

Our Ref: J27035

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Attention: EARTH LIFE AFRICA

Dear Madam

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**ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (EIA:12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE: COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

Your correspondence to Ms. Grobbelaar of DEA refers.

Arcus GIBB acknowledges receipt of the above-mentioned letter. We thank you for your valuable comments and your participation in the Eskom Nuclear Power Station (NPS) Environmental Impact Assessment (EIA) process to date. Your questions and comments concerning the Nuclear-1 have been noted.

Responses to your comments / questions are as follows:

**Your comment (1)**

This submission will evaluate the Final Environmental Impact Report ("FEIR") against the legal requirements for such reports and the requirements set out in correspondence from the Department of Environmental Affairs and Tourism.<sup>1</sup>

The submission will argue that the document has failed to place relevant considerations before the decision maker as required under PAJA section 6 and NEMA section 24.

**Response (1)**

Your comments are noted. However, please note that the document made available for public review and comment is the Draft Environmental Impact Report (Draft EIR). No final EIR has been issued yet. A revised version of the Draft EIR will be made available for public review and only thereafter will the Final EIR be prepared for submission to the competent authority for decision-making purposes.

**Your comment (2)**

1. Legal Framework
2. *The Promotion of Administrative Justice Act section 6 requires a decision maker to consideration of all relevant considerations*
3. *The National Environmental Management Act section 24, states:*

*"(1) In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on-*

*(a) the environment;*

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<sup>1</sup> DEAT letter dated 19/11/2008

(b) socio-economic conditions; and

(c) the cultural heritage,

*of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorising, permitting or otherwise allowing the implementation of an activity."*

NEMA section 24(4) states that procedures for the investigation, assessment and communication of the potential impact of activities must ensure as a minimum:

*"(a) investigation of the environment likely to be significantly affected by the proposed activity and alternatives thereto";*

Regulation 29(1)(d) states that:

*"The scoping report must include a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity."*

### **Response (2)**

Your comments are noted.

### **Your comment (3)**

#### **The FEIR fails to properly assess the socio economic impacts of the NPS**

*Issues not properly identified and evaluated.*

*Economic effects of a nuclear accident.*

#### ***The scoping stage***

During the scoping phase the following impacts were identified by interested and affected parties as being highly significant for the site at Koeberg. The draft EIA has suggested that the site at Bantamsklip is the most favourable site. However insofar as the FEIR indicates that there are no fatal flaws in regard to any of the three sites the comments in regard to the Duynefontein site still remain relevant for that site as it remains a potential site for the siting of a nuclear reactor.

The following issues were identified as being of concern in the scoping report by the Legal Resources Centre on behalf of the Namaqualand Action Group for Environmental Justice.<sup>2</sup>

(This submission supports the submission of the Legal Resources Centre and therefore refers to it as a basis for the submission to the FEIR.)

- a) the impact on the price of electricity of the expenditure by R120 billion rand on a new nuclear power station and how this will affect consumers, in particular the poor;
- b) Impact on household income. It was submitted that when dealing with the impact on household income, the scoping report states that only the benefits of remuneration of employees who will work in the plant is considered. The impact on the taxpayer and the consumer is not explained or suggested for evaluation in the EIA even though this is probably the most significant socio economic impact of the project.<sup>3</sup> No response was given hereto by the consultants;

<sup>2</sup> Submission of LRC on behalf of Namaqualand communities dated 13 March 2008 ("LRC Submission")

<sup>3</sup> Id parag 2.3 (b)

- c) the economic impact of a catastrophic incident on adjacent communities and in particular the economy of the Cape Peninsula should such an accident take place at the nuclear power station, (if the reactor is built at Koeberg); and
- d) the economic impacts of all phases of the nuclear power plant's life including decommissioning, which could be of the same order as commissioning.<sup>4</sup>

The LRC submission stated that the scoping report fails to give a comprehensive indication of costs and benefits from which it would be possible to assess the socio-economic impacts of the project. No reasonable response was given to this comment by the consultants, who merely state that it is government policy to support nuclear power and the issue of cost will be addressed by the Public Finance Management Act the National Integrated Resource Planning and the NERSA licensing process.<sup>5</sup> As such it constitutes a failure to comply with the requirements of section 6 (2) (e) of the Promotion of Administrative Justice Act, No 3 of 2000.

The response hereto contained in the letter of Arcus Gibb was to state

*"Catastrophic incidents will be discussed in future reports"*<sup>6</sup>

Concerns were raised as to the fact that the economic risk was not fully explained. Eskom's response hereto was:

*"all economic issues relating to the construction of a nuclear plant station will be assessed by the economic specialist study to be undertaken as part of the impact assessment and phase."*<sup>7</sup>

The scoping report was accepted subject to a number of conditions set out in the DEAT letter dated 19/11/2008 which states:

*"2.37 Economic Study*

*This study must address the cost implications of the proposed NPS in relation to other electricity generating activities"*

*2.6 Decommissioning*

*"The EIR must address the decommissioning of the NPS in more detail. The long term impacts and long term sterilisation of land must be addressed."*

The following general observation was made in this letter regarding public participation:

*2.44 Public participation: DEAT is concerned over the fact that the issues trail as well as various other responses given to the Interested and Affected Parties do not give a clear indication on how their inputs have been taken into account in the scoping report and more importantly, how it has been used to define the Plan of Study for the EIA (POS for the EIR). The EAP must ensure that all issues are addressed in the EIA phase and that the Issues Trail in the EIA phase allows readers to track how the responses to issues have affected the report.*

### **Response (3)**

Your comments are noted.

Please note that the Draft EIR did not indicate Bantamsklip as the preferred site. The recommended site was indicated as Thyspunt in the Eastern Cape.

In your comments above you also refer to the Scoping Report. The Scoping Report is no longer available for comment. It is therefore unclear to which report your submission is related.

With respect to the potential increase in the electricity price: such increases are determined by the National Electricity Regulator of South Africa (NERSA), through Eskom's application process for an

<sup>4</sup> LRC submission parag 2.1(a) page 4

<sup>5</sup> Letter Arcus Gibb page 7

<sup>6</sup> Letter Arcus Gibb to LRC 11 July 2008

<sup>7</sup> letter from ARCUS Gibb to the Legal Resources Centre 11 July 2008

increase in the price it charges to its customers. As such, the increase in electricity prices falls outside the scope of the Environmental Impact Assessment for Nuclear-1. The application for an increase in the electricity price that Eskom submits to NERSA takes into account all possible electricity infrastructure, including generation, transmission and distribution infrastructure.

The cost of a nuclear power station is addressed in the Revised Draft EIR. However, it must be stressed that the purpose of this EIA process is not to provide a detailed analysis of the costs of nuclear generation in comparison to other generation alternatives, such as coal-fired generation and various renewable alternatives. It is indicated in the EIR and the Revised Draft EIR that nuclear generation is not regarded as an alternative to other forms of generation, and that all relevant forms of power generation in South Africa must be pursued in parallel. This EIA process cannot make a recommendation in this regard, and it is the purpose of the Integrated Resource Plan (of which a draft was released for public comment in October 2010), to decide on the relative contribution of various generation options to South Africa's overall energy mix.

Please note that the Economic Specialists were briefed to compare the three sites and in order to accomplish this, a detailed a Macro Economic Analysis (MEA) of the construction phase and a Cost Effectiveness Analysis (CEA) was conducted. The construction cost of a nuclear power station was needed to do the MEA, as the core costs of a power station would not differ from site to site, however the impacts on the economy would differ from site depending on a number of factors. The Western Cape economy is much bigger than the economy of the Eastern Cape, so the linkages differ. Thyspunt is for instance closer to the steel factories in Gauteng than the sites in the Western Cape. That is where the CEA came in and the transport of the Nuclear waste.

Thus, firstly, decommissioning is not going to influence the process except in the transport of the nuclear waste. Secondly, the Economic Specialists were not asked to compare nuclear power to coal or any other, where the actual decommissioning costs become a very important factor.

All issues and response reports are cross-referenced to the relevant sections of the EIR to enable interested and affected parties to determine where their issues are addressed.

#### **Your comment (4)**

##### ***The Plan of study for environmental impact assessment***

In this document it was stated that the following impacts would be studied under the heading "Economic"

The following criteria were included for the economic impact analysis:

*"Impacts on poor (low income households), other households, fiscal impacts, balance of payment impacts and social impacts, costs implications of the proposed NPS in relations to other electricity generation activities as indicated in the long term mitigation strategy document."*<sup>8</sup>

*The report shall focus on the potential health implications to persons who reside and operate in the area of the proposed NPS and how this translates into overall social welfare."*

It is submitted that the requirements of the Plan of Study read together with the letter from the DEAT dated 19 11 2008 in essence require that the issues raised by the LRC submission be pertinently

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<sup>8</sup> Plan of Study page 27

considered in the FEIR. However the FEIR fails to properly consider these economic impacts, in particular the economic impacts of a major accident and the impact on the price of electricity of the construction of a NPS as compared to other energy sources.

#### **Response (4)**

Your comments are noted. The health impacts of the proposed Nuclear Power Station have been assessed, both in the Air Quality Assessment (Appendix E 10 of the DEIR) and in the Human Health Risk Assessment (Appendix E24 of the DEIR). The predicted dose of radioactivity was found to be far below legislated levels as prescribed by the NNR, and no health impacts are therefore predicted. This was found with regards to the radioactive monitoring programme carried out for the existing Koeberg Nuclear Power Station, as well as for the proposed Nuclear-1.

Social impacts are assessed in the Social Impact Assessment (Appendix E18 of the DEIR).

#### **Your comment (5)**

##### **Health impacts**

##### ***The scoping stage***

The LRC submission in response to the scoping report commented that:

- a) *The Human Health Risk Assessment is similarly incomplete, in that it only considers the impacts on health of normal emissions, not abnormal or catastrophic emissions, even though our legal regime for impact assessments mandates the consideration of all potential as well as actual impacts.*<sup>9</sup>

As stated above the response hereto contained in the letter of Arcus Gibb was to state

*“Catastrophic incidents will be discussed in future reports”*<sup>10</sup>

##### ***The Plan of study***

The Plan of Study fails to mention the potential impact on health of releases of radiation during normal as well as abnormal conditions even though this was pertinently raised as an issue of concern in the scoping stage. The report only refers in the section entitled “3.2 Key impacts identified to date” the following rather unclear statement:

*“Health, safety and security of the site as well as limitations to surrounding land used.”*<sup>11</sup>

And:

*“The economics report will focus on the following ....*

*Potential health implications on persons who reside and operate in the area of the NPS; and how this translates into overall social welfare*<sup>12</sup>

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<sup>9</sup> NEMA s 2(4) (b)

<sup>10</sup> Letter Arcus Gibb to LRC 11 July 2008

<sup>11</sup> Final Plan of Study September 2009 parag 3.2

<sup>12</sup> Plan of Study page 27

A human health risk assessment is then referred to which will form part of the detailed impact assessment phase “because it was communicated to the interested and affected parties as part of the scope.” But will not be assessed by the DEA and the DEA will not be making any decisions in this regard.<sup>13</sup>

In response to the Plan of Study the DEAT letter states:

*Human health risk assessment:*

*2.27.1 A risk assessment would require plant specific and site specific data not available at present and therefore it is not feasible to include in this as part of the EIA*

As it is therefore clear that this study will not be placed before the decision maker and any comment thereon would be futile. Further comment on the lawfulness of this approach is contained in the paragraphs that follow.

The Plan of Study does identify what will be contained in the Human Health Risk Assessment even though the DEA will not be making any decisions in regard to it. It is submitted that the terms of reference of this study are fatally flawed as a basis for assessment of health impact. As regards the requirements for an environmental impacts under section 24 of NEMA, the assessment is non compliant as the study does not propose to consider the impacts on health of abnormal or catastrophic releases, confining itself purely to the assessment of risk, which is fundamentally distinguishable from impact and is not regulated as such by the NEMA.

### **Response (5)**

Your comments are noted. The quantitative assessment of the potential radiological impact on the public will be presented to the NNR by Eskom in support of the overall safety case for each of the candidate sites. Public dose assessments will consist of the following primary components:

- Description of the radioactivity source;
- Site-specific exposure assessment; and
- Public dose quantification.

The health impacts of the proposed Nuclear Power Station have been assessed both in the Air Quality Assessment (Appendix E 10 of the DEIR) and in the Human Health Risk Assessment (Appendix E24 of the DEIR). The predicted dose of radioactivity was found to be far below legislated levels as prescribed by the NNR, and no health impacts are therefore predicted. This was found with regards to the radioactive monitoring programme carried out for the existing Koeberg Nuclear Power Station, as well as for the proposed Nuclear-1. The Human Health Risk Assessment is based on the premise that the NNR will issue a license for a site only if full compliance with regulatory requirements is demonstrated. The study thus outlines the assessment methodologies and places the NNR regulatory requirements in context with potential risks to human health.

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<sup>13</sup> Id parag 4.5.15

## Your comment (6)

### WASTE IMPACTS

Waste disposal sites and long term storage of high level nuclear waste. 2.10 and 2.11

The LRC submission to the scoping report contained the following concerns, to which the consultants submitted a complete non response

The proposed facility will produce low, medium and high level nuclear waste. The low and medium level waste is proposed to be stored at Vaalputs, in Namaqualand. It is proposed that high-level nuclear waste will be stored on the site of the nuclear reactor until such time as a disposal facility for high-level radioactive waste ("HLRW") has been built. Although a policy has been approved by the South African Cabinet for the management of radioactive waste, legislation to implement the policy has not yet been drafted and no long-term repository for the storage of high-level radioactive waste has been developed.<sup>14</sup>

The Draft Scoping Report does not mention waste as an issue for study in the EIA, except for referring to possible incidents during the transportation of waste the creation of additional roads and the costs of transportation in the event that great distances are required. This is so even though the issue of the fate of high level nuclear waste was pertinently raised as an issue of concern by interested and affected parties. The issue of the impacts of low and medium level waste impacts was also raised but ignored as an issue for study.<sup>15</sup>

The regulations to NEMA governing environmental impact assessments identify the construction of facilities or infrastructure including associated structures for nuclear reaction including the production, enrichment, processing, re-processing, **storage and disposal of nuclear fuels**, radioactive products and waste as activities which have a substantial effect on the environment and which as a result require an environmental impact assessment.<sup>16</sup> This means that it is a statutory requirement that the issue of storage of low, medium and high-level radioactive waste be subject to an environmental impact assessment.

However the draft scoping report fails to describe site or technological alternatives for the storage for such waste and in particular high-level nuclear waste. As a consequence the draft scoping report fails to include as an issue for study, the extent and significance of environmental impacts associated with alternative storage sites or methods for low, medium and high level radioactive waste. The socio-economic impacts of the construction and operation of such installations and sites cannot be assessed, and the EIA will thus be rendered incomplete. In the light of the above it was submitted that the Draft Scoping Report is proposing an invalid EIA.

Since there is no facility establishing a high-level repository or disposal site in South Africa and until the economic and scientific uncertainties of establishing such a site have been resolved, a risk averse approach should be adopted by the Department of Environmental Affairs and Tourism<sup>17</sup>. It is irresponsible for the applicant to propose a development which will produce high-level radioactive waste which presently cannot be finally disposed of. Future generations will inevitably be burdened with any possible future environmental pollution and health impacts. The Department of Environmental Affairs and Tourism has a constitutional responsibility to protect the environment for the benefit of present and future generations, and it is submitted that the only reasonable administrative action that it can take is to refuse the application to build the plant until such time as:

<sup>14</sup> draft scoping report page 4-14 and 4-17

<sup>15</sup> Item 23 meeting on 11 July 2007 with Kommagas Community

<sup>16</sup> EIA regulations GN 387 of 21 April 2006

<sup>17</sup> as required by section 2(4)(a) (vii) of NEMA

- the Department of Minerals and Energy have made the appropriate regulations, after a process of public participation, prescribing the manner of management, storage and disposal of radioactive waste in irradiated nuclear fuel;
- the applicant either alone or in conjunction with other current producers of high-level radioactive waste, has conducted a full environmental impact assessment and obtained approval from the department of environmental affairs and tourism to build a final high-level radioactive waste disposal facility;
- the applicant and other generators of high-level radioactive waste have made final appropriate financial provision for the costs of building and administering a final high-level radioactive waste disposal facility

Response of the consultants to these comments:

The non response by the consultants to these concerns was stated as follows:

- The alternatives proposed to the development were adequate ;
- The EIA process is not complete and therefore it is inappropriate to make submissions on whether the application for authorisation of the proposed development should be granted or not.<sup>18</sup>

**The plan of study**

The plan of study likewise does not contain reference to these issues and only mentions the issue of waste in the following terms: “ *waste handling, management and transport.*”<sup>19</sup> No specialist study is proposed. In response to the Plan of Study the DEAT advised that it further requires that the long term storage of high level nuclear waste must be addressed in the EIR, and whether or not a new waste disposal site will be established.<sup>20</sup>

**The final environmental impact assessment report**

The same shortcomings as were referred to in regard to the Scoping Report, referred to above, apply to the FEIR. High level waste is proposed to be stored on site until a national policy surrounding the disposal of nuclear waste is finalised. The impacts of various alternative strategies to store high level nuclear waste cannot be assessed. The socio economic impacts of the cost of storage of high level nuclear waste cannot be addressed. As a consequence the FEIR is incomplete.

**Response (6)**

The impacts of handling and storage of radioactive waste is a matter that is firmly within the ambit of the NNR and the newly established National Radioactive Waste Disposal Institute. The disposal of low and intermediate level radioactive waste will be undertaken at a facility that is licensed for this purpose (Vaalputs waste disposal site) and the impacts of disposal are therefore adequately managed within legally accepted criteria. This disposal site is audited on a regular basis against legal requirements. High level waste will be stored indefinitely at the power station site (as is the case at Koeberg Nuclear Power Station and as approved by the relevant environmental decision-making authorities) until government has made a decision on the long-term storage of high level nuclear waste. Vaalputs is being considered for the storage of high-level nuclear waste, no firm decision has been taken in this regard and there are several authorisation processes that would have to be followed before such a decision is ratified. A specialist radioactive waste assessment, which assesses the impacts associated with radioactive waste, has been included in the Revised Draft EIR and will be provided for public comment.

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<sup>18</sup> Arcus Gibb letter 11 July 2008 pp 14 and 15

<sup>19</sup> Plan of Study parag 3.2

<sup>20</sup> DEAT letter 19/11/2008

### **Your comment (7)**

#### **UNLAWFUL DELEGATION**

The plan of study states that :

*“The human health risk assessment study will continue to form part of the detailed impact assessment phase of the environmental authorisation process because it was communicated to I&AP’s and key stakeholders as part of the scoping. However, based on an agreement between the DEA and the NNR, the study will not be assessed by the DEA and thus the DEA will not make any decisions in this regard. The NNR will be the responsible authority regarding human health risk assessment”.*<sup>21</sup>

#### **Comments:**

As per the description of the human health risk assessment in the plan of study<sup>22</sup>, this assessment is described as, i.e. it purports to be an impact assessment, and it therefore is governed by the regulatory framework for environmental impact assessments under the National Environmental Management Act. In the first place this assessment is deficient in complying with section 24 of NEMA in that it only considers the impact of emissions during normal operations as opposed to the impact on health as a consequence of catastrophic releases or accident conditions which arise under abnormal operations.<sup>23</sup>

#### **Response (7)**

Your comment is noted. The Human Health Risk Assessment is a specialised study which accompanies and is used to inform the assessment of impacts within the Environmental Impact Assessment process. Therefore whilst it is regulated by the requirements for specialist studies as contained within GN R 385 of 2010 it is not defined as an Environmental Impact Assessment Report. This study has been included as an appendix to the DEIR in terms of the requirements of the co-operative agreement between the NNR and the DEA.

### **Your comment (8)**

Furthermore the purported delegation of decision making functions of the DEAT to the NNR in respect of this aspect of the study is unlawful.

In amplification of this submission reference is made to the following provisions:

Article 2 of the Memorandum of Cooperative Agreement in respect of the Monitoring and Control of Radioactive Material or Exposure to Ionising Radiation published in GN 759 of 18 July 2008 as well as the Co Operative Agreement in Respect of The Monitoring and Control of Radioactive Material or Exposure to Ionising Radiation signed on the 15th of June 2006 provide that:

*“in regard to the issuing of environmental impact assessment authorisations for construction and operation, where applicable, of nuclear installations in terms of NEMA or ECA, the lead responsibility will be the DEAT. Mechanisms and procedures for co-operation will be provided “through a mechanism and process as established by the DEA and the NNR.”*

It is also stated in a letter dated the 30th of January 2009 entitled: Statement By The Director-General Concerning The Consideration of Matters Pertaining to Nuclear Safety in Environmental Impact Assessment Process in Nuclear Installations that:

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<sup>21</sup> a plan of study page 30 parag 4.5.15

<sup>22</sup> id

<sup>23</sup> id

*"I have therefore decided that as detailed in the agreement between DEAT and the NNR 15 June 2006, these issues will fall outside the ambit of the EIA process and that the department would not make pronouncement on the acceptability of these impacts. Any authorisation granted to nuclear installations would accordingly be conditional on the necessary nuclear licence being in place."*

## **THE PRACTICAL IMPLICATION OF THE PROVISIONS**

It appears from the above that these agreements **intend** that DEAT will in certain circumstances rely on decisions to be made by the NNR. (either by reliance on such decisions in the process of taking a decision on the EIR, or making such a decision contingent on approvals to be obtained from the NNR).

The NNR will consequently become the final decision-maker in respect of certain issues that are relevant to the making of a decision in terms of the EIA process.

This conclusion is supported by the presence of the following key provision in Article 9 of the Co Operative Governance Agreement of 18 July 2008

The latter states that:

*"the DEAT would provide expert assistance and support in respect of Environmental Impact Assessment procedures to the NNR.*

## **THE LEGAL IMPLICATIONS**

It is submitted that the analysis set out above has the following legal implications:

The decision-making process envisaged in the **FEIR** does not comply with sections 24(7) and 24(8) of the National Environmental Management Act 107 of 1998 (as these provisions were stated, prior to their amendment by Act 62 of 2008, since the application for authorisation predated this amendment<sup>24</sup>).

The decision-making process envisaged in the **FEIR** does not comply with the principles of administrative justice in the following respects:

It allows for unauthorised delegation of the DEAT's decision-making functions to the NNR;

It requires the DEAT to "act under dictation" of the NNR;

It requires the DEAT to make a decision without considering material facts;

It is procedurally unfair in that the provisions of the National Nuclear Regulator Act 47 of 1999 allowing for public participation are far more limited than those of NEMA in that persons have to be directly affected before they are entitled to make representations. This constitutes a significant limitation on the participation of the public generally which is allowed without qualification to comment on environmental impact assessments under NEMA. The said provision in fact provides no greater right to be heard than would have existed anyway under the Promotion of Administrative Justice Act of 2000.

In conclusion, it is submitted that the FEIR is legally deficient for the reasons set out above.

## **Response (8)**

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<sup>24</sup> Act 62 2008 section 12(2) dealing with transitional provisions

As indicated in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement that governs the consideration of radiological issues in EIA processes. The distinction between the duties of the DEA and NNR is based on the requirements of the South African Constitution.

You are referred to the objectives of the NEMA contained in its pre-ambble, where it is stated that the Act's purposes are:

"To provide for co-operative environmental governance by establishing **principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for co-ordinating environmental functions exercised by organs of state ...**". Furthermore, Section 35 of the NEMA provides specifically for the conclusion of "Environmental Management Cooperation Agreements", which may be entered into between the Minister, every MEC and municipality for the purpose of promoting compliance with the principles laid down in this Act.

The co-operative agreement between the DEA and the NNR has not been legally challenged and is therefore regarded as a legally valid agreement to define the responsibilities of the relevant decision-making bodies.

### **Your comment (9)**

#### **FAILURE TO ASSESS THE ENVIRONMENTAL CONSEQUENCES OF A SEVERE ACCIDENT**

This memo concludes the following:

- The EIA for the proposed Eskom Nuclear Power Station and Associated Infrastructure does not contain an assessment of the environmental consequences of a severe accident.
- It is submitted that this is in violation of the requirements of section 24 of the Constitution which requires the State to take reasonable measures to prevent pollution, including the proper assessment of potential significant impacts. In interpreting the content of the Bill of rights regard may be had to foreign law<sup>25</sup> and for this reason the submission compares what the FEIR assesses with what would be required if the project were being proposed for example in the United States in order to assist the decision maker with the determination of what would be a reasonable measure in the assessment of impacts under NEMA. This submission does not suggest that foreign law be applied to this decision making process but that it be used as guidance in determining the content of the "reasonable measures" requirement of Section 24 of the Constitution in the context of an EIA for a nuclear reactor which is an inherently hazardous industry.<sup>26</sup>

The EIA for the Eskom Nuclear Power Station and Associated Infrastructure represents a complete failure to assess the environmental consequences of a severe accident in reference to the principles above.

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<sup>25</sup> Section

<sup>26</sup> DME White Paper on Energy Policy 1998 paragraph 7.2.2

Page 9-193 of the EIA states:

*”(d) Severe Accident Releases (SAR)*

*Severe accidents occur when the safety systems are impaired and are unable to prevent significant core damage, with the greatest release fractions. Such events, according to the Emergency Response Assessment, are extremely unlikely because a large number of coincident failures of process and safety systems would need to occur. Furthermore, in some scenarios, the accident may threaten the integrity of the containment envelope. These are the worst case scenarios.*

*One such extremely rare postulated event is a power excursion with impairment and/or failure of the cooling systems leading to early core failure and disassembly. In this postulated event, the shutdown system fails to prevent a significant and prompt power increase. At the Duynfontein site the significance of the potential impact, without mitigation is very low and with mitigation, insignificant.”*

Page 9-194 of the EIA further states:

*”(d) Severe Accident Releases (SAR)*

*“At the Duynfontein and Bantamsklip sites the significance of the potential impact, without mitigation is very low and with mitigation, insignificant.*

*”(d) Severe Accident Releases (SAR)*

*“At the Thyspunt site the significance of the potential impact, without mitigation is very low and with mitigation, insignificant.”*

This is misleading information because other parts of the EIA make it clear that the project proponent will not assess the consequences of a severe accident as part of the EIA process, and that the assessment of the consequences of a severe accident will occur at a future point in time. It is also contrary to the description of the inherently hazardous nature of nuclear power contained in para 7.2.2 of the DME White Paper on Energy Policy 1998.<sup>27</sup>

Page 1 of Appendix 24 of the EIA (Assessment of the Potential Impacts on Human Health Environmental Impact Report) states:

*“Subsequently, a co-operative agreement was reached between the DEA and the National Nuclear Regulator (NNR), in which it was agreed that the NNR will be the responsible authority regarding the assessment of all matters relating to impacts of ionising radiation on human health. Reference is made to a document titled ‘Notification of statement issued by the Department of Environmental Affairs and Tourism regarding the consideration of matters pertaining to nuclear safety in environmental impact assessment processes on nuclear installations’, dated 10 February 2009. The document serves to communicate consensus reached between the DEA and the National Nuclear Regulator (NNR) in terms of management of issues relating to radiological matters. One of the main purposes of the engagement between DEA and the NNR was to ‘prevent unnecessary and unavoidable duplication of effort’. According to Section 20 (1) of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999), no person may site, construct, operate, decontaminate or decommission a nuclear*

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<sup>27</sup> Paragraph 7.2.2 states that government recognizes that nuclear installations have the potential for acute exposures and catastrophic accidents and therefore require special liability regimes with compulsory financial security, sophisticated safety assessment to ensure that risk is engineered to acceptably low levels and high level spent fuel waste requires especially engineered storage and disposal facilities

*installation without a nuclear installation license. The NNR process applies specifically to issues of nuclear and radiation safety related to the siting, design, construction, operation and decommissioning of nuclear installations. The document refers to a meeting held on the 15 June 2006, whereby it was agreed that **nuclear safety, radiation and radiology ‘are better placed within the regulatory process of the National Nuclear Regulator Act and that consideration of the same issues in an EIA process will result in unnecessary and avoidable duplication.***

*“This Environmental Impact Report has been prepared by INFOTOX (Pty) Ltd in conjunction with SRK Consulting and **will** be submitted to the NNR for approval.”*

Because the EIA for the Eskom Nuclear Power Station and Associated Infrastructure admittedly lacks an assessment of the consequences of a severe accident it cannot serve as a rational basis for South African authorities and the general public to decide whether the environmental consequences of the proposed nuclear power plant outweigh its claimed benefits. Furthermore, the assessment of the environmental consequences of a severe accident in the EIA for the Eskom Nuclear Power Station and Associated Infrastructure is deficient for two additional reasons:

- There is no assessment of the consequences of an aircraft impact with the proposed facility; and
- There is no assessment of the consequences of a terrorist attack on the proposed facility.

Such assessments are required in other jurisdictions e.g. the USA, and therefore a reasonable basis exists for such assessment in South Africa.<sup>28</sup>

For comparison of requirements for impact assessments for nuclear reactors, the following information pertaining to requirements in USA for the assessment of the impact of accidents at nuclear reactors is included in order to provide guidance to the decision maker as to what should be assessed under NEMA. As stated above this submission does not suggest that foreign law be applied to this decision making process but that it be used as guidance in determining the content of the “reasonable measures” requirement of Section 24 of the Constitution in the context of an EIA for a nuclear reactor which is an inherently hazardous industry.<sup>29</sup>

In September 2008, the U.S. Environmental Protection Agency published the following guidance stating:

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<sup>28</sup> With respect to the consequences of an aircraft impact with the proposed facility, the U.S. EPA has stated. In 2008, the NRC finalized a rule that requires reactor designs to be assessed for the effects of the impact of a large, commercial aircraft on the nuclear power plant. This assessment is completely lacking in the EIA for the Eskom Nuclear Power Station and Associated Infrastructure.

With respect to the consequences of a terrorist attack on the proposed facility, the U.S. EPA has also stated:

“Protecting NPPs from land-based assaults, deliberate aircraft crashes, and other terrorist acts has been a heightened national priority since the attacks of September 11, 2001, and the NRC has strengthened its regulations on nuclear reactor security. Several provisions to increase nuclear reactor security are included in the Energy Policy Act of 2005 (CRS 2006). ...

“As of the date this guidance document was finalized, whether NPP EISs must consider the impacts of terrorist acts depends on the location of the proposed plant. The Ninth Circuit Court of Appeals concluded in *San Luis Obispo Mothers for Peace v. Nuclear Regulatory Commission* that it was unreasonable for the NRC to categorically dismiss the possibility of terrorist attack on the Storage Installation and on the entire Diablo Canyon facility as too remote and highly speculative to warrant consideration under NEPA. (449 F.3d 1016, 1030 (9th Cir. 2006)). The U.S. Supreme Court declined to hear an appeal of the decision.”<sup>28</sup>

The Ninth Circuit has jurisdiction over proposed projects in the States of California, Oregon, Washington, Idaho, Montana, Nevada, Arizona, Alaska and Hawaii. An assessment of the impacts of terrorist acts is completely lacking in the EIA for the Eskom Nuclear Power Station and Associated Infrastructure.

<sup>29</sup> DME White Paper on Energy Policy 1998 para 7.2.2

*“In accordance with NRC guidance, [nuclear power plant environmental impact statements] evaluate design basis accidents, **severe accidents**, and transportation accidents, and should summarize severe accident mitigation alternatives. ....*

*“**Severe accidents** are those involving multiple failures of equipment or function. Therefore, their likelihood of occurrence is lower but their consequences would be higher. Examples of severe accidents that may be evaluated, some of which are only relevant for particular designs, include the following .....*

- *No loss of containment.*
- *Transients followed by failure of high-pressure coolant makeup water and failure to depressurize in a timely fashion.*
- *Short-term station blackout with reactor core isolation cooling (RCIC) failure and onsite power recovery in eight hours.*
- *Station blackout with RCIC available for about eight hours.*
- *Station blackout (more than eight hours) with RCIC failure.*
- *Transients followed by failure of high-pressure coolant makeup water, successful depressurization of reactor, failure of low-pressure coolant makeup water.*
- *Transient, loss-of-coolant accident (LOCA), and anticipated transient without scram (ATWS) events with successful coolant makeup water, but potential prior failure of containment.*
- *Small/medium LOCA followed by failure of high-pressure coolant makeup water and failure to depressurize.*
- *LOCA followed by failure of high pressure coolant makeup water [NRC 2006c, Table 5-13].*
- *ATWS followed by boron injection failure and successful high-pressure coolant makeup water.*

*“**Severe accident** risks are evaluated for exposures occurring through the atmospheric pathway, the surface water pathway, and the groundwater pathway. Unlike the potential exposures to individuals that are estimated as a result of the analysis of design-basis accidents, the consequences of severe accidents are characterized in terms of exposures to population groups ....*

*“The risks for specific accident types are defined as the product of the probability of that type of accident occurring multiplied by the estimated consequences for that type of accident. As with the evaluation of design-basis accidents, detailed quantitative documentation of the basis of probabilistic estimates of releases do not need to be laid out in the EIS, but can be referenced to details in FSARs and safety evaluation reports.”<sup>30</sup>*

In the U.S., the scope of the assessment in an EIA document of a **severe accident** at a proposed nuclear power plant is further defined by the following guidance of the U.S. Nuclear Regulatory Commission:

*“This environmental standard review plan (ESRP) directs the staff’s evaluation and input to the **environmental impact statement (EIS) of the environmental risks of accidents involving radioactive material that can be postulated for the plant under review.***

*“The scope of this review should include **dose consequence analysis for severe accidents**, including the socioeconomic impacts and, where applicable, the impact to biota. This includes coordination with the reviewers of safety analysis report (SAR) Chapter 19, 10 CFR 50.34(f),*

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<sup>30</sup> U.S. EPA (September 2008) “§309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements, EPA Publication 315-X-08-001 <http://www.epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf>

the reviewers of the individual plant examination (IPE), and the individual plant examination of external events (IPEEE). ...

*“The type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of the potential impacts. The following data or information should be obtained:*

*“- a list of leading contributors to (1) core-damage frequency (e.g., from dominant severe-accident sequences or initiating events), (2) large-release frequency (e.g., from each containment failure mode or accident-progression bin), and (3) dose consequences with and without interdiction (e.g., from each release class and associated source term) (from the ER)*

*“- the projected demographic data within an 80-km (50-mile) radius from the plant for the 5 years from the time of the licensing action under consideration (from ESRP 2.5.1)*

*“- meteorological data for a 1-year period represents current conditions (from ESRP 2.7) socioeconomic impacts that might be associated with emergency measures during or following an accident (from the ER)*

*“- radiological dose consequences and health effects associated with normal and anticipated operational releases (from ESRP 5.4.3). ...*

***“The depth and extent of input to the EIS will be governed by the nature of the plant accidents and their impacts on the proposed project. The following information should be included:***

***“- a summary of atmospheric releases in severe-accident sequences (this includes the accident sequence or sequence group, the probability of the accident sequence per reactor year, and the fraction of the core inventory released)***

***“- a summary of the environmental impacts and probabilities of severe accidents (including the probability of impact per reactor-year, the number of persons exposed to doses greater than 2 sieverts (200 rem) and greater than 0.25 sievert (25 rem), the population exposure, the number of latent cancers, and the cost of offsite mitigating actions)***

***“- a summary of early fatalities and probabilities (including the probability of impact per reactor-year)***

***“- the average values of environmental risks resulting from accidents per reactor-year (see NUREG- 0921 [NRC 1983], Tables 5.8 through 5.13 for examples).”<sup>31</sup>***

For an example of an EIA document meeting the above requirements, see: Draft Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site (November 2004)<sup>32</sup>

## **Response (9)**

<sup>31</sup> U.S. Nuclear Regulatory Commission: “Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan (NUREG-1555)”

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/>

<sup>32</sup> <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1811/draft/sr1811.pdf> At pages 5-72 to 5-82.

Your comments are noted. However as stated in Response 8, it has been indicated in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement that governs the consideration of radiological issues in EIA processes.

Eskom's application to the NNR for licensing of the proposed power station has not yet commenced and will only commence once the vendor has been selected. Commencement of this expensive and complicated process in parallel to the EIA process is not practical since NNR cannot issue a Nuclear installation license without an identified and confirmed site, or a detailed design of the power station.

The NNR's licensing process does make provision for public hearings and is subject to the provisions of the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000), as are all authorisation processes to which the public has access. The NNR's process is therefore required to be an open and transparent process.

The agreement between the DEA and the NNR indicates that the DEA would not "make a pronouncement on the acceptability" of radiological safety issues, and that this issue (severe accidents) falls firmly within the ambit on the NNR licensing process. However, at the DEA's request, information relevant to radiological safety issues has been included in the Draft EIR.

Apart from the environmental authorisation, there are more than 30 different other authorisations that need to be obtained before construction of the nuclear power station can commence. Although it may be ideal for information relevant to all these processes to be considered in parallel, clearly this is not practical.

The emergency preparedness report also falls within the ambit of the NNR licensing process and the public will be granted insight into further details about emergency planning through the public hearing process that forms part of that process.

#### **Your comment (10)**

#### **FAILURE TO ASSESS THE ENVIRONMENTAL CONSEQUENCES OF THE TRANSPORTATION OF RADIOACTIVE MATERIALS**

The EIA for the Eskom Nuclear Power Station and Associated Infrastructure completely lacks any assessment of the consequences of the transportation of radioactive materials.

With regard to the assessment of the environmental consequences of the transportation of radioactive materials, the U.S. Environmental Protection Agency provides the following guidance, which is instructive in determining the content of "reasonable measures" required to protect the environment under the SA Constitution:

*"Overall, potential radiological impacts from transportation include possible exposures of transport workers and the general public along the proposed transportation routes, and radiation exposure to these groups that may occur through accidents along transportation corridors. ...*

*"Environmental impact data exist for light water reactors meeting specific criteria, including transportation of fuel and waste to and from light water reactors, but not other reactor types. These data are presented in 10 CFR 51.52 in Table S-4, —Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water-Cooled Nuclear Power Reactor. For reactors not meeting the conditions listed in 10 CFR 51.52 (a) for which the*

*Table S-4 data are relevant, the EIS must present a full description and detailed analysis of the environmental effects of transportation of fuel and wastes to and from the reactor, including values for the environmental impact under normal conditions of transport and for the environmental risk from accidents in transport.”<sup>33</sup>*

### **Response (10)**

Your comments are noted. The transportation of radio-active material will, for safety and security purposes not be transported via a set route. It will therefore be difficult to assess a particular route with respect to the transport of radioactive waste. GIBB is however determining the shortest route and a description of this route will be incorporated in the revised Draft EIR

### **Your comment (11)**

#### **FAILURE TO ASSESS ALTERNATIVES TO THE PROPOSED PROJECT**

The NEMA requires an assessment of alternatives to be undertaken in an environmental impact assessment. The EIA is a decision making tool, and consultants drafting EIA reports are required to place relevant information before a decision so that it can meet the requirements of PAJA which require the decision maker to consider all relevant information. However the EIA for the Eskom Nuclear Power Station and Associated Infrastructure utterly fails to provide critical information in order to enable this assessment, including the assessment of alternatives to the proposed project, to take place. Page 5-6 of the EIA states:

*“In order for Eskom to achieve its objectives, Eskom requires a reliable source of power generation that will supply a consistent base load that can be efficiently integrated into the existing South African power network. Only certain electricity generation technologies are presently commercially available, although not necessarily financially viable in South Africa, based largely on the availability of resources (fuel) and geographical constraints. The range of viable technologies, which were discussed and compared during the Scoping Phase of the EIA, is listed in Table 5-1.”*

This submission seeks to provide guidance to the decision maker as to what would be a reasonable requirement in the impact assessment process and therefore regard to the assessment of alternatives in EIAs for proposed nuclear power plants, the U.S. Environmental Protection Agency provides the following guidance which is drawn to your attention:

*“NRC guidance also calls for an assessment of **competitive alternative energy sources and systems** (NRC 2007a, Section 9.2). ... Detailed information and evaluation criteria for energy alternatives analysis are provided in recently updated sections of NUREG 1555 (NRC 2007a, Sections 9.2.1 – 9.2.3); the following paragraphs summarize the new information.*

*“The alternatives presented in this section should include either supplying the electrical energy demand without constructing new generating capacity (for example, purchasing from another utility) or **initiating energy conservation (including energy efficiency) measures that would avoid the need for the plant**. Information should be systematic, comprehensive, subject to confirmation, and responsive to forecasting uncertainty.*

*“The alternatives presented in this section should include either alternatives not yet commercially available, fossil fuels (taking into account national policy regarding their use as fuels), and alternatives uniquely available within the region (such as hydropower and*

<sup>33</sup> U.S. EPA (September 2008) “§309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements, EPA Publication 315-X-08-001 <http://www.epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf>

geothermal). **The energy sources listed below should be considered;** however, they should be categorized as either competitive or non-competitive (according to criteria laid out in NUREG 1555). If they are determined to be non-competitive, reasons for dismissing them from further analysis should be provided:

- wind**
- geothermal**
- natural gas
- hydropower
- advanced nuclear
- municipal solid wastes
- biomass
- coal
- photovoltaic cells
- solar thermal power**
- wood waste
- energy crops
- other advanced systems (such as fuel cells, synthetic fuels, or other)

*“In this evaluation, the EIS should determine if one or more of the competitive (as defined above) alternatives can be expected to provide an appreciable reduction in overall environmental impact or offer solutions to potential adverse impacts predicted for the proposed project for which no mitigation procedure could be identified. It should also include an economic assessment if a competitive environmentally preferable source is identified.”<sup>34</sup>*

The scope of the assessment in an EIA document of alternatives to a proposed nuclear power plant is further defined by the U.S. Nuclear Regulatory Commission, which has issued the following guidance:

*“This environmental standard review plan (ESRP) directs the staff’s review and assessment of the economic and technical feasibility of (1) supplying the projected demand for electrical energy identified in ESRP 8.4 without constructing new generating capacity or (2) initiating energy conservation measures that would avoid the need for the plant. The scope of the review directed by this plan should include consideration of (1) power purchases from other utilities or power generators and reactivation or extended service life of plants within the power system in combinations that should provide a supply alternative to the proposed project and (2) the potential for energy conservation on demand management measures that would be equivalent to the output of the proposed project.”<sup>35</sup>*

The EIA for the Eskom Nuclear Power Station and Associated Infrastructure utterly fails to provide this critical information. Page 5-6 of the EIA, as referred to above states:

*“In order for Eskom to achieve its objectives, Eskom requires a reliable source of power generation that will supply a consistent base load that can be efficiently integrated into the existing South African power network. Only certain electricity generation technologies are presently commercially available, although not necessarily financially viable in South Africa, based largely on the availability of resources (fuel) and geographical constraints. The range of viable technologies, which were discussed and compared during the Scoping Phase of the EIA, is listed in Table 5-1.”*

<sup>34</sup> U.S. EPA (September 2008) “§309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements, EPA Publication 315-X-08-001 <http://www.epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf>

<sup>35</sup> U.S. Nuclear Regulatory Commission: “Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan (NUREG-1555)” <http://www.nrc.gov/reading-rm/doc-collections/nureqs/staff/sr1555/>

Missing from Eskom's analysis is an assessment of supplying the projected demand for electrical energy without constructing new generating capacity or initiating energy conservation measures that would avoid the need for the plant, i.e. a detailed analysis of the no-go option.

Furthermore, Table 5-1 of the EIA contains clearly erroneous information. This table includes a list of "Proven base load technologies," but does not include wind power among these proven base load technologies. Instead, it lists wind power under the category of "Proven (nondispatchable)" technologies.

In a scholarly, peer-reviewed publication, U.S. scientists have concluded that:

*"The combination of wind energy generation and energy storage can produce a source of electricity that is functionally equivalent to a baseload coal or nuclear power plant."<sup>36</sup>*

In a subsequent, peer-reviewed publication, U.S. scientists found:

*"The economic viability of producing baseload wind energy was explored using a cost-optimization model to simulate two competing systems: wind energy supplemented by simple- and combined cycle natural gas turbines ("wind+gas"), and wind energy supplemented by compressed air energy storage ("wind+CAES"). ... We estimate that the wind+CAES system, with a greenhouse gas (GHG) emission rate that is one-fourth of that for natural gas combined cycle plants and about one-tenth of that for pulverized coal plants, has the lowest dispatch cost of the alternatives considered (lower even than for coal power plants) above a GHG emissions price of \$35/tCequiv., with good prospects for realizing a higher capacity factor and a lower total cost of energy than all the competing technologies over a wide range of effective fuel costs."<sup>37</sup>*

The results of this study are especially relevant to South Africa in that they show that wind can provide base load power (i.e. wind energy supplemented by compressed air energy storage) even with scarce natural gas supplies.

The estimated potential for wind power generation in South Africa is substantial, 50 petajoules (one billion megajoules) per year.<sup>38</sup>

### **Response (11)**

Your comments are noted. This application for environmental authorisation relates specifically to the impacts of a Nuclear Power Station on one of three specific sites: Duynefontein, Bantamsklip and Thyspunt. It does not aim to establish the energy mix to be implemented in South Africa in terms of energy provision, as this falls within the ambit of the IRP and IRP 2010 processes. In this respect, you are referred to the draft IRP 2010 documents which were released for comment during October 2010. As such site and layout alternatives were assessed as reasonable and feasible alternatives in terms of the application for environmental authorisation.

As indicated above, the purpose of this EIA process is not to provide a detailed analysis of the environmental costs of nuclear generation in comparison to other generation alternatives, such as

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<sup>36</sup> Denholm, P., et al (2005) "Emissions and Energy Efficiency Assessment of Baseload Wind." Environ. Sci. Technol. 39:1903-1911

<sup>37</sup> Greenblatt, J.B. (2007) "Baseload wind energy: modeling the competition between gas turbines and compressed air energy storage for supplemental generation." Energy Policy 35: 1474-1492.

<sup>38</sup> Winkler, H. (2005) "Renewable energy policy in South Africa: policy options for renewable electricity, Energy Policy 33:27-38; Howells, M. (1999) "Baseline and greenhouse gas mitigation options for bulk energy supply, South African Country Study on Climate Change. Draft. Energy Research Institute, University of Cape Town.

coal-fired generation and various renewable alternatives. It is indicated in the EIR and the Revised Draft EIR that nuclear generation is not regarded as an alternative to other forms of generation, and that all relevant forms of power generation in South Africa must be pursued in parallel in order to reach the goal of 40 000 MW of new generation by 2025. According to the IRP 2010 draft, nuclear generation, as well as demand-side management and renewable technologies all need to form part of the energy supply mix in South Africa.

Table 5-1 does not include wind power as a base load technology because its load factor is not above 75%, which is regarded as the cutoff for base load. According to the EPRI (2010)<sup>39</sup>, in research completed for the IRP 2010, wind power in South Africa has a load factor of 30%.

Given the urgent power demand based on economic growth in South Africa, the No-Go alternative is not considered to be a feasible alternative. Eskom, would in all likelihood, apply to develop more coal-fired power stations if the current application is declined. The life-cycle environmental impacts of coal-fired power generation are much greater than nuclear-fuelled power generation. It would become increasingly difficult to develop more coal-fired power stations in the future, due to carbon tax that would be imposed on countries that continue to emit greenhouse gases. The No-Go alternative would imply that potential benefits that emanate from the proposed project would not be realised. In this respect, it is important to balance the interest, needs and perceptions of neighbouring communities with the national interest for a secure electricity network that facilitates long-term sustained development of South Africa's economy. Although potential negative impacts of the proposed project would be avoided with the No-Go alternative, it is imperative that South Africa develops its power generation capacity, particularly in the Western and Eastern Cape.

### **Your comment (12)**

#### **SOLAR ENERGY**

The FEIR fails to place relevant information before the decision maker as to the viability of concentrated solar energy as an alternative source of power.

We refer to two published articles in this regard.

The first article, published by German scientists, discusses the global potential of Concentrating Solar Power, but includes scientific information that solar is a potential large source in South Africa in particular.

1. Trieb, F., et al. (2009) "Global Potential of Concentrating Solar Power." Published in the Proceedings of the SolarPaces Conference Berlin, September 2009 [http://www.dlr.de/tt/en/Portaldata/41/Resources/dokumente/institut/system/projects/reaccess/DNI-Atlas-SP-Berlin\\_20090915-04-Final-Colour.pdf](http://www.dlr.de/tt/en/Portaldata/41/Resources/dokumente/institut/system/projects/reaccess/DNI-Atlas-SP-Berlin_20090915-04-Final-Colour.pdf)

This article states:

*"This paper presents an analysis of the technical potential of concentrating solar power (CSP) on a global scale elaborated within the European project REACCESS. The analysis is based on annual direct normal irradiation (DNI) data provided by NASA Surface Meteorology and Solar Energy program (SSE) Version 6.0. ...*

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<sup>39</sup> Electric Power Research Institute. 2010. *Power Generation Technology Data for Integrated Resource Plan of South Africa*. EPRI, Palo Alto, California. .

*“A world wide data set of direct normal irradiation is available from the NASA SSE 6.0 (NASA 2008). It is based on 22 years of data and has a spatial resolution of about 100 km, which is considered sufficient to assess the potential of CSP plants on a global scale (Figure 1). Site exclusion criteria for CSP plants were applied world wide yielding a global exclusion map shown in Figure 2. ....*

*“Both maps were combined to yield a global map of annual direct normal irradiance for potential CSP sites (Figure 3). This map was subdivided according to the world regions defined within the REACCESS project, and a statistical analysis of the distribution of DNI intensity classes with values higher than 2000 kWh/m<sup>2</sup>/y was made for each region, yielding the land area available for CSP classified by DNI intensities (Table 1).”*

Figure 3 shows that there are large areas in the Western and Central regions of South Africa, particularly in Northern Cape Province, that, because of their high levels of annual direct normal irradiation, are particularly well-suited as locations for of (sic) Concentrating Solar Power plants.

This article moreover also contains important information about the global potential of concentrating solar power plants relative to global power demand. The article concludes:

*“The global technical potential of concentrating solar power amounts to almost 3,000,000 TWh/y, a number considerably larger than the present world electricity consumption of 18,000 TWh/y.*

*This immense renewable energy resource is mainly concentrated in the deserts of the earth. Under desert conditions, CSP plants with large solar fields and thermal energy storage are in principle capable of producing base load electricity at full capacity for up to 8000 hours per year.”*

That is, the global potential of concentrating solar power is some 166 times world energy demand.

The article also contains important information about the cost competitiveness of concentrating solar power. The article states:

*“The cost of concentrating solar power plants was modelled as function of time individually for the different components of such plants. For each component, a separate learning curve and progress ratio for future cost development was assumed (Table 5). ...*

*“The model was based on a scenario of world wide CSP expansion adopted by (Viebahn & Lechon, 2007) as optimistic/realistic scenario. It starts with 354 MW solar power capacity installed in 2005 and expands to 5,000 MW by 2015, 150,000 MW by 2030 and 500,000 MW by 2050. According to this expansion and the learning rates assumed here, the specific investment cost of CSP plants would develop as shown in Figure 7 for different plant configurations with varying solar multiple and solar operating hours (SM1 - SM4). .... The CSP cost model considers current oil-cooled parabolic trough technology with molten salt storage and steam cycle power block with dry cooling tower as reference.*

*“In Figure 8 the cost of CSP has been compared to the cost of electricity produced by fossil fuels as calculated by (Nitsch 2008). The energy-economic model and the parameters used by Nitsch were the same as used in our model above. The comparison shows that CSP can become fully competitive between 2020 and 2030, and can later contribute significantly to stabilize global electricity costs.”*

In other words, as countries gain more experience with CSP technology and therefore reduce its costs, by 2020 CSP will be a less costly means of generating electricity in locations, such as South Africa, that have high levels of annual direct normal irradiation.

The second article, published by scientists with the Energy Research Centre at the University of Cape Town, discusses the potential of Concentrating Solar Power specifically in South Africa.

2. Edkins, M., et al (September 2009) "Large-scale rollout of concentrating solar power in South Africa." [http://www.erc.uct.ac.za/Research/publications/09Edkins-et-al-Rollout\\_of\\_CSP.pdf](http://www.erc.uct.ac.za/Research/publications/09Edkins-et-al-Rollout_of_CSP.pdf)

This article is a comprehensive discussion of the potential for CSP in South Africa, its present-day and future cost-competitiveness with other sources of energy, including nuclear and coal, and barriers to fully developing the potential for CSP in South Africa, including, in particular, needed changes in South Africa's Renewable Energy Feed-In Tariff (REFIT) policies.

The article includes the following explanation:

*"South Africa has among some of the best solar resources in the world; the country has already committed itself to a target of 10,000GWh of renewable energy by 2013 (DME 2003). At the Department of Minerals and Energy (DME) Renewable Energy Summit in March 2009, the then Energy Minister indicated that more ambitious targets 'for the period 2013 and 2018 could be set in the range of six to nine percent and nine to fifteen percent of the current capacity respectively' (DME 2009). This may result in a renewable energy target of 14,500-22,000GWh for 2013 and 22,000-36,000GWh for 2018. By pursuing a higher renewable energy target, which would be dominated by large-scale rollout of CSP, South Africa's GHG emissions may (if other mitigation actions are also pursued) peak between 2020-2025, then stabilise for ten years, and decline in absolute terms thereafter – a target aligned with the mitigation actions required to prevent dangerous climate change (see Figure 1).*

*"According to South Africa's Long-term Mitigation Scenarios (LTMS), one of South Africa's main carbon mitigation options lies in shifting its electricity generation away from coal (Winkler 2007). ....*

*"For the large-scale rollout of CSP only parabolic trough and power towers are assessed, which are assumed to have technology learning ratios of 15% and 20% respectively (Winkler 2007; Winkler et al. 2009). According to the model output the proportion of renewable electricity generated is increasingly supplied by CSP, rising from none in 2010, to 60% by 2015, to 70% by 2020, and to about 90% after 2050 (see Figure 2). The first CSP plants would be installed in 2014, with installed generation capacity projected to increase to about 2 GW by 2015, 7 GW by 2020, 24 GW by 2030 and 100 GW by 2050, which equates to 4%, 13%, 27% and 55% of the total generation capacity required (see Table 2)."*

With regard to present-day and future cost-competitiveness of CSP in South Africa, the article states:

*"Internationally, the CSP industry is expected to experience major growth in the next decade, with governments around the world introducing policies to further the CSP innovation cycle. Three major policies are operating worldwide; firstly, there are mandatory purchases of renewable energy at a fixed price (known as a feed-in tariff) in Germany and Spain, and more recently also in South Africa. Secondly, renewable portfolio standards, which require a minimum share of power to come from renewables, are used in many US states. The third policy of government-sponsored competitive bidding for renewable energy concessions uses long-term contracts awarded to lowest-price projects, as in China and Ireland (Nersa 2009).*

*"Market creation by government is thought to pull the CSP industry towards greater commercialisation and eventually drive the price of electricity from CSP low enough to make it competitive with other generation sources, in particular coal-generated electricity. CSP learning curves are thought to be anywhere in the ranges of 5-32% and 2-20% for parabolic trough technology and central receiver technology respectively (Winkler 2007; Winkler et al.*

2009; see also Sargent and Lundy 2003; Solar Task Force 2006). As the technology matures on a global scale, cost reductions are thought to come from production changes (process innovations, learning effects and scaling effects), product changes (innovation, design standards and redesign) and changes in input prices (World Bank and GEF 2006).

*“Accordingly, the levelled cost of electricity from CSP is estimated to be competitive with the levelled cost of conventional coal by 2045 and with nuclear by 2026 (see Figure 6). If coal power plants are to be built with carbon capture and sequestration (CCS) then the levelled costs of electricity from these would increase considerably (Marquard et al. 2008).*

*Furthermore, the levelled cost of CSP generated electricity may experience a greater learning rate due to local production of CSP components (Holm et al. 2008), estimated here at reducing the LEC further at an annual rate of 1% after the construction of the first CSP plant in 2014 (Figure 6).*

*“In the long-term, post-2030, therefore the large-scale rollout of CSP is expected to achieve cost savings for the South African electricity generation sector. Until then, however, the additional cost to the electricity system is estimate at R 2.5 billion for 2010-2015, R 8 billion for 2016-2020 and R 23 billion for 2021-2030 (Table 2).”*

Finally, we submit recent information about the Andasol Solar Power Station, "Europe's first commercial parabolic trough solar thermal power plant, located near Guadix in the province of Granada, Spain."

[http://en.wikipedia.org/wiki/Andasol\\_Solar\\_Power\\_Station](http://en.wikipedia.org/wiki/Andasol_Solar_Power_Station)

This power plant is now fully operational, according to the following description:

*“Andasol is the first parabolic trough power plant in Europe, and Andasol 1 went online in March 2009. ... Each plant has a gross electricity output of 50 megawatts (MWe), producing around 180 gigawatt-hours (GW·h) per year (21 MW·yr per year). Each collector has a surface of 51 hectares (equal to 70 soccer fields); it occupies about 200 ha of land.[*

*“Andasol has a thermal storage system which absorbs part of the heat produced in the solar field during the day. This heat is then stored in a molten salt mixture of 60% sodium nitrate and 40% potassium nitrate. A turbine produces electricity using this heat during the evening, or when the sky is overcast. This process almost doubles the number of operational hours at the solar thermal power plant per year. A full thermal reservoir holds 1,010 MW·h of heat, enough to run the turbine for about 7.5 hours at full-load, in case it rains or after sunset. The heat reservoirs each consist of two tanks measuring 14 m in height and 36 m in diameter and containing molten salt. Andasol 1 is able to supply environmentally friendly solar electricity for up to 200,000 people.”*

## **Response (12)**

Your comments are noted. Please see our response to item 11.

## **Your comment (10)**

## **CONCLUSION**

Page 3-1 of the ESKOM NUCEAR 1 FEIA admits that the proposed nuclear power plant would not commence generating electricity until 2018. Energy conservation and wind power are both measures that can fill South Africa's energy needs in a matter of months, not years. Therefore, the EIA needs to inform South African authorities and its citizens whether the staggering cost of building a new nuclear power plant (taking commissioning, decommissioning and storage of waste into account) is a better

way forward than investing limited public funds in initiating energy conservation measures or certain new energy generating projects that close the gap between energy needs and energy availability over a much shorter time period.

In conclusion, it is therefore submitted it is incumbent on the FEIR to consider the alternatives mentioned above and to provide a cost benefit analysis of the various options indicated above (especially the option of concentrated solar energy) against the cost of producing nuclear power, since in terms of the NEMA it is imperative to pursue the selection of the "best practical environmental option"<sup>40</sup>. This option is defined in NEMA as:

*"the option that provides the most benefit or causes the least damage to the environment as a whole , at a cost acceptable to society in the long term as well as in the short term"*<sup>41</sup>

The failure to conduct such analysis, in particular with regard to concentrated solar energy constitutes a violation of the duty to place relevant information before the decision maker as well as a violation of NEMA Principle 2(4) (b), and any decision flowing from the FEIR which is devoid of such analysis will be fatally flawed.

### **Response (10)**

Your comments are noted. Please refer to the responses above relating to the consideration of other generation alternatives within this EIA process.

Should you have any queries with respect to the above please do not hesitate to contact Arcus GIBB.

Yours faithfully  
For Arcus GIBB (Pty) Ltd

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Jaana-Maria Ball  
Nuclear-1 EIA Manager



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Jaana-Maria Ball  
Nuclear-1 EIA Manager

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<sup>40</sup> Principle 2(4)(b) NEMA.

<sup>41</sup> NEMA definitions section 1