

# TOOLKIT

## Tool 3 Search protocol

Children's Environmental Rights and the O&G  
Industry

¿How to consider children's rights in due  
diligence?



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## ***Tool 3. Using systematic search tools to understand environmental risks to children***

*One of the basic steps to integrate human rights into environmental management is the effective use of new scientific knowledge in environmental impact assessments. This is particularly important in the context of children's environmental health (See a brief description of recent evolution on this topic in the introduction in Tool 1) Systematic search methods provide a clear pathway to add a children's rights approach to these assessments (IPIECA - DIHR, 2013). They do not include, however, other elements that are very important, such as the participation principle, that is better addressed through other practices (see tool 2 for recommendations on stakeholder engagement).*

*Here are some general guidelines for any company that is preparing a systematic search. First, it is important to define the purpose of the tool in each particular case. This ensures that the systematic search provides useful information for the risk management process. Once the purpose is established, it provides the framework for the scope, form and content of the search. To establish the purpose, it is useful to consider the following aspects:*

### *Vulnerability*

*A systematic search can be designed to gather information on the children's vulnerability to each project's impacts, and in which cases the evidence suggests differences with the general population.*

### *Criteria*

*Environmental, social and health impact assessments (ESHIA) use the term "significance" to describe the criteria to be used by companies to determine which human rights impacts to be considered, while UNGPs refer to the term "severity"<sup>1</sup>. The following chart illustrates the differences between these two concepts and how systematic search on children's environmental health provides inputs to define them.*

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<sup>1</sup> For a detailed discussion on the differences between severity and significance see Appendix 6 in IPIECA's guidelines to integrate human rights into impact assessments (IPIECA - DIHR, 2013)

	<i>Significance</i>	<i>Severity</i>
<i>Gravity of the impact: What is the scale/magnitude of impact for children?</i>	<i>Search should provide information to determine degree in all these elements to establish level of <b>materiality</b>.</i>	<i>Search should add evidence to establish <b>priorities</b> and type of risk <b>treatment</b> considering all three elements.</i>
<i>Number of people affected: How many children would be affected?</i>		
<i>Sensitivity/resilience. Ability of individuals to withstand and recover from impacts: are children more sensitive to a particular impact? What is the evidence on “irremediability”?</i>		

*Other criteria to be considered in the search:*

- *Evidence on indirect, long term and cumulative consequences to children. WHO (2011) offers good summary of the children’s susceptibility according to each developmental stage and describes recent [methodological advances in children’s risk assessment](#).*
- *Uncertainty issues.*

### *Leverage issues*

*A systematic search may point at some consequences to children that do not emerge from the company’s actions but are the result of the actions of another institution. In these cases the information obtained in the search should help managers to determine:*

- *The type of leverage or influence required and if the company is in the right position to act upon it.*
- *Severity of the situation in terms of the children’s wellbeing and of potential consequences for the company.*

### *Transparency*

*A systematic search specific to children’s environmental health provides also a good opportunity to make environmental management decisions regarding children more transparent: they provide information tools (e.g. reports with results and conclusions based on explicit procedures) that can be used in accountability processes and that provide a tracking device of the foundations for company’s decisions on risk management.*

### What is a systematic search?

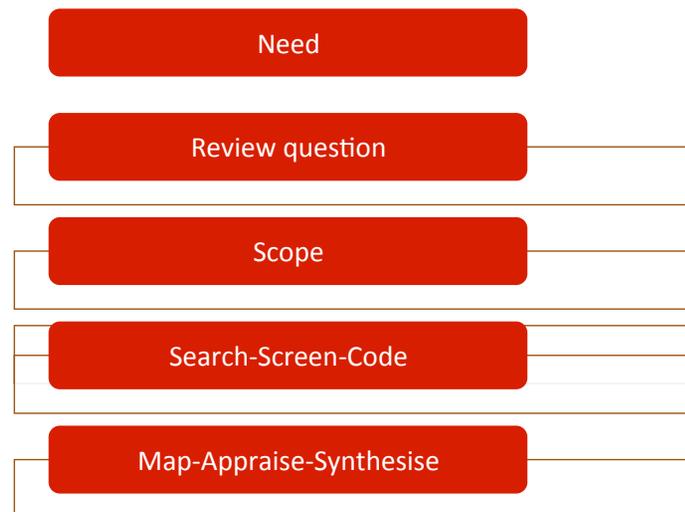
*A systematic search is a design based on explicit, and reproducible procedures for identifying, evaluating, and interpreting the existing evidence on a particular topic. It ponders available information from epidemiological, toxicology studies in a clear, transparent way. Because it provides a consistent procedure to gather and assess this information, results are easier to communicate and to replicate. A systematic search can be designed to support risk management decisions.*

*The **purpose and scope** of this exercise may vary (World Health Organization - Regional office for Europe, 2000). It typically considers chemical pollutants, but can be adapted to consider other sources of impacts. In order to provide the necessary inputs from the children's environmental health perspective the search may focus on:*

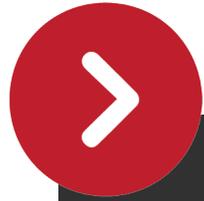
*Children's **health hazard** characterization: collection, evaluation, and interpretation of available evidence concerning the association between an environmental factor, either originated by company's operations or from other sources in the context of the company's operations, on children's health.*

*Children's **health impact** assessment: how large is the health burden due to an environmental exposure, and how much of it is attributable to a certain activity or group of activities? The information needed to answer this question requires the combination of knowledge on: exposure, dose-response behaviour, and risk characterization. This approach overlaps in many aspects with the previous one.*

*Typical steps to perform a systematic search (the sample search included in this tool illustrates each of them) :*



## 2. Steps to perform a systematic search

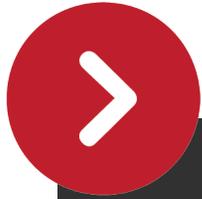


NEED

The company's need could be one or a combination of the following:

- The company needs to increase visibility of children as a specific group to consider in risk management processes.
- The company needs to gain a better understanding of children's environmental issues to use its leverage with other institutions. For instance, to advocate for children-specific considerations in international standards and country regulations.

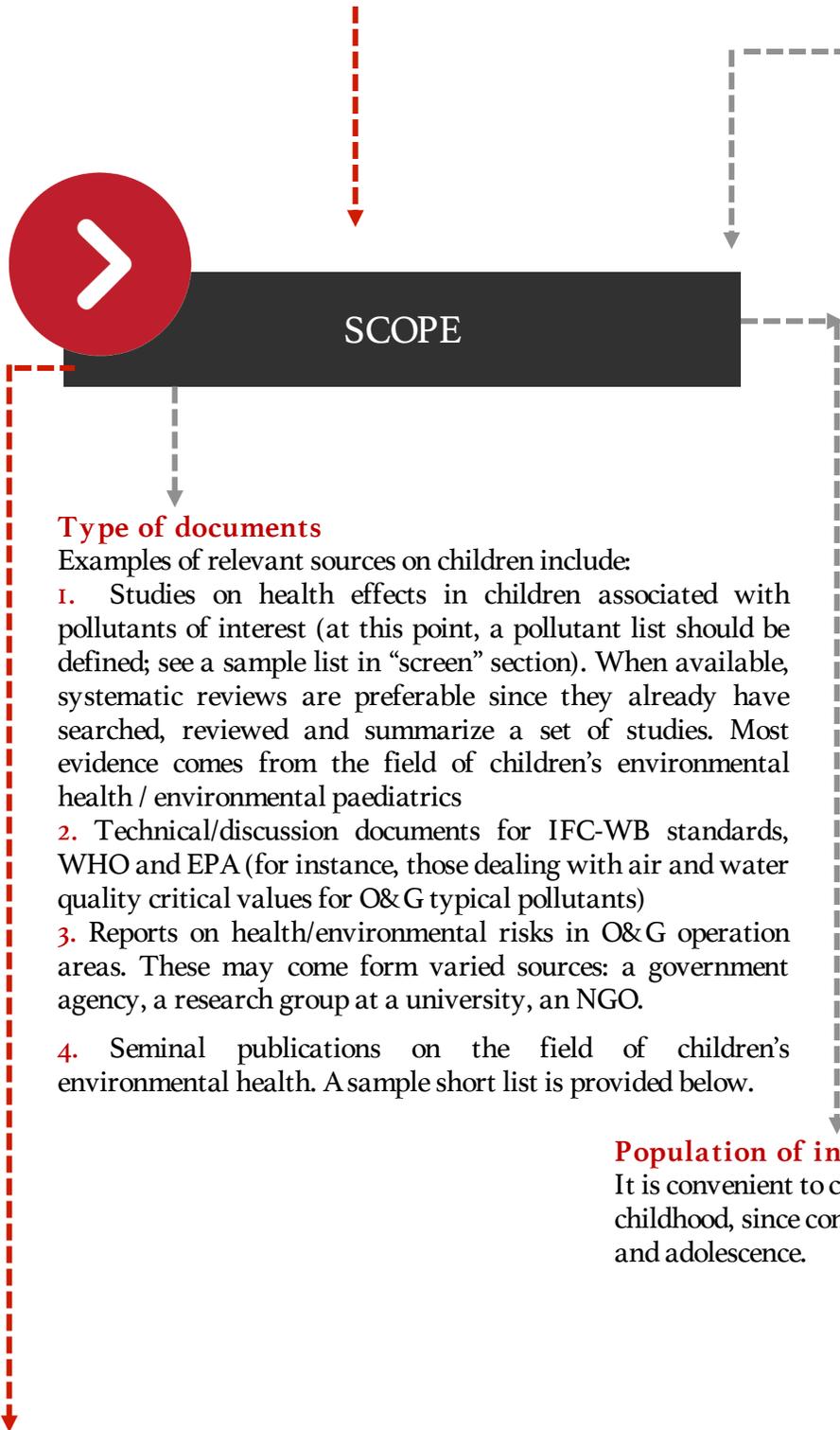
At this point, it is also important to establish the intended users of the results.



REVIEW QUESTIONS

These are examples of questions used to define the purpose of different search exercises and how they can help to determine the sources, type of documents to be considered, and the codes to be used in the analysis of information.

1. What are the main effects in children's health attributable to environmental changes associated with oil and gas activities?
2. What are the specific environmental thresholds for children according to international guidelines?
3. Are current thresholds by WHO and EPA consistent with this evidence?
4. Is local regulation consistent with this evidence?
5. Regarding children's rights, which best practices for environmental management in O&G are relevant to secure compliance with the "do no harm" principle?



## SCOPE

### Type of documents

Examples of relevant sources on children include:

1. Studies on health effects in children associated with pollutants of interest (at this point, a pollutant list should be defined; see a sample list in “screen” section). When available, systematic reviews are preferable since they already have searched, reviewed and summarize a set of studies. Most evidence comes from the field of children’s environmental health / environmental paediatrics
2. Technical/discussion documents for IFC-WB standards, WHO and EPA (for instance, those dealing with air and water quality critical values for O&G typical pollutants)
3. Reports on health/environmental risks in O&G operation areas. These may come from varied sources: a government agency, a research group at a university, an NGO.
4. Seminal publications on the field of children’s environmental health. A sample short list is provided below.

### Conceptual framework

If children’s rights principles-CRBP are used as framework, then the topics consider in the search strategy may consult the elements in Principle 7 “all businesses should respect and support children’s rights in relation to the environment and to land acquisition and use”. However, some aspects would be less explored in the literature than others. The search may consider localized environmental impacts throughout upstream<sup>1</sup> and downstream sectors in O&G. According to the company’s information needs, it may cover activities pertaining to exploration, production, transport, refining (excluding petrochemicals), distribution, and retail.

It is always important to be explicit about search boundaries. For instance,

- Limiting the search to potential direct impacts on children associated with:
  - Exposure to harmful chemicals
  - Changes in access to adequate sources of water
- Considering a wider set of impacts that include those on parents, with a resulting impact on children:
  - Loss of livelihoods as a result of environmental pollution

### Population of interest

It is convenient to consider a broad definition of childhood, since conception into infancy, childhood and adolescence.

*Selected seminal publications on children's environmental health*

<b>Document</b>	<b>Main contribution to search</b>
<b>Book: Landrigan, P. J. and Etzel, R. A. (eds.) (2014) Textbook of Children's Environmental Health. New York, NY, Oxford University Press.</b>	<i>Extensive discussion of evidence on chemical and environmental hazards and their effects on children. One of the most comprehensive sources on this matter to date.</i>
<b>Recent literature review: Children's Health in Latin America: The Influence of Environmental Exposures <a href="http://ehp.niehs.nih.gov/1408292/">http://ehp.niehs.nih.gov/1408292/</a></b>	<i>Map environmental hazards in the region (not specific to O&amp;G). Results were intended as an input to define priorities for PAHO.</i>
<b>Report: Global Energy Assessment (chapters on Energy and health) <a href="http://www.kirksmith.org/assessments/">http://www.kirksmith.org/assessments/</a></b>	<i>Characterization of specific types of health effects associated with energy-related air pollutants (p. 276) and Energy-Related Pollutants in Water and Soils (p. 280); regional impacts (p. 280); global health impacts from climate change (p. 286); pathways for impacts.</i>





The following search protocol provides the tools to produce search results that are:

- Accountable
- Replicable
- Updateable

Given the dynamic development of the children's environmental health field during the past decade, a trend that might continue in the future, an updateable tool is very useful to incorporate new knowledge in companies' strategies.

### Sources

Search sources in this example are: the seminal literature described in the previous section; one electronic database - Health and Environmental Research Online ([HERO](#)) database - including only systematic reviews published in scientific journals for a 2 year period to complement the information provided in the seminal sources; and 3 website searches (WHO, PAHO, EPA). These sources can be supplemented by other website searches (an extensive list with suggestions is provided here), and by personal communication with environmental/public health experts.

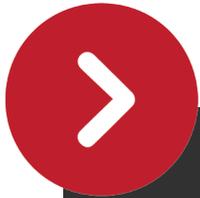
### Organizations with key information resources on children and the environment

It is possible to schedule a regular search update using the following sources (links direct to the sites' search engines where the search was performed and can be updated).

1. WHO. [Website on children's environmental health](#): Publications from 1999-2015 on diverse topics related with children and the environment. Information is not specific for O&G, but emerging issues such as endocrine disrupting chemicals should be of interest.
2. PAHO. [Regional programme in children's environmental health](#). Sustainable Development and Environment Area (SDE) developed a strategy on children's environmental health. This area organized the [workshop on children's environmental health indicators](#) in 2004.
3. EPA's [website on children](#). Includes [reference documents](#) that explicitly consider risks to children for the development of quality standards.

### Other sources of information

1. [European Environmental Agency](#).
2. [UNEP United Nations Environment Programme](#).
3. [IARC. Monographs on the Evaluation of Carcinogenic Risks to Humans](#).
4. International programme on chemical safety-INCHEM resources from their [Chemical Safety Information](#) from Intergovernmental Organizations: (search engine)
  - a. One example taken from this source for [hydrogen cyanide](#)
5. American Academy of Paediatrics Council ([APP committee on Environmental Hazards](#)).
6. [Children's Environmental Health Network](#). For instance, the proceedings of Policy conference in children's environmental health (the first one took place in 1994).
7. [Academic Paediatric Association](#).
8. US [National Cancer Institute](#).
9. US [National Institute of Environmental Health Sciences](#).
10. [Health Effects Institute](#).
11. [Agency for Toxic Substances and Disease Registry \(ATSDR\)](#)
12. Google Scholar. This is a good source for very specific queries. For instance, a search performed in June, 2016 with the search terms [children AND "health effects" AND "air quality" AND "oil and gas", excluding "unconventional", since 2015](#), produced 33 results.



## SCREEN

The following chart lists the main chemical substances associated with O&G activities. It also identifies the media where it is typically found and the source that documents the relevance of the substance in O&G environmental impacts.

<i>Media</i>	<i>Chemical substance</i>	<i>Source of information</i>	<i>1/</i>	<i>Types of impact</i>	<i>Search criteria</i>
<i>Air</i>	<b>VOC (Volatile Organic Compounds)</b>	<a href="http://www3.epa.gov/airquality/oilandgas/basic.html">http://www3.epa.gov/airquality/oilandgas/basic.html</a>		<b>Air quality</b>	<b>"volatile organic"</b>
<i>Air</i>	<b>O<sub>3</sub> Ground-level ozone (smog)</b>	<a href="http://www3.epa.gov/airquality/oilandgas/basic.html">http://www3.epa.gov/airquality/oilandgas/basic.html</a>		<b>Air quality</b>	<b>ozone</b>
<i>Air</i>	<b>benzene</b>	<a href="http://www3.epa.gov/airquality/oilandgas/basic.html">http://www3.epa.gov/airquality/oilandgas/basic.html</a>		<b>Air quality</b>	<b>benzene</b>
<i>Air</i>	<b>ethylbenzene</b>	<a href="http://www3.epa.gov/airquality/oilandgas/basic.html">http://www3.epa.gov/airquality/oilandgas/basic.html</a>		<b>Air quality</b>	<b>ethylbenzene</b>
<i>Air</i>	<b>n-hexane</b>	<a href="http://www3.epa.gov/airquality/oilandgas/basic.html">http://www3.epa.gov/airquality/oilandgas/basic.html</a>		<b>Air quality</b>	<b>hexane</b>
<i>Air</i>	<b>Methane</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Climate change</b>	<b>methane</b>
<i>Air</i>	<b>CO<sub>2</sub> Carbon dioxide</b>	<a href="http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/">http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/</a>		<b>Climate change</b>	<b>CO<sub>2</sub> Carbon dioxide</b>
<i>Air</i>	<b>SO<sub>2</sub> Sulphur dioxide</b>	<a href="http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/">http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/</a>		<b>Acidification</b>	<b>SO<sub>2</sub> Sulphur dioxide</b>
<i>Air</i>	<b>NO<sub>x</sub> Nitrogen oxides</b>	<a href="http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/">http://www.environment.no/Topics/Marine-areas/Oil-and-gas-activities/Environmental-impact-of-petroleum-activity/</a>		<b>Acidification</b>	<b>NO<sub>x</sub> Nitrogen</b>
<i>Air</i>	<b>PM Particulate matter (2,5/10)</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfj4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfj4g</a>	*	<b>Air quality</b>	<b>PM Particulate Dust</b>
<i>Water/soil</i>	<b>Cadmium</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water/soil quality</b>	<b>Cadmium</b>
<i>Water</i>	<b>Chlorine</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water quality</b>	<b>Chlorine</b>
<i>Water/soil</i>	<b>Mercury</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water/soil quality</b>	<b>Mercury</b>

<i>Media</i>	<i>Chemical substance</i>	<i>Source of information</i>	<i>1/</i>	<i>Types of impact</i>	<i>Search criteria</i>
<i>Water</i>	<b>Oil and Grease</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water quality</b>	<b>Grease</b>
<i>Water</i>	<b>PAH (polynuclear aromatic hydrocarbons reported as phenanthrene)</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water quality</b>	<b>PAH polynuclear aromatic hydrocarbons phenanthrene</b>
<i>Water</i>	<b>Produced sand</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water quality</b>	<b>sand</b>
<i>Water</i>	<b>Produced sand (brine)</b>	<a href="http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml">http://www.gpo.gov/fdsys/pkg/CFR-2014-title40-vol30/xml/CFR-2014-title40-vol30-part435.xml</a>		<b>Water quality</b>	<b>brine</b>
<i>Water/soil</i>	<b>Arsenic</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g</a>	*	<b>Water/soil quality</b>	<b>arsenic</b>
<i>Water/soil</i>	<b>Barium</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g</a>	*	<b>Water/soil quality</b>	<b>barium</b>
<i>Water/soil</i>	<b>Chromium</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g</a>	*	<b>Water/soil quality</b>	<b>chromium</b>
<i>Water/soil</i>	<b>Lead</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g</a>	*	<b>Water/soil quality</b>	<b>lead</b>
<i>Water/soil</i>	<b>Selenium</b>	<a href="https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g">https://www.earthworksaction.org/issues/detail/air_contaminants#.VjvPDYSfq4g</a>	*	<b>Water/soil quality</b>	<b>selenium</b>
<i>General search criteria</i>					<b>petroleum O&amp;G "Oil and gas" oil upstream downstream</b>

***These are suggested inclusion criteria to identify relevant studies and discard those that are not:***

- 1. Time of exposure:***
  - i. Parental exposures prior to conception with potential effects on children's health.*
  - ii. Exposure at any time during childhood.*
- 2. Type of outcome: Health and development outcomes, not only in childhood, but also later in life.***
- 3. Type of exposure:***
  - Inclusion of:***
    - a. Chemical exposures during childhood. Any of the chemical substances listed in Chart 3*
    - b. Nutritional environment in mother's womb*
    - c. Built environment. Decent housing conditions, landscape changes, safety issues*
  - Exclusion of exposures related to:***
    - a. Stress*
    - b. Interactions among different exposures*

*Topics of interest regarding both children and environmental issues in O&G operations (UNESCO, 2002-2015) (ARPEL, 2012) (UNEP - E&P Forum, 1997) (Smith, 2012). This list will include impacts of interest mentioned by companies and stakeholders and is subject to changes according to findings during search process:*

- a. Use of safe water resources and impact on its availability for children*
- b. Vector control*
- c. Children safety in environmental emergency situations (like oil spills)*
- d. Effluent and waste discharges*
- e. Decommissioning issues (specific to environment)*

***Exclusion of impacts related to:***

- f. Impacts without an specific attribution to O&G, such as changes in consumption patterns associated with operations through difficult to discern environmental pathways; increased stress and noise linked to increased traffic; population displacement effects on land use) Food prices/quality, House prices*

***4. Specific topics for downstream:***

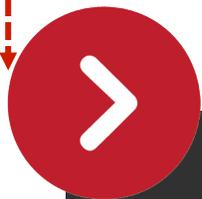
- a. Lead exposure (soil/air)*
- b. PM 2,5 PM10 (air)*
- c. Climate change pathways and children*

*Quality appraisal of the selected documents is secured by using primarily systematic reviews and consensus documents from authoritative sources. However, when considering individual studies the following check list<sup>2</sup> will be used:*

- 1. Is the research hypothesis clear and does it address directly the population of interest?*
- 2. Are methods clearly described and appropriate?*
- 3. What are the sources of bias?*
- 4. Are result studies applicable to different contexts?*

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<sup>2</sup> *Adapted from EVIPNET: Lewin S, Oxman AD, Lavis JN, Fretheim A: SUPPORT Tools for evidence-informed health Policymaking (STP). 8. Deciding how much confidence to place in a systematic review. Health Research Policy and Systems; 2009, 7(Suppl 1):S8 doi:10.1186/1478-4505-7-S1-S8.  
<http://www.health-policy-systems.com/content/pdf/1478-4505-7-S1-s8.pdf>*

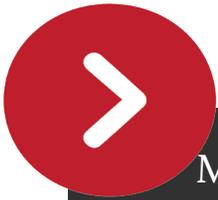


## CODE

Coding is the stage of the process that allows making explicit, traceable choices in the selection of material that would ultimately be analysed more carefully to draw conclusions and recommendations.

All documents found in the selected sources should be recorded using the same set of descriptors. Here is an example of codes used to classify the documents found in EPA's website:

<i>Code Description</i>	
<i>Source</i>	Document's source (from the list defined in search protocol)
<i>Document</i>	Full citation, including page
<i>URL</i>	Link to the document or document abstract, in Internet, when available
<i>Meets inclusion criteria</i>	I= meets inclusion criteria (see protocol search/inclusion criteria) o= does not meet inclusion criteria
<i>Comments</i>	Indicate reasons for exclusion or inclusion to be discussed with second researcher
<i>Substances</i>	Substance of interest (from list defined in search protocol)
<i>Use</i>	Use in O&G, type of exposure, pathways
<i>Comment</i>	Describes if specific impacts in O&G contexts are mentioned. States any questions raised by this evidence.
<i>Fate</i>	Persistent/non persistent substance. Evidence of pollutant migration to other areas
<i>Effects</i>	Specific effects in children (if mentioned, otherwise, general health effects on the population)
<i>Check for epidemiological studies (o/i)</i>	I= Cohort studies support evidence o= no cohort studies available
<i>Substance group</i>	Type of substance according to list defined in search protocol
<i>Health effect category</i>	General health effect category according to list defined in search protocol



## MAPPING SEARCH RESULTS

### *Search results summary*

*The following is an example of the documents selected after searching the three main sources mentioned above, considering the elements established in the **scope**. Relevance of each document needs to be established according to the purpose of the search. Here the results are provided as an illustration of the type of outcome obtained.*

I. **SOURCE**: WHO - Children's environmental health:

*This website includes some of the most comprehensive discussions on children's environmental health. Here is a selection of the documents that would be more relevant for an O&G company concerned about improving its knowledge on Children and the environment. Older reports on recurrent topics are not included in this list.*

*The first group of WHO's documents provide insights into emerging issues that may not be relevant for all O&G projects, but for certain contexts, technologies and downstream operations.*

- a. *[State of the science of endocrine disrupting chemicals](#) (2012). Two documents, one reviewing scientific evidence and research challenges and another with a summary for decision makers that presents the most salient aspects of potential consequences of exposure to these chemicals, and why children are a main group of concern. This is a topic that may be of particular relevance for non-conventional operations, although it also involves persistent organic pollutants in conventional operations (see [here](#) an updated list of scientific literature concerning chemicals related to O&G operations, with emphasis on unconventional extraction).*
- b. *Endocrine disruptors and child health (2012). This is a summary focusing on congenital disorders and other early effects.*

*Another group of documents, cited in the [Annual Report](#) (2011), offer valuable methodological advice and training resources.*

- c. *Summary of Principles for Evaluating Health Risks in Children Associated with Exposure to Chemicals - 2011.. This is not specific to the O&G sector, but describes the elements to be considered when performing children's environmental risk assessments associated with chemical substances.*
- d. *Training Package for the Health Sector on Children's Environmental Health*

*Finally, these documents are useful to understand the policy context over the past decade and future trends:*

- e. WHO (2011) [\*Healthy Environments for Healthy Children\*](#)
- f. Gavidia T, Bruné MN, McCarty KM, Pronczuk J, Etzel R, Neira M, Carpenter DO, Suk WA, Arnold RG, Ha EH, Sly PD (2011) *Children's environmental health - from knowledge to action. Lancet; 377(9772):1134-6*
- g. Pronczuk J, Bruné MN, Gore F (2011) *Children's environmental health in developing countries. In: Encyclopedia of Environmental Health. J. Nriagu, ed. Elsevier.*
- h. *Childhood lead poisoning*
- i. *Persistent Organic Pollutants: Impact on Child Health*
- j. *Children's environmental health indicators*

*Example of a summary of findings for three air pollutants considered relevant after performing the search*

Pollutant	Type of standard	Integrated Science Assessments	Date	Description	Relevant
Carbon Monoxide (CO)	Air Quality Standards	Integrated Science Assessment for CO - Final Report	ene-10	<p>Most susceptible populations:</p> <ul style="list-style-type: none"> <li>- those with coronary heart disease; followed by people with COPD, diabetes, and anemia.</li> <li>- Children less susceptible than elderly population.</li> <li>- Gestational exposure: epidemiological studies show changes in birth outcomes, including PTB, cardiac birth defects, reductions in birth weight, and infant mortality in the postneonatal period.</li> </ul> <p>No evidence of threshold Only mentions short-term exposure effects</p>	1
Lead (Pb)	Air Quality Standards	Integrated Science Assessment for Lead – Final	jun-13	<p>New evidence confirms neurodevelopmental effects in children and cardiovascular effects in adults.</p> <ul style="list-style-type: none"> <li>-Small shifts in the population mean IQ can be highly significant from a public health perspective because such shifts could translate into a larger proportion of the population functioning at the low end of the IQ distribution.</li> <li>-Children are at increased risk for the effects of Pb exposure. Among children, the youngest age groups were observed to be most at risk of elevated blood Pb levels, with levels decreasing with increasing age of the children.</li> <li>- uptake of Pb into fauna and subsequent effects on reproduction, growth and survival are established and are further supported by more recent evidence.</li> </ul>	1
Ozone (O3)	Air Quality Standards	Integrated Science Assessment for Ozone and Related Photochemical Oxidants – Final Report	feb-13	<p>Synthesis and evaluation of the most policy-relevant science. Scientific bases for EPA's decision regarding the adequacy of the current national ambient air quality standards for ozone to protect human health, public welfare, and the environment. <u>Conclusions:</u></p> <ul style="list-style-type: none"> <li>- Evidence integrated across controlled human exposure, epidemiologic, and toxicological studies and across the spectrum of respiratory health endpoints continues to demonstrate that there is a causal relationship between</li> </ul>	1

Pollutant	Type of standard	Integrated Science Assessments	Date	Description	Relevance
				<p>short-term O3 exposure and respiratory health effects.</p> <ul style="list-style-type: none"> <li>- recent epidemiologic evidence, combined with toxicological studies in rodents and nonhuman primates, provides biologically plausible evidence that there is likely to be a causal relationship between longterm exposure to O3 and respiratory health effects.</li> <li>- there is likely to be a causal relationship between short-term exposures to O3 and cardiovascular effects. However, a lack of coherence with epidemiologic studies of cardiovascular morbidity remains an important uncertainty.</li> <li>-there is likely to be a causal relationship between short-term O3 exposures and total mortality</li> <li>- evidence is suggestive of a causal relationship between long-term O3 exposures and total mortality; cardiovascular effects; central nervous system effects; reproductive and developmental effects.</li> </ul> <p>CHILDREN: studies comparing age groups reported greater associations for respiratory hospital admissions and ED visits among children than for adults. Biological plausibility for this increased risk is supported by toxicological and controlled human exposure studies. Also, children have higher exposure and dose due to increased time spent outdoors and ventilation rate, and childrens' respiratory systems are also still undergoing lung growth.</p> <p><b>Threshold:</b> both short- and long-term exposure studies indicate a linear, no threshold C-R relationship when examining the association between O3 exposure and multiple health effects across the range of 8-h max and 24-h avg O3 concentrations most commonly observed in the U.S.</p>	

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