Guideline 5:

Assessment of Alternatives and Impacts

in support of the Environmental Impact Assessment Regulations, 2006

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Abbreviations

EIA Environmental impact assessment
I&APs Interested and affected parties
Regulations Environmental Impact Assessment Regulations, 2006
1.

INTRODUCTION

In April 2006 the Minister of Environmental Affairs and Tourism passed environmental impact assessment regulations\(^1\) (the Regulations) in terms of Chapter 5 of the National Environmental Management Act, 1998\(^2\) (NEMA). The Regulations replace the environmental impact assessment (EIA) regulations which were promulgated in terms of the Environment Conservation Act, 1989\(^3\) in 1997.

In order to assist potential applicants, environmental assessment practitioners (“EAPs”) and interested and affected parties (I&APs) to understand what is required of them in terms of the Regulations, what their rights are and/or what their role may be, the Department of Environmental Affairs and Tourism has expanded its Integrated Environmental Management Guideline Series to include the following documents:

- Guideline 4: Public participation
- Guideline 5: Assessment of impacts and alternatives
- Guideline 6: Environmental management frameworks

The additional documents are intended to be guides only and should be read in conjunction with NEMA and the Regulations. The documents are not intended to be a substitute for the provisions of NEMA or the Regulations in any way.

This document is Guideline 5: Assessment of Alternatives and Impacts in support of the Environmental Impact Assessment Regulations, 2006. It provides a basic guide to the assessment of alternatives and impacts which are key components of an EIA process. The purpose of the document is to create a common understanding amongst the different role-players what is required in the assessment of alternatives and impacts and alternatives.

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\(^1\) Environmental Impact Assessment Regulations, 2006
\(^2\) Act No. 107 of 1998
\(^3\) Act No. 73 of 1989
2. ASSESSMENT OF ALTERNATIVES

2.1 THE OBJECTIVES OF ASSESSING ALTERNATIVES

The Regulations require that alternatives to a proposed activity be considered. Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the no-go alternative. (The no-go alternative is the option of not undertaking the proposed activity or any of its alternatives. The no-go alternative also provides the baseline against which the impacts of other alternatives should be compared).

The identification, description, evaluation and comparison of alternatives are important for ensuring the objectivity of the assessment process. In cases where there is no objective and thorough assessment of alternatives, the EIA process usually only confirms a chosen activity and the value of the assessments as an input to decision-making may be compromised.

2.2 NEED AND DESIRABILITY OF THE PROJECT

In order to ensure that the assessment of alternatives is appropriate, it is important to develop a clear definition of the need and desirability for the proposed activity. This definition of need and desirability will help to set the context of the activity and enable the determination of appropriate alternatives to the proposed activity. It will also help the competent authority to assess the implications of the different alternatives, including the reasonableness of the no-go alternative, in a context of the risks and benefits of the proposed activity. Without a proper description of the need and desirability for a proposed activity, it is difficult for a competent authority to make an informed decision.

2.3 THE SELECTION OF ALTERNATIVES

The Regulations indicate that alternatives that are considered in an assessment process be reasonable and feasible. I&APs must be provided with an opportunity of providing inputs into the process of formulating alternatives. Once a full range of potential alternatives has been identified, the alternatives that could be reasonable and feasible should be formulated as activity alternatives for further consideration during the basic assessment or scoping and EIA process.

The number of alternatives that are selected for assessment should not be set arbitrarily, but should be determined by the range of potential alternatives that could be reasonable
and feasible and should include alternatives that are real alternatives to the proposed activity. The process of selecting alternatives should be clearly documented.

The assessment of alternatives should, where possible, be done in a way that feeds back into the planning or design of the activity, thereby optimising the positive aspects and minimising the negative aspects that are highlighted during the assessment process. The assessment process should also be iterative where necessary to reflect the optimal formulation of alternatives. In instances where it is clear that such an interactive and iterative process has been followed in the development of a preferred alternative, it may be appropriate to terminate the assessment of other alternatives, excluding the no-go alternative, that have been considered and assessed in such a process during the course of the assessment. In order to justify the termination of the assessment, or further assessment of any alternative, it is, however, important to document the interactions and iterations properly.

It should be noted that the no-go alternative may sometimes not be a “real” or “implementable” alternative (for example, where the capacity of a sewage pipeline has to be increased to cope with current demand). It should, however remain the default option and must always be included to provide the baseline for assessment of the impacts of other alternatives and also to illustrate the implications of not authorising the activity.

2.4 THE ASSESSMENT OF ALTERNATIVES

The assessment of alternatives should follow the impact assessment process described in the next section and should, as a minimum, include the following:

- the consideration of the no-go alternative as a baseline scenario (even in cases where the no-go alternative is not a realistic alternative);
- a comparison of the selected alternatives; and
- the providing of reasons for the elimination of an alternative.

Where alternative locations or sites are identified as alternatives, the features of each location or site should be investigated to the same level of detail for the purposes of the comparative assessment of the alternatives. The comparative assessment should at least include the following aspects:

- capital and operating costs;
- direct, indirect and cumulative impacts;
- mitigation measures;
- physical, legal or institutional constraints; and
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- compliance with policy and legal requirements.
3. ASSESSMENT OF IMPACTS

3.1 THE OBJECTIVES OF ASSESSING IMPACTS

The Regulations require that a basic assessment or scoping and environmental impact assessment (EIA) process be undertaken to support an application for environmental authorisation. An key component of these processes is the identification and assessment of potential impacts of the proposed activity.

The objective of the assessment of impacts is to identify and assess all the significant impacts that may arise from the undertaking of an activity. The findings of impact assessments are used to inform the competent authority’s decision as to whether the activity should be authorised, authorised subject to conditions that will mitigate the impacts to within acceptable levels or should be refused.

It is sometimes difficult to make predictions in respect of the impacts that may occur. Value judgments may therefore be required on less than perfect information. The use of a logical approach, where uncertain elements are assessed, in a clear and methodical process, helps to ensure that the assessment is focused and provides a basis for making predictions and value judgements that will ultimately inform the decision of the competent authority. The process of assessing impacts

3.1.1 Types of impacts

Impacts are the changes in an environmental parameter that result from undertaking an activity. The change is the difference between the effect on the environmental parameter where the activity is undertaken compared to that where the activity is not undertaken. Impacts occur over a specific period and within a defined area.

Different types of impacts may occur from the undertaking of an activity. The impacts may be positive or negative and may be categorized as being direct (primary), indirect (secondary) or cumulative impacts.

Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

### 3.1.2 Approaches to the assessment of impacts

Assessment of impacts include:

- identifying and assessing the potential impacts associated with a proposed activity and its alternatives;
- predicting the nature, magnitude, extent and duration of potentially significant impacts;
- identifying the range of mitigation measures that could be implemented to lessen the impacts of the activity; and
- evaluating the significance of residual impacts i.e. impacts that remain after taking mitigation measures into account.

There are different approaches that can be adopted to the undertaking of the assessment of impacts, but they should always be based on a methodology that includes:

- a clear process for impact identification, prediction and evaluation;
- specification of impact identification techniques;
- criteria for evaluating the significance of impacts;
- the design of mitigation measures to address impacts;
- defining types of impacts (direct, indirect or cumulative); and
- specifying uncertainties.

The four components of an impact assessment study are discussed in more detail below.
3.1.3 Impact identification

The identification of the potential impacts of an activity on the environment should include impacts that may occur during the commencement, operation and termination of an activity.

In order to identify impacts it is important that the nature of the proposed activity is well understood so that the potential impacts that are associated with the activity can be understood. The process of identification and assessment of impacts includes the:

- determination of current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- determination of future changes to the environment that will occur if the proposed activity does not take place;
- an understanding of the activity in sufficient detail to understand its consequences; and
- the identification of significant impacts which are likely to occur if the activity is undertaken.

3.1.4 Impact prediction

After all the potentially significant impacts have been identified the nature and characteristics of the impacts can be predicted. Impact prediction, or impact forecasting, involves the consideration of physical, biological, socio-economic and cultural information to estimate the likely characteristics and parameters of the impact. The aim of impact prediction is to provide a basis for determining the likely significance of each impact with sufficient accuracy to develop appropriate mitigation measures.

Factors that should be taken into account in impact prediction include:

- the nature of the impact i.e. positive, negative, direct, indirect, cumulative;
- the magnitude of the impact i.e. severe, moderate, low;
- the extent and location of the impact in terms of the area covered, volume distribution, etc;
- when the impact will occur i.e. during construction, operation and/or decommissioning as well as whether the impact will occur immediately or be delayed;
- the duration of the impact i.e. short term, long term, intermittent or continuous;
- the extent to which the impact can be reversed or not;
- the likelihood or probability of the impact actually occurring; and
- the significance of the impact on a local, regional or global level.
The methods used to predict the characteristics of impacts should always be clearly described to the extent that the competent authority that evaluates the assessment will be able to understand exactly how the predictions were made. The methods include:

- professional judgement;
- quantitative mathematical models;
- experiments and physical models;
- physical or visual simulations or maps (including GIS tools);
- case studies; and
- past experience.

The choice of which method to use in a given situation will depend on how significant the impact is likely to be. In general, the more significant an impact is likely to be, the more sophisticated the methods used to predict impacts should be.

Where possible, impacts should be predicted quantitatively to make a comparison between alternatives with baseline conditions easier and to facilitate impact monitoring and auditing after the EIA process. If quantification is not possible it is important to use methods that allow the impacts to be estimated and compared systematically. For example, rating techniques can be used to assist impact estimation as well as to assign values where there is insufficient data and/or a high level of uncertainty.

In some instances the use of qualitative descriptions is unavoidable. An example of this is environmental attributes such as scenic quality and sense of place. In such instances the description of impacts should be based on some type of classification and the impacts should be summarized in appropriate formats such as maps, cross section drawings or photomontages.

### 3.1.5 Mitigation of potential impacts

Once the impacts have been identified and predicted, appropriate mitigation measures need to be established. Mitigation measures are the steps that are taken to reduce the identified impacts as far as possible. Mitigation measures should address the predicted factors of the impacts clearly to demonstrate how the impacts will be reduced through mitigation. The objectives of mitigation are to:

- find more environmentally sound ways of doing things;
- enhance the environmental benefits of a proposed activity;
- avoid, minimise or remedy negative impacts; and
ensure that residual negative impacts are within acceptable levels.

The mitigation of impacts should be organised in a hierarchy of actions namely:

- Firstly, avoid negative impacts as far as possible though the use of preventative measures;
- Secondly, minimise or reduce negative impacts to “as low as practicable” levels; and
- Thirdly, remedy or compensate for negative residual impacts which are unavoidable and cannot be reduced further.

### 3.1.6 Evaluation of the significance of impacts

After the impacts of an activity have been predicted and mitigation measures have been determined, the impacts must be evaluated to determine how significant the impacts are likely to be.

The process of evaluating significance distinguishes between ‘as predicted’ (the impact before mitigation is considered) and ‘residual’ impacts (the impact after mitigation measures have been taken into account). This process consists of two parts namely:

- evaluating the significance of ‘as predicted’ impacts to define the requirements for mitigation and other remedial actions; and
- evaluating the significance of the ‘residual’ impacts that remain after mitigation measures are taken into account.

Key factors that should be considered in evaluating the significance of an impact include:

- environmental standards, guidelines and objectives;
- level of public concern (including both norms and values); and
- scientific and professional evidence of the:
  - loss or disruption of valued resource stocks and ecological functions;
  - negative impact on social values, quality of life and livelihood; and
  - foreclosure of land and resource use opportunities.

The determination of the significance of an impact should also be based on a methodical approach that includes:

- the use of procedures and guidelines established by the competent authority;
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- the adoption of relevant criteria from comparable cases;
- a consistent approach to the comparison of alternatives; and
- documenting the reasons for the judgements made.

There are various sets of criteria that can be applied to assist in the determination of significance. The criteria selected for assessing individual activities should be based on the environmental context of the areas in which the activities occur.

The evaluation of the significance of the impact must always consider the likelihood of the impact eventuating and acceptability of risk. Four other criteria to evaluate whether adverse impacts are significant include considering whether the impact will result in:

- environmental loss and deterioration;
- social impacts resulting directly or indirectly from environmental change;
- non-conformity with environmental standards, objectives and guidelines; and
- likelihood and acceptability of risk.

3.2 THE ASSESSMENT OF CUMULATIVE IMPACTS

The assessment of cumulative impacts on a site-specific basis is complex - especially if many of the impacts occur on a much wider scale than the site being assessed and evaluated. It is often difficult to determine at which point the accumulation of many small impacts reaches the point of an undesired or unintended cumulative impact that should be avoided or mitigated. There are also often factors which are uncertain when potential cumulative impacts are identified. In view of the range of issues that may influence the identification and assessment of potential cumulative impacts, it is therefore important that the approach which has been adopted is clearly explained.

Authorities, including the competent authority, may often have information which can assist in the assessment of cumulative impacts. This information may include:

- spatial information;
- statistics on other similar applications or applications that could have impacts on the same type of environmental resources;
- time series monitoring results; and
- legal or policy thresholds and limits.

3.2.1 Types of cumulative impacts

Cumulative impacts can arise from one or more activities. A cumulative impact may result in an additive impact i.e. where it adds to the impact which is caused by other similar impacts, or an interactive impact i.e. where a cumulative impact is caused by different
impacts that combine to form a new kind of impact. Interactive impacts may be either countervailing (the net adverse cumulative impact is less than the sum of the individual impacts) or synergistic (the net adverse cumulative impact is greater than the sum of the individual impacts).

### 3.2.2 Steps in assessing cumulative impacts

The assessment of cumulative impacts should not be done separately from the assessment of other impacts. Cumulative impacts however tend to have different time and space dimensions and therefore require specific steps which may even mean that some of the actions in the assessment process that preceded general impact identification may have to be revisited after potential cumulative impacts have been identified to ensure that the scope of the EIA process is adequate to deal with the identified cumulative impacts. Four general steps, which are discussed below, are recommended to ensure the proper assessment of cumulative impacts.

**a) Determining the extent of cumulative impacts**

To initiate the process of assessing cumulative impacts, it is necessary to determine what the extent of potential cumulative impacts will be. This can be done by adopting the following approach:

- identify potentially significant cumulative impacts associated with the proposed activity;
- establish the geographic scope of the assessment;
- identify other activities affecting the environmental resources of the area; and
- define the goals of the assessment.

**b) Describing the affected environment**

The following approach is suggested to the compilation of a description of the environment:

- characterise the identified environmental resources in terms of their response to change and capacity to withstand stress;
- characterise the stresses affecting these environmental resources and their relation to regulatory thresholds; and
- define a baseline condition that provides a measuring point for the environmental resources that will be impacted on.

**c) Assessment of cumulative impacts**

The methodology which is used for the assessment of cumulative impacts should be coherent. In general the methodology should comprise of the following:

- an identification of the important cause-and-impact relationships between proposed activity and the environmental resources;
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- a determination of the magnitude and significance of cumulative impacts; and
- the modification, or addition, of alternatives to avoid, minimize or mitigate significant cumulative impacts.
4. CONCLUSION

The main purpose of the assessment of alternatives and impacts is to provide the competent authority with relevant and objective information that will enable the authority to make informed decisions on an application for environmental authorisation. In order to achieve this purpose it is important that:

- methodologies that are used are clearly described so that it can be understood and considered by the competent authority and I&APs;
- methodologies and techniques are applied in such a way that accurate and objective information and/or opinions are provided;
- any issues raised by I&APs in respect of alternatives and impacts are addressed in the comments and responses report; and
- the assessment of alternatives and impacts results in options that represent the minimum impact on the environment.
5. REFERENCE TO HELPFUL RESOURCES


8. Lee N and George C (eds) (2000), Environmental Assessment in Developing and Transitional Countries – Principles, Methods and Practice, University of Manchester, United Kingdom


The references that are indicated in bold were the main references used in the compilation of this guideline.