely impact water availability in PICs. ● Surface water impacts are possible in the event of a spill.
<p>Food and nutrition related issues—changes in subsistence practices; stunting, wasting, anaemia, micro-nutrient diseases (including folate, vitamin A, iron, and iodine), gastroenteritis (bacterial and viral); food inflation</p> <ul style="list-style-type: none"> ● If large quantities of food are procured from any of the PICs, food price inflation may occur.
<p>Accidents/injuries—road traffic related spills and releases</p> <ul style="list-style-type: none"> ● The project will operate vehicles that have the potential to interact with and potentially impact inhabitants of the PICs, i.e. road traffic accidents, releases/spills. ● The project will create numerous excavations and trenches that may pose a risk to community safety.
<p>Exposure to potentially hazardous materials—road dusts, air pollution (indoor and outdoor related to industrial activity, vehicles, cooking, heating or other forms of combustion/incineration), landfill refuse or incineration ash, any other project-related solvents, paints, oils or cleaning agents and by-products</p> <ul style="list-style-type: none"> ● The project is a potential incremental additional source of road dust. ● The project is a potential incremental additional source of noise. ● Project activities could result in leaks, spills or other releases of potentially hazardous materials.
<p>Social determinants of health (SDH)—psychosocial, resettlement/relocation, violence and security concerns, substance misuse (drug, alcohol, smoking), depression and changes to social cohesion</p> <ul style="list-style-type: none"> ● The project will employ local area residents bringing increased wages and concomitant social issues. ● Tensions may arise over who is (or is perceived to be) benefitting more or less from the project.
<p>Cultural health practices—the role of traditional medical providers, indigenous medicines and attitudes and beliefs regarding health-enhancing and health-lowering practices</p> <ul style="list-style-type: none"> ● The project will occur in an area endemic to medicinal plants of cultural importance. ● Certain cultural beliefs are likely to have an impact on the management of disease outbreaks.
<p>Health services infrastructure and capacity—physical infrastructure, staffing levels and competencies, technical capabilities of healthcare facilities</p> <ul style="list-style-type: none"> ● A casualty event in the PICs related to project activities (e.g. road traffic, local accidents, the release of significant potentially hazardous materials) could require local community response and interaction. <p>Programme management delivery systems—coordination and alignment of the project with existing national and provincial level health programmes (e.g. TB, HIV/AIDS, non-communicable diseases (NCDs) such as diabetes and hypertension), and future development plans</p> <ul style="list-style-type: none"> ● The project has a positive opportunity to coordinate and contribute to ongoing health programmes.
<p>Non-communicable diseases—hypertension, diabetes, stroke and cardiovascular disorders</p> <ul style="list-style-type: none"> ● Indirect effects, i.e. individual changes in lifestyle and behaviours (diet, smoking, exercise, etc.) are likely with increased income. ● A shift to NCDs is already under way in the country and is likely to increase with higher wages and rising standards of living.

Risk assessment paradigm

Health regulatory agencies throughout the world have agreed on a conceptual framework and methodology for performing quantitative risk assessment. For HIA utilization, the risk assessment paradigm could be used prospectively as a way to quantitatively assess the potential project, using the EHA 'Potential Exposure to Hazardous Materials', i.e. specific emissions such as fine particulate matter or volatile organics during construction and operations. The US Environmental Protection Agency (US EPA) has significantly expanded the science and application of quantitative risk assessment over the past three decades, and has established methodology and terminology that is utilized globally. Human health risk assessment includes four basic steps:

- **Step 1—Hazard identification:** examines whether a stressor has the potential to cause harm to humans and/or ecological systems, and if so, under what circumstances.
- **Step 2—Dose-response assessment:** examines the numerical relationship between exposure and effects.
- **Step 3—Exposure assessment:** examines what is known about the frequency, timing, and levels of contact with a stressor.
- **Step 4—Risk characterization:** examines how well the data support conclusions about the nature and extent of the risk from exposure to environmental stressors.

These steps are illustrated in Figure 5.

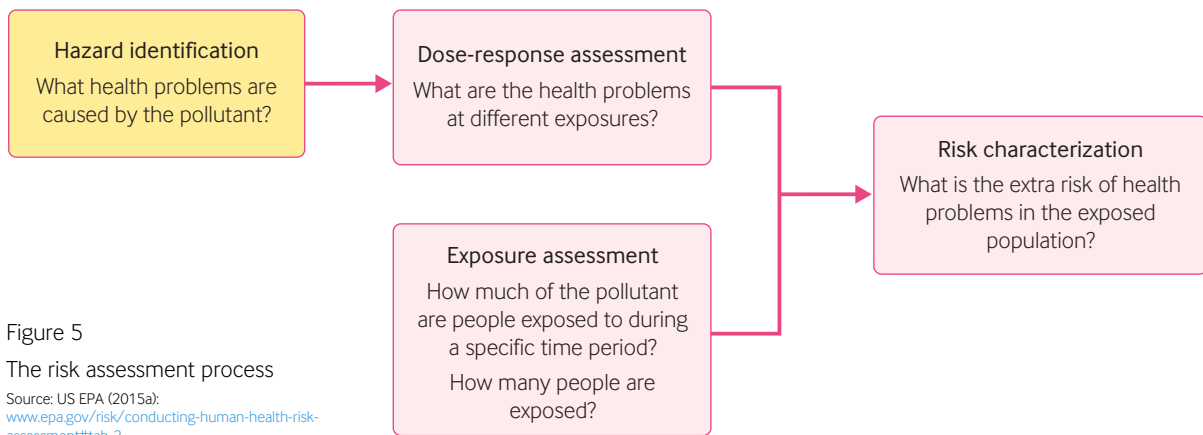
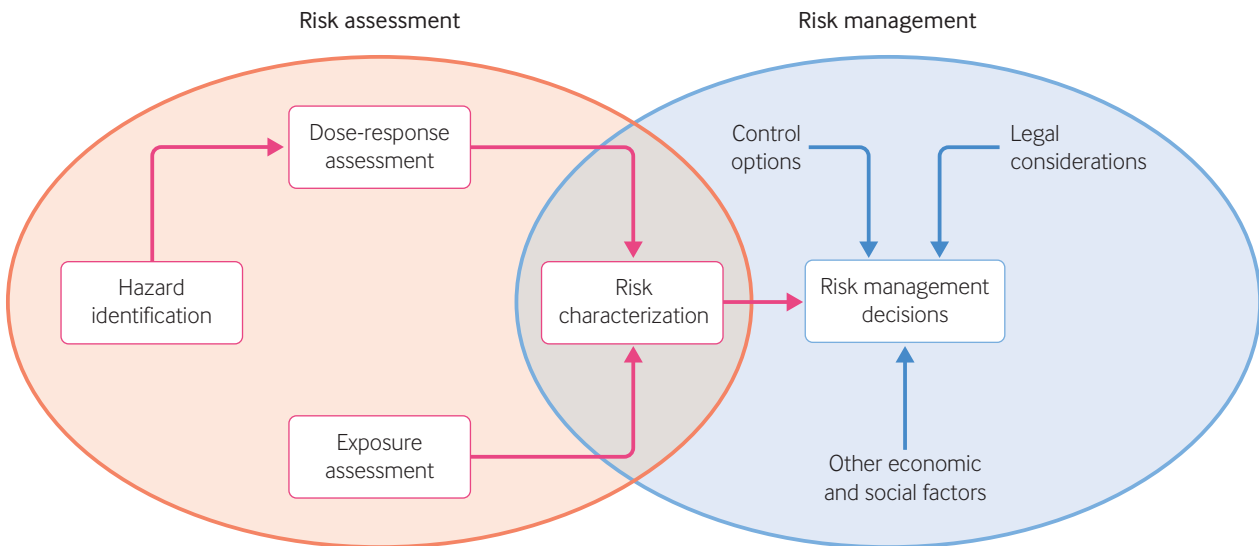


Figure 5
The risk assessment process
Source: US EPA (2015a):
www.epa.gov/risk/conducting-human-health-risk-assessment#tab-2

Figure 6
Risk assessment/risk management paradigm

Source: US EPA (2015b):
www2.epa.gov/fera/nrc-risk-assessment-paradigm



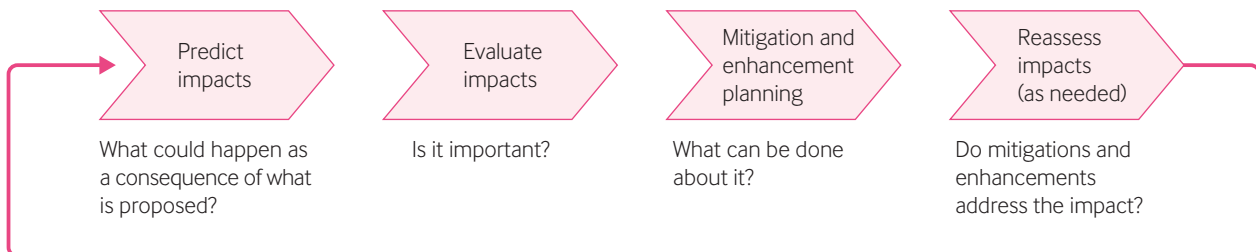
As shown in Figure 6, the risk assessment methodology differs from risk management. Risk assessment provides *information* on potential health or ecological risks, and risk management is the *action* taken based on consideration of that and other information.

New developments in toxicology

New strategies and testing technologies have emerged for evaluating the hazards or risks associated with exposure to industrial and other chemicals. These developments in toxicology will potentially have a profound effect on the future practice of HIA. The US National Research Council has published three significant monographs on: *Human Biomonitoring for Environmental Chemicals* (NRC, 2006); *Toxicity Testing in the 21st Century: A Vision and a Strategy* (NRC, 2007a); and *Applications of Toxicogenomic Technologies to Predictive Toxicology and Risk Assessment* (NRC, 2007b). As the testing technology becomes cheaper, more portable and increasingly available, the strategies for performing baseline community health evaluations are likely to change profoundly.

The application of innovative genomic technologies to toxicology has ushered in a new field known as 'toxicogenomics' where genotypes and toxicant-induced genome expression, protein, and metabolite patterns can be used to: screen compounds for hazard identification; monitor individuals' exposure to toxicants; track cellular responses to different doses; assess mechanisms of action; and predict individual variability in sensitivity to toxicants. The proposed applications of toxicogenomics include: hazard screening; the study of toxicologic mechanisms of action; exposure assessment; and characterizing variability in susceptibility. Toxicogenomic technologies have the potential to affect decision making for both risk assessment and regulatory toxicology. Hence, it is inevitable that these newer technologies, particularly those related to biomonitoring and biomarker surveys for community populations, will eventually be adopted by HIA practitioners.

Figure 7 Process to develop management plans



Step 5: Mitigation and enhancement

Mitigations are measures that aim to avoid, minimize, eliminate or remedy an adverse effect, or maximize a potential benefit. The project can use the outcomes of the impact assessment step to: (1) prioritize the health impacts for which mitigations will be developed; and (2) identify opportunities for enhancing health benefits. The process to develop mitigation measures, as shown in Figure 7, should include a reassessment component to ensure that the mitigation measures selected are effective. Even companies that have a strong reputation can risk losing their credibility when they fail to put systematic approaches in place to ensure effective implementation of mitigation measures to prevent or reduce health impacts and enhance positive impacts associated with the project.

In developing mitigation and enhancement measures based on the identified impacts, the following framework is recommended:

- Assess the regulatory requirements of the local jurisdiction and ensure measures meet local regulations.
- Evaluate options for design changes/engineering controls. This allows identification of opportunities to prevent or reduce the impact. Elimination and minimization strategies are more likely to be successfully implemented, particularly where local capacity is weak.
- If the impact cannot be avoided, develop measures via design changes/engineering controls. This should be done in an interdisciplinary fashion with environment, health, safety and social experts to address the remaining effects.

- Engage local stakeholders. Stakeholders may identify special community concerns and additional areas of mitigation for the project team that ensure planned mitigations will work for a particular community and local culture. In addition, local stakeholders can assist in developing additional and/or different measures that may be required to reach vulnerable groups (e.g. women and children or a disenfranchised ethnicity).

Use of a multi-disciplinary team that includes both subject matter experts, as well as stakeholders, facilitates consideration of a wider variety of mitigation strategies than those solely related to health. For example, for road transportation and infrastructure impacts, health expertise is important (e.g. drug and alcohol policy development), but traffic experts, construction managers and engineers, and local community members can all contribute to the design of mitigation strategies.

Mitigation strategies are typically organized around anticipating, recognizing and evaluating impacts. Implementation plans focus on control strategies such as prevention, elimination and minimization.

Another important consideration when developing mitigation measures is to distinguish between regulatory mitigations enforced by law (e.g. contaminants of concern, the transport of hazardous materials) and negotiated or voluntary mitigations. Many proponents have internal corporate policies that prioritize attentiveness to negotiated or voluntary mitigations. Listing of voluntary controls is a way to fully

communicate a commitment to mitigate health impacts.

Mitigation should be designed to be specifically linked to an impact. In most cases it should be clear that mitigations aim to address a project impact, rather than to simply improve social conditions among communities.

Nevertheless, the HIA team is in a unique position to help proponents consider appropriate ways to improve the local communities where they operate if the project wishes to make these types of investments. It is possible to design a mitigation strategy that not only addresses the project impact but goes above and beyond the reduction of negative effects and creates a health benefit for the community. While not always present or strategically feasible, opportunities sometimes arise to use the information gathered as part of the HIA, and to specifically use mitigation measures to generate health benefits. This work should be coordinated between social investment specialists within the company and the HIA team, as well as with other key project personnel. Input on mitigation and enhancement measures from affected and other key stakeholders is critical to developing practical measures that are locally implementable. When engaging stakeholders on this topic it is important to clearly set out the expectation, ahead of time, that not all suggested measures may be adopted by the company; this can help to avoid adverse community reaction if not all of the mitigation measures discussed with stakeholders are implemented.

As with Step 3 (*Baseline data collection and reporting*) a separate analysis of the mitigation requirement for each project phase is necessary to ensure that appropriate mitigation measures are allocated to all impacts across the various project phases.

Implementation—health management/action plan

After measures are developed for each impact, a health management plan (HMP) is created that presents the rationale for the selected mitigation strategies and the detailed methodology on how the mitigation strategies will be implemented (Table 10). It is crucial that the health management plan be integrated into the over-all management plan for the project to ensure health mitigations are part of the entire project’s management system.

The HMP includes:

- the types of mitigations selected, including specific and clear actions and approaches necessary to implement them, and timescales for implementation;
- roles and responsibilities of people/organizations responsible for all the actions planned;
- identification of additional support and resources from external organizations that may be necessary to implement the action (i.e. construction contractor, health institutions, local community organizations etc);
- methods that will be used for documenting, monitoring and reporting on the selected mitigations/actions;
- schedule for periodic review and update of the plan (usually on an annual basis);
- a process for change management; and
- the cost of implementing the plan.

Defining responsibilities is one of the most critical aspects of the HMP. The division of responsibilities between the project, construction contractor and the host government at local, regional and even national levels is crucial. Specific and detailed division of responsibilities should be considered and articulated. An analysis of local, regional and national health

Table 10 Health management plan (HMP)

HEALTH ACTION PLAN	MITIGATION APPROACH
Addressing identified impacts	<ul style="list-style-type: none"> ● Action ● Resource flows and responsibilities ● Timing (construction, operations, decommissioning) ● Collaborating organizations, if applicable

infrastructure and management capacity is a key consideration during both the development of mitigation strategies and the HMP, as well as during the process of identifying mitigations that other parties (outside the project) will be implementing. If there are systematic weaknesses in the host country health systems, capacity considerations will become one of the most important issues. Capacity building is a long and slow process. Close coordination and training of host resources require long-term planning and commitment. The absorptive capacity of host institutions, at all levels, is often the limiting factor for successful implementation of the mitigation strategy.

The assignment of responsibility includes project contractors, since day-to-day responsibility is often devolved to prime contractors, particularly during the construction phase of project. Contractor responsibilities can be assigned by requesting specific and detailed health implementation plans from each major contractor or developing these with them depending on their capacity and level of expertise in this area. These types of issues need to be anticipated early in the project so that the proper contract requirements can be developed and unplanned budget overruns can be avoided. Defining staffing levels also requires careful consideration since projects frequently underestimate the time and staffing levels required for implementation and monitoring.

Step 6: Monitoring and evaluation

The goal of monitoring and evaluation for the HMP is to ensure that the mitigation strategies selected have been (1) implemented and (2) are effective at addressing the impact they were designed to mitigate. Monitoring can be thought of as an ongoing, methodical collection of data that provides early indication of progress toward achieving the desired goal. Evaluation, on the other hand, is conducted periodically (often annually) and focuses primarily on measuring long-term results and the overall effectiveness of the actions implemented.

Effective management, monitoring, and evaluation depend on the identification of key performance indicators (KPIs). Effective performance measurement needs to:

- use appropriate units for measuring change;
- be able to distinguish between inputs, outputs and outcomes;
- measure effectiveness and efficiency; and
- assess both qualitative and quantitative dimensions of change.

Table 11 Monitoring and evaluation

Monitoring and evaluation	<ol style="list-style-type: none"> 1. Define key performance Indicators (KPIs) 2. Determine the approach to data collection <ul style="list-style-type: none"> ● Implement ● Evaluate
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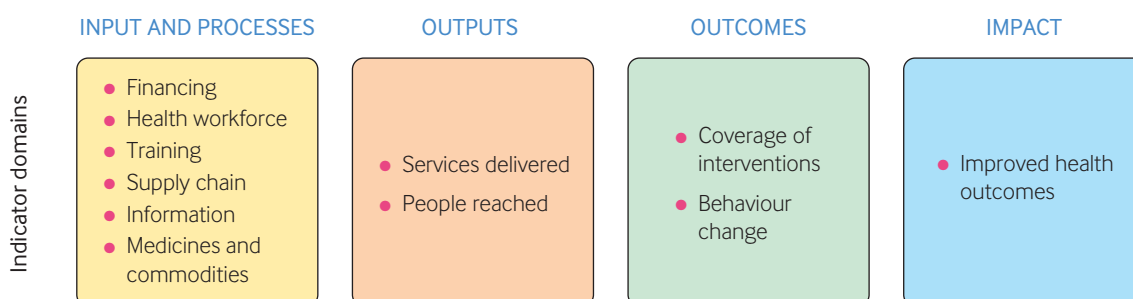
Key performance indicators

Effective management, monitoring and evaluation rely on the development of appropriate KPIs, which can be defined once clear goals and objectives have been identified in the health action plan (HAP). Understanding and being able to distinguish between input, output and outcome indicators is a critical step toward identifying the appropriate KPIs.

For a programme or project to achieve its goals, inputs and processes, such as drugs, information materials, training or staff time, etc. need to result in outputs, such as the number of people reached by a particular service. If these outputs are well designed and reach the populations for whom they were intended, the programme or project is likely to have positive short-term effects or outcomes, such as increased condom use with casual partners, increased use of bednets, or adherence to TB drugs. These positive short-term outcomes should lead to changes in the longer-term impact of programmes, such as fewer new cases of HIV, TB or malaria.

A visual representation of the different types of indicators is provided in Figure 8 on page 42. The framework builds upon general principles on aid harmonization and effectiveness as well as the IFC guidance on strategic community investment (IFC, 2010). As such it is consistent with the M&E

Figure 8: Hierarchy of Indicators
Sources: SOS International, 2012 and WHO, 2010



frameworks of all potential partners involved in the health management/implementation plan, and enables the tracking of both positive as well as negative impacts.

A combination of input, output and outcomes indicators is often useful to monitor progress as well as to measure the overall effectiveness of the HAP. Impact and outcomes are more powerful indicators because they show not only that money is invested (staff hired) and properly used (mosquito nets distributed), but that it is also making a real difference (the number of malaria cases has gone down). However, obtaining data for these indicators can be cumbersome. It can also be difficult to determine the causal relationship of the 'impact' indicators. An ad-hoc approach to data collection can be influenced by a range of factors and will require detailed analysis of the collected data. Careful consideration is therefore necessary when choosing the appropriate outcome indicators, and where health outcome indicators are chosen this is best done in coordination with, and/or relying on, data from government health surveillance systems. Where such data is not appropriate or available, or where the use of certain health outcome indicators is too costly, proxy measures may also be used.

Once the various input, output and outcome indicators have been developed based on the goals of the HMP, it is often useful to refine and test the chosen indicators to make sure that they will be useful and can be feasibly implemented. From a practical perspective, the selected indicators should:

- be measurable;
- measure impacts on the community;
- detect both acute and chronic changes within potentially affected communities (PACs)—acute changes appear within weeks to months, such as acute disease-rate changes for respiratory infection; chronic non-communicable disease-rate changes for diabetes or cardiovascular disorders evolve over a much longer period of time; a well-selected set of KPIs will detect both acute and chronic changes in health status;
- be clearly linked to the project (monitoring and evaluating community health changes unrelated to a project is important, but beyond the scope of the HIA);
- capture both positive and negative health impacts (for example, the alleviation of poverty will produce both positive and/or negative changes across many health outcomes); and
- be drawn from existing host country health information systems, where feasible.

Appendix 4 presents a case study of a comprehensive monitoring programme developed by ExxonMobil PNG for the Papua New Guinea (PNG) Liquid Natural Gas (LNG) Project.

Evaluation and verification

Evaluation and verification of the effectiveness of the HMP and the selected KPIs is a critical and often overlooked step in the HIA process. The HIA team should plan an evaluation and verification process at least on an annual basis to review and update management actions as well as to update the KPIs selected to ensure a continual improvement process.

This verification process is critical considering that, as the project activities change throughout each phase, new impacts will emerge; mitigation and KPIs will therefore need to be continually updated.

For most projects, it is unrealistic to begin the evaluation and verification process before the project has collected at least 6–12 months’ worth of information. Target milestones are often created, for example vaccination rates, malaria incidence rates, etc. Auditing against these target goals and objectives can be readily performed. These audits may be conducted internally and/or as part of an external and independent auditing process, based on the goals of the project. Audit systems should be integrated with, and not duplicate, other environmental and social verification systems.

Involving stakeholder input and participation in monitoring and evaluation and the development of KPIs is often a useful approach to add transparency to the process and ensure that appropriate KPIs are selected, especially when results are being measured based on community perception.

- *A note on evaluation of contractor performance:* It is important to remember to include contractor performance as a natural extension of project performance when developing and evaluating the HMP, in particular when contractors may be heavily involved in generating impacts during construction and in implementing mitigations per the HMP.

STAKEHOLDER COMMUNICATION AND CONSULTATION

Effective stakeholder engagement (Table 12) is an essential component of an HIA. Stakeholders are persons or groups, both internal and external to the project, who are affected by the project. Stakeholders will have varying degrees of interest in a project and/or ability to influence its outcome. Stakeholders may include locally-affected communities or individuals, their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations, special interest groups, the academic community, or third-party businesses. The term ‘stakeholder’ has broadened over time to include any interested parties, regardless of their location or their direct contact with the project.

Table 12 Steps for stakeholder engagement

Stakeholder engagement	<ol style="list-style-type: none"> 1. Mapping of Stakeholders 2. Transparent process 3. Consultation 4. Response/feedback for public comments 5. Accountability, including consideration of participatory monitoring/verification <ul style="list-style-type: none"> ● evaluate
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Stakeholder communication has evolved rapidly into a systematic process that is incorporated into the overall impact assessment strategy such that an active and integrated communication process has become an essential part of conducting a stand-alone HIA or an integrated ESHIA. The communication process is not just a one-way exercise of information dissemination; it includes consultation, active feedback and participation. Ideally, the optimal timing for initiating a stakeholder communication programme would be as early as possible in the overall business project development cycle. However, such a programme should be carefully considered and planned in a coordinated and systematic fashion that is responsive to overall business objectives and coordinated with the other impact disciplines, and particularly with the social impact team.

The objectives of stakeholder engagement and public participation include:

- obtaining public input on the nature of health risks and benefits posed by the project, and possible locally-relevant solutions;
- ensuring that the analysis of potential impacts proceeds in a publicly transparent and unbiased manner;
- obtaining information regarding local and traditional knowledge, scientific data and other sources of information that may be available to contribute to a more complete HIA; and
- building trust and collaboration between stakeholders.

The public participation process should be coordinated so that relevant health issues are integrated into the overall environmental/social process. In general, effort should be made to avoid duplicative community meetings as stakeholders can experience 'consultation fatigue' just as easily as 'survey fatigue'. Health-specific key informant and focus group interviews are more likely to be successful if conducted by experienced health professionals with knowledge of social science research skills. In addition, sensitivity should be exercised surrounding cultural and health taboos and settings, e.g. separating men from women when discussing certain issues such as gender-based violence, contraception/family planning, STIs, etc. Health sessions that target specific groups (e.g. women) should be led by an experienced and culturally acceptable facilitator.

MANAGEMENT AND RESOURCING

Many companies have sophisticated medical departments that can easily carry out the initial steps of the HIA process. However, for some projects, some level of specialist consulting support may still be required. In addition, external consultants or an independent review process may help to identify gaps or other issues not fully considered by an internal team, and enhance validity and transparency. Clear terms of reference should be in place for managing the costs of consultants from inside and outside the organization. For some extremely high-profile projects, the appointment of an independent advisory board may be appropriate, particularly where cultural sensitivities may conflict with the need to thoroughly assess certain diseases, for example HIV/AIDS.

Areas of competency necessary for external consultants include:

- epidemiology, and a knowledge of diseases endemic to the area under consideration;
- health data analysis;
- occupational health (including relationships with industrial hygiene and safety);
- sanitation, including food, water and waste-related issues and diseases;
- public health planning at a community level;
- risk communication;
- experience with infectious diseases such as tuberculosis and respiratory diseases;
- assessment (including modelling), prevention and planning for HIV/AIDS;
- knowledge, attitudes, practice, belief surveys;
- risk assessment—qualitative and quantitative modelling and ranking;
- surveillance system planning;
- insect and pest control;
- management of accidents, injuries and chemical exposure-related risks;
- assessment of existing health infrastructure (systems analysis);
- assessment of psychological impacts and possible effects of relocation;
- use of geographic information systems (GIS) for mapping of disease and impact areas; and
- community stakeholder facilitation.

Cost and time management

Costs are largely a function of scope, schedule and final deliverable report. Clear terms of reference are a key tool for managing both internal and external consultants' costs. The adequacy of baseline data is one of the most important considerations. New data collection takes time and money and is often an iterative process generating frequent travel and per diem costs. In many areas of the world the available support infrastructure is weak, and survey and health data collection can be a difficult and slow process. The time required to complete a comprehensive HIA will depend on the scope of the project, availability of adequate baseline data and the complexity of the stakeholder engagement and consultation process.

Appendix 1: Interdependencies

The table in this Appendix, organized by environmental health areas (EHAs), identifies key indicators and disciplines that the HIA relies on for data input.

Table A1 Interdependencies for the HIA ('X' indicates the key project discipline that typically collects data to feed into the HIA)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROONENT HEALTH	
		ECONOMIC	SOCIAL							
Social determinants of health (SDH)	Conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power, access, and resources at global, national, state, regional and local levels. The SDH are mostly responsible for health inequities.	Early childhood development		X						X
		Mental health and suicide		X						X
		Substance abuse/ binge drinking		X						X
		Domestic violence		X						X
		Life expectancy								X
		Economic indicators: ● household income ● employment status ● job growth projections ● job training opportunities	X							
		Tax revenue sharing targeting health	X							
		Applicant's fees allocated for health mitigation	X							
		Educational attainment		X						X
		Household Indicators: ● rent or own ● length of time there ● number of rooms ● water/sanitation ● household availability ● household inflation	X	X						
		Land use, parks, recreation, zoning, aesthetics	X					X		
		Schools, locations, enrolment		X						
Mental health indicators								X		

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROONENT HEALTH	
		ECONOMIC	SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	
Social determinants of health (continued)		School-based health and social programmes		X					X	
		Population forecasts	X	X						
		Hiring practices and work rotations				X				
		Transportation impacts	X		X					
		Changes in access to business, residence, community facilities		X						
		Regional impacts	X	X					X	
		Population size							X	
		Train volumes	X							
		Number of crossings			X					
		Demographic characteristics		X					X	
Accidents and injuries	<p>Health outcomes and determinants related to accidents and injuries. The key outcomes considered are increases and decreases in intentional and unintentional injuries with fatal and non-fatal results.</p> <p>The key determinants in this category include items such as the presence of law enforcement, traffic patterns, alcohol involvement, distance to emergency services, and the presence of prevention programmes.</p>	Unintentional fatal and non-fatal injury rates						X		
		Intentional fatal and non-fatal injury rates						X		
		Road traffic accident rates			X				X	
		Traffic levels (road, air, rail, river)			X			X		
		Traffic impacts	X		X					
		Community alcohol policy		X					X	
		Presence of law enforcement		X						

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROPONENT HEALTH		
		ECONOMIC	SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROPONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROPONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROPONENT HEALTH		
Accidents and injuries (continued)		Community public safety programmes		X						X	
		Anticipated changes in traffic			X			X			
		Time to emergency services			X			X		X	
		Commute times	X		X						
		Number of workers/schedule for construction/operations					X				
		Materials deliveries for construction/operations						X			
		Asthma/COPD ^a prevalence and exacerbations								X	
		Cancer rates								X	
		Thyroid disorders								X	
		Developmental delay		X						X	
Exposure to potentially hazardous materials	Health outcomes and determinants that may arise from exposure to hazardous materials. The key health outcomes considered are increases and decreases in documented illnesses or exacerbation of illnesses commonly associated with pollutants of potential concern. These may be mediated through inhalation, ingestion or physical contact.	Acute poisonings								X	
		Birth defects								X	
		Soil quality/contamination			X			X			
		Existing contaminated sites			X			X			
		Air quality monitoring/modelling data (e.g. levels of fine particulate)			X			X			
		Water quality monitoring data			X			X			
		Subsistence food contaminant levels			X			X			

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS	ECONOMIC SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROPONENT HEALTH
Exposure to potentially hazardous materials (continued)		Human biomonitoring data			X
		Dust exposure in workers			X
		Arsenic		X	X
		Mercury, lead, etc.		X	X
		Bioaccumulation modelling (e.g. mercury in fish tissue)		X	X
		Noise impacts		X	
Food and nutrition	This category includes health outcomes and determinants related to food security, dietary choices and the consumption of subsistence foods. The key health outcomes considered are nutrient levels, malnutrition or improvements in nutrient intake, and the subsequent increases or decreases in related diseases. The key determinants include diet composition, food security and the consumption of subsistence foods in rural settings.	Rate of obesity/ overweight			X
		Rate of hypercholesterolemia			X
		Child nutrition indicators			X
		Diet composition	X		
		Subsistence food consumption	X		
		Food security and food costs	X		
		Traditional and local knowledge	X		X
Vector-related diseases; housing and respiratory; sexually transmitted diseases (STIs)	Health outcomes and determinants that result from infectious diseases. The key health outcomes include rates of increase or decrease for a range of infectious diseases, such as vector-borne diseases, STIs, blood-borne pathogens, respiratory illness or skin infections. Important health determinants may include immunization rates, and the presence of infectious disease prevention efforts, including vector management and control programmes.	Pneumonia rates			X
		Communicable respiratory diseases			X
		Vector-related diseases, especially malaria			X
		TB infection (latency status) and active illnesses			X
		STI rates (esp. gonorrhoea, chlamydia, syphilis)			X

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROONENT HEALTH	
		ECONOMIC	SOCIAL							
Vector-related diseases; housing and respiratory; STIs (continued)		HIV rates								X
		Reportable blood-borne infections								X
		Skin infections								X
		Immunization rates								X
		Housing costs, inhabitants per household	X							X
		STI education efforts/practices								X
		Worker housing plans	X					X		
		Worker numbers both locally, regionally and nationally	X					X		
		Project occupational health plan						X		X
		Source of water					X			
Diseases related to soil, water, sanitation and waste	Changes to access, quantity and quality of water supplies. Key determinants reviewed may include distance to clean water, presence or absence of latrines including type, adequate volume of water resources.	Water quality—biologics, metals, etc.				X				
		Potential for contamination of water source				X		X		
		Level of human waste management, e.g. latrines, etc.				X				
		Level/adequacy of water supply				X				
		Maintenance of water supply				X				
		Household and community waste management	X							

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROONENT HEALTH		
		ECONOMIC	SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH		
Non-communicable diseases	Health outcomes and determinants related to chronic disease. Important outcomes include increases or decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases and mental health disorders. Key determinants for chronic diseases may include smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centres, as well as cancer screening rates.	Obesity/BMI ^b data								X	
		Diabetes rates									X
		Cancer deaths by type									X
		Cancer rates									X
		Most common cancer types									X
		Leading causes of cardiovascular disease mortality									X
		% of residents with hypertension									X
		% of residents with hypercholesterolemia									X
		Heart disease mortality rates									X
		Rate of COPD (self reported)									X
		Cerebrovascular disease mortality									X
Chronic lower respiratory mortality									X		
Cases of mental health disorders									X		
Self-reported diagnoses: asthma, CHD ^c , heart attack, diabetes, stroke, cancer										X	
Self-reported indicators of good mental health										X	

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS				ENVIRONMENT AND TRANSPORTATION			PROJECT PROONENT HEALTH		
		ECONOMIC	SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH	ENVIRONMENT AND TRANSPORTATION	PROJECT PROONENT HEALTH		
Non-communicable diseases (continued)		% of residents who are overweight or obese								X	
		Physical activity levels, recreation		X							
		Sweetened beverage consumption		X							
		Tobacco use								X	
		Exposure to second-hand smoke								X	
		Drug use								X	
		Medical evacuations								X	
		Health services								X	
		Health facility utilization								X	
		Health expenditures			X						
Health services capacity and infrastructure	<p>Considers health outcomes and determinants related to healthcare access and healthcare infrastructure.</p> <p>Important outcomes include the increase or decrease in the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, medevac facilities/aircraft, the presence of community health aides, and the frequency of physician visits to the area.</p>	Health staffing patterns and capacity							X		
		Available health services (regional/community-level assessment of existing health care and public health services)								X	
		Description of emergency response system and staffing								X	
		Mode of travel to advanced medical facilities; boat, ambulance, etc.						X			X

Table A1 Interdependencies for the HIA (continued)

ENVIRONMENTAL HEALTH AREA	DESCRIPTION	KEY PERFORMANCE INDICATORS	ECONOMIC SOCIAL	ENVIRONMENT AND TRANSPORTATION	PROJECT PROPONENT	HEALTH
Health services capacity and infrastructure (continued)		Anticipated change in demand for services (influx of population; health benefits for employees)	X			X
Zoonotic diseases	Health outcomes related to the transmission of diseases from animal to person, particularly related to animal husbandry at the household and community level. Changes in land use including water sources, crop locations, etc. can also have a significant impact.	New cases of zoonotic diseases	X	X		X

Appendix 2: Emerging infectious diseases and the extractive sector

Emerging infectious diseases and the extractive sector

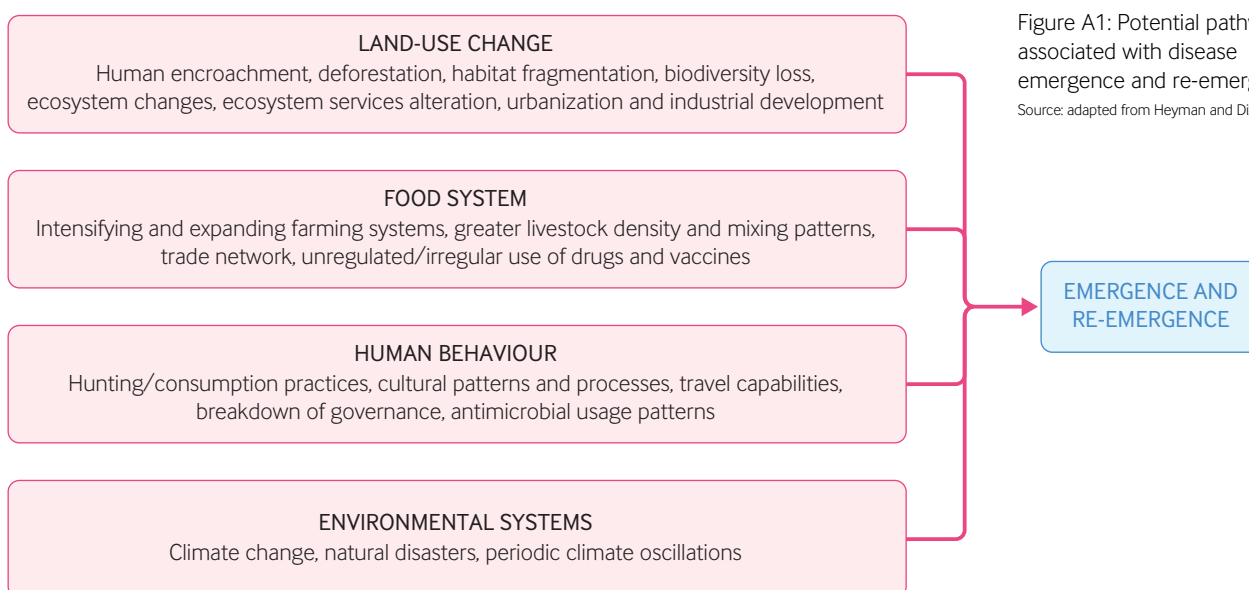
WHAT ARE EMERGING INFECTIOUS DISEASES?

Emerging infectious diseases (EIDs) are defined as infections that have newly appeared in a population or have existed previously but are rapidly increasing in incidence or geographic range (Morse, 1995). Between 1940 and 2004, 335 EIDs have been reported globally, concentrated in hotspots located mainly in low-latitude developing countries; these remain a significant threat to global health and the global economy despite attention to their identification, surveillance, epidemiology, containment and prevention (Jones *et al.*, 2008).

Nearly three-quarters of emerging infectious diseases originate from wildlife. Three wild animal groups, which comprise approximately 70 percent of mammal species, are considered most likely to spread new infections to people: bats (coronavirus responsible for SARS; filovirus

responsible for Ebola and Marburg, Nipah and rabies viruses), rodents (Lassa, hanta and monkeypox viruses) and non-human primates (yellow fever viruses). As EIDs originate from animals, there has been a growing global focus on the development of systems that focus on surveillance at the animal-human environment interface, lending further support to what is known as the 'One Health' approach³. The One Health approach is defined as a collaborative effort of multiple disciplines to attain optimal health for people, animals and the environment.

Disease emergence can result from a number of factors including genetic, biological, physical, environmental, ecological, social and political changes, as shown in Figure A1.



³ www.onehealthglobal.net/what-is-one-health

Alterations in land use as a consequence of economic, industrial and technological development are risk factors that are particularly relevant to the extractive industry. As a consequence of the industry's activities, these changes result in: increased contact with wildlife through encroachment into previously uninhabited areas; changes in the distribution and abundance of wildlife and their associated pathogens; increased movement of wildlife and livestock; population growth; and ecosystem change (Morse, 1995; Smolinski *et al.*, 2003; Patz *et al.*, 2004).

WHY EIDs ARE RELEVANT FOR THE EXTRACTIVE SECTOR

This phenomenon is amplified by the extractive industry operating in areas recognized as EID 'hotspots'. The extractive industry's ability to assess and manage the risk of EIDs is therefore crucial to prevent or mitigate the occurrence of such an emergence with potentially global consequences.

Compared with other health risks such as malaria, EIDs remain a low-probability but high-impact event in these areas. Approximately 2% of all EID events between 1940 and 2004 have occurred among workers in the natural resource industry and in their local communities. In 2007, an outbreak of Marburg haemorrhagic fever occurred among miners in Kamwenge and Ibanda District, Uganda. In 2004 in DRC, outbreaks of pneumonic plague and leptospirosis occurred in a miners' camp.

Outbreaks of EIDs affect extractive sector operations. In 2013–2014 the most widespread outbreak of Ebola known today occurred in West Africa. It is likely that this began with a single human contact with bats in Guinea in December, 2013; it then expanded in Liberia and Sierra Leone and was finally declared a Public Health Emergency of International Concern (PHEIC)⁴ by WHO in August 2014. Prior to the outbreak, mining represented

14% and 17% of Liberia's and Sierra Leone's GDP, respectively. A World Bank assessment predicted shrinking economies for these countries in the second half of 2014, and a forgone income across all three in 2015 of about \$1.6 billion. This is more than 12% of their combined GDP. Declining national output has translated into weaker revenues, while government spending needs have grown, weakening public finances.

THE ROLE OF HIA/EIA IN MANAGING EIDs

The extractive industry, particularly companies working in previously unexplored areas in tropical latitudes, is aware that its workforce and surrounding communities are susceptible to a range of adverse health effects exacerbated by its operations. In order to assess and mitigate these health-related risks, companies commission HIAs, or EIAs incorporating a health aspect, prior to commencing or expanding projects.

When these assessments are conducted, many companies actively mitigate the potential adverse effects of their operations on wildlife and promote biodiversity, but do not often consider the potential transmission of zoonotic pathogens⁵. The USAID 2012 *Guidelines for Adding Zoonotic Diseases to Health Impact Assessments* provides steps for incorporating emerging infectious diseases of zoonotic origin into an HIA.

The determinants of emergence are risk factors that align in such a manner as to modify the equilibrium among and between three species: humans, animals, and the infectious organisms carried by those animals. Hence, the EIA/HIA needs to focus on all components of an extractive project that can alter this equilibrium (see Table A2 on page 58).

⁴ Public Health Emergency of International Concern is a procedure introduced by the 2005 revision of the *International Health Regulations* (IHR). www.who.int/ihr/9789241596664/en

⁵ A zoonotic disease is a disease that can be passed between animals and humans. Zoonotic diseases can be caused by viruses, bacteria, parasites and fungi. These diseases are very common. Scientists estimate that more than 6 out of every 10 infectious diseases in humans are spread from animals. Information available at www.cdc.gov/onehealth/zoonotic-diseases.html

Appendix 2

Emerging infectious diseases and the extractive sector

Table A2 Typical health impact issues associated with zoonotic disease transmission

Adapted from the USAID *Guidelines for Adding Zoonotic Diseases to Health Impact Assessments*, 2012

IMPACT ISSUES	EFFECT	EMERGING INFECTIOUS DISEASE ISSUES LEADING TO DISEASE TRANSMISSION RISK
Influx (job seekers, family, service workers, camp followers)	<ul style="list-style-type: none"> ● Increases population ● Stresses community infrastructure ● Introduces an immunologically susceptible immigrant population or introduce carriers of diseases not present in the area 	<ul style="list-style-type: none"> ● Increases person-to-person contact ● Increases potential for evolution and/or amplification of disease ● Immunological susceptibility altered
Resettlement; relocation	<ul style="list-style-type: none"> ● Existing social/community structures altered ● Might shift hunting/gathering subsistence population to peri-urban settlements 	<ul style="list-style-type: none"> ● Increased in person to person contact ● Immunological susceptibility altered ● Increased proximity of animal and human interaction
Water management (including creation of new water bodies, altering existing water bodies, and changes in drainage patterns)	<ul style="list-style-type: none"> ● Insect-breeding habitat created or modified ● Animal watering areas created or modified. ● Increases stress on or competition for water resources 	<ul style="list-style-type: none"> ● Food and water storage containers contaminated by nuisance wildlife and vectors ● Increases potential for shared use of water between humans and wildlife, with associated contamination
Linear features (roadways; transportation routes; transmission lines)	<ul style="list-style-type: none"> ● Increased access to remote undeveloped areas ● Increased bushmeat hunting ● Modifies existing wildlife habitat 	<ul style="list-style-type: none"> ● Increases human-wildlife contact ● Potential consumption of nuisance wildlife meat and their fluids
Infrastructure facilities (including on-site housing catering facilities, housing and laundry, sewage treatment plants (STP), surface-water run-off control, dams and containment facilities)	<ul style="list-style-type: none"> ● Attracts nuisance wildlife due to sewage, water and food containers ● Increases habitat for rodents and bats 	<ul style="list-style-type: none"> ● Increases potential human-wildlife or vector contact if buildings are not sufficiently wildlife/vector proofed
Habitat fragmentation; edge effect; biodiversity loss (due to human population influx, construction of linear features, and construction of facilities and labour camps)	<ul style="list-style-type: none"> ● Modifies existing wildlife habitat ● Wildlife may search for food and shelter in nearby human settlements and labour camps 	<ul style="list-style-type: none"> ● Increase human-wildlife contact
Agricultural production (including nuisance wildlife, land clearing for agriculture, and food and waste storage)	<ul style="list-style-type: none"> ● Modifies existing wildlife habitat ● Provides food source for wildlife 	<ul style="list-style-type: none"> ● Increases human-wildlife contact ● Increases wildlife-domestic animal contact ● Increases potential for wildlife-livestock disease transmission

Table A2 highlights critical project components that can alter the pre-project baseline. The USAID guidelines identify appropriate and internationally recognized management measures. Most of the measures are not a direct 'health action'; close coordination among several departments and project teams is therefore required and illustrates the interdependency between health and the environmental and social assessments.

THE IMPORTANCE OF UNDERSTANDING 'OUTSIDE THE FENCE LINE' DETERMINANTS AND RISK FACTORS

EIDs become a significant health issue when there is a disease breakout, i.e. when existing prevention mechanisms have failed. When dealing with outbreaks, two aspects are usually considered: (i) the modality of transmission of the disease, and (ii) the severity of the disease and its capacity to kill those infected.

Transmission of EIDs occurs in given set of political, social and economic conditions. This context further facilitates the control and/or spread of the infection. However, within these conditions, operating companies have no immediate direct control; hence, 'manageability' is a significant concern. From an HIA perspective, the critical 'conditions' are external to the project; therefore, any mitigation measures are likely to require coordination and/or partnerships with other actors.

A study (Llamas *et al.*, 2014) conducted within mining companies in a known EID hotspot area found that all of the companies had strict infection, prevention and control (IPC) measures in place. The 'inside the fence line' measures were, in general, primarily designed to limit contact between humans, wildlife and domestic animals. For example, workers' accommodation and camp facilities were kept clean, rubbish was collected regularly and food was kept in locked containers to avoid attracting nuisance animals (e.g. rats). Safe food and water were available in camp, kitchen staff were regularly tested for infectious diseases, and hunting was strictly forbidden, while adequate nutrition for workers was ensured and efforts were made to preserve the existing biodiversity in the locality. All companies were proactive with health prevention and promotion outreach for both the workforce and adjacent communities.

The IPC measures implemented by the companies also included health programmes to promote worker and community health (outside the fence line) for diverse problems such as HIV/STIs, malaria, and water/sanitation and hygiene. Nevertheless, companies were still vulnerable to disease outbreaks originating from host communities where the chance of disease spread was increased due to weak public health infrastructure, underdeveloped hygiene/sanitation systems and low levels of household education.

Most international oil and gas producers have either general emergency response plans or detailed outbreak response plans. However these plans are often not shared with the national health system, and joint exercises are not carried out. In case of an EID outbreak, the company needs to collaborate with the national health system and other critical stakeholders in order to maximize the efforts required for response and control. An early engagement with the national health system can influence the capacity of surveillance and early detection as well as the development of an integrated response plan that includes companies operating in the country.

Overall, important components that address EIDs in the HIA/EIA include:

- assessment of land-use change and change in ecosystem services;
- assessment of population influx;
- assessment of the national public health system capacity to conduct surveillance, prepare and respond to outbreaks;
- community subsistence strategies and husbandry practices; and
- community attitudes and practices toward infectious diseases in animals and humans.

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Appendix 3: Ecosystem Services in ESHIA

Ecosystem services in ESHIA

The 2012 International Finance Corporation (IFC) Performance Standards (PS) have incorporated ecosystem services in order to improve the environmental, social and economic sustainability of its projects. These new IFC PS, which have been adopted by the Equator Principles Financial Institutions, require clients to 'maintain the benefits from ecosystem services' and 'conduct a systematic review' to identify those services on which the project is directly dependent on for its operations. This is different from looking at impacts on the beneficiaries of ecosystem services (ES) because it considers project feasibility in terms of whether or not its reliance upon an ES may be unsustainable from an ecological standpoint. The PS also consider whether or not there is a viable alternative to the project's reliance on ES.

ESHIA practitioners have identified a lack of guidance as a major barrier to wider use of the ES approach in ESHIA. The World Resources Institute (WRI), a major proponent of the ES methodology has issued guidance in order to address this concern (www.wri.org/publication/ecosystem-services). The use of the ES framework up front in scoping can potentially reveal 'hidden issues'. This includes asking stakeholders/ecosystem beneficiaries what their view of 'well-being' is as well as carrying out the proscribed scoping steps.

The following is an oil/gas industry example of using the ES approach for HIA. This example is created for illustration purposes only.

LNG Expansion Project

OVERVIEW OF POTENTIAL PROJECT HEALTH IMPACTS

Introduction

IFC Performance Standard 4 (PS 4) recognizes that project activities, equipment and infrastructure, can increase community exposure to risks and impacts (IFC PS4, 2012). The Project's direct and indirect impacts on ecosystem services may result in adverse health impacts and safety risks to affected communities (IFC, PS6, 2012). The diminution or degradation of natural resources, such as adverse impacts on the quality, quantity and availability of fresh water, for example, may result in health-related risks and impacts (IFC PS4, 2012). IFC Performance Standard 3 (PS 3) recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional and global levels (IFC PS 3, 2012).

HIA practitioners could identify high-level potential project health impacts on ecosystem beneficiaries by environmental health area (EHA). EHAs are a standard set of health effects categories that have been developed by the oil and gas industry and international multilateral lending institutions, which have been developed to capture a variety of determinants of health (IPIECA, 2015; IFC, 2008). Table A3 provides an overview of direct and indirect drivers of ecosystem change identified in the exercise, and lists the associated ecosystem service categories and the EHAs in which these potential impacts are anticipated to occur. The sections that follow describe these potential impacts in detail.

Table A3 Identifying the drivers of ecosystem change likely to be associated with the project

		DRIVER DETAILS		DRIVER EXAMPLE		ECOSYSTEM SERVICE CATEGORIES IMPACTED		ENVIRONMENTAL HEALTH AREAS IMPACTED	
Direct drivers of ecosystem change	Change in local land use and cover	Changes in: wildlife migration patterns and habitat use; land available for hunting and/or agriculture; disease vector and host habitat; availability of medicinal plants; culturally significant locations for traditional healing practices	Provisioning, regulating, cultural, supporting	Food and nutrition issues, VRDs, zoonotic disease, accidents and injury, cultural health practices					
	Harvest and resource consumption	Changes in: availability of subsistence fish and wildlife species; water availability	Provisioning, regulating, cultural, supporting	Food and nutrition issues, water and sanitation (WATSAN) disease					
	Pollution	Changes in: water resource quality, water resource use patterns	Provisioning, regulating, supporting	Exposure to potentially hazardous materials, food and nutrition issues, WATSAN disease					
	Introduction of invasive species	Changes in: wildlife migration patterns and habitat use; land available for hunting and/or agriculture; disease vector and host habitat; availability of medicinal plants, etc.	Provisioning, regulating, cultural	Food and nutrition issues, VRDs, zoonotic disease, cultural health practices					
	Demographic change	In-migration, resettlement	Provisioning, regulating	Housing and respiratory issues, WATSAN disease, food and nutrition issues, accidents and injury, VRDs, zoonotic disease					
Indirect drivers of ecosystem change	Economic change	Decreased dependence on: water purification and waste treatment; soil quality and disease regulation; and harvest and resource ecosystem services	Regulating	Food and nutrition issues, WATSAN disease					
	Sociopolitical change	Decreased use of medicinal plants, traditional healing practices	Provisioning, cultural	Cultural health practices					
	Cultural and religious change Scientific and technological change	Decreased dependence on: water purification and waste treatment; soil quality and disease regulation; ecosystem services; increased efficiency of agricultural practices	Provisioning, regulating	WATSAN disease, STIs, food and nutrition issues					

Changes in the well-being of ecosystem beneficiaries can affect direct as well as indirect drivers of ecosystem service change (Landsberg *et al.*, 2011). In addition, changes in human well-being can affect community-driven impacts on ecosystems. HIA practitioners are concerned with assessing the impact of ecosystem change upon the well-being of ecosystem service beneficiaries (as described above). In addition, the HIA will also identify some impacts that are independent of ecosystem services. These impacts typically concern the built environment (i.e. project infrastructure such as camps, landfills, etc.). These impacts are described in the third section of each EHA following a description of direct and indirect drivers.

Many drivers for ecosystem change are inherently interconnected, which can create an overlap among impacts. Here, drivers with overlapping impacts are described separately in an effort to illustrate that multiple pathways can lead to the same impact. For example, water-related diseases are often strongly related to the absolute per capita volume of water available for personal hygiene, e.g. bathing, hand washing, etc. Thus, a water shortage or the use of an alternate (unsafe) water source due to a contamination event can both lead to a surge in water and sanitation (WATSAN)-related diseases. In this example, *Non-communicable diseases* (NCDs, see EHA 12), is not considered separately within the ES framework but is largely covered under EHA 6, *Food and nutrition-related issues*.

Environmental health area analysis

ENVIRONMENTAL HEALTH AREA 1: VECTOR-RELATED DISEASE

(malaria, dengue, Chikungunya, lymphatic filariasis, tick-related diseases and ectoparasites, etc.)

New exposure to vector-related disease is facilitated by landscape change and project infrastructure that promotes vector breeding (e.g. standing water). **Change in local land use and cover** and the **introduction of invasive species** can drive VRD impacts directly through a variety of pathways as described below. **Resettlement** is an indirect driver when people are

relocated to a vector habitat. Housing design measures can be taken to reduce risk of exposure to VRDs.

Direct drivers of ecosystem change (change in local land use and cover, introduction of invasive species)

- Change in local land use and cover leads to change in vector habitat use, resulting in community exposure to VRDs.
- Changes in land available for hunting leads community members to utilize new areas, resulting in VRD exposure.
- Changes in land available for agriculture leads community members to utilize new areas, resulting in VRD exposure.
- Introduction of invasive species leads to changes in vector habitat use, resulting in community exposure to VRDs.

Indirect drivers of ecosystem change (resettlement)

- Community members are resettled into vector habitat, resulting in exposure to VRDs.
- Community members are resettled into an area adjacent to vector habitat that is used for hunting and other provisioning services, resulting in exposure to VRDs.

Project to community health impacts (built environment)

- Design of housing (e.g. inclusion of screens) for resettled community members reduces exposure to VRDs.

ENVIRONMENTAL HEALTH AREA 2: HOUSING AND RESPIRATORY DISEASE ISSUES

(acute respiratory infections (bacterial and viral), pneumonias, tuberculosis, including multidrug-resistant TB (MDR-TB); respiratory effects from housing, overcrowding, housing inflation, immunization coverage)

Housing and respiratory issues are primarily impacted by demographic shifts and crowding at worker camps, however these effects are not driven by changes in ecosystem services but by infrastructure. For example, living area allocation per worker and living area

ventilation specifications are drivers for the occurrence of respiratory events at project camps, which can then be transmitted back to the community. Similarly, crowding within homes due to in-migration and/or failure to design resettlement homes with adequate ventilation can lead to a surge in respiratory disease. The in-migration to communities of disease-carrying or non-immune job seekers and workers at camps can spark a surge in respiratory disease prevalence.

- Respiratory disease can be transmitted from in-migrating (job seeking) non-locals to the community.
- Undersized/under-designed and inadequately-ventilated worker housing can generate an increase in respiratory disease, which may be transmitted to the community.
- Resettlement housing that is not properly designed to accommodate indigenous cooking practices can lead to respiratory disease via exposure to particulate matter generated in the combustion of cooking fuels.

ENVIRONMENTAL HEALTH AREA 3: ZOOONOTIC DISEASE

(potential disease distributions secondary to changes in animal migration patterns due to project-related activities or infrastructure)

New exposures to zoonotic disease can occur with community and wildlife land-use pattern change. This may occur directly via **changes in local land use and cover** that can facilitate impacts through a variety of pathways as described below, and via the **introduction of invasive species**. **Resettlement** may be an indirect driver of ecosystem change that results in adverse health impacts if people are resettled into habitat for zoonotic disease hosts.

Direct drivers of ecosystem change (change in local land use and cover, introduction of invasive species)

- Change in local land use and cover leads to change in wildlife migration patterns or habitat utilization resulting in community exposure to zoonotic disease.
- Changes in land available for hunting leads community members to utilize new areas resulting in exposure to zoonotic disease.
- Changes in land available for agriculture leads community members to utilize new areas resulting in exposure to zoonotic disease.

- Introduction of invasive species leads to changes in wildlife migration patterns or habitat utilization resulting in community exposure to zoonotic disease.

Indirect drivers of ecosystem change (resettlement)

- Community members are resettled into zoonotic disease host habitat resulting in exposure to zoonotic disease.
- Community members are resettled into an area adjacent to zoonotic disease host habitat that is used for hunting and other provisioning services, resulting in exposure to zoonotic disease.

ENVIRONMENTAL HEALTH AREA 4: SEXUALLY TRANSMITTED INFECTIONS (STIs)

(HIV/AIDS, syphilis, gonorrhoea, chlamydia, hepatitis B)

STI impacts are independent of ecosystem services and largely driven by the influx of project workers and an increase in income. For example, long-haul truckers are a well-known 'vector of spread' for STIs. This is a common occurrence in most countries. If worker camps are 'open', workers residing in camps located in nearby communities can interact with locals. Individuals originating from areas outside the potentially affected areas (PACs) where STI prevalence is higher may 'import' these diseases to PACs, which could inflate the overall prevalence of STIs in a given community.

- Project long-haul logistical support stops along the transport route could give rise to short-term mixing between drivers and locals, resulting in an increase in STI prevalence.
- Local girls may engage in risky behaviour in order to attract men with money, placing themselves at risk of contracting STIs.

ENVIRONMENTAL HEALTH AREA 5: SOIL, WATER AND SANITATION (WATSAN)- RELATED DISEASES

(melioidosis, cholera, protozoan parasites, e.g. giardia, cryptosporidium; and geohelminths, e.g. hook and pin worms, etc.)

HIA practitioners identified high-level potential project impacts on soil, water and sanitation (WATSAN)-related diseases, within an ecosystem services framework. As

described below, the HIA found: potential for **pollution** and **water resource consumption** as direct drivers of ecosystem change, and **demographic** (i.e. in-migration and resettlement) and **technological change** (i.e. improved water and/or sanitation facilities) as indirect drivers of ecosystem service change that may result in adverse health impacts for ecosystem service beneficiaries. For example, pathogen pollution of a community drinking or bathing water supply as a result of a project sewage treatment plant is a direct driver of ecosystem change, which can adversely impact the health of ecosystem beneficiaries via exposure to WATSAN-related diseases. An example of an indirect driver is in-migration, resulting in increases in open-defecation practices leading to a rise in prevalence of soil-transmitted helminthes and WATSAN-related diseases. Potential project impacts fall under the categories of *provisioning*, *regulating* and *supporting* ecosystem services.

Direct drivers of ecosystem change (pollution, water resource consumption)

Direct drivers of ecosystem change that may result in WATSAN impacts include contamination of **fresh water** drinking and bathing **resources**.

- A spill of hazardous materials contaminates drinking water, resulting in community use of an alternative, unsafe source, which leads to a change in WATSAN-related diseases.
- A spill from the project sewage treatment plant contaminates drinking or bathing water supply with pathogens, resulting in a change in community WATSAN-related diseases.

Direct drivers of ecosystem change that may result in WATSAN impacts include project **water resource consumption**.

- Changes in surface water flows and quality: potential groundwater drawdown leads to decreased water resource availability for personal hygiene, leading to changes in WATSAN-related diseases.
- Increased prevalence/incidence of water-related diseases due to altered hydraulic regime or vegetation/habitat and consequential development of additional/expanded locations for water bodies.

Indirect drivers of ecosystem change (demographic shifts, technological change)

Indirect drivers of ecosystem change include **demographic shifts** due to resettlement and in-migration that may affect services such as **water purification and waste treatment**, as well as **regulation of soil quality** and **regulation of diseases**. There are also potential project-to-community WATSAN impacts that do not involve ecosystem services. These impacts typically result from the built environment, and are independent of ecosystem change.

In-migration

- Overburdening of sewage lagoons leads to overflow, resulting in community water-related diseases.
- Increased demand on local latrines (if present) creates increases in soil-transmitted helminthes and potential increases in WATSAN-related diseases.
- Increases in community open defecation practices creates increases in soil-transmitted helminthes and potential increases in WATSAN-related diseases.
- Overcrowded housing with poor personal hygiene leads to increases in skin-related diseases.
- Outbreaks of cholera and other diarrhoeal diseases are associated with in-migration and changing population locations.

Resettlement

- Bathing facilities omitted from resettlement housing design creates exposure while bathing in streams containing pathogens.
- Underdesign of latrines in resettled communities contaminates soil and/or water, leading to WATSAN disease.

Technological change

- Improvements in water and/or sanitation facilities and infrastructure may decrease dependence on water purification and waste treatment, soil quality, disease regulation and ecosystem services.

Project-to-community health impacts (built environment)

Camps

- Increased prevalence of skin and foot conditions among project workers residing in villages, with poor laundry/personal hygiene, that are transmitted to household members while on leave.

Waste management

- Community-based project landfill accessed by local population results in exposure to hazardous materials and/or WATSAN-related diseases.

Linear features

- Inadequate disposal of human waste by construction workers during short-term rolling fieldwork.

Resettlement housing design

- Resettlement housing provides improved water and sanitation access reducing community exposure to WATSAN-related disease.

ENVIRONMENTAL HEALTH AREA 6: FOOD AND NUTRITION- RELATED ISSUES

(changes in subsistence practices; stunting, wasting, anaemia, micro-nutrient diseases (including folate, Vitamin A, iron, iodine), gastroenteritis (bacterial and viral); food inflation)

Food and nutrition impacts may be driven directly by changes in **local land use and cover, harvest and resource consumption, pollution and introduction of invasive species**. These impacts may also be driven indirectly via **demographic change, economic change and scientific change**. There may also be impacts on food costs that are not mediated through ecosystem services.

Direct drivers of ecosystem change (change in local land use and cover, harvest and resource consumption, pollution and introduction of invasive species)

- A change in local land use and cover leads to a change in wildlife migration patterns or habitat utilization, resulting in impacts on the availability (increase or decrease) of important subsistence resources (hunting, fishing, harvest of wild plants).
- A hazardous materials release event leads to reduced availability (via a mass mortality event, an incremental increase in morbidity, impacts on forage and/or habitat, etc.) of important subsistence resources.
- A hazardous materials release event contaminates irrigation water supply, reducing the community's capacity for agriculture.
- The introduction of invasive species leads to a change in availability (increase or decrease) of

important subsistence resources (hunting, fishing, harvesting of wild plants).

- Project workers compete with community members for important subsistence resources, thereby reducing the availability of important subsistence resources (hunting, fishing, harvesting of wild plants).

Indirect drivers of ecosystem change (in-migration, resettlement)

- In-migration leads to over-harvesting (hunting, fishing, wild plants) reducing the availability of subsistence resources.
- Resettlement leads to adverse impacts on keystone species, with community utilization of new areas for hunting and/or fishing, reducing the availability of important subsistence resources.
- In-migration or resettlement leads to a reduced availability of land for agriculture.
- Increased income generated via project employment and/or the increase in local procurement of goods and services, facilitates the purchase of food items thereby decreasing community dependence on harvest and resource consumption ecosystem services.
- Project-provided science or technology leads to more sustainable harvest and resource consumption practices.

Project-to-community health impacts

- Project procurement of food locally generates inflation of food prices adversely impacting food security for community members.

ENVIRONMENTAL HEALTH AREA 7: ACCIDENTS/INJURIES

(road traffic-related spills and releases, construction (home and project related) and drowning)

Risk of accident and injury is mainly driven by project-driven landscape changes, infrastructure (including linear features such as roadways) and increased volumes of traffic due to population influx. With the exception of landscape change, these are project-to-community impacts that are not mediated through ecosystem services.

Unimproved roadways in remote, rural areas, with difficult terrain and extreme weather events, are

particularly vulnerable. Increased income can be used to purchase vehicles, resulting in an overall increase in the number of vehicles on the road. These factors, especially in combination with a lack of local knowledge regarding roadways and vehicle safety, drives a high potential risk of accidents. The focus of this EHA is on project-related, road traffic-related injuries and accidents, and transportation-related releases of potentially hazardous materials outside the fence line. The release event aspect of this risk is covered in EHA 8: *Exposure to potentially hazardous materials*.

Direct drivers of ecosystem change (change in local land use and cover)

- The creation of landscape features, such as borrow pits, bodies of water, etc. can increase the risk of fall injuries and drowning.

Project-to-community health impacts

- The project builds new unimproved roads in areas of difficult terrain, leading to increased risk of road traffic accidents involving community members (vehicle operators, passengers, pedestrians).
- Increased traffic volumes on existing roadways due to population influx (worker and job seekers) increases the risk of road traffic accidents.

ENVIRONMENTAL HEALTH AREA 8: EXPOSURE TO POTENTIALLY HAZARDOUS MATERIALS

(road dusts, air pollution (indoor and outdoor, related to industrial activity, vehicles, cooking, heating or other forms of combustion/incineration), landfill refuse or incineration ash, any other project-related solvents, paints, oils or cleaning agents, by-products)

Direct drivers of ecosystem change that may adversely impact ecosystem beneficiaries include pollution of provisioning services such as fresh water and harvest resources as well as regulating and supporting ecosystem services. Drivers that are not mediated through ecosystem services include: road traffic accident spills outside the fence line (as described in EHA 7), infrastructure such as landfills and fugitive dust from construction and roadways.

Direct drivers of ecosystem change (pollution)

- A spill of hazardous materials contaminates drinking or bathing water, leading to exposure of the community to contaminants.
- Project emissions adversely impact air quality regulating services, leading to exposure of the community to contaminants.
- Project emissions or release event contaminate harvest resources (hunting, fishing, wild plants), thereby compromising ecosystem regulating and supporting services which leads to exposure of the community to contaminants.

Project-to-community health impacts

- A release event associated with a road traffic accident outside the fence line results in community exposure to potentially hazardous materials.
- Community members access the project landfill, resulting in community exposure to potentially hazardous materials.
- Project generation of fugitive dusts during construction and on roadways increases community exposure to particulate matter.

ENVIRONMENTAL HEALTH AREA 9: PSYCHOSOCIAL/SOCIAL DETERMINANTS OF HEALTH (SDH)

(psychosocial, resettlement/relocation, violence, security concerns, substance misuse (drug, alcohol, smoking), depression and changes to social cohesion)

Social determinants of health include, but are not exclusive to, resettlement/relocation, violence, security concerns, substance use (drug, alcohol, tobacco), depression and communal social cohesion. SDH impacts are largely independent of ecosystem services. For example, households often perceive a disparity between the 'haves' versus the 'have nots', with regard to jobs and housing, that may trigger resentment and increased demands for 'across-the-board' compensation. Gender violence may also be a concern but is difficult to assess accurately. Psychosocial impacts related to the stress of newcomers moving into the town at accelerated rates during construction, and then leaving at the end of the project, may also be of concern.

- Compromise of community cohesion due to in-migration of job seekers.

- Conflict between the 'haves' (those employed by, and/or have been compensated by, the project) and the 'have nots'.
- Increased wages and/or psychosocial stress lead to an increase in substance misuse.

ENVIRONMENTAL HEALTH AREA 10: CULTURAL HEALTH PRACTICES

(role of traditional medical providers, indigenous medicines and unique cultural health practices)

Direct drivers of ecosystem change that can impact cultural health practices include changes in **local land use and cover** and the **introduction of invasive species**. **Cultural and religious change** can have indirect impacts via modification of, or discontinuation of, cultural health practices involving local ecosystem services such as medicinal plants.

Direct drivers of ecosystem change (change in local land use and cover, introduction of invasive species)

- Project-induced change in local land use and cover can potentially impact the availability of plants and/or geographic locations utilized for cultural health practices.
- Invasive species can outcompete native species for food and habitats, and impact the availability of plants, etc. utilized in cultural health practices.

Indirect drivers of ecosystem change (cultural and religious change)

- Project-induced change in cultural health practices can decrease utilization of provisioning services such as wild plants.

ENVIRONMENTAL HEALTH AREA 11: HEALTH SERVICES INFRASTRUCTURE AND CAPACITY INCLUDING PROGRAMME MANAGEMENT DELIVERY

(physical infrastructure, staffing levels and competencies, technical capabilities of healthcare facilities, immunization programmes)

Impacts on health services infrastructure and capacity are mediated independently of ecosystem services. Adverse impacts on this EHA are driven by the potential

project burden on local services and infrastructure via accident/injury and in-migration, and also by removal of healthcare workers from the community due to employment by the project. Positive impacts can occur if the project contributes to the improvement of local services and capacity.

- A community casualty event that occurs due to the project, including road traffic accidents, spills or releases, could require local medical services/ infrastructure response and interaction.
- Local clinics are not equipped to handle a major industrial release event and/or fire/explosion and/or a mass casualty event (e.g. involving multipassenger vehicles or multiple vehicles).
- Increased demands on the local healthcare infrastructure and services, as a result of in-migration and potential increases in accidents.
- Construction traffic could potentially delay access to treatment.
- Healthcare workers obtain jobs at the project, reducing local capacity.
- The project provides/supports or enhances local infrastructure, services or skills related to healthcare.

Coordination and alignment of the project to existing national and provincial-level health programmes (e.g. TB, HIV/AIDS, malaria) and future development plans

Impacts on programme management delivery systems occur independently of ecosystem services. These impacts are driven by the project's coordination and alignment with existing public health authority programmes and reporting requirements for communicable and non-communicable disease.

- Health authorities will receive an influx of data when new employees are screened (and turn up positive) for reportable diseases.
- Project-mediated increases in NCDs may necessitate establishment or enhancement of existing NCD programmes.

ENVIRONMENTAL HEALTH AREA 12: NON-COMMUNICABLE DISEASES (NCD)

This is largely covered under EHA 6 and not separately analysed in this ecosystem services example.

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Appendix 4:
Example of monitoring/
longitudinal data
available from large oil
and gas projects

Example of monitoring/ longitudinal data available from large oil and gas projects

As operator of the PNG LNG Project in Papua New Guinea, ExxonMobil PNG Limited (EMPNG), the local affiliate of ExxonMobil Corporation in Papua New Guinea, recognized the importance of establishing effective partnerships with government, universities, and international and local non-governmental organizations to support sustainable population health benefits and health sector improvements. The objectives were to: (1) accurately characterize and track the Project area (PA) socio-economic indicators of health status and compare to similar control communities; (2) reliably diagnose and track disease occurrence in communities of interest; (3) implement specific intervention programmes to promote health sector improvements and prevent adverse health outcomes in PA communities; and (4) to create a robust and sustainable integrated health and demographics surveillance system (iHDSS) to collect and analyse community health data to inform the Project team, provincial and national governments and non-governmental organization regarding priorities for future health improvement objectives and investments.

BACKGROUND

EMPNG established a Community Health Impact Management Programme to include Project worksites and community-based health initiatives designed to prevent potential adverse health events related to Project activity. Worksite health initiatives are guided by the PNG LNG Project's Health Risk Assessment (HRA), Project Health Plan, Health Project Design Specification: Minimum Health Requirements for Project Execution, and PNG LNG Environmental and Social Management Plan. Community-based health initiatives support activities identified in the PNG LNG Project's Community Health Impact Assessment (2008), the International Finance Corporation's guidance on community health, safety and security, and the PNG LNG Environmental and Social Management Plan.

Strategic focus: the Partnership in Health Project (PiHP)

- Scientific and educational capacity building
- Establish demographic surveillance systems for longitudinal monitoring and evaluation
- Strengthen diagnostic capabilities for emerging infectious diseases (including construction of National Infectious Disease Diagnostic and Research Laboratory—partners are the PNG Institute of Medical Research (PNGIMR) and the University of Papua New Guinea (UPNG) School of Medicine and Health Science
- Sustainable scientific efforts for communicable disease (TB) at local level (adjacent to Project operations)
- Research in how to improve healthcare delivery and system performance
- Enhance quality of project management and financial stewardship

The PiHP was validated by an independent Science Advisory Panel composed of internationally recognized tropical disease and demographic experts.

RECENT DEVELOPMENTS

The Community Health Programme was developed and implemented in partnership with the PNG Institute of Medical Research (PNGIMR). A key component is the Integrated Health Demographic Surveillance System (iHDSS) that provides a platform to systematically collect objective health and population data at key Project locations and matched control sites. It also provides timely response to disease outbreaks that could potentially disrupt Project operations through the placement of clinicians at selected health facilities along the Project areas. Results from the iHDSS baseline and follow-up health and social demographic data demonstrate the absence of negative community impacts and the presence of positive community health trends and improvements potentially related to Project activity.

Partnership with the PNGIMR and the University of Papua New Guinea (UPNG) School of Medicine and Health Sciences led to the funding by EMPNG of the construction and outfitting of the National Infectious Disease Diagnostic and Research Laboratory. This state-of-the-art facility is managed by PNGIMR and is used to advance important biomedical research in tropical medicine and emerging and neglected infectious diseases such as cholera and tuberculosis.

The Community Health Programme has improved village-level capacity to accurately diagnose disease, with PNGIMR clinicians visiting community clinics to share good clinical procedures and diagnostic tools to assess various illness rates. Examples of this include: fever studies using rapid diagnostic testing (RDT) for malaria diagnosis; passive and active TB surveillance; and diagnosis of sexually transmitted disease and non-communicable disease (e.g. cancer, diabetes). As a result of the data collected, provincial and national health authorities will be able to effectively plan and implement health services.

Following the publication of the first two PNGIMR reports, EMPNG and the National Department of Health (NDoH) co-hosted a workshop to review key findings and how data can better inform public policy development and implementation. The summary sheets developed for the workshop are reproduced on pages 74–85 of this guidance.



Healthy Pregnancy

SEXUALLY TRANSMITTED INFECTIONS (STIs)

CHALLENGE

- PNG has a large burden of STIs that can cause significant illness, particularly among pregnant women and their new born babies;
- PNG also has among the highest burden of cervical cancer in the world with an estimated 1500 deaths every year;
- The vast majority of cervical cancer cases world wide are due to infection with Human Papilloma Virus (HPV), however the level of infection in PNG is unknown;
- A vaccine to prevent HPV infection is available and therefore many cervical cancers are now preventable.

RESPONSE STRATEGY 1

A bio-behaviourial study is being conducted among 1000 pregnant women attending antenatal clinics at iHDSS sites.

PROGRESS

At end of March 2014, 716 women have been recruited at three iHDSS sites:

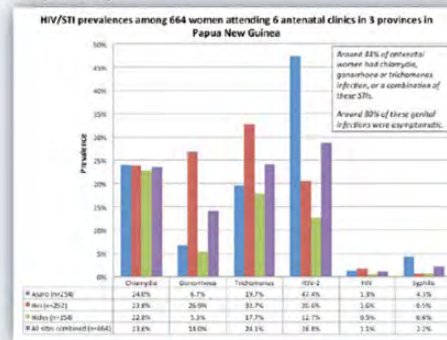
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Hiri	255
Karkar	258

IMPACT

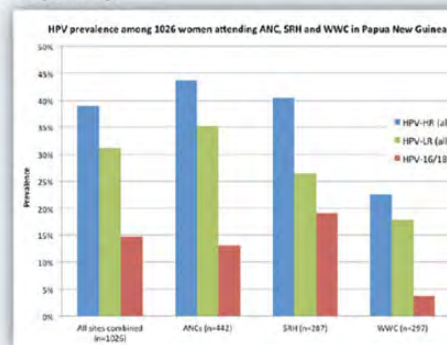
- "Healthy Pregnancy Study" is a landmark study in public health research in PNG;
- Results of this study can inform public health policy decisions in PNG on cervical cancer prevention, and the management of STIs in pregnant women;
- PNG LNG Project has not, to date, impacted underlying HIV/AIDS rates.

KEY FINDINGS

STI Prevalence among women attending antenatal clinics (n=664).



HPV Prevalence among women attending antenatal clinics (n=799).



Note: ANC - Antenatal clinic at Papa, Mananda, Asaro; SRH - sexual reproductive health clinic in Port Moresby; WWC - Well Women Clinic



Supported by ExxonMobil and the PNG LNG Project



RESPONSE STRATEGY 2

ExxonMobil PNG Ltd has supported PSI-PNG in conducting Marital Relationship Training activities.

See table below.

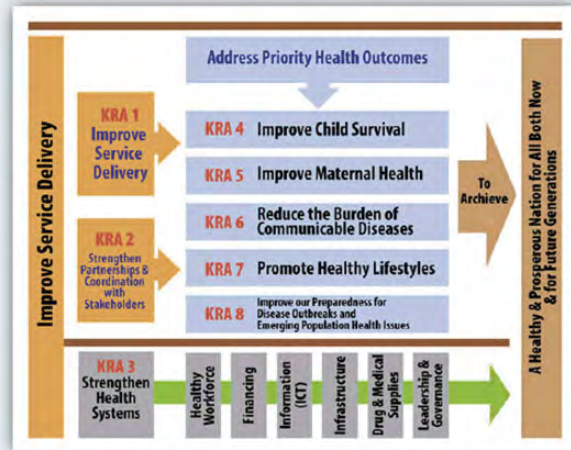
1	PSI Partnered with Marie Stopes International and conducted health promotion and awareness training at mobile health clinics reaching health workers	299 participants
2	PSI conducted Marital Relationship Training (MRT) + Tokaut Na Tokstreet (TnT) - (STI, HIV prevention, violence prevention)	9,643 participants
3	Truckers + Health & Safety officers reached through modified MRT programs	780 participants
4	Vouchers distributed for STI/HIV testing and healthy pregnancy care	3,606
5	Participants in sexual reproductive health information sessions	14,541
6	New condom outlets created	32

IMPLICATIONS FOR PNG

- Consideration of HPV vaccination is a critical policy consideration;
- Routine pap smear screening should be considered;
- Continued HIV monitoring at key clinics;
- STI awareness and prevention programs;
- Continued focus on Marital Relationship Training programs aimed at reducing violence and preventing STIs.


ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

- Partnership in Health (PiH) program – KRA 2, 3;
- Healthy Pregnancy Study (STIs) – KRA 4, 5.



Supported by ExxonMobil and the PNG LNG Project





integrated Health Demographic Surveillance System (iHDSS)

CHALLENGE

- In PNG many people are born, live and die without leaving a trace in the official vital statistics;
- Developing a sustainable, evidence-based monitoring and surveillance program is a key iHDSS objective.

RESPONSE STRATEGY


1. Integrated Health Demographic Surveillance System (iHDSS):
 - Internationally recognized solution to the lack of a comprehensive vital statistics programme;
 - Understanding
 - Individual
 - Household unit
 - Community and its context including key social determinants;
 - In partnership with PNGIMR, the Project established sites at key locations with matched comparison sites
 - 70,000+ lives covered;
 - Two impact locations, Hiri villages (LNG location) and Hides (gas conditioning plant and well fields) have been established;
 - Two matched comparison sites have been developed, as follows: Karkar Island - Hiri; and Asaro Valley (near Goroka) - Hides.
2. Fundamental research and monitoring platform:
 - Objective Health, Demographic and Social outcomes
 - Morbidity & Mortality
 - Emerging disease patterns
 - In and out migration
 - Socio-economic changes
 - Training and research platform for PNG scientists
 - Informs crucial public health decisions for PNG based on objective evidence.

PROGRESS


- All iHDSS sites are fully functional, registered and accepted by international scientific consortium (INDEPTH Network) for demographic surveillance;
- Scientific training of PNG nationals;
- Biannual scientific progress reports are available;
- Potential impacts are objectively evaluated.

FUTURE


- Core demographic studies are continuously performed at iHDSS locations:
 - In and Out Migration including births
 - Socio-economic surveys including wealth analysis (all households and communities)
 - Morbidity (illness) and Mortality (death);
- Specialty Studies:
 - Febrile/diarrheal illness
 - Tuberculosis
 - Sexually Transmitted Infections including HIV, Herpes and Human Papilloma Virus (HPV)
 - Maternal and Child Health including vaccination coverage and antenatal clinic performance
 - Non-communicable diseases (NCDs).




PNG-IMR



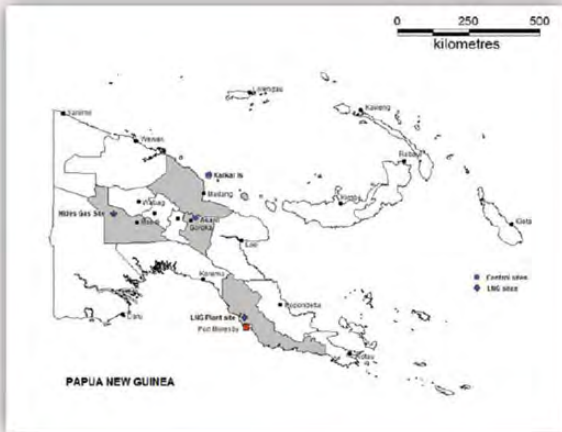
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PNG LNG



KEY FINDINGS

1. Study results are available across all iHDSS locations.
2. Critical information regarding morbidity and mortality patterns available.

Hiri

Clearly demonstrating an URBAN pattern of disease—general movement from infectious diseases towards non-communicable disease pattern, however:

- Tuberculosis is a major concern and number one cause of death;
- Confirmed malaria is extremely low but other febrile causes under investigation;
- Non-communicable diseases are rapidly rising
 - Diabetes, hypertension rates are >20% in adults.

Hides

Demonstrates a RURAL pattern of diseases dominated by infectious diseases—respiratory and diarrhea:

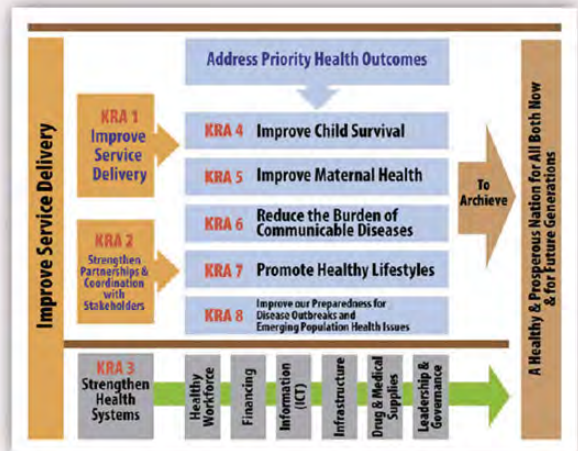
- Hides pattern documented since late 1970s and showing remarkable stability;
- Road traffic and violence account for a significant mortality burden.

IMPLICATIONS FOR PNG

- Objective mortality and morbidity and socio-economic monitoring platform for informing public health policy fully established.

ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

- Partnership in Health (PiH) program – KRA 2, 3;
- iHDSS – KRA 1, 2 & 3.



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Maternal and Child Health (MCH)

CHALLENGE

- PNG has an extremely high burden of childhood diseases;
- PNG maternal mortality ratio (MMR) is quite high at 733 per 100,000 live births;
- Antenatal care and vaccination coverage can be used as critical key performance indicators.

RESPONSE STRATEGY

- Using the iHDSS platform, PNGIMR performed:
 - An In-depth vaccination coverage survey at iHDSS sites - WHO standard is 90% coverage globally;
- Expanded Programme of Immunization (EPI) by age 12 months:
 - An antenatal standard of care survey for Hiri and Karkar Island.



KEY FINDINGS- VACCINATION COVERAGE

Hiri (LNG Villages)

- Extremely variable coverage with decreases for all vaccinations from the first to the last dose;
- Coverage rates as low as 57%;
- Measles 2nd dose at 16%;
- Mis-timing of vaccination extremely common Hides;
- Extremely low levels of coverage and many children (32%) not available for assessment;
- Coverage varied from 17%-79%;
- Rates 2-3 fold lower than international norms;
- Significant delay in vaccination of 200 days on average.

Asaro

- Completion rates two times lower than international norms;
- Coverage varied from 34-82%;
- Lowest coverage of measles vaccination at 17%;
- Significant delay in vaccination of 200 days on average Karkar Island;
- Dose completion rates two times lower than international norms;
- 38% of children received no measles vaccination;
- Mis-timing of vaccination extremely common.



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KEY FINDINGS- ANTENATAL STANDARD OF CARE

Hiri women significantly outperform Karkar Island women in terms of:

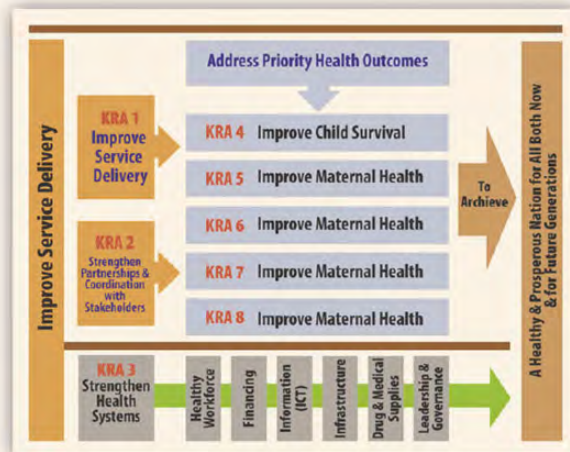
- Knowledge of danger signs in neonates;
- Better knowledge of danger signs in neonates;
- Significant differences in educational attainment;
- Access to functioning clinics;
- Both Hiri and Karkar clinics have deficiencies;
- Full suite of antenatal care services is not being offered;
- Low levels of core lab testing, e.g., HgB, HIV, STIs;
- Poor recognition of risk factors by clinic staff.

IMPLICATIONS FOR PNG

- Poor vaccination coverage all locations but significantly worse in Highlands;
- Risk of an epidemic of a vaccine preventable infectious disease is high;
- Measles risks extremely high;
- Antenatal clinic service delivery is suboptimal;
- Female educational attainment significant factor.

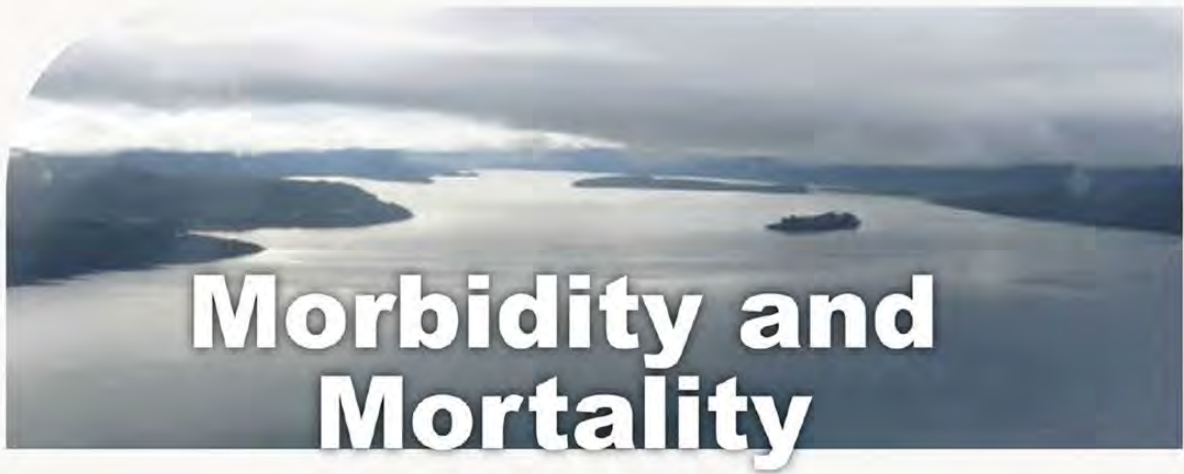
ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

- Partnership in Health (PIH) program – KRA 2, 3;
- MCH Study – KRA 4.



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CHALLENGE

- By understanding the objective pattern of illness and death, appropriate public health policy can be developed and implemented.

RESPONSE STRATEGY

- Use the iHDSS platform to accurately track and monitor morbidity and mortality across all sites.

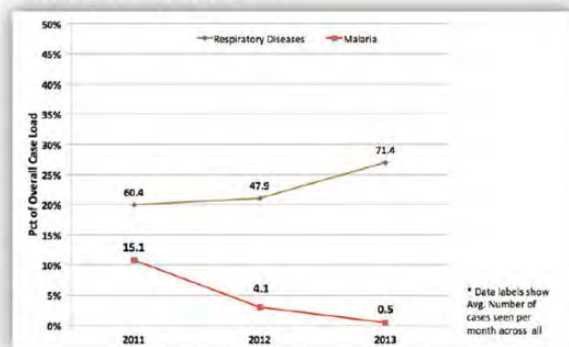
PROGRESS

- Morbidity (illness) tracking is performed on a monthly basis at key iHDSS clinics;
- Development of a Verbal Autopsy (VA) program that meets international standards.

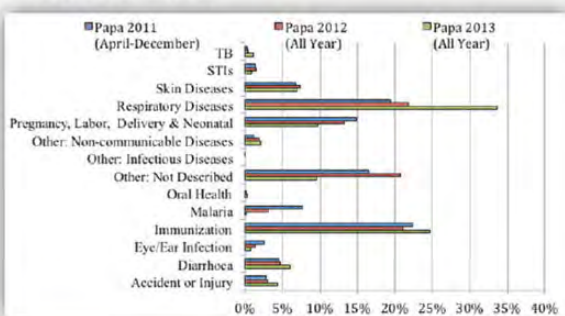
KEY FINDINGS - MORBIDITY

- Respiratory diseases dominate the morbidity pattern at Hiri and Hides;
- Malaria has fallen as objective testing has been introduced.

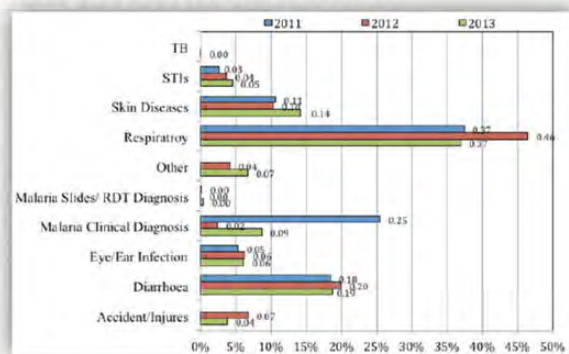
Hiri Respiratory vs Malaria



Hiri iHDSS Locations



Hides iHDSS Location-Mananda Clinic



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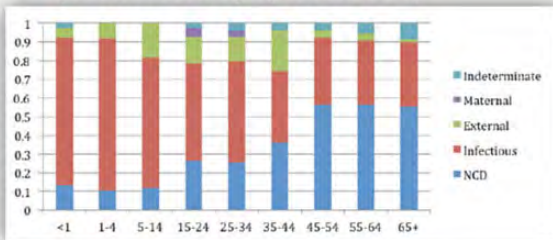


KEY FINDINGS – MORTALITY

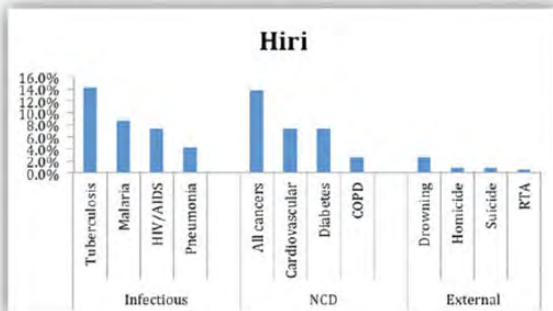
Epidemiological transition is occurring especially in coastal communities.

Cause of death 2010-2013 iHDSS

(Cause of death by age and disease)



- Infectious diseases dominant at early age;
- NCDs are rising especially in the working age groups.



- Hiri Mortality results indicate:
 - High TB burden;
 - Significant burden of NCDs especially cancer, cardiovascular and diabetes.

IMPLICATIONS FOR PNG

- Significant burden of respiratory diseases;
- High burden of pneumonia in Hides;
- High burden of TB in Hiri;
- Epidemiological transition is occurring but captured by mortality data not morbidity;
- Silent epidemic of NCDs;
- Malaria burden is falling rapidly
 - Bed nets
 - Treatment
 - Accurate diagnosis;
- Policy implications
 - Communicable respiratory diseases
 - NCDs (Cervical cancer, Cardiovascular, Diabetes).

ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

- Partnership in Health (PiH) program – KRA 2, 3;
- Morbidity and Mortality – KRA 1, 2, 8.



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CHALLENGE

As incomes rise, there is a burden of disease transition from infectious to non-communicable diseases (NCDs) - epidemiological transition.

- Non-Communicable Diseases – diabetes, hypertension, heart disease, cancer and stroke;
- PNG health professionals inexperienced with NCDs;
- Objective laboratory testing for NCDs is minimal across the PNG health care system;
- NCDs are a silent epidemic as patients do not typically present for treatment until they are at advanced stages of a disease;
- NCDs disease burden is significantly underestimated;

RESPONSE STRATEGY

- The Partnership in Health Programme has designed a large NCDs monitoring and surveillance system based on the iHDSS locations;

PROGRESS

- Large cross-sectional NCDs survey at all iHDSS locations has begun;
- Aim to recruit 1200 adults and 800 children for each location;
- Final sample size planned is 2000 participants.

KEY FINDINGS

- Silent NCDs epidemic is well underway especially at Hiri site
- Mismatch between clinic-based illness and verbal autopsy mortality data
- Outpatient data for NCDs shows low burden but mortality data is high
- Patients are NOT being diagnosed at early, more treatable stages of their disease

NCD Blood Glucose Study Exceedances (%)

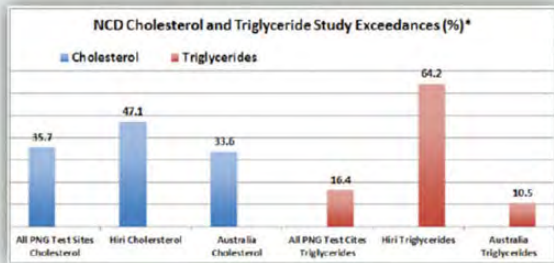


*Data show percent of measured patients over normal cutoffs for prediabetes and diabetes. Approximately 3-10% of prediabetics convert to Type 2 diabetes per year. Australia national survey data shown for comparison.



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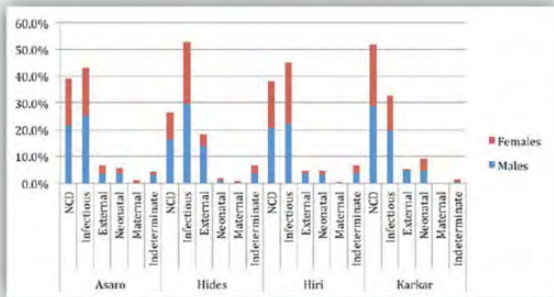


- NCDs are impacting the most productive age groups;
- NCDs are chronic and expensive diseases to treat and manage;
- Cost implications to the overall PNG health system are enormous;
- Workforce morbidity and mortality will be significant.

ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

- Partnership in Health (PiH) program – KRA 2, 3;
- NCD Study – KRA 7.

NCDs Cholesterol and Triglyceride Study Exceedances (%)
Data show percent of measured patients over normal cutoffs for cholesterol and triglycerides

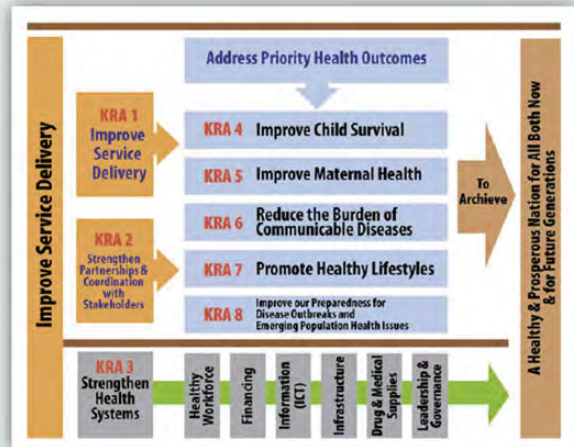


Leading causes of death in Hiri, 2010-2013, iHDSS, 2013

IMPLICATIONS FOR PNG

A silent epidemic of NCDs is developing.

- Elevated levels of prediabetes, Type 2 diabetes, abnormal lipids and hypertension;



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CHALLENGE

- The PNG LNG Project medical team recognized early that TB was a severe and growing public health issue for PNG;
- Early Project experience questioned whether available published data were underestimating the severity and magnitude of the TB burden in PNG, especially in the Kikori and Hiri areas.

RESPONSE STRATEGY

- Enhance and develop laboratory capacity and technical training;
- iHDSS used as a platform for understanding TB burden at Hiri, Hides, Asaro and Karkar Island with a supplemental TB project at Kikori.

PROGRESS

- Intensive TB investigations performed at Hiri and Kikori by PNGIMR;
- TB Diagnostic Lab Work at Kikori Hospital;
- Project workforce TB evaluation and diagnosis efforts intensified across all work sites;
- Port Moresby based Diagnostic Infectious Diseases Laboratory Project developed with major TB research component;
- TB active and passive surveillance conducted at Hiri, Hides, Asaro and Karkar Island and Kikori hospital;
- TB "Knowledge, Attitudes, Practices and Beliefs" survey in Hiri.

KEY FINDINGS

- High incidence of TB at Hiri and Kikori

Results from the ACD survey in Hiri 2013	
Hiri iHDSS Number	(N=13,310)
Number of villages	4
Total population survey	13310
Cough for more than 3 weeks	185
Sputum submitted	370
TB diagnosed from this ACD survey*	16
TB cases diagnosed by ISOS (PNG LNG workers)	18
TB rate from ACD in 2013	120/100000
TB cases from Passive case finding in 2013	34
TB rate from passive case detection in 2013	255/100000
Total new TB cases (ACD and Passive detection)	61
Incidence rate of TB in 2013	458/100000
Total TB cases	68
Prevalence TB rate in 2013	510/100000
RIF + from GeneXpert	4

* ACD= active case detection

- Hiri incidence rate estimated at 458/100,000 is much higher than reported PNG national incidence rate of 348/100,000;
- HIV co-infection not significant so far;
- TB is leading cause of death in Hiri based on PNGIMR mortality study;
- MDRTB rates at 6%;
- High household occupancy rate (8.6 persons/household) a clear cofactor for disease transmission. Poor individual knowledge of TB transmission and treatment.



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RESULTS FROM ACD SURVEY IN KIKORI 2013

- Incidence rate from Kikori study amongst highest in the world at 1290/100,000;
- HIV co-infection NOT a factor in Kikori:
 - African TB rates are strongly affected by HIV co-infection;
 - Swaziland TB rate 1287/100,000 with extremely high HIV prevalence (43%);
- 10%+ levels of MDRTB in Kikori;
- Historic trade route connection between Kikori and Hiri Villages.



IMPLICATIONS FOR PNG

- There is a severe TB epidemic in PNG that should be considered a Public Health Emergency:
 - Published rates are likely underestimating the true magnitude of the problem;
 - MDRTB is a major problem;
- TB is an expensive and disruptive disease:
 - A typical TB patient is isolated from family and unable to work for minimum 1 month;
 - Multi Drug Resistant (MDR) TB treatment is extremely expensive and requires extended treatment times of up to 2 years with at least 2 months isolation;
 - Extreme Drug Resistant (XDR) TB is a Global emergency and requires 6 months isolation, 2 years treatment and enormous cost impact.
 - Port Moresby likely has a high TB incidence HIV co-infection may be important;
 - DOTS treatment program challenges widespread, especially remote locations like, Kikori.

IMPLICATIONS FOR PNG LNG PROJECT

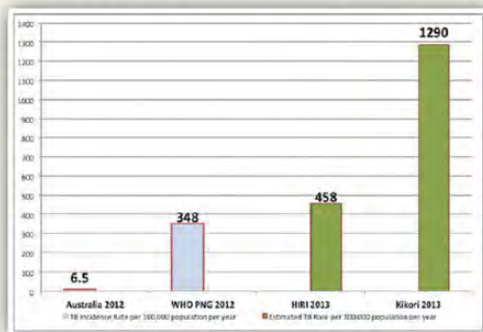
- PNG LNG Project draws workforce from Hiri and Port Moresby;
- Worker morbidity;
- TB Control Program implementation.

ALIGNMENT WITH GoPNG NATIONAL HEALTH PRIORITIES

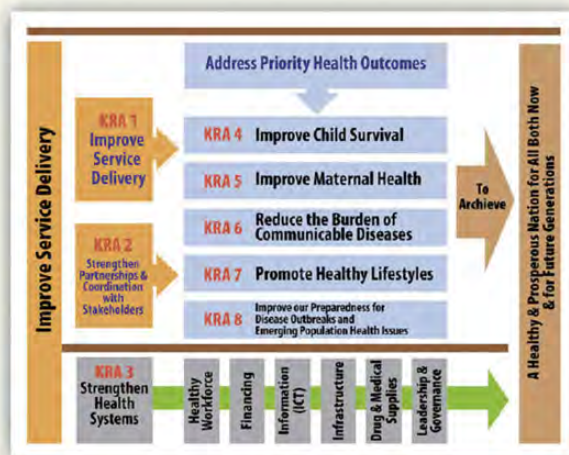
- Partnership in Health (PiH) program – KRA 2, 3;
- Reduce the Burden of Communicable Diseases – KRA 6.

PROJECT EXPERIENCE:

- During 2013, the LNG Project diagnosed thirteen (13) active TB cases from Hiri and seven (7) from Port Moresby:
 - All workforce cases received treatment;
 - Close contact tracing was conducted;
 - No worksite transmission occurred.



TB Incidence Rate in PNG Communities and Australia



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Appendix 5: Glossary

Glossary

Anthropometric surveys	<p>Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle and adipose (fat) tissue.</p> <p>The word 'anthropometry' is derived from the Greek word 'anthropo' meaning 'human' and the Greek word 'metron' meaning 'measure'.</p> <p>The purposes of anthropometric surveys are to: characterize overall nutritional status of population groups and variations by demographic and socio-economic characteristics, e.g. age, sex, location, income; monitor trends in nutritional status; evaluate the impact of changing health and socio-economic conditions; assess the impact of intervention programmes; and increase awareness of nutritional problems and define appropriate policies and programmes for addressing them.</p>
Baseline health survey	<p>Process of systematically identifying and assessing the current environmental and infectious health hazards and risks facing the local community and developmental workforce.</p>
Biomonitoring	<p>Biomonitoring is the measurement of chemicals (or their metabolites) in a person's body fluids or tissues, such as blood or urine. It tells us the amount of the chemical that actually gets into people from all sources (for example, from air, soil, water, dust and food) combined.</p> <p>Biomonitoring can therefore provide useful information on how much exposure to toxic chemicals a person has had.</p>
Birth rate	<p>The birth rate (also known as crude birth rate) is the annual number of live births per 1,000 people at mid-year. When calculating the crude birth rate, the age structure of the population is not taken into account. If a large portion of a population is of childbearing age, the birth rate will automatically be relatively high. The crude birth rate is an important measure of a country's population growth.</p>
Community	<p>A group of individuals broader than the household, who identify themselves as a common unit because of shared locality or recognized social, religious, economic or traditional government ties.</p>
Communicable or infectious diseases	<p>Communicable or infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another.</p> <p>Zoonotic diseases are infectious diseases originating from animals.</p>
Demography	<p>The study of changes (such as the number of births, deaths, marriages and illnesses) that occur over a period of time in human populations.</p>

Demographic and health survey (DHS)	<p>Demographic and health surveys (DHS) are nationally representative household surveys that provide data for a range of monitoring and impact evaluation indicators in the areas of population, health and nutrition. DHS have large sample sizes (usually between 5,000 and 30,000 households) and typically are conducted every five years, to allow comparisons over time.</p> <p>The Demographic and Health Survey (DHS) Program⁶ is currently funded by USAID. DHS reports, methodology and data are available online at www.dhsprogram.com.</p>
Environmental impact assessment (EIA)	<p>Part of project management concerned with identifying, through a formal written technical evaluation, the likely impact (positive and negative) of a proposed development or activity on the natural and man-made environment. A process whereby the assessment is used in reaching a consensus on acceptable levels of change, defining the means by which agreed standards of operation and procedure will be achieved and establishing management procedures to ensure that these objectives are achieved and maintained.</p> <p>A formal, written, technical evaluation of potential effects on the environment (atmosphere, water, land, plants and animals) of a particular event or activity.</p>
Emerging infectious diseases	<p>An emerging disease is one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range.</p>
Endemic diseases	<p>The constant presence of diseases or infectious agents within a given geographic area or population group. May also refer to the usual prevalence of a given disease with such an area or group.</p> <p>It includes holoendemic and hyperendemic diseases. A holoendemic disease is one for which a high prevalent level of infection begins early in life and affects most of the child population, leading to a state of equilibrium such that the adult population shows evidence of the disease much less commonly than do children (malaria in many communities is a holoendemic disease). A hyperendemic disease is one that is constantly present at a high incidence and/or prevalence rate and affects all groups equally.</p>
Equator Principles	<p>The Equator Principles is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects, and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.</p>
Equity	<p>Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically.</p>
Environment, social and health impact assessment (ESHIA)	<p>ESHIA is also defined as 'integrated impact assessment' as it assesses a project in a comprehensive manner, and includes an assessment of the interactions among impacts. ESHIA requires multidisciplinary teams to evaluate environmental, social and health impacts and risks, and to develop subsequent management plans and a monitoring and evaluation framework.</p>

Front end engineering design (FEED)	<p>FEED is the basic engineering which comes after the conceptual design or feasibility study. FEED focuses on the technical requirements as well as on the investment cost for the project.</p> <p>FEED can be divided into separate packages covering different portions of the project. The FEED package is used as the basis for bidding the execution phase contracts (EPC, EPCI, etc.) and is used as the design basis.</p>
Health	<p>A state of complete physical, mental, social and spiritual well-being and not merely the absence of a disease or infirmity.</p>
Health determinants	<p>The range of personal, social, economic and environmental factors that determine the health status of individuals or populations.</p>
Health impacts	<p>A health impact can be both, positive and negative. It refers to changes in community health that are attributable to a policy, programme or project.</p>
Health impact assessment (HIA)	<p>A combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a project on the health of a population and the distribution of those effects within the population. An HIA identifies appropriate actions to manage those effects.</p>
Health inequality	<p>Health inequalities are the differences in health status or in the distribution of health determinants between different population groups.</p>
Health needs assessment	<p>A systematic method of identifying unmet health and healthcare needs of a population and making changes to meet these needs.</p>
Health promotion	<p>Health promotion is the process of enabling people to increase control over, and to improve, their health. It moves beyond a focus on individual behaviour toward a wide range of social and environmental interventions.</p>
Health outcomes	<p>Health outcomes are measurable changes in the health status of an individual, group or population that can be attributed to an intervention or series of interventions.</p>
Health system	<p>A good health system delivers quality services to all people, when and where they need them. The exact configuration of services varies from country to country, but in all cases requires a robust financing mechanism; a well-trained and adequately paid workforce; reliable information on which to base decisions and policies; and well maintained facilities and logistics to deliver quality medicines and technologies.</p>
Human development index	<p>Human development index is a composite index measuring average achievement in three basic dimensions of human development: a long and healthy life; knowledge; and a decent standard of living.</p>
Human rights	<p>Human rights are rights inherent to all human beings, whatever their nationality, place of residence, sex, national or ethnic origin, colour, religion, language or any other status, without discrimination. These rights are all interrelated, interdependent and indivisible. Human rights are codified internationally by Conventions and Covenants and nationally by Constitutions and other legal frameworks.</p>

Information, education and communication (IEC)	IEC refers to a public health approach aiming at changing or reinforcing health-related behaviours in a target audience, concerning a specific problem and within a pre-defined period of time, through communication methods and principles
Institutional Review Board (IRB)	An IRB is a committee established to review and approve research involving human subjects. The purpose of an IRB is to ensure that all human subject research is conducted in accordance with all federal, institutional and ethical guidelines.
Multidrug-resistant TB (MDR-TB)	Multidrug-resistant TB (MDR-TB) is defined as the resistance to the two most commonly used drugs in the current four-drug (or first-line) regimen, isoniazid and rifampin. WHO treatment standards require that at least four drugs be used to treat TB in order to avoid the development of further resistance.
Non-governmental organization (NGO)	<p>A non-governmental organization, also often referred to as a 'civil society organization' (CSO) is a not-for-profit group, principally independent from government, which is organized on a local, national or international level to address issues in support of the public good.</p> <p>Task-oriented and made up of people with a common interest, NGOs perform a variety of services and humanitarian functions, bring public concerns to governments, monitor policy and programme implementation, and encourage participation of civil society stakeholders at the community level. Some are organized around specific issues, such as human rights.</p>
Primary healthcare	Affordable and practical methods of delivering essential healthcare that are scientifically sound and socially acceptable.
Primary prevention	Primary prevention seeks to prevent the onset of specific diseases via risk reduction, by altering behaviours or exposures that can lead to disease, or by enhancing resistance to the effects of exposure to a disease agent. Examples include smoking cessation and vaccination. Primary prevention reduces the incidence of disease by addressing disease risk factors or by enhancing resistance.
Public health	Public health refers to all organized measures (whether public or private) to prevent disease, promote health and prolong life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases. Thus, public health is concerned with the total system and not only the eradication of a particular disease.
Sexually transmitted infections (STIs)	Sexually transmitted infections (gonorrhoea, chlamydia, syphilis, etc.). These infections increase the risk for the transmission of the HIV virus.
Social impact assessment (SIA)	The processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programmes, plans, projects) and any social change processes invoked by those interventions.
Subsistence	The minimal resources that are necessary for survival.

Sustainable development	Meeting the needs of the present in such a way that the benefits will be capable of being sustained for the future without excessive external support.
Surveillance	Surveillance is the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation and evaluation of public health practice.
Traditional medicine (TM)	Traditional medicine (TM) refers to the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, used in the maintenance of health and in the prevention, diagnosis, improvement or treatment of physical and mental illness. Traditional medicine covers a wide variety of therapies and practices which vary from country to country and region to region. In some countries, it is referred to as 'alternative' or 'complementary' medicine.

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The HIA practice is constantly changing and evolving. Aside from peer-reviewed published papers, many countries, regulatory agencies, development agencies and international financial institutions have issued HIA practice guidelines and toolkits. The HIA practitioner should always review the standard published literature and any host country guidelines that may be applicable for a given project.

Equator Principles

- www.equator-principles.com

International Association for Impact Assessment (IAIA)

- International Best Practice Principles 5: www.iaia.org/publicdocuments/special-publications/SP5.pdf
- HIA FasTips 8: www.iaia.org/publications-resources/pdf/Fastips_8%20Health.pdf

International Finance Corporation (IFC)

- IFC Performance Standards: www.ifc.org/wps/wcm/connect/c8f524004a73daeca09afdf998895a12/IFC_Performance_Standards.pdf?MOD=AJPERES
- Health Impact Assessment Toolkit: www.ifc.org/wps/wcm/connect/a0f1120048855a5a85dcd76a6515bb18/HealthImpact.pdf?MOD=AJPERES
- Project Induced In-Migration: www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/learning+and+adapting/knowledge+products/publications/publications_handbook_in_migration_wci_1319576839994
- Stakeholder Engagement: www.ifc.org/wps/wcm/connect/938f1a0048855805beacfe6a6515bb18/IFC_StakeholderEngagement.pdf?MOD=AJPERES
- Environmental Health, and Safety Guidelines—industry-specific and covering oil/gas offshore and onshore:
 - Onshore: www.ifc.org/wps/wcm/connect/4504dd0048855253ab44fb6a6515bb18/Final%2B-%2BOnshore%2BOil%2Band%2BGas%2BDevelopment.pdf?MOD=AJPERES&id=1323153172270
 - Offshore: www.ifc.org/wps/wcm/connect/f3a7f38048cb251ea609b76bcf395ce1/FINAL_Jun+2015_Offshore+Oil+and+Gas_EHS+Guideline.pdf?MOD=AJPERES

Pew Charitable Trust

- HIA portal: www.pewtrusts.org/en/projects/health-impact-project/health-impact-assessment

Society of Practitioners of Health Impact Assessment (SOPHIA)

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- EIA process including mitigation:
 - *Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach*: www.unep.ch/etb/publications/EnvImpAss/textONUBr.pdf

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- HIV inclusion in EIA:
 - *Guidelines for Integrating HIV and Gender-Related Issues into Environmental Assessment in Eastern and Southern Africa*: www.undp.org/content/dam/undp/library/hivaids/English/Guidelines_for_Integrating_HIV_and_Gender_related_Issues_into_Environmental_Assessment_in_Eastern_and_Southern_Africa.pdf

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- University of New South Wales, Research Centre for Primary Health Care and Equity (Australia): <http://hiaconnect.edu.au>
- University of Liverpool, Institute of Psychology, Health and Society (UK): <https://www.liverpool.ac.uk/psychology-health-and-society/research/impact/about/>
- University of California Los Angeles, Health Impact Assessment Project (USA): <http://www.ph.ucla.edu/hs/health-impact>
- University of Birmingham (UK): www.birmingham.ac.uk
 - *A Training Manual for Health Impact Assessment*: <http://www.apho.org.uk/resource/view.aspx?RID=44927>

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 - *Audit Checklist For An Operating Facility Emerging Infectious Diseases*, June 2012: www.usaid.gov/sites/default/files/documents/1864/Audit-Tool.pdf

US Centers for Disease Control (CDC)

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 - *Toxicity Testing in the 21st Century: A Vision and a Strategy* (2007a): <http://nap.edu/11970>
 - *Applications of Toxicogenomic Technologies to Predictive Toxicology and Risk Assessment* (2007b): <http://www.nap.edu/catalog/12037.html>

Key journals that publish HIA-focused papers

- Environmental Impact Assessment Review (EIAR): www.journals.elsevier.com/environmental-impact-assessment-review
- Environmental Health Perspectives (EHP): <http://ehp.niehs.nih.gov>
- Journal of Epidemiology and Community Health (JECH): <http://jech.bmj.com/>
- The Lancet: www.thelancet.com
- British Medical Journal: www.bmj.com/thebmj

IPIECA

IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance, and is the industry's principal channel of communication with the United Nations.

Through its member-led working groups and executive leadership, IPIECA brings together the collective expertise of oil and gas companies and associations. Its unique position within the industry enables its members to respond effectively to key environmental and social issues.



IOGP 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, IOGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is IOGP's role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

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