

Resource Kit for HIA Practitioners: HIA for Industrial Projects



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Acronyms

CDC	U.S. Centers for Disease Control and Prevention
CH ₄	Methane
CO ₂	Carbon dioxide
DOH	Determinant of health
EA	Environmental assessment
EAP	Employee Assistance Programs
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Environmental Review
FIFO	Fly-in-fly-out
HHRA	Human health risk assessment
HIA	Health impact assessment
NEPA	National Environmental Policy Act
SIA	Social impact assessment

Definitions

Construction: The period during which a site is cleared and an industrial facility is erected.

Decommissioning: The end phase of the end of a project, when the facility is deconstructed and the site remediated.

Environmental Review (ER): The process mandated by the National Environmental Policy Act of identifying the potential adverse effects of a proposed project on elements of the environment (including, in some cases, the social environment and/or health concerns) and identifying mitigations to minimize adverse effects. Environmental reviews include an **Environmental Assessment (EA)**. If the EA determines that the environmental impacts of a proposed Federal action will be significant, an **Environmental Impact Statement (EIS)** is prepared.

Mobile Workers: Mobile workers, also known as fly-in-fly-out (FIFO) workers, comprise large workforces brought into a region for a temporary period of time in order to execute a large batch of work, such as the construction of an industrial facility.

Industrial Facility: A contained facility that creates a physical product or output. This output is one that is consumed by society, either directly or through another industry prior to reaching society.

Industrial Project: The process that comprises the construction, operation and decommissioning of an industrial facility.

Operations: The period during which the industrial facility is using raw materials and other resources to undergo a transformation process, to produce a final product for sale.

Proponent: The company or organization that is proposing to build a specific project or facility.

Remediation: A process that takes place after decommissioning in which contaminants are removed from the land and the area is rehabilitated to make it suitable for another use.

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1. About This Resource Kit

As most Health Impact Assessment (HIA) practitioners are aware, HIA is a growing but still young field. As of fall 2016, the Health Impact Project had recorded over 400 HIAs that were complete or currently in progress. The majority of these HIAs have been conducted on either government policy or on urban development issues. The number of HIAs that have been conducted on industrial projects, such as mining or manufacturing projects, is relatively low—fewer than 20 in the United States by the beginning of 2016.

Industrial projects are an important part of the American economy. Over the past 10 years, the manufacturing industry has contributed just under 20% of the nation's gross output, while construction has accounted for 4.3% and mining/oil and gas has contributed 1.9%.⁴ Similarly, these industries provide jobs for about 13% of the American workforce, and this figure is expected to grow.⁵ Between the fiscal output and the workforce involved in industrial projects, the impact on the national economy and the country as a whole is substantial. The application of HIA in these contexts represents a significant opportunity to protect and enhance public health.

The objective of this guidebook is to provide HIA practitioners with information that will help them conduct HIAs of industrial projects, and particularly if the HIA practitioner has no previous knowledge of how industrial projects 'work'.

Specifically, the guidebook is intended to:

- Identify what constitutes an industrial project and describe features and characteristics that are common across multiple types of industrial projects;
- Describe the potential links between industrial project activities and health outcomes, such that appropriate health issues may be considered in the HIA scoping process;
- Provide background information on Environmental Assessments and Human Health Risk Assessments: two types of studies with which HIA practitioners working in an industrial project setting should be familiar;
- Provide resource materials (checklists, diagrams and links to other resources) that may be useful for the HIA practitioner.

19



19 million US workers employed in the 'goods-producing' sector: manufacturing, mining and construction in 2014



19 percent of US Gross Output attributable to manufacturing in 2014



19 HIAs published in the US on industrial projects as of 2016

This guidebook does not attempt to describe or teach the steps that are involved in HIA; it is assumed that readers are already familiar with how HIA is conducted, but need a better understanding of how to apply it in an industrial project context.

How HIA has been applied to industrial projects in the United States

As mentioned above, relatively few HIAs have been published in the United States on industrial projects. Where HIAs have been conducted, they tend to cluster into three areas: HIAs on **energy generation** (biomass facilities, oil & gas production, coal-fired power plants), HIAs on **waste disposal**, and HIAs on **mining**. Appendix 1 lists the HIAs that are publicly available and that have been conducted on industrial projects or facilities in the United States and other countries.

There are also a number of HIAs that have been conducted on industrial projects in the United States and internationally that have not been made public. These HIAs have been commissioned primarily by large oil and gas companies to help their own organizations to understand and identify mitigation for the potential community health risks of their operations. These HIAs are generally considered to be part of the company's internal risk management strategy, and are not made public.

As a result, the number of HIAs that have been conducted on industrial project is larger than can be identified through a review of published sources.

2. What Are Industrial Projects?

Defining industrial projects and industrial facilities

Although the term 'industrial project' or 'industrial facility' may bring some specific ideas to mind, defining what is meant by an industrial project is surprisingly difficult, with no single clear definition. It is easy to assume that a car manufacturing plant would be an industrial facility, but how about a wastewater treatment plant? A data storage center? A new housing development?

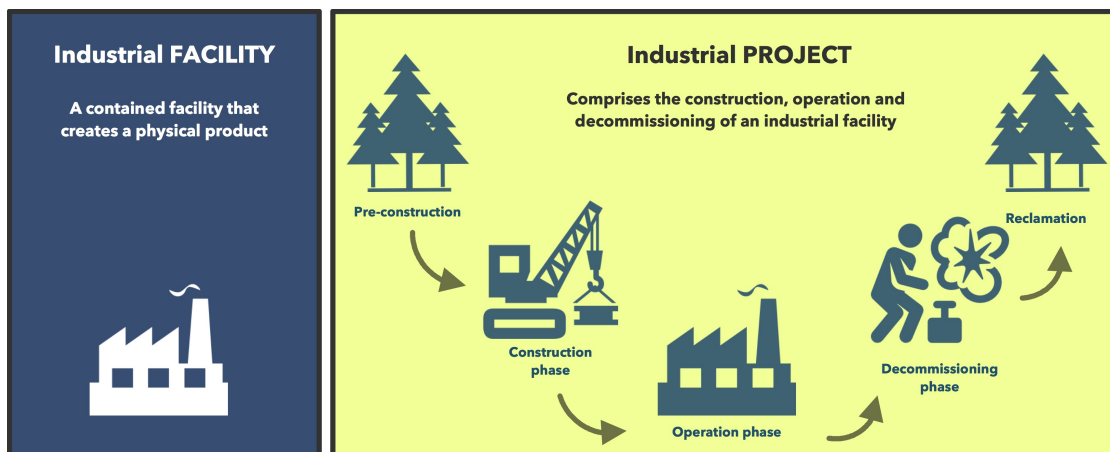
In this section, we describe what is meant by the term 'industrial project' as it is used throughout this Resource Kit. Because there is no clear consensus in the literature, the reader should note that these terms may be used differently in other publications.

Industrial facilities vs. industrial projects

In this document, we use the term '**industrial facility**' to refer to **a contained facility that creates a physical product or output**. This output is one that is consumed by society, either directly or through another industry prior to reaching society.^{6,7} For example, a manufacturing plant would be an industrial facility, as would an oil refinery or a cement plant.

The term '**industrial project**' is used in this document to refer to the process that comprises the **construction, operation and decommissioning of the industrial facility**. As shown in Figure 1, this begins with a site being selected and land acquired, the facility and its components being constructed, the operation of the facility for its intended purpose (e.g., the manufacturing of cars), eventual decommissioning/destruction of the facility, and the reclamation of the site for a different use. This process, which usually takes place over a period of decades, is explained in more detail in Section 3.

Figure 1: Industrial facilities and industrial projects - What's the difference?



What comprises an industrial project?

For the purposes of this guidebook, an industrial project is one that meets the following three criteria:

1. **Contained facility:** A facility exists in a discrete and identifiable location; for example, a refinery that is located at 222 Maplegrove Ave., Springfield. The “facility” could include a number of different buildings, storage areas, parking lots, excavation areas, etc., but these are located in a contained physical space.
2. **Facility life cycle:** The facility experiences (or will experience) three phases: a construction phase during which it is built; an operations phase during which it operates; and a decommissioning phase, during which the facility is taken down and the site may be remediated for other use.
3. **Product generation:** During the operations phase, the facility receives inputs of some type of physical material, transforms that material, and produces a physical product in addition to waste materials. That product is often, but not always, sold to another user.

Some examples of industrial projects that meet these criteria include:

- A manufacturing facility that makes consumer electronics
- A pulp and paper mill
- An automobile manufacturing plant
- A waste treatment facility
- A mine or gravel pit
- A petroleum refinery
- A food processing plant
- A brewery or distillery
- A solar energy ‘farm’

There are several other types of projects or developments that share components with the industrial project criteria above, but may not meet all criteria. Linear features that extend for great distances—such as pipelines or transmission lines—meet all but the first criterion. A shopping mall does not result in product generation, but would meet the other two criteria. For those projects that share some but not all features of an industrial project, this guidebook may still be useful to help the HIA practitioner identify relevant parameters of the project as well as possible health effects.

Vocabulary: What is a ‘proponent’?

‘Project proponent’ is a term that is used to describe the company or organization that is proposing to build a specific project or facility. This term is most commonly used as part of the environmental assessment process.

3. Common Attributes of Industrial Projects

Industrial projects, as defined in the previous section, encompass a very broad range of types, purposes and processes. Nonetheless, industrial projects share a number of common attributes. This section describes the features that are common across almost all industrial projects.

As an HIA practitioner, why do I need to know this?

- You need to understand how projects unfold in order to obtain appropriate and relevant information for the project description.
- You need correct terminology to be able to communicate with project operators, regulatory agencies, decision-makers and other assessment professionals during your HIA.
- This information provides the groundwork for understanding the health effects described in Section 4 of this Resource Kit.

Life cycle

The assessment of industrial projects usually focuses on three distinct life cycle phases: 1) construction, during which a facility is built; 2) operations, during which the facility produces its intended outputs; and 3) decommissioning, during which the facility is taken down and the site prepared for other uses.

Project planning

Although typically construction, operations and decommissioning are the only three phases considered in an environmental or health impact assessment, it is important to recognize that even before construction there is a period of project planning that may last for years (see Figure 1). During the planning phase, the project proponent—that is, the company or agency planning to construct and operate the facility—will undertake extensive internal business planning, will commission technical studies (including an EIA and/or HIA), and will often engage with stakeholders including community members and/or government. Planning will also usually involve a project application to a governing board, which could be a federal, state or municipal agency.

Construction

Construction of an industrial facility usually takes somewhere between one and five years. Construction is very a resource-intensive process, and involves the use of a considerable supply of materials and people.



First, the site is prepared, which involves clearing the area of current environmental and non-environmental material (e.g. plant growth or old infrastructure). Then, the facility structures (e.g., a manufacturing plant, offices, worker housing) are erected and necessary infrastructure (e.g., water lines, power transmission lines, waste disposal) are added.⁸ Typical activities that occur during the construction phase of an industrial project include:^{8, 9}

- Changing the local biophysical environment. To prepare the site, trees and other vegetation is often cleared. Depending on the location, manmade structures (e.g. parks, trails, etc.) may also be partially or fully demolished or altered.
- Blasting, which can be needed to prepare the land for construction.
- Digging and moving of materials, which often results in the release of dust (particulate matter).
- Use of generators to power equipment, which may result in the release of airborne contaminants such as diesel emissions.
- Disposal of waste materials.
- Operating heavy trucks to haul materials needed for site construction or disposing of waste.
- Physically constructing buildings and other structures, which often generates noise.
- Constructing temporary or permanent access roads, which may result in the generation of dust.
- Short-term employment of workers to complete these construction activities. [Note: construction workers are not generally hired by the project proponent directly; the proponent will hire a contractor to complete construction, and the contractor will hire workers as it sees the need.] Workers may be local or brought in from elsewhere for a limited period.
- Limiting the access of the general public to the construction site.
- Spending money in the community to hire local businesses for construction needs or other provisioning (e.g., catering).

The potential health implications of these construction activities are discussed in Section 4 of this Resource Kit.

Operations

Operations of an industrial facility comprises the period during which the facility is doing what it was intended to do: producing widgets, processing food, turning biowaste into energy, etc. The operations phase generally lasts for several decades.



Operations is often a less resource-intensive period than construction, although this varies by industry. In extreme cases, construction may require thousands of workers whereas operation may require only dozens.

Typical activities that occur during the construction phase of an industrial project include:

- Transportation of raw materials to the facility. This may be by truck, rail or ship.
- Transportation of finished products from the facility. Again by truck, rail or ship, or in the case of electricity as the product, by transmission line.
- Consumption of other inputs required for facility operation and production of the finished product, including power and water.
- Disposal of waste materials (both waste from the manufacturing process, and waste produced by the people who work there). Some of this may wind up in a landfill; other waste is disposed of by releasing it into the air or into water bodies. The waste may be 'normal' (for example, office waste or inert materials) or hazardous waste that requires special treatment.
- Production of noise from facility operations or power generators.
- Longer-term employment opportunities (as well as the transportation of workers to and from the site daily).
- Remitting of taxes or other revenue to applicable agencies.
- Permanent changes in public access to the site.

The potential health implications of these activities are discussed in Section 4 of this Resource Kit.

Decommissioning

Decommissioning refers to the end of the project, when the facility is dismantled. Although most projects will eventually be decommissioned, the lifespan of these projects can be very long, spanning decades, and so plans for decommissioning may not be well-developed at the start of the planning process when an environmental impact assessment or an HIA takes place.



Decommissioning is essentially the reversal of construction; this means that the same activities that are described in the above list for construction, will apply to decommissioning, only in the opposite direction (i.e., instead of building facilities, these will be taken down).

Resource needs

Construction, operations and decommissioning all require a set of resources, ranging from a location on which to build the facility to the materials needed to keep the facility producing on a daily basis during operations.

The initial resource need is for **land** on which to build the facility. For some types of industrial operations, such as most manufacturing, the specific site is chosen based on economic and zoning considerations. However, some types of industrial projects rely on specific properties of the land and cannot be as easily relocated—for example, mining facilities, which need to be located at the site where the geological deposits (e.g. copper or gold) occur.

Another need is for **transportation**. Construction materials will also be transported as the facility is built. Raw materials need to come into the facility, and the finished product needs to come out of the facility. Additionally, personnel need to be transported on a daily basis. Transportation options include heavy trucks, rail, ship, air transport and/or private vehicles.

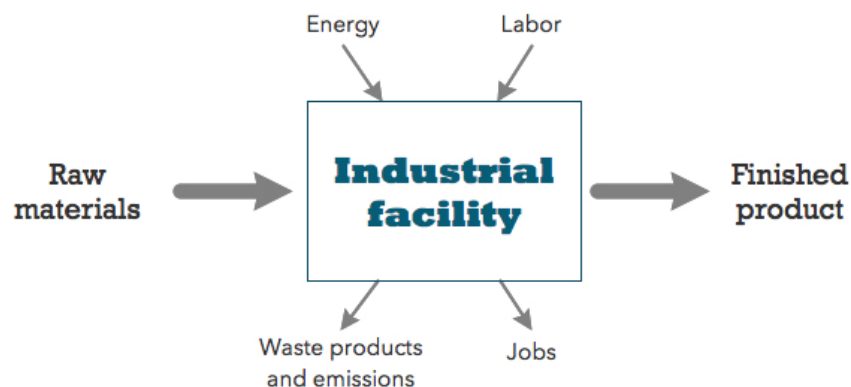
Converting raw materials to a finished product requires **energy input**. This is primarily in the form of electricity, but a facility may produce power onsite through the combustion of fuels such as biomass, oil, natural gas or coal.

In the process of turning raw resources into a finished product, there will be a range of **waste products** that require disposal. Often, facilities will emit some waste into the air (e.g., through a smokestack), some to water (e.g., to a tailings pond or local water bodies), and some to landfill or storage.

The final resource need of an industrial facility is **labor**. As described above, the need for workers will be different during construction vs. operations phases of the project, and workers may come from nearby communities, may relocate from elsewhere for the job, or may be brought in as a temporary workforce.

The figure below shows a graphic representation of these resource inputs and outputs. It is important to remember that the quantity and types of resources needed and produced will differ depending on the facility, and this requires the HIA practitioner to develop a nuanced understanding of these characteristics for the specific project being investigated.

Figure 2: Overview of industrial inputs and outputs



Project information checklist for HIA Practitioners

When conducting an HIA, practitioners need to learn both about the proposed project and about the local communities that may be affected.

Most HIA guidebooks provide good information about the type of information that is important to obtain to understand the local community (for example, information on demographic composition, measures of health status, health and economic equity, etc.). Gathering this information about the affected community remains vital in an HIA of an industrial project.

In addition, it is important for the HIA practitioner to obtain accurate and appropriate information about the project itself. The checklist on the following pages can be considered a 'cheat sheet' of what information may be useful to search out. Some of this information may be publicly available; however, some will require working with the project proponent to obtain. In the authors' experience, some of this critical information has often not been finalized by the proponent at the time the HIA is being conducted, which can make assessment challenging.

Not all items on the checklist are relevant for every industrial project; the HIA practitioner should use their best judgment on what is likely to be applicable for any given situation.

By combining information this about the project with an understanding of community conditions, it is possible to begin an assessment of how the project may result in effects on the local population.

Project Information Checklist

Project Description

Maps:

- ☐ Location of project (e.g. facilities, roads)
- ☐ Regional map (e.g., industrial facility area, surrounding communities, watercourses, road network)

Project overview:

- ☐ What is being built?
- ☐ What is it replacing? What are the current / historic use of that site?
- ☐ What will the facility do when it is complete? (e.g., manufacture cars, refine oil, mine copper, etc.)
- ☐ What are the industrial processes that will be used? (e.g., digging, burning, crushing, etc.)

Project schedule:

- ☐ When is construction expected to start?
- ☐ How long will construction last?
- ☐ When will operations start?
- ☐ How long will operations last?
- ☐ Has a decommissioning date been set?

Labor

Size and composition of labor force (data needed for both construction and operations phases):

- ☐ Number of jobs in full time equivalents (FTE)
- ☐ Types of jobs (e.g. temporary or permanent; high-skill or low-skill)
- ☐ Where will hires come from? From the local area or from a distance?
- ☐ For those workers coming from a distance, are they likely to resettle locally with their families, or work temporarily and leave?
- ☐ What are the company's hiring policies? (e.g., are there targets for local recruitment or to bolster hiring of specific groups?)
- ☐ Do the hiring policies extend to contractors as well, or only direct hires by the project proponent?

Compensation and benefits:

- ☐ What is known about planned wages?
- ☐ What benefits (e.g., health care will be offered)? Will benefits extend to all workers or only to direct employees?

Training programs:

- ☐ What, if any, training programs will be established?
- ☐ If so, will this allow for more employment among disadvantaged groups or local residents?

Worker health and safety:

- ☐ Have worker health and safety programs and policies been established? (If so, you will want to review them)

- ☐ Will Employee Assistance Programs (EAPs) be provided?* If so, to all workers, or only direct hires?

Worker accommodation

- ☐ Will temporary accommodation be needed for workers?
 - ☐ If yes, what type of accommodation? (mobile worker camp, or housed in the local community)

If a mobile work camp will be needed:

- ☐ Where will this camp be located?
- ☐ What policies will be in place for alcohol in camps?
- ☐ What are the policies around worker-community interaction?
- ☐ What health and safety standards will be used in the camp setting?

Traffic and Transportation

Transportation infrastructure:

- ☐ Will roads be upgraded as a result of the project?
- ☐ Will new roads be created as a result of the project?

Vehicle traffic related to the project (data needed separately for both construction and operation phases)

- ☐ Anticipated traffic volume and types of vehicles (e.g., heavy trucks, passenger cars, ships)
- ☐ Planned traffic routes

Traffic policies:

- ☐ Will driver safety training be provided to project drivers?
- ☐ What policies will be put in place around driver behavior (e.g., speed limits, talking on a cellphone, seatbelt use, etc.) and what enforcement mechanisms will be used?
- ☐ Will there be communal rides (e.g., ride-sharing or shuttles) for workers?
- ☐ What traffic management plans have been established? (Traffic management plans cover aspects such as routing, hours of operation, avoiding creating congestion, etc.)

Noise

- ☐ Sources and levels of project-related noise (construction and operations)
- ☐ Noise management plans (construction and operations)

Environmental Interactions

Air Quality:

- ☐ What are the sources, levels and types of project-related air pollution during construction and operations?
- ☐ Air contaminant and dust management plans

* Employee Assistance Programs (EAPs) may comprise a part of benefits provided by employers to their workers. EAPs provide short-term counseling and referral services to help employees deal with personal problems that might adversely impact their work performance, health, and wellbeing, such as substance abuse, mental health issues, smoking cessation, health care concerns, and family or personal relationship issues.

Hazardous materials:

- ☐ Hazardous materials used (construction and operations)
- ☐ How will these be contained and disposed of?
- ☐ Spill prevention management plans
- ☐ Emergency response management plans

Water management:

- ☐ What is the anticipated water demand?
- ☐ Where will water for the project come from?
- ☐ What are the sources, levels and types of project-related water pollution during construction and operations?
- ☐ Water management plans

Waste management:

- ☐ Type and quantity of waste generated
- ☐ Waste management plans (including any use of local municipal sewage infrastructure)

Community Interaction and Engagement

- ☐ How is the project engaging local stakeholders and how often?
- ☐ What is the plan for communicating health and safety rules and risks of the industrial facility to the community?
- ☐ What emergency and risks communication plans are in place, and do these involve protective measures for the community (where appropriate)?
- ☐ What mechanism does / will exist for the community to express complaints or concerns about the project?

Municipal Services

- ☐ Will the project need to use municipal services, such as fire or police?
- ☐ What medical services will be provided on site or in camps? What health services might be needed from local communities?
- ☐ Are there any community investments planned as a part of this project?

Other Technical Studies

What other technical studies are being conducted, and when will these be completed? Useful studies often include:

- Traffic studies
- Noise studies
- Traditional land use studies
- Traditional knowledge studies
- Human health risk assessment
- Economic studies
- Socio-cultural studies
- Environmental justice studies

4. Links Between Industrial Project Activities and Health

In this section, we review nine major components of industrial projects in terms of their potential effects on human health:

- Land Acquisition
- Air Emissions
- Water Quantity and Quality
- Traffic and Transportation
- Noise
- Workers and Employment
- Taxes and Royalties
- Community Investment
- Accidents and Malfunctions.

These topics have been chosen because they occur in almost all industrial projects and have strong links with health. It should be remembered, however, that not all the potential linkages between projects and health are included. For example, this section does not consider the potential effects of waste management, project security, or the procurement and supply process, any of which could result in health effects under specific conditions.

Similarly, not all health effects are described: for example, almost all the adverse health impacts described will ultimately affect health care services; however, this linkage is not made explicit in these descriptions. In addition, there are implications for health equity and vulnerable populations for each of these potential effects.

The HIA practitioner is encouraged to think broadly about how the project under review will actually take place, in order to scope the potential health issues appropriately.

Hot Tip: “Effect” vs. “Impact”

In the HIA world, the words ‘effect’ and ‘impact’ are often used interchangeably to mean either a positive (beneficial) or a negative (adverse) effect of a project, policy or program.

However, for most environmental assessment practitioners, people who regulate projects, and project proponents, **‘impact’ almost always connotes an adverse effect.**

In other words, when you use the word ‘impact’, it is synonymous with an undesirable outcome. Use the word ‘effect’ to imply a change that could be either positive or negative.

Land Acquisition

Industrial facilities require land on which to be sited. From a community health perspective, it is important to understand what the land has been used for prior to the project, and how this use may change with the establishment of the project.

If the land to be used for siting the facility is a brownfield—that is, a site that had previous industrial development on it—then the acquisition of this land for a new project may be of less concern than converting a greenspace for industrial purposes. Establishing the new facility may improve environmental quality and have health benefits if land remediation is required. That is, there may be a requirement to clean up previous contamination before building of the new facility can begin.

If the land was used for recreational, subsistence or leisure purposes, this can have impacts in terms of lost resources and opportunities for recreation, subsistence and leisure. The acquisition of land with cultural or spiritual significance can be particularly inflammatory among local communities.

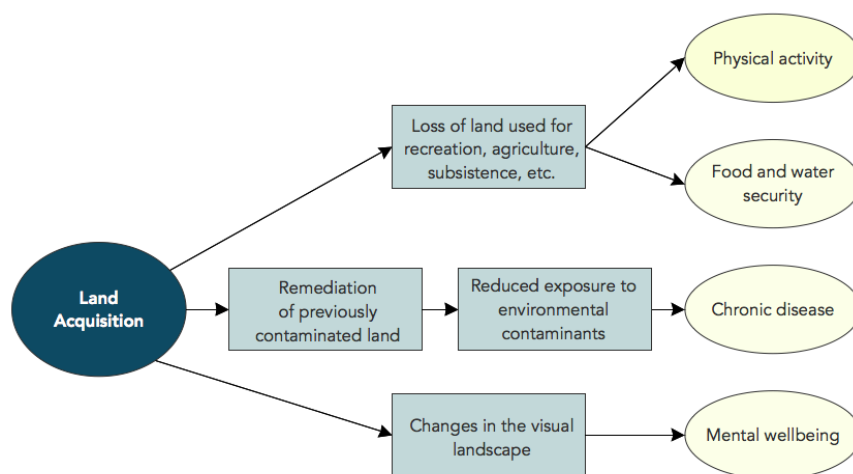
The location chosen for the facility will also influence the community's experience of other health effects, such as exposure to air emissions, or changes in the visual landscape. Projects sited close to communities may result in more concerns for human health than project sited in remote locations.

Major international industrial projects sometimes result in the forced resettlement of individual families or entire communities. Resettlement has enormous impacts on almost all facets of life, and there are numerous resources and guidelines concerning best practices and mistakes to avoid in the resettlement process. However, in the United States it would be rare (although not unheard of) that an industrial project would require resettlement.

Useful questions for the HIA:

- Where will this project be situated? How close is it to houses, schools, or other places where people congregate?
- In what ways is the land currently used (e.g., housing, agricultural, recreational, cultural uses)? Is there a suitable alternative location for these activities?
- Will rezoning be required for the industry to be located at the proposed site?
- Will the project be located in a community that already suffers from a disproportionate environmental burden?
- Does the land currently provide an important food source—either for agricultural or subsistence uses (e.g., community gardens, hunting for populations that rely on traditional subsistence foods)—that could be impacted by the project?
- Are there infrastructure or amenities on the land, such as parks, trails, short-cuts or river access? What are the proponent's plans for providing these amenities elsewhere, or allowing access to these amenities during the project lifespan?
- Will the proposed project remediate previous contamination? What requirements are there for remediating the site when the project is finished?
- How will the use of this land for an industrial facility affect health equity?

Figure 3: Selected links between land acquisition and health



Air Emissions

Air emissions are among the most common concerns raised by communities about industrial projects. Air emissions refers to the discharge of gases and particles into the air from either natural or human sources. In the case of industrial projects, the main sources of air emissions include construction activities, road dust, power generation, vehicle and machinery emissions, and incineration of waste.

The substances emitted into the air by an industrial facility vary enormously depending on the facility type, size of facility, and technologies used. Common types of substances that are emitted by industrial facilities include nitrogen oxides (NO_x); sulfur dioxide (SO₂); particulate matter (PM), including both PM_{2.5} and PM₁₀; carbon dioxide (CO₂); ozone (O₃); volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylenes; and other hazardous air pollutants (HAPs) including acrolein, 1,3-butadiene, diesel particulate matter and diesel exhaust organic gases (diesel PM), formaldehyde, lead, naphthalene, and polycyclic aromatic hydrocarbons (PAHs).

There is a strong body of evidence linking exposure to high doses of some airborne chemical contaminants with physical health effects including irritation or inflammation of the lungs, cardio-respiratory disease, cancer, and irritation of the eyes, nose or throat. The increase in risk depends on several factors. These include the nature of the hazard (what the substance is that a person is being exposed to); the amount and duration of exposure; and the susceptibility of the person who is exposed. Several populations are at higher risk, including children, seniors, and people with some medical conditions. Human Health Risk Assessment (HHRA) is a study approach that is used to model the level of risk associated with exposure to emissions. **Section 5** of this Resource Kit discusses HHRA in more detail.

Under the Clean Air Act, EPA establishes air quality standards to protect public health with an “adequate margin of safety”, considering the health of “sensitive” populations such as people with asthma, children, and older adults.¹⁰ Industrial facilities must adhere to these standards. The EPA standards are updated

every five years. However, some professionals have argued that the air quality standards are not sufficiently stringent to protect public health.¹¹

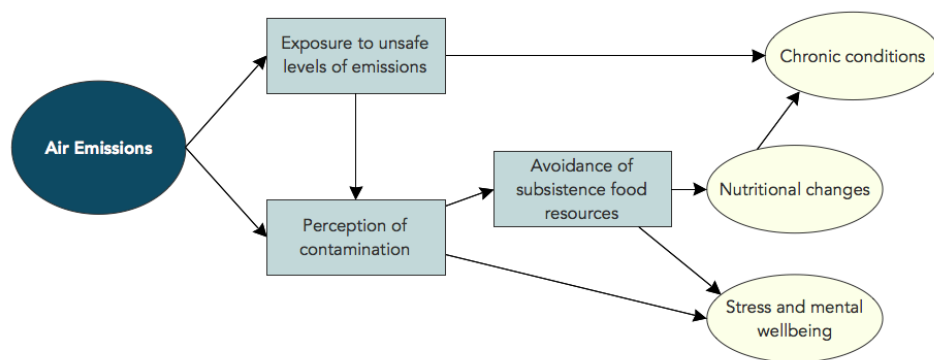
The possibility that disease might be caused by chemical exposure can be a highly alarming issue. Complicating matters is the fact that the most feared health outcomes are often rare and their cause is usually multifactorial. This is particularly the case with rare diseases such as certain environmentally-mediated cancers. HIA practitioners need to be careful in communicating the health risk that may stem from project-related air emissions. Identifying the risk posed by exposure is important to helping communities and decision-makers understand the potential impacts of a project, but 'overselling' the possible risk can also create unnecessary fear, stress or harm.

Although exposure to chemical contaminants has the potential to result in a specific set of disease outcomes, the perception of contamination may lead to a different set of health problems. Perceived contamination—whether or not “actual” contamination exists—can cause stress and anxiety and erode mental wellbeing.^{12, 13} In addition, the perception of contamination of subsistence food sources can lead some people to avoid those food sources and instead rely increasingly on less nutrient-dense foods.¹⁴

Useful questions for the HIA:

- How will air emissions be monitored over the life cycle of the project? How will this information be reported to the public?
- Has the proponent prepared management plans to control dust and emissions during construction and operations? Are these planned measures appropriate for human health?
- Are there subsets of the population who are likely to change their behavior as a result of actual or perceived air emissions? Are there subsets of the population who are likely to become stressed or worried?
- What risk communication activities are planned by the proponent? Are these risk communication activities sufficient?
- Is a Human Health Risk Assessment (HHRA) assessing potential health risk from exposure to airborne contaminants being conducted? If yes, would it be useful to summarize these results in the HIA? If not, should an HHRA be conducted?
- How are cumulative exposure (that is, exposure to all sources of air pollution, not just those from the project) being assessed?

Figure 4: Selected links between air emissions and health



Water Quantity and Quality

Water is a resource that is frequently needed in large quantities for industrial processes. As a result, industrial projects have the potential to substantially affect both water access, water quality and water security in a number of ways.

One important question is whether the industry's use of water will reduce the availability of water for other users, such as agricultural or municipal users, people using wells, recreational users or people who fish for food. Industrial water users will usually sign an agreement with a regulatory body to allow them to draw specific quantities of water. Where that water comes from—municipal sources, lakes, rivers or aquifers—may have an effect on the present or future viability of water access for other users. In addition, the water-based ecosystems themselves may be affected, resulting in environmental damage and/or secondary impacts on human health.

Once water is used for industrial processes, it needs to be disposed of. Common disposal methods include shunting the water into rivers or lakes, injecting it underground into aquifers, or evaporating it in ponds. At this point, the water is often contaminated with other substances, either chemical or biological, and disposal needs to take into consideration the content of the water at that point. The Clean Water Act and regional/local regulations stipulate many of the conditions for proper water disposal, but this is also an area in which violations are common. In the case of hydraulic fracturing ("fracking"), the injection of these large quantities of water back into deep wells can be linked to increased earthquakes in areas that are already prone to seismic activity.¹⁵

Water that may be chemically contaminated presents similar issues to those described above under Air Quality. The potential for human exposure to these chemical exists, as does the issue of perceived contamination and resulting changes in stress and health-related behaviors.

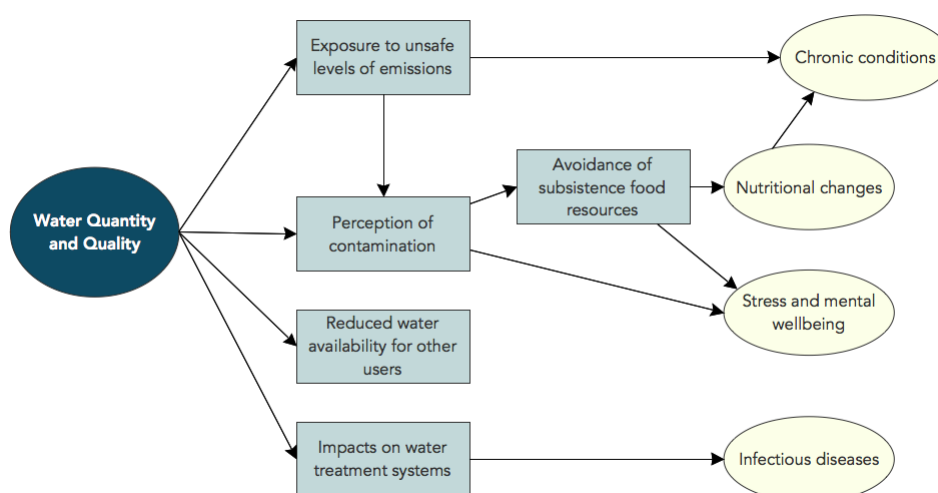
A final issue to consider is municipal water treatment: whether the industrial facility will change the demand placed on water treatment systems, and whether those systems have the capacity to handle those changes. This may result from the movement of water from one body to another, or from an increase in waste and sewage from the industrial facility. Water treatment systems are ubiquitous to the point of almost being invisible; but when there is a failure, there can be a widespread outbreak of disease. An example comes from the cryptosporidiosis outbreak that occurred in Milwaukee in 1993, during which over 400,000 people became ill following a problem at one of the city's water treatment plants.¹⁶ Although it was not linked to industrial processes, the outbreak highlights the importance of effective water treatment systems.

Useful questions for the HIA:

- Where is water for the project being drawn from? How much is being drawn? Who else relies on this water currently?
- How is water being disposed of and what processes will be used to treat water before its release?
- What is the potential of water discharges to impact ground water and surface water quality?
- How will emissions to water be monitored over the life cycle of the project? How will this information be reported to the public?

- Are there subsets of the population who are likely to change their behavior as a result of actual or perceived emissions to water? Are there subsets of the population who are likely to become stressed or worried?
- Is an HHRA assessing potential health risk from exposure to waterborne contaminants being conducted? If yes, would it be useful to summarize these results in the HIA? If not, should an HHRA be conducted?
- Could municipal water treatment systems be affected?
- What is the potential of industry to impact existing users of water and their quality of life?

Figure 5: Selected links between water quantity and quality and health



Traffic and Transportation

The need for transporting materials and personnel means that virtually all industrial facilities will generate a substantial amount of traffic. There are a number of distinct components that should be considered in term of how traffic may affect health:

- The volume of traffic. Any increase in traffic volume is tied to a greater risk of collisions, with some resulting in injury or fatality. However, the HIA should put any project-related increase in traffic in the context of the total traffic in the area. An increase of 30 trucks per day on a rural road is likely to have a very different impact than an increase of those same trucks on an already-busy highway.
- The location of traffic. Whether project traffic passes near or whether it is routed to avoid locations with high numbers of pedestrians or with 'vulnerable' areas such as schools, seniors homes, etc.
- Vehicle type. Heavy trucks are associated with higher accident frequency and more severe injury.^{17, 18}

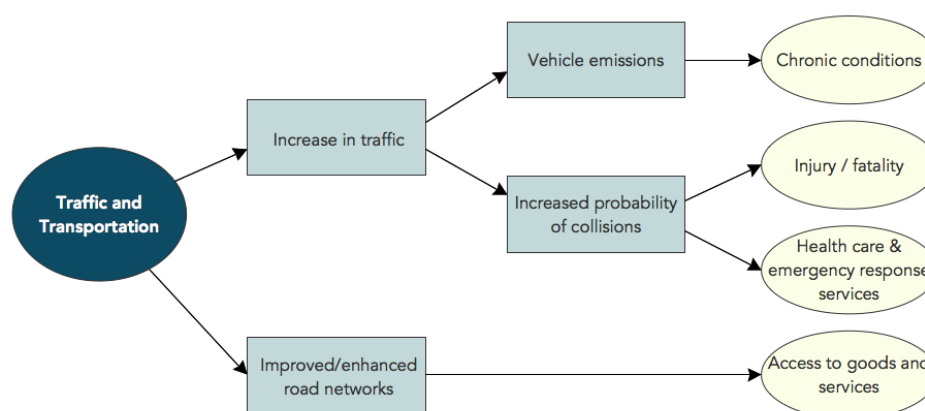
- Vehicle speed and driver behavior. Driver behaviors that increase the risk of collision include excessive speed, use of a cell phone, use of alcohol or medicinal or recreational drugs, fatigue, and traveling in darkness.
- Vehicle emissions. Emissions from project traffic should be examined in terms of its potential impact on cardiorespiratory outcomes. However, within an HIA it is often easiest to house this discussion alongside other emissions from the facility (e.g., as part of an air quality discussion) rather than alongside traffic safety issues.
- Road building or improvement. A potential positive health benefit may be generated if the industrial project involves the building of new roads or the improvement or upgrade of existing roads.
- Multi-modal traffic. There may be an influence of traffic associated with the industry on other modes of transport (e.g., active and public transport).

It should be remembered that traffic safety is an issue that is generally taken very seriously by industry, and that this is an area where collaboration with the project proponent may be helpful.

Useful questions for the HIA:

- What is the anticipated volume of new traffic that is projected for the construction and operation phases?
- What policies and procedures are in place for monitoring and enforcing driving behavior among project vehicle drivers?
- Are there any plans for reducing the number of private worker vehicles on the road - for example, through bussing, shuttles or carpooling?
- What routes are planned to be used? Can sensitive areas be avoided (e.g., near schools during pick-up or drop-off times)?
- Are any roads being built or upgraded as a part of this project?
- How will industry-associated traffic interact with multi-modal traffic?

Figure 6: Selected links between traffic and transportation and health



Noise

Excessive noise in or adjacent to communities can lead to annoyance and adverse health impacts.¹⁹ According to the World Health Organization (WHO), “People annoyed by noise may experience a variety of negative responses, such as anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion.”²⁰ Exposure to noise is also associated with interference with oral and written communication, sleep disturbance, cardiovascular disease, and cognitive impairment in children.²¹ Children, seniors and people with chronic illness tend to be more sensitive to noise disturbances.²²

Many communities have regulations that limit noise from commercial or industrial sources, and that specify not only acceptable thresholds in terms of decibels, but also times of the day in which noise can be produced. However, it is important for the HIA practitioner to recognize that there is little guidance on acceptable noise levels from a public health perspective, and that adherence to local noise regulations therefore may not be sufficiently protective of public health.

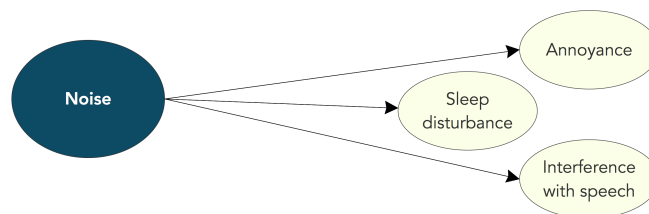
There are three health-related outcomes that are relatively easy to link to noise in the context of an industrial project, because thresholds have been set for observing community health effects. These are:

1. Sleep disturbance. The World Health Organization suggests an indoor nighttime sound level of 30 decibels (dBA) as a threshold for sleep disturbance, or an outdoor level of 45 dBA.²³
2. Interference with speech comprehension. Indoor sound levels for continuous noise should be maintained below 35 dBA to sustain adequate speech comprehension.²³ For outdoor speech comprehension, the EPA advises that sound levels be kept below 55 dBA for continuous noise.²⁴
3. “Percent Highly Annoyed” (often written as %HA). This estimates the percent of the community that will become highly annoyed at noise from a single source, based on modeled noise predictions. The threshold of 6.5% of the community being highly annoyed is often used as a gauge for unacceptability of project-related noise effects.²⁵

Useful questions for the HIA:

- How will the current background noise level change with the addition of this project?
- How close are residences, schools or other important community features to project noise sources (including both stationary and mobile noise sources)?
- Has a noise study been conducted? If so, what are the results?
- Are there local noise regulations that the project must adhere to? What are the restrictions on levels and timing of noise?

Figure 7: Selected links between noise and health



Workers and Employment

Employment and income are key benefits of industrial projects and have strong links to health. Both positive and negative health outcomes can occur through the provision of jobs and income, and these positive and negative effects usually accrue to different groups.

Those who stand to benefit are people who gain employment or whose income is bolstered as a direct or indirect result of the project. This includes project employees, contracted workers and employees of local businesses and organizations that benefit from economic growth. In practice, these employment opportunities are not distributed equally across the population. Rather, the most desirable jobs go to those who have the skills, experience and mobility to take advantage of these opportunities.

This pattern limits employment-related health benefits for already-vulnerable populations, who are less likely to have the education, experience and resources needed to be competitive. This includes individuals who are unemployed or “hard to employ” (e.g., due to mental health issues), or people with disabilities or pre-existing health problems. In this regard, employment opportunities with an industrial project may add to health inequity in the local community.

In addition, where the industrial project fuels economic growth in the community, prices may start to rise. Basic necessities may become less affordable as inflation affects the cost of food, shelter and clothing, and this may further increase health inequity across the local population as well as contributing to food and housing insecurity.

Finally, it should be noted that rapid economic growth (a ‘boom’) in a localized area has often been linked to a variety of negative health effects. With resource extraction projects in rural and remote settings, income and employment have been found to be associated with an increased prevalence of social pathologies, including substance abuse, assault, domestic violence, and unintentional and intentional injuries.²⁶

The focus on negative health consequences in the explanation above is not meant to downplay the importance of the potential positive benefits of employment and income, which are substantial. Rather, the explanation is intended to direct the HIA practitioner’s attention to those effects that may be most in need of mitigation—which can be accomplished, for example, by targeting employment or creating training programs to benefit specific groups.

In undertaking an assessment of the effects of employment and income on health, it is helpful to understand how the number and nature of jobs varies by project phase.

The **construction** phase usually requires a large workforce (often hundreds to thousands of workers) to be brought on for a period of months to years. Generally, these workers are not hired directly by the project proponent, and are not considered ‘employees’ of the company. Rather, the proponent hires a contractor for construction work, with that contractor preferentially using their own workers.

This is important for two reasons. First, the distinction between an employee and a worker may affect the types of recommendations that a proponent is willing or able to implement. For example, even if the proponent is willing to consider establishing an Employee Assistance Program (EAP -- see footnote on page 12) for its own employees, it may be limited in its ability to require this for contracted workers.

Second, the need for such a large workforce during the construction period means that very often, there is not a sufficient pool of workers available in the local community, and a large population of workers are brought in from other regions to fill the need.

These temporary workforces brought in for the construction phase are known by several names: construction workforces, mobile workers, or FIFO (fly-in-fly-out) workers, or—from a municipality’s point of view—a ‘shadow population’. Often, this mobile workforce is stereotyped as being young, male and single, and more interested in partying than contributing to the wellbeing of the community; however, women, people with families and older workers also comprise an important part of this workforce.²⁷

The importation of this mobile workforce population can lead to tensions within a community. However, new faces in a community can also be energizing and increase diversity. The pace at which these changes take place often dictate how well communities adapt.

If a mobile workforce is used, it is important to understand where workers will be housed. Sometimes workers are housed within a community in hotels or rental accommodation, which can put pressure on housing prices and availability. In other circumstances, the workforce may be housed in a construction camp near the community, or in a remote area. There is no ‘correct’ answer for what is best from a community wellbeing perspective; some communities have preferred workers to be in town so that they are generating money for local business, whereas other communities prefer workers to stay in camps with minimal impact on the local services and infrastructure.

When the project reaches the **operation** phase, a different set of workers is usually recruited. These are people who have specialized skills that match the needs of facility operation, and are typically hired as employees, with much greater job stability. However, the number of jobs needed for operation is often far less than for the construction phase. In extreme examples, the construction of a project may require thousands of workers, whereas operation of that same project requires only a few dozen employees. In both operation and construction phases, the quality of jobs (hazard, pay, stress levels, shift work, etc.) is also important to consider.

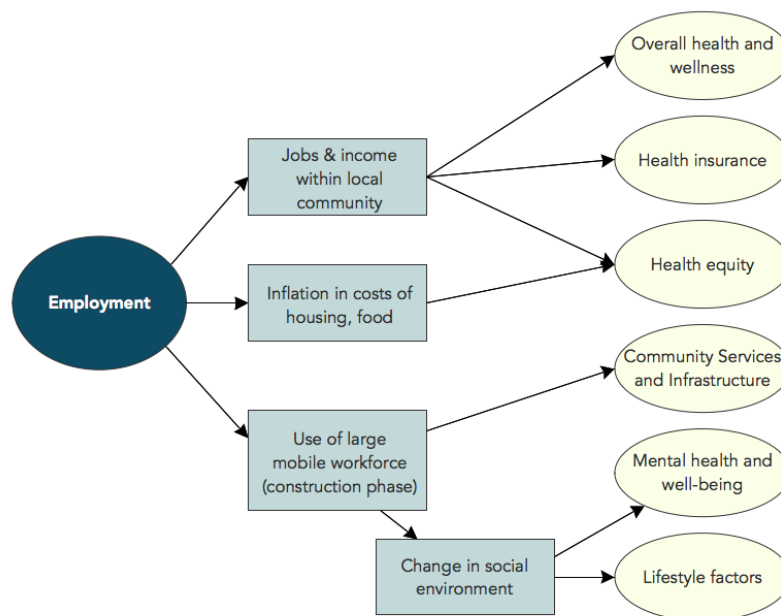
Definition: FIFO/Mobile Workforce

During construction, large industrial projects often import a large number of workers from outside the region, who leave the area after the construction phase finishes.

These populations are known as mobile or fly-in-fly-out (FIFO) workers. They can have a large impact on local economic and social environments.

Useful questions for the HIA:

- How many workers will be needed for construction, and over what time period?
- Will a mobile workforce be required? If yes, where will they be sourced from? Where will they be housed? What are the company's policies on the interaction of the mobile workforce with the local community?
- How is the local community likely to react to a large workforce brought in from outside the region?
- How many employees will be required for operation of the facility?
- Are there plans in place for training programs or for employment targets for specific groups?
- Do the salary levels greatly outweigh current average earnings in the community?

Figure 8: Selected links between employment, income and health

Taxes and Royalties

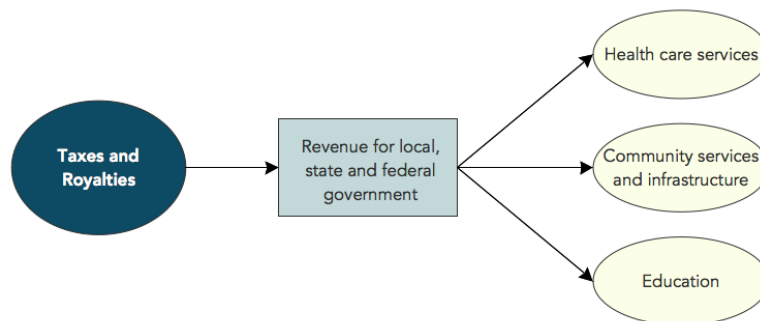
Project operators are generally required to pay taxes such as corporate income tax, business tax and/or property tax to various levels of federal, state and municipal government. In addition, some industrial project operators are required to pay royalties to federal or state governments: that is, money paid to compensate for natural resources that are extracted and permanently removed.²⁸

These taxes and royalties represent a substantial economic benefit to government, and can—in theory—result in improved community services and infrastructure, education, health care services, or other assets that benefit community health. In practice, however, it is almost impossible to tie the receipt of taxes by government to specific health-supportive programs that may result. Therefore, although these taxes constitute an important part of the community benefit generated by an industrial project and should be recognized as such, it is very difficult to accurately characterize their effects within an HIA. It should also be recognized that in some cases, governments offer a reduction or elimination of tax in order to incentivize industry to locate to a particular area, with the hope that job creation will offer an economic stimulus. In this case, the potential benefit from taxes paid by the industry will not materialize.

Useful questions for the HIA:

- How much revenue will be derived by federal, state or local governments from taxes on the facility?
- Have there been any commitment made by government for how this revenue will be used?
- Has the government offered a tax incentive, or other benefit, for the industry to locate in a particular community? If so, what is the amount of the tax burden on existing tax payers?

Figure 9: Selected links between taxes and royalties and health



Community Investment

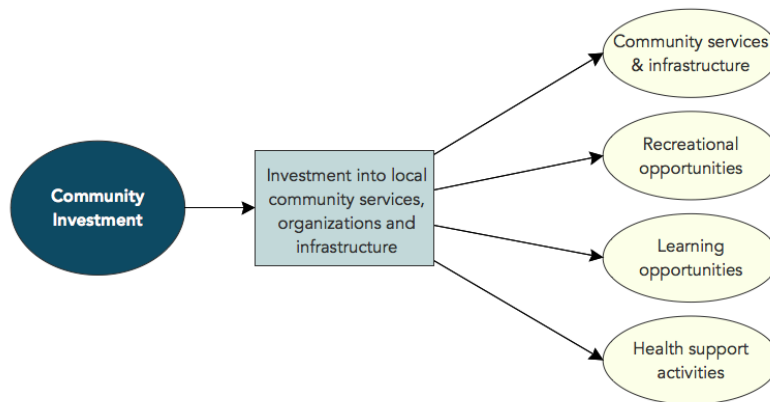
Many businesses choose to invest in their host communities, often as part of a Corporate Social Responsibility (CSR) or other corporate “giving” plan. This may involve a combination of funding, employee volunteer time, or both, and may be directed towards youth recreation programs and recreational spaces, investment in education and training programs, investment in school programs, support for housing or health care services, or support for community infrastructure, for example.

This community investment is elective, and is not inherently tied to business operations; nonetheless, it can constitute a benefit for the community, and an HIA may identify ways to target this investment towards outcomes that improve health in the community.

Useful questions for the HIA:

- Has the company identified a target amount for corporate giving or CSR?
- How will funds be invested into the community during the project lifespan, and how will the delegation of funds be decided?

Figure 10: Selected links between community investment and health



Accidents and Malfunctions

Most of the analysis in an impact assessment of an industrial facility focuses on potential effects associated with the 'normal' or planned function of the facility. However, it is also important to consider the potential effects of an accident or malfunction. In most environmental assessment documents, the effects of accidents or malfunctions are considered in a separate chapter, rather than being integrated into the assessment of 'usual' practices.

Accidents and malfunctions include events such as fires, explosions, spills, dam breeches, or releases of hazardous materials. There are a number of distinct health effect categories to consider with respect to accidents and malfunctions. These include:

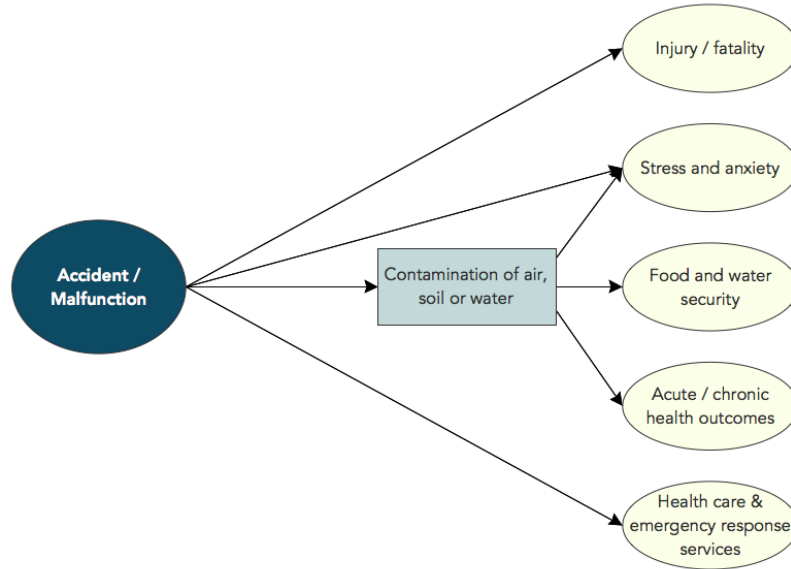
- The potential for injury or fatality.
- The potential for exposure to contaminants among the general population or among clean-up workers.
- The potential for impact on the quality or acceptability of locally-grown or locally-sourced foods (commercial or personal)
- The potential for stress and anxiety among the general population.
- The impact on health care services and emergency responders from both the primary and secondary effects of the accident.

It is important for HIA practitioners to keep in mind that accidents and malfunctions that have a large public health impact are rare, and most businesses work hard to prevent these adverse events, which are in no one's interest. While the HIA needs to discuss the potential for accidents and malfunctions—particularly so that recommendations can be made to minimize potential adverse effects—it is also critical that the HIA does not overstate the risks of an accident or malfunction. Doing so may result in the HIA itself causing unnecessary stress in the local community.

Useful questions for the HIA:

- What are the potential and most-likely accident scenarios for the industrial facility?
- What agreements are in place between the industry and other stakeholders in the event of an emergency or accident?
- Are company and community resources available to adequately respond to emergencies or accidents?
- Do the company's management plans adequately consider community health effects and interests?

Figure 11: Selected links between accidents and malfunctions and health



Populations to Consider: Health Effects in Native American Communities

HIA should always include consideration of effects on vulnerable populations, and many HIAs assess potential impacts to low income populations, housing-insecure population, communities of color and other groups that may be disproportionately impacted. While this focus on all vulnerable groups remains important, HIA practitioners assessing industrial projects should also think specifically about the potential for unique impacts to Native American communities.

Industrial projects are frequently situated near Tribal lands. For example, it has been estimated that about 10 percent of all power plants operate within 20 miles of reservation land.¹ There are several important considerations that HIA practitioners should be aware of when industrial projects are sited on or near tribal lands or Native American communities.

- The meaning of health is often conceptualized differently in Native American communities than elsewhere, and is deeply rooted in the inter-relationships between land, water, culture, and identity.² It is important to engage with affected Native American communities during the scoping process to understand how health is experienced in the community.
- Tribal governments are different than municipal or other community governments. Federally-recognized tribal governments are politically independent, with a right to sovereignty and self-governance. They are able to regulate activities on their lands independently from state government control.³
- Traditional subsistence foods procured through hunting, fishing and gathering remain very important for many Native American communities. Projects that adversely impact access to, availability of, quality of, or acceptability of subsistence resources may have a very strong effect on nutritional as well as cultural outcomes. [Note: This Resource Kit refers in several places to subsistence foods; while this is highly relevant to Native American communities, it may apply to non-Native populations as well.]
- The legacy of colonization has had enormous impacts, and continues to do so. Many of these communities are also experiencing a loss of culture with modernization.² The HIA should consider how a project may affect these processes and identify opportunities to help preserve culture.
- Finally, many Native American communities have high levels of poverty and health inequity, and there exist many communities in which basic amenities necessary for healthy living (such as safe piped drinking water) are not universally available.

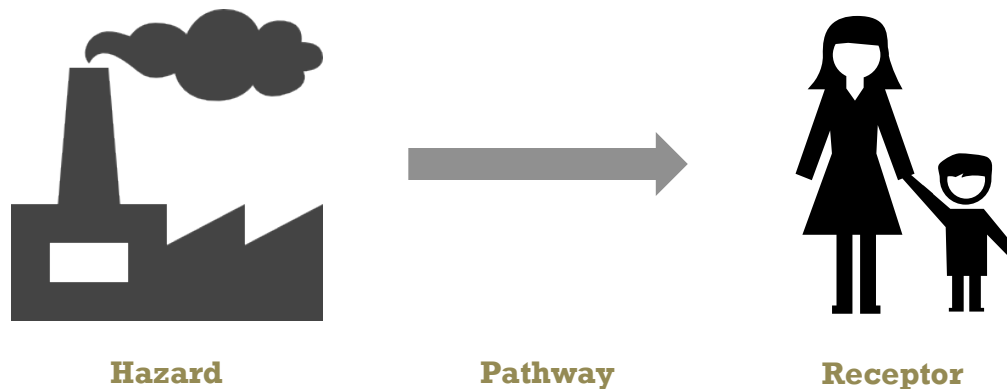
In some cases, Native American groups have developed industrial projects such as solar and wind technology and manufacturing on their lands as a source of economic sustainability. In these cases, the industrial project may have very different effects for the community than for cases in which the proponent is not from the community.

5. Human Health Risk Assessment (HHRA) and HIA

HIA and Human Health Risk Assessment (HHRA) are complementary but different, even though both consider potential impacts on human health.

The purpose of HHRA is to assess the potential for **human exposure to chemical substances**, and to predict the change in health risk that could occur. These chemical substances may comprise nitrogen oxides (NO_x); sulfur dioxide (SO₂); particulate matter (PM), including both PM_{2.5} and PM₁₀; carbon dioxide (CO₂); ozone (O₃); volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylenes; or other hazardous air pollutants (HAPs) such as acrolein, formaldehyde, naphthalene, lead, and polycyclic aromatic hydrocarbons (PAHs). HHRA models the potential increase in the risk of health outcomes including cancer, heart disease, liver disease, respiratory disease, irritation of the eyes, nose and throat, or other medical conditions.

This change in risk is predicated on three factors that must be present: a **hazard**, a **receptor**, and a **pathway**. A hazard comprises a chemical (e.g. benzene, arsenic, or lead) that can cause adverse health effects at sufficiently high concentrations. A receptor is one or more people. A pathway is a mechanism for the person to be exposed to the hazard—from inhaling the substance, ingesting it, or absorbing it through the skin. All three must be present in order for risk to occur.



The methods used for HHRA are quite different than those used for HIA. A limited number of locations are chosen to represent a variety of exposure scenarios: nearby residences, outdoor areas that may be used by people (such as parks), or institutional settings such as schools or long-term care facilities. Using air quality data and information about the people who are likely to be exposed, the HHRA develops a model to identify whether sensitive individuals are likely to encounter contaminants at these locations at a level that increases the risk of adverse health effects to unacceptable levels. The definition of 'unacceptable' is usually predicated on thresholds that have been developed by agencies such as the

CDC, the EPA, the International Agency for Research on Cancer, the World Health Organization, or state-level agencies such as the Texas Commission on Environmental Quality.

The HHRA modeling approach involves four steps:²⁹

- Hazard identification is used to identify whether a given project will produce chemical substances that have the potential to cause harm to humans.
- Dose-response assessment pulls together information from studies in humans and animals to identify how the amount of exposure to a given chemical substance (the 'dose') is related to specific adverse health effects (the 'response').
- Exposure assessment comprises the process of identifying the population that is likely to be exposed to the substances as a result of the project, including the timing, frequency, and duration of exposure, as well as the characteristics of the exposed population.
- Finally, risk characterization brings this information together to draw conclusions about the additional burden of health risk faced by the population due to the exposure.

The HHRA is usually conducted through the application of a standardized model, and provides quantitative outputs. These outputs are formulated as either an *incremental lifetime cancer risk* (ICLR) – that is, the risk of occurrence of cancer in a lifetime as a result of exposure to the chemical substance of concern, or a *hazard quotient* that compares the predicted exposure to the substance with published maximum exposure limits.

There are a number of criticisms that have been leveled at HHRA, including an inability to model cumulative exposure to multiple chemicals, and the use of threshold limits that may not be sufficiently protective of health for all people. However, HHRA is still considered by many US agencies to be the appropriate approach for evaluating the potential for chemical exposure in defined populations and the potential for an increase in risk of certain health outcomes as a result of that exposure.^{30, 31}

Because industrial projects commonly involve the emission of contaminants, it can be useful for HIA practitioners to work together with HHRA specialists around issues of contaminant exposure. Including an HHRA can complement the HIA process.

Vocabulary: 'Hazard Quotient' or 'Risk Quotient'

An HHRA often presents results in terms of a Hazard Quotient (HQ) or Risk Quotient (RQ) – two different terms for the same thing.

The HQ (or RQ) compares the measured concentration of the substance with published maximum exposure limits. It produces a ratio that is less than or greater than 1.0.

- Where the HQ is less than 1.0, it means that the concentration of the substance is less than the permitted limit. The lower the number, the less the predicted risk.
 - Where the HQ is greater than 1.0, it means that the concentration of the substance in the air is higher than the permitted limit. The higher the number, the greater the predicted risk.
-

6. Environmental Impact Assessment (EIA) and HIA

Environmental impact assessment (EIA) refers to the process of evaluating the potential environmental impacts of a proposed project, program or policy to guide decision-making and implementation. The initial impetus for EIAs came from developments in the environmental movement that identified the potential for catastrophic effects on the health and wellbeing of people from anthropogenic changes in the biophysical environment.³²

The practice of EIA began in the United States in 1969 with the passing of the National Environmental Policy Act (NEPA). Other countries soon followed suit, and EIA was fully recognized at the international level in 1992, at the United Nations Conference on Environment and Development.³³ Currently, both in the United States and in most other countries, many (although not all) major projects that have the potential to create significant environmental impacts are required to undergo further investigation through an EIA process.*

Helpful Hint: EIA, NEPA, EA, EIS...What are all these acronyms?

The terminology around environmental assessment can be confusing: common terms include: environmental impact assessment (EIA), environmental review, environmental assessment (EA) and environmental impact statement (EIS).

Environmental impact assessment (EIA) is the broad term for describing an approach to analyzing potential impacts, similar to the use of the term HIA for the broad approach to assessing health impacts.

In the United States, at the federal level, the National Environmental Policy Act (NEPA) is the instrument used to ensure that appropriate assessment occurs. Under NEPA, an Environmental Review is conducted to determine what type of analysis is needed. A federal agency can decide that no assessment of a particular project is needed, and issue a Categorical Exclusion (CATEX). Or, the agency may decide that a brief Environmental Assessment (EA) should be prepared to identify whether the project is likely to cause significant impacts. If the EA finds there are likely to be no significant impacts, the process stops there. If significant effects are likely, a more in-depth Environmental Impact Statement (EIS) is prepared.

Some states have additionally enacted their own legislation to require environmental impact assessment, and while the terms EA and EIS are common at the state level, other terms (such as environmental impact analysis) are also used, and vary across jurisdictions.

Although the terms NEPA, environmental review, EA and EIS are important for understanding the procedural elements of assessment at the federal level in the United States, the term EIA captures this process more broadly, and may be more useful when searching for literature, guidance documents or other resource material.

* NEPA only applies to projects located on federal lands or that use federal funding. Some, but not all, states have implemented similar legislation at a state level.

The NEPA Act explicitly mentions health six times, and states that the purpose of NEPA is to “attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.”³⁴ Despite the legislation’s original objectives, EIA practice quickly became focused on the biophysical elements of the environment, rather than directly examining potential impacts to human health. EIAs assessed potential impacts to air, water, soil, vegetation, wildlife and other biophysical media, with the assumption that by taking care of these environmental components, human health and welfare would be sufficiently protected.

The practice of EIA has evolved over the last 40 years to include a more explicit consideration of issues outside the biophysical environment. EIAs have begun to incorporate issues such as archaeological and heritage resources, economic impacts, social justice, although these issues are not consistently—or even commonly—included.

In terms of considering health within EIA, HHRA was initially the only approach used to directly address health concerns within the EIA process. With the recognition that health impacts of major development or infrastructure projects are much broader than just exposure to contaminants, some EIAs have begun to include assessment of other health components as well.

When this occurs, the EIA will include a section that may be called “community health”, “population health” or another term that indicates health is being considered. The term HIA is not generally used, in order to maintain consistency among chapters (which are not called ‘fish impact assessment’, ‘air impact assessment’, etc.). Table A2 in Appendix 1 highlights a number of Environmental Impact Statements that include health as a constituent element.

7. Framing Health Effects

A last issue to consider is one of communication: when writing up the HIA report, how do we describe the effects of the proposed industrial project in a way that will both make sense to stakeholders and influence the decision-making process?

As shown in the diagrams in Section 4, there are numerous links between specific project components and determinants of health (DOH) as well as between DOH and health outcomes. In organizing the HIA report, it is possible to frame effects under any one of these groupings, as shown below:

Project components	Determinants of health	Health outcomes
<ul style="list-style-type: none">• Air emissions• Water take• Labor and procurement• Transportation• Noise• Etc.	<ul style="list-style-type: none">• Housing• Water security• Exposure to contaminants• Physical activity• Recreational amenities• Etc.	<ul style="list-style-type: none">• Chronic conditions• Infectious disease• Nutritional outcomes• Injury• Mental wellbeing• Etc.

That is, the HIA report can be organized by the topics in any one of these boxes. For example, the report can be organized by different **project components**, such as labor and procurement, and describe the various health outcomes that stem from the way in which labor is contracted and jobs are structured (e.g., how labor and hiring policies impact income equity, food security, rates of injury, etc.).

Or, the report can be organized around different **health outcomes** and describe the various ways in which the project will affect that outcome (e.g., chronic conditions may be influenced by emissions that may increase rates of cardio-respiratory disease; through the building of a new bicycle path, which may increase physical activity and decrease rates of diabetes or heart disease, etc.).

The report can also be structured around the **determinants of health**, and describe linkages in both directions (e.g., the project will affect housing availability by bringing 300 new workers to the community; decreased housing availability may lead to overcrowding, infectious disease transmission, safety issues and food insecurity).

It is also possible to have a hybrid approach—for example, including some DOH and some health outcomes, although the overlap between the two can make it difficult to identify the best fit for some issues.

Helpful Hint: Determinants of Health

For HIA practitioners, “determinants of health” is everyday language. However, it’s important to remember that this is not necessarily a concept that is familiar to people in other professions. It’s useful to frame HIAs with a discussion of the determinants, and clear links between the project and health determinants. This will help a broad audience understand the report, and make the case for health more convincing.

There are also advantages and disadvantages to each type of organization in terms of the ability to communicate and persuade various audiences, as shown below:

Project components	Determinants of health	Health outcomes
<p><u>Pros</u></p> <ul style="list-style-type: none"> • This is how the proponent understands their project. It is therefore easier for them to integrate the recommendations from the HIA into their business processes. <p><u>Cons</u></p> <ul style="list-style-type: none"> • This may be confusing to non-industrial audiences (such as the general population, or health agencies). • This may not highlight health issues as strongly as framing the report around health determinants/ outcomes. 	<p><u>Pros</u></p> <ul style="list-style-type: none"> • DOH are amenable to recommendations for mitigation (or enhancement) since there is a direct connection between the project activity and the determinant of health. • DOH are also more amenable to monitoring than health outcomes, since the project's influence on that determinant is relatively easily able to be measured. <p><u>Cons</u></p> <ul style="list-style-type: none"> • Many people, including some decision-makers and other non-'health' audiences, have a hard time understanding the links between DOH and health outcomes. • Some of the relevant DOH may have already been the subject of other studies—for example, a study may have been conducted about the project's impacts on housing, or water quality, or parks. Although those studies may not have considered the issues from a health perspective, some proponents/decision-makers may not see the value in including these same topics in an HIA. 	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Speaks to your expertise in health, and may therefore carry more weight with decision-makers. • Aligns best with what you are conducting: a <u>health</u> impact assessment. <p><u>Cons</u></p> <ul style="list-style-type: none"> • Because health outcomes are very 'downstream' from the project activities, it can be difficult for project proponents and decision-makers to fully accept that the project is 'responsible' for these changes. • Project-related changes in most health outcomes are secondary to changes in DOH; it can therefore be difficult to identify mitigations to act directly on the health outcomes. • Health outcomes (e.g. prevalence of asthma or obesity) do not make good indicators for monitoring, as they are influenced by a wide range of factors. Change in these indicators therefore cannot be directly attributed to the project.

Fundamentally, the purpose of the HIA is to both communicate the likely effects of the project, and to bring forward recommendations to mitigate potential adverse effects and enhance benefits. How this is best done for any given project—and what approach is most likely to lead to success—will be up to the HIA practitioner to decide.

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Appendix 1: Additional Resources

Approaches to HIA in the Context of Industrial Projects

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Common Health Effects Associated With Industrial Projects

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World Health Organization. (2010). Managing the public health impacts of natural resource extraction activities: A framework for national and local health authorities.

Available at: <https://commdev.org/wp-content/uploads/2015/06/WHO-Managing-the-public-health-impacts.pdf>

Other Resources

Bhatia, R., & Wernham, A. (2008). Integrating Human Health into Environmental Impact Assessment: An Unrealized Opportunity for Environmental Health and Justice. *Environmental Health Perspectives*, 116(8):991-1000. doi: 10.1289/ehp.11132

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Appendix 2: Examples of HIAs on Industrial Projects

This appendix provides examples of HIAs that have been conducted on industrial projects or facilities in the United States and elsewhere, to give HIA practitioners real-world examples to refer to.* It should be noted that not all HIAs on this list are of the same quality, and the approaches that they used in assessing industrial projects vary substantially—for example, some HIAs do not distinguish between construction and operation of a facility. In addition, some of these projects examined would not strictly fit the criteria for industrial projects as defined in this Resource Kit (for example, the HIA considers the broad area effects of strategic industrial development rather than site-specific issues).

Despite their individual shortcomings, these HIAs may all be useful to the HIA practitioner in terms of providing a model for:

- Appropriate scope of issues for a particular industry or location
- Appropriate geographic or temporal boundaries pertaining to specific industrial activities
- Relevant indicators for the community baseline profile
- Types of community organizations and key informed sources who contributed to discussion on a particular topic
- Literature relating to the assessment of a particular health issue
- Definitions for characterizing effects in a particular industry context
- Demonstrating how HIA fits with other industrial assessment and permitting processes
- Demonstrating how HIA may be included as part of an environmental impact assessment

The HIA examples are grouped into three different tables. Table A1 lists HIAs that were conducted in the U.S. and are available as stand-alone HIA reports. Table A2 lists HIAs that were incorporated into environmental assessments (EAs, EIAs or EISs). In some cases, the HIA appears as a distinct technical appendix in the EIS; in other cases, the HIA is broken up across different volumes of the EIS, with methods appearing in one volume, baseline conditions appearing in another volume, and the assessment appearing in a different volume, for example.

Because the number of industry types represented in U.S. HIAs is limited, Table A3 lists selected HIAs from international locations that have focused on other industries.

* Sources used to identify these HIAs included HIA repositories (Health Impact Project, HIA Gateway, UCLA HIA Clearinghouse), Google searches, and recommendations by HIA practitioners. The list of published HIAs may, however, be incomplete. It should also be noted that HIAs completed on behalf of industrial project proponents are commonly not made publicly available.

Table A1: Publicly-available HIAs pertaining to industrial projects, United States – Stand-Alone HIAs

Industry	Title	Date	Location	Author(s)
Biomass Energy	The Potential Health Impact of a Poultry Litter-to-Energy Facility in the Shenandoah Valley, Virginia http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/virginia/hia-of-a-poultry-litter-fired-power-plant	2013	Virginia	Virginia Commonwealth University Center on Human Needs Organization
Biomass Energy	Placer County Biomass Energy Facility http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/california/placer-county-biomass-energy-facility	2013	California	Sequoia Foundation
Biomass Storage	Neenah-Menasha Sewerage Commission Biosolids Storage Facility, Greenville, WI Rapid Health Impact Assessment http://www.apho.org.uk/resource/item.aspx?RID=111534	2011	Wisconsin	Outagamie County Public Health Division
Coal Power	HIA of the Shawnee Fossil Plant http://www.kyenvironmentalfoundation.org/health-impact-assessments-shawnee-fossil.html	2014	Kentucky	Kentucky Environmental Foundation
Mining	Health Impact Assessment for a Proposed Coal Mine at Wishbone Hill, Matanuska-Susitna Borough Alaska http://dhss.alaska.gov/dph/Epi/hia/Documents/WishboneHillCompleteHIA.pdf	2014	Alaska	Newfields Companies
Mining	Health Impact Assessment of Industrial Sand Mining in Western Wisconsin http://www.instituteforwihealth.org/hia.html	2016	Wisconsin	Institute for Wisconsin's Health Inc.
Oil and Gas	Health Impact Assessment of the Shell Chemical Appalachia Petrochemical Complex http://www.cleanair.org/program/environmental_health/childrens_environmental_health/health_impact_assessment_ethane_cracker	2014	Pennsylvania	Clean Air Council
Oil and Gas	Hermosa Beach Oil Production Project HIA http://www.hermosabch.org/index.aspx?page=739	2014	California	Intrinsic Environmental Sciences
Oil and Gas	Battlement Mesa HIA (2nd Draft - final report never produced) http://www.garfield-county.com/environmental-health/battlement-mesa-health-impact-assessment-ehms.aspx	2011	Colorado	Colorado School of Public Health
Pipeline	Lobos CO₂ Pipeline Health Impact Assessment http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/new-mexico/lobos-co2-pipeline	2015	New Mexico	Human Impact Partners and Partnership for a Healthy Torrance Community
Waste Disposal	Mountain View Material Recovery Facility http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/new-mexico/mountain-view-material-recovery-facility	2011	New Mexico	Bernalillo County Place Matters Team
Wind Energy	Strategic Health Impact Assessment on Wind Energy Development in Oregon http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Pages/windenergy.aspx	2013	Oregon	Public Health Division, Oregon Health Authority
Waste Disposal	North Valley Health Impact Assessment of the Proposed Edith Transfer Station https://static1.squarespace.com/static/56ce22b640261dd50dcd4fa2/t/56d4d7b2d210b814da27e5e2/1456789434011/final+NV+HIA.pdf	2015	New Mexico	Healthy Places Consulting, the North Valley HIA Committee and the North Valley Coalition

Table A2: Publicly-available HIAs pertaining to industrial projects, United States - HIA incorporated into Environmental Assessment

Industry	Title	Date	Location	Author(s)
Mining	Red Dog Mine Extension Aqqaluk Project Final Supplemental Environmental Impact Statement	2009	Alaska	U.S. Environmental Protection Agency http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/alaska/red-dog-mine-extension-aqqaluk-project-final-supplemental-environmental-impact-statement
Mining	Roca Honda Mine	2013, amended 2015	New Mexico	Habitat Health Impact Consulting / U.S. Forest Service http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/new-mexico/roca-honda-mine
Oil and Gas	Chukchi Sea Planning Area - Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea	2015	Alaska	Bureau of Ocean Energy Management http://www.pewtrusts.org/en/multimedia/data-visualizations/2015/hia-map/state/alaska/chukchi-sea-planning-area-oil-and-gas-lease-sale-193-and-seismic-surveying-activities-in-the-chukchi-sea
Oil and Gas	Effects of Oil and Gas Activities in the Arctic Ocean Supplemental Draft Environmental Impact Statement	2013	Alaska	Habitat Health Impact Consulting / National Oceanic and Atmospheric Administration http://www.nmfs.noaa.gov/pr/permits/eis/arctic_sdeis.pdf
Oil and Gas	National Petroleum Reserve-Alaska Integrated Activity Plan/Environmental Impact Statement	2012	Alaska	Habitat Health Impact Consulting / North Slope Borough https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702
Oil and Gas	Northeast National Petroleum Reserve Supplemental Environmental Impact Statement	2007	Alaska	Aaron Wernham / U.S. Bureau of Land Management, Alaska Intertribal Council, Columbia University Institute on Medicine as a Profession http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/northeast_npr-a_final.html
Oil and Gas	Point Thomson Oil and Gas leasing EIS/HIA	2011	Alaska	State of Alaska HIA Program Department of Health and Social Services http://dhss.alaska.gov/dph/Epi/hia/Documents/PointThomsonCompletedHIA.pdf

Table A3: Select Key International HIAs (English-language only)

Industry	Title	Date	Location	Author(s)
Airport /Airport Expansion	London Luton Airport HIA http://www.apho.org.uk/resource/item.aspx?RID=134376	2012	UK	Ove Arup & Partners Ltd
Airport /Airport Expansion	London City Airport Interim Application Health Impact Assessment http://www.apho.org.uk/resource/item.aspx?RID=54354	2007	UK	RPS Planning and Development Ltd
Biomass Energy	Health Impact Assessment of Biosolids Management Alternatives http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=7f5411b440eb5410VgnVCM10000071d60f89RCRD	2015	Canada	Habitat Health Impact Consulting
Cement Kiln	Health Impact Assessment Report on proposal to substitute chopped tyres for some of the coal as fuel in cement kiln http://www.apho.org.uk/resource/item.aspx?RID=44206	2002	UK	Health Impact Assessment Research Unit, University of Birmingham
Hospital Development	Health Impact Assessment of the Redevelopment of Liverpool Hospital http://hiaconnect.edu.au/wp-content/uploads/2013/04/Liverpool_Hospital_Phase_1_HIA_Final_Report.pdf	2007	UK	Sydney South West Area Health Service (SSWAHS) Population Health
Nuclear Power Plant	Hinkley Point C Health Impact Assessment http://www.healthprofiles.info/resource/item.aspx?RID=111230	2011	UK	EDF Energy Ltd.
Recycling Center	Willows Power & Recycling Centre Health Impact Assessment http://www.apho.org.uk/resource/item.aspx?RID=106399	2010	UK	RPS Planning and Development Ltd
Shipping Port	Robert Banks Terminal 2 Project Environmental Impact Statement, Section 27.0 Human Health Effects Assessment http://www.ceaa-acee.gc.ca/050/documents/p80054/101355E.pdf	2015	Canada	Habitat Health Impact Consulting / Port Metro Vancouver