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PostNet Suite 112 Private Bag X25723 Monumentpark 0105 SOUTH AFRICA
Tel: 27(12) 346 4668 Fax: 086 513 5478 Cell: 082 416 5864
e-mail: Info@infotox.co.za www.infotox.co.za

Project conducted for
SRK Consulting on behalf of Eskom

Human Health Impact Assessment of the Used Fuel Transient Interim Storage Facility at Koeberg Nuclear Power Station

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Compiled by

Willie van Niekerk PhD QEP(USA) PrSci Nat (Environmental Science)
Marlene Fourie PhD MSc PrSci Nat (Toxicological Science)

8 September 2016

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WCA van Niekerk PhD QEP (USA) Pr Sci Nat (Environmental Science)
Managing Director

8 September 2016

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This report was prepared by INFOTOX (Pty) Ltd ("INFOTOX"). Established in 1991, INFOTOX is a professional scientific company, highly focused in the discipline of Health Sciences. Both occupational and environmental human health risks, as well as risks to ecological receptors, are addressed.

Dr Willie van Niekerk, Managing Director of INFOTOX, has BSc, Hons BSc and MSc degrees from the University of Potchefstroom and a PhD from the University of South Africa. He is a Qualified Environmental Professional (QEP), certified by the Institute of Professional Environmental Practice (IPEP) in the USA (No 07960160), and a registered Professional Natural Scientist (PrSci Nat, Environmental Science, No 400284/04). Dr Van Niekerk has specialised in chemical toxicology and human health risk assessment, but he has experience in many other areas in the disciplines of analytical and environmental sciences.

Dr Marlene Fourie has BSc and Hons BSc degrees from the University of Stellenbosch and MSc and PhD degrees from the University of Pretoria. Her field of specialisation is reproductive biology/toxicology. Dr Fourie also has an MSc-degree in epidemiology from the University of Pretoria. Following positions as Medical Natural Scientist at the Andrology Unit, Department of Urology, University of Pretoria and the Pretoria Academic Hospital from 1987 to 2001, she joined INFOTOX as a Medical Biological Scientist. Dr Fourie has conducted many health risk assessments and projects relating to the health status of communities. She is registered as a Professional Natural Scientist (PrSci Nat, Toxicological Science, No 400190/14).

This specialist report was compiled for SRK Consulting on behalf of Eskom. We do hereby declare that we are financially and otherwise independent of Eskom and SRK Consulting.

Signed on behalf of INFOTOX (Pty) Ltd, duly authorised in the capacity of Managing Director:

Willem Christiaan Abraham van Niekerk

8 September 2016

Executive Summary

SRK Consulting ("SRK") on behalf of Eskom requires a Human Health Impact Assessment (HHIA) for the construction of a Transient Interim Storage Facility (TISF) for the temporary storage of dry casks at the Koeberg Nuclear Power Station (KNPS). These casks will store used nuclear fuel from the KNPS reactors, thereby ensuring the continued safe operation of the power station.

This report presents the HHIA, which is informed mainly by the Eskom technical assessment report titled *Radiological Assessment: Used Nuclear Fuel Cask Loading; Transfer to On-Site Storage; and Storage at the Koeberg Transient Interim Storage Facility* (also referred to as the Eskom TISF radiological assessment report). The impacts were assessed and rated according to SRK's standard impact rating methodology, as specified in the *SRK Koeberg TISF Scoping Report* (Report Number 478317/05).

The main health effect of potential concern regarding nuclear power stations is cancer. The sensitivity to cancer of the City of Cape Town and Western Cape population surrounding the KNPS is considered in the baseline health assessment. The baseline health data do not indicate that the population surrounding the KNPS is more vulnerable to cancer than the other Western Cape districts.

The baseline radiation dose of the surrounding population was obtained from the 2016 Eskom Environmental Survey Laboratory (ESL) report and the baseline radiation cancer risk was calculated based on this dose. The resultant baseline cancer morbidity and mortality risks were not significant. Therefore, the current risk associated with the KNPS cannot be viewed as a factor predisposing the surrounding community to sensitivity to cancer.

Although at present a radiation dose applicable to the TISF is not available, it is concluded from information presented in the Eskom TISF radiological assessment report that the potential risk associated with the TISF should be a fraction of that currently associated with the KNPS. It is unlikely that the operation of the TISF should cause a significantly increased cancer risk in relation to the existing risk associated with existing developments and operations at the KNPS. Therefore, a cumulative impact is also unlikely.

Impacts on aspects of health other than cancer are unlikely, since the TISF is not a major addition to the KNPS and major construction activities are not required. Potential impacts on the social interface with health, such as usually considered during the construction and commissioning of a nuclear power station, are thus not expected.

Options for mitigation of the health impact on the public are not evident, since the impact of the TISF is fully dependent on the resulting potential radiation exposure, which is by default required to be As Low As Reasonably Achievable (ALARA). Mandatory radiation control and monitoring measures are already in place in and around the KNPS. Additional measures relevant to the public are not proposed, but it is essential that the current measures are maintained.

The TISF health impact is assessed as of low significance, with a negative impact status and medium confidence in the assessment. Since options for mitigation are not available, the "assuming mitigation" rating is not different from the "without mitigation" rating. According to the prescribed assessment criteria, an impact of low significance should be interpreted as not having any meaningful influence on the decision regarding the construction and operation of the TISF.

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1 Introduction and terms of reference

SRK Consulting ("SRK") on behalf of Eskom requires a Human Health Impact Assessment (HHIA) for the construction of a Transient Interim Storage Facility (TISF) for the temporary storage of dry casks at the Koeberg Nuclear Power Station (KNPS). These casks will store used nuclear fuel from the KNPS reactors, thereby ensuring the continued safe operation of the power station. Eskom published a technical assessment report titled *Radiological Assessment: Used Nuclear Fuel Cask Loading; Transfer to On-Site Storage; and Storage at the Koeberg Transient Interim Storage Facility* (also referred to as the Eskom TISF radiological assessment report), which has informed this HHIA.

The terms of reference for the human health specialist study are described in the *SRK Koeberg TISF Scoping Report* (Report Number 478317/05). These are copied below:

- Compile a baseline assessment based on exposure scenarios prior to development of the TISF.
- Contextualise radiation dose (using data from the Eskom TISF radiological assessment report) in terms of risk for morbidity and mortality using generic numerical factors to convert total radiation dose to cancer risk.
- Identify potential impacts of the project on human health of the communities surrounding the KNPS.
- Assess the impacts of the project on human health in the area using the prescribed impact assessment methodology.
- Identify and assess potential cumulative human health impacts resulting from the proposed development in relation to existing developments at the KNPS.
- Recommend practicable mitigation measures to avoid and/or minimise/reduce impacts and enhance benefits.
- Assess the effectiveness of proposed mitigation measures using the prescribed impact assessment methodology.
- Recommend and draft a monitoring campaign to ensure the correct implementation and adequacy of recommended mitigation and management measures, if applicable.

The terms of reference, the relevant South African impact assessment legislation and international impact assessment guidelines presented in Section 2 informed the approach to the HHIA, which is presented in Section 3.

2 The human health impact assessment paradigm

The international financial industry has long recognised the financial advantages of assessing and managing environmental and social risks of projects. The health impact assessment methods and approaches used in this INFOTOX report are derived from three internationally recognised benchmarks, namely:

- International Association for Impact Assessment (IAIA) Health Impact Assessment: International Best Practice Principles (Quigley et al. 2006)
- International Finance Corporation Performance Standards on Environmental and Social Sustainability (IFC 2012)
- The Equator Principles: a financial industry benchmark for determining, assessing and managing environmental and social risk in projects (EPFI 2013)

IAIA has adapted their description of health impact assessment (HIA) from the World Health Organization (WHO 1999): *"(HIA) may be defined as a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, programme or project on the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects*" (Quigley et al. 2006).

Applying the above guidelines and principles, the Koeberg TISF HHIA should identify how the development of the TISF induces unintended changes in determinants of health in the surrounding sensitive receptor communities in the study area (Figure 4.1). The HHIA should describe the resulting changes in health outcomes and ideally should provide a basis for proactive measures to address and mitigate any risks associated with health hazards.

3 The HHIA approach

A rapid appraisal format was chosen for the Koeberg TISF HHIA, which would avoid the need for complex, time-consuming and expensive complete community surveys. The Koeberg TISF HHIA is on the level of a limited in-country HIA, according to the Good Practice guidance of the International Finance Corporation (IFC), a member of the World Bank Group (IFC 2009). The IFC differentiates between two types of HIAs, namely a comprehensive and a rapid appraisal HIA. The comprehensive HIA is recommended when the project is likely to attract or involve a significant influx of people, for example a large construction work force. Other factors in favour of a comprehensive HIA include resettlement or relocation of local inhabitants or communities, significant construction activity, or the assessment of a large project in a rural setting. The development of the Koeberg TISF does not involve relocation of people and does not have a strong emphasis on any of these factors. Therefore, a rapid appraisal is considered appropriate and has been performed.

The required baseline assessment of exposure scenarios prior to development of the TISF is informed by the 2016 Eskom Environmental Survey Laboratory (ESL) report (Eskom 2016a). The assessment is presented in Section 5, with the radiation dose contextualised in terms of cancer risk.

The potential sensitivity of the community surrounding the Koeberg TISF HHIA is assessed with baseline health data obtained from desktop literature searches, which are presented and interpreted in Section 5.2. The surrounding communities are identified in the description of the study area (Section 4).

The projected radiation dose resulting from the TISF, obtained from the Eskom TISF radiological assessment report (Eskom 2016b) is used to calculate the potential cancer risk associated with the development of the TISF, which is contextualised in terms of current baseline cancer risks. The potential cumulative risks associated with the baseline, the development of the TISF, and other current developments and operations at the KNPS, are presented in Sections 5.4 and 5.6.

The potential cumulative impacts are discussed in Section 6 and assessed in Section 8, using the impact assessment methodology prescribed in the Scoping Report (SRK 2016). Practicable mitigation measures are considered in Section 7. Recommendations for a monitoring campaign to ensure the correct implementation and adequacy of recommended mitigation and management measures, where applicable, are included in Section 7.

4 The study area

The study area is shown in Figure 4.1 and the following concise description is obtained from the *SRK Koeberg TISF Scoping Report* (Report Number 478317/05) (SRK 2016). The KNPS is situated in the Blaauwberg Planning District and Subcouncil 1 of the City of Cape Town. The geographical boundaries of these two entities in the City of Cape Town are almost identical. Development around the KNPS is restricted in a 5 km Precautionary Action Planning Zone (PAZ) and 16 km Urgent Protective Action Planning Zone (UPZ) delineated around the KNPS; therefore, the population density around the KNPS is low.

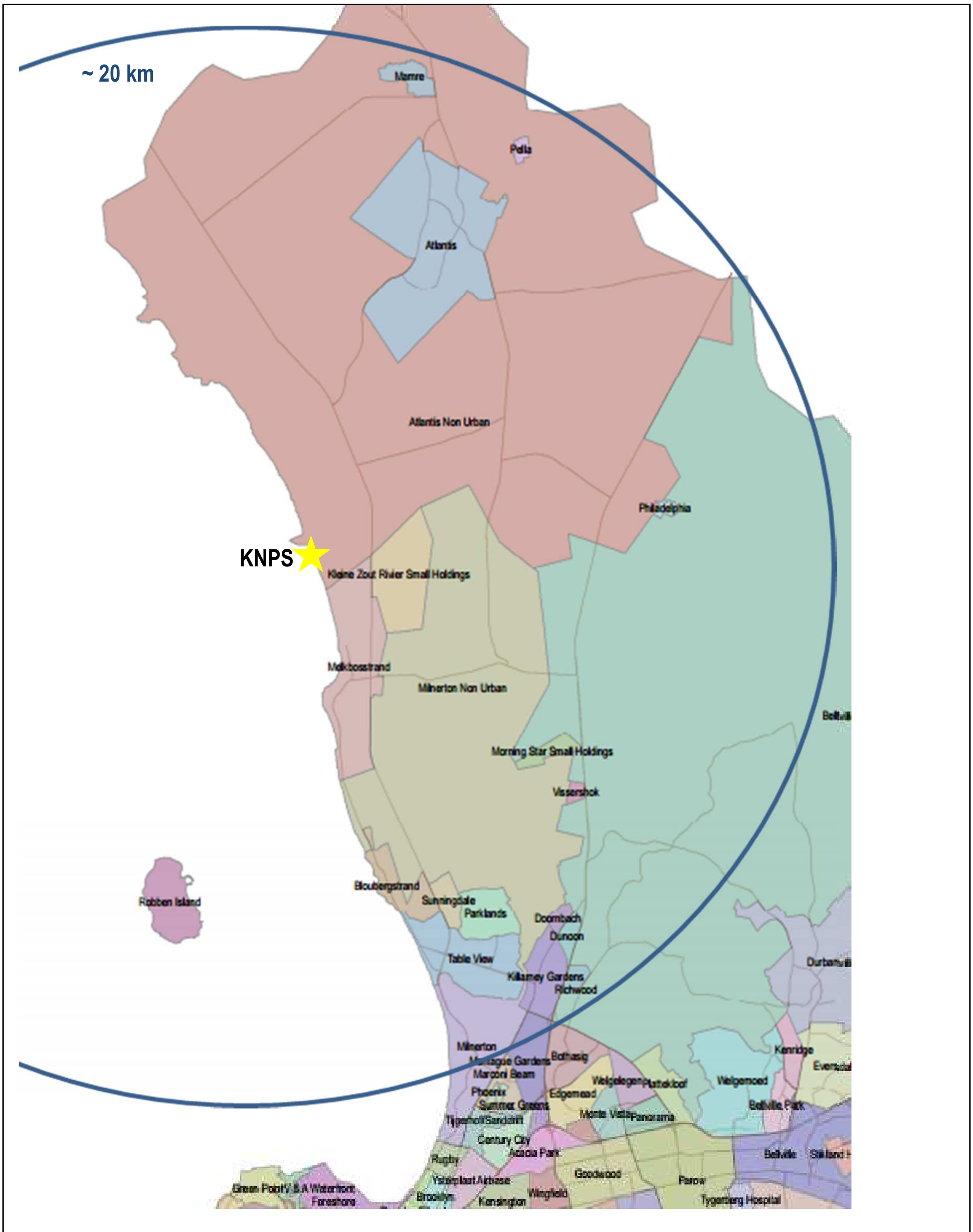
The study area for the socio-economic impact assessment has been taken as within a 20 km radius of the KNPS. According to the Radiological Assessment Report (Eskom 2016b), the TISF must meet the requirements of 10 CFR[1] 72 and the dose constraints prescribed by the National Nuclear Regulator (NNR) in RD-0022, which is based on "*the annual dose equivalent to any real individual located beyond the owner-controlled area boundary*". This boundary is "*an area outside of a restricted area, but inside the site boundary, to which the licensee can limit access for any reason*" (Eskom 2016b). Since the owner-controlled boundary is inside the site boundary, which is within the 20-km radius, this radius also delineates the study area for the health impact assessment.

Key residential areas (suburbs) within the study area include (see Figure 4.1):

- Within 5 km of the KNPS: Melkbosstrand, Kleine Zout River Small Holdings and portions of the Atlantis and Milnerton non-urban areas
- Within 5 – 10 km of the KNPS: Portions of the Atlantis and Milnerton non-urban areas
- Within 10 – 15 km of the KNPS: Morning Star Small Holdings, Sunningdale, Atlantis and Philadelphia
- Within 15 – 20 km of the KNPS: Parklands, Vissershok, Bloubergstrand, Table View, Doornbach, Du Noon, Mamre and Milnerton

[1] US Code of Federal Regulations.

The "suburb" of Killarney Gardens, although indicated in Figure 4.1, is a wholly industrial area with no residential population.



srk consulting	**KOEBERG TISF EIA** SUBURBS IN THE STUDY AREA	Project No. 478317

Figure 4.1: Suburbs in the study area (within 20 km arc) (SRK 2016).

5 Risk assessment

5.1 Health effects of low levels of ionizing radiation

In Great Britain, a review of pregnancy outcomes following preconceptional exposure to radiation by the Committee on Medical Aspects of Radiation in the Environment (COMARE) was published in 2004. The review confirmed that the available epidemiological data did not indicate a link between congenital abnormalities as a whole and parental exposure to radiation. The other pregnancy outcomes studied, namely miscarriage or spontaneous abortion, neonatal death, congenital abnormalities as a whole, and the ratio of baby boys to girls, did not appear to be significantly associated with parental radiation exposure before conception (COMARE 2004). This finding is confirmed in the most recent report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR 2013). However, although these epidemiological studies have failed to demonstrate a link, experimental studies on plants and animals have demonstrated that radiation can induce hereditary effects and humans are unlikely to be an exception (UNSCEAR 2013). Therefore, the hazard of hereditary effects is recognised, although the potential risk cannot currently be quantified.

Prenatal (in utero) exposure to ionizing radiation is a known risk factor for childhood cancers. UNSCEAR (2013) cites a statistically significant increased risk among children of leukaemia and all solid cancers of about 40 per cent relative to the baseline. Regarding exposure in childhood, the risk of cancer associated with a given radiation dose is higher in children compared with adults. The latency period is variable, with the result that radiation exposure at a young age may induce a cancer within a few years, or the cancer may present decades later (UNSCEAR 2013).

Circulatory diseases present the only significant group of non-cancer somatic effects. Although a matter of much debate, it was concluded that a dose of 0.5 gray (Gy)[2] represented a threshold for developing circulatory diseases more than 10 years after exposure (UNSCEAR 2013).

Cancer is the major concern for the long term effects of radiation exposure. A 2001 review of the cancer risks associated with radiation exposure indicated that leukaemia and cancers of the lung and female breasts are associated with the highest risk per radiation dose (Harley 2001). Cancer of the bone, thyroid and skin were reported at lower risk levels. More recent reviews focussed on the effects of protracted exposure to low levels of ionising radiation and indicated the risk of leukaemia (Brenner et al. 2003). Most recently, an international study of occupational exposure to low levels of ionising radiation confirmed the risk of leukaemia, but also of solid cancers; that is, cancers of the organs and soft tissues of the body (Richardson et al. 2015).

5.2 Baseline health data

The main health effect of concern is clearly cancer. The sensitivity of the surrounding City of Cape Town and Western Cape population to cancer is assessed in this section.

Stefan et al. (2015) sourced data from the South African Children's Tumour Registry (SACTR) and determined the age-standardised average annual incidence rate (ASR) of cancer in the age range 0 to 14 years, expressed as an average annual number of cases per million person years. The SACTR is populated with data reported by the paediatric oncology units of

[2] The amount of energy (absorbed dose) deposited in human tissue, measured in the unit gray (Gy).

secondary public hospitals in South Africa. The ASRs were highest in the Western Cape (88.4 annual cases per million person years) and in Gauteng (81.0 annual cases per million person years). The authors suggested that the lower incidence rates in other provinces were likely due to under-diagnosing, misdiagnosing and under-reporting, amongst other reasons. Other possible explanations raised by the authors were lower registration rates in black African children, who present a smaller proportion in the Western Cape population compared to other provinces, and higher incidence rates among white children, who are proportionally more in the Western Cape. Therefore, it cannot be concluded from the higher ASR that the Western Cape is more vulnerable to childhood cancer than other regions in South Africa.

Two publications were found which described the cancer incidence in various regions of the Western Cape; namely, the Western Cape Mortality Profile 2011 (Groenewald et al. 2011) and the South African Health Review 2016 (Gray and Vawda 2016). Gray and Vawda (2016) considered the years of life lost (YLL) due to cancer in the province, differentiated in 6 districts comprising the province. The YLL in 5 of these districts was similar and the KNPS is situated in one of these districts, namely, the West Coast district. Therefore, the YLL around the KNPS is not significantly different from surrounding districts in the Western Cape. Groenewald et al. (2011) analysed the Western Cape cancer data in terms of the mortality rate, showing that the mortality rate in the West Coast district was not higher compared to other districts, or to the rate in the Western Cape. These publications presented cancer data in maps and graphs, without detailed numbers; therefore, data are not reproduced in this report. The maps and graphs are presented in Annexure A. In conclusion, the baseline health data do not indicate reasons to believe that the population surrounding the KNPS is more vulnerable to cancer than the other Western Cape districts.

5.3 Baseline radiation dose

Eskom currently follows a program of environmental monitoring of radionuclide concentrations occurring in various environmental media in the vicinity of the KNPS. Annual reports on the environmental measurements are submitted to the National Nuclear Regulator (NNR) by the KNPS Environmental Survey Laboratory (ESL). The ESL report includes a calculation of the committed effective radiation dose[3] experienced by members of the public in the vicinity of the KNPS, based on the results of environmental monitoring. The committed effective radiation dose reported for 2015 is 1.788E-06 Sievert (Sv)[4], or 1.79 µSv (Eskom 2016a).

5.4 Baseline cancer risk

The most recent nominal cancer risk coefficients proposed by the International Commission on Radiological Protection (ICRP) are presented in ICRP publication 103, referred to as ICRP 103 (ICRP 2007). These coefficients are used to estimate the baseline cancer risk as required in the terms of reference for the HHIA, that is, the risk based on exposure scenarios prior to development of the TISF. The terms of reference requires contextualisation of the radiation dose in terms of risk for morbidity and mortality using generic numerical factors to convert total

[3] The committed effective dose is the sum of the products of the committed organ or tissue equivalent doses and the appropriate tissue weighting factors, considering a specific integration time in years following the intake. The integration time is 50 years for adults and to age 70 years for children.

[4] Sievert is the unit of radiation absorption in the International System of Units (SI). 1 Sv is the amount of radiation roughly equivalent in biological effectiveness to one gray.

radiation dose to cancer risk. The nominal risk coefficient for fatal cancer (resulting in mortality) is 414 cases per 10 000 persons per Sv, or 0.041 Sv^{-1}. The risk coefficient for non-fatal cancer (not resulting in mortality) is 0.13 Sv^{-1}. The coefficient for total cases is 0.17 Sv^{-1}, which is the morbidity, or the total number of cases regardless of whether or not a fatality follows.

The cancer risk for each cancer parameter, that is, fatal, non-fatal or total, is calculated with Equation 5.4.1:

$R = E(\tau) \times nrc$ Equation 5.4.1

Where:

R	Cancer risk (unitless)
E(τ)	Committed effective dose in Sv
nrc	Nominal risk coefficient in Sv^{-1}

The calculations and the results thereof are illustrated in Table 5.4.1. The interpretation and discussion of the results are presented in Section 6.

Table 5.4.1: Baseline cancer risks.

Parameter	Value	Units	Reference
Committed effective KNPS radiation dose in 2015	1.788E-06	Sv	Eskom (2016a)
Nominal risk coefficient - total cancer (morbidity)	0.17	Sv^{-1}	ICRP (2007)
Morbidity cancer risk associated with KNPS radiation dose	3.04E-07	unitless	Calculated by INFOTOX
Nominal risk coefficient – non-fatal cancer	0.13	Sv^{-1}	ICRP (2007)
Non-fatal cancer risk associated with KNPS radiation dose	2.32E-07	unitless	Calculated by INFOTOX
Nominal risk coefficient - fatal cancer (resulting in mortality)	0.041	Sv^{-1}	ICRP (2007)
Cancer mortality risk associated with KNPS radiation dose	7.33E-08	unitless	Calculated by INFOTOX

5.5 TISF-associated radiation dose

The Eskom TISF radiological assessment report (Eskom 2016b) evaluates the radiological consequences of the operation of a TISF at KNPS in terms of the collective radiation exposure to the nearest public individuals. The assessment states that Requirements Document RD-0022 of the South African National Nuclear Regulator (NNR 2004) prescribes an individual dose limit of 0.25 mSv per annum for the average representative of the critical group applicable to KNPS. According to the assessment, this limit applies to "*any real public individual at or beyond the controlled area boundary*".

The approach to ensure compliance to this requirement was not to estimate the TISF-associated radiation dose at the controlled area boundary, but to determine the distance from the TISF at which an exclusion security fence should be placed in order to ensure that the prescribed dose is not exceeded. According to the assessment, this distance is 400 m from the TISF, which is within the owner controlled area at KNPS. A large margin of safety is implied, as it is stated that the owner controlled area extends to approximately 1 500 m from the TISF, at the closest point, depending on which of the two identified sites are chosen for the construction of the TISF. Furthermore, if the contributions from both the TISF and the KNPS are considered, the dose to a hypothetical individual standing on the Eskom owner controlled area boundary at 1 500 m for 2 000 hours (83.3 days) per year would be below the regulatory limit of 0.25 mSv per year (Eskom 2016b). This corresponds with a dose rate of less than 0.0005 mSv/h at the exclusion security fence to ensure compliance with RD-0022 for public exposure. It is derived from the annual limit of 1 mSv for public exposure divided by 2000 hours. Therefore, in essence, the TISF does not contribute radiation to such a degree that the regulatory limit would be exceeded and Eskom demonstrates continued adherence to RD-0022, without determining the specific dose rate. Eskom states that the specific dose rate is required for the licensing of the TISF, but will be calculated in the NNR licensing phase of the project and not at present. A detailed radiological survey and assessment is planned once the TISF is constructed, in order to verify that the dose rates meet the prescribed criteria (Eskom 2016b). The current assessment has been conducted on very conservative assumptions and it is likely that the confirmatory study will indicate even lower health risks.

5.6 TISF-associated cancer risk

Although the approach followed by Eskom demonstrates preliminary compliance with regulations, it does not allow quantification of the cancer risk associated with the operation of the TISF, since an applicable radiation dose is not available at this stage. However, considering the large margin of safety implied by the difference in the distances from the TISF of the exclusion security fence (400 m) based on ensuring compliance for the TISF, and the owner controlled boundary (at least 1 500 m) from the TISF, a significant additional risk due to the TISF is unlikely. Furthermore, based on the margin of safety, the TISF-associated cancer risk should be only a fraction of the current risk estimated for the KNPS. The estimated current risk of cancer morbidity is 3.04E-07 (approximately 3 cases in a population of ten million) and the risk of mortality is less, namely, 7.33E-08 (approximately 7 cases in a population of 100 million) (Table 5.4.1). Therefore, the potential risk associated with the TISF should be a fraction of each of these numbers. The resultant risk cannot be viewed as significant and cannot be seen as a reason for concern. It is unlikely that the planned operation of the TISF will result in a discernible increase in cancer incidence in the population surrounding the KNPS.

6 Impact assessment

The main health impact of concern regarding exposure to low levels of ionising radiation, as expected around a nuclear power station, is cancer (Section 5.1). The KNPS is situated in the West Coast district of the Western Cape. The baseline health status of the population in this district, with regard to cancer, is in agreement with the Western Cape population at large. Therefore, the population surrounding the KNPS is apparently not more vulnerable to cancer than the other Western Cape districts (Section 5.2) and thus not more sensitive to the health effects of low levels of ionising radiation potentially emitted from the TISF.

The current estimated cancer risk associated with current levels of radiation from the KNPS is so low as not to result in a discernible effect in the surrounding population (Section 5.4). Therefore, the current risk associated with the KNPS cannot be viewed as a factor predisposing the surrounding community to sensitivity to cancer.

Although at present a radiation dose applicable to the TISF is not available, it is concluded from information presented in the Eskom radiological assessment report (Eskom 2016b) that the potential risk associated with the TISF should be a fraction of that currently associated with the KNPS (Section 5.6). Regarding potential cumulative human health impacts resulting from the proposed TISF in relation to existing developments and operations at the KNPS, it is unlikely that the cancer risk would be significantly increased in relation to the existing risk, and a cumulative impact is also unlikely.

Based on the above information, it is concluded that the potential impact of the operation of the TISF on human health in the surrounding communities is negligible with regard to the risk of cancer. Impacts on other aspects of health are unlikely, since the operation is not a major addition to the KNPS, which is an existing operational nuclear power station. Potential impacts on the social interface with health, such as usually considered during the construction and commissioning of a nuclear power station, are thus not expected.

The impact rating according to SRK's standard impact rating methodology (SRK 2016) is presented in Table 6.1 below.

Table 6.1: Impact rating for the operation of the TISF at Koeberg.

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Regional 2	Low 1	Long-term 3	**Medium** 6	Improbable	**LOW**	**– ve**	Medium
Essential mitigation measures: • No mitigation possible								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium** 6	Improbable	**LOW**	**– ve**	Medium

7 Mitigation and recommendations

The scope of reference (Section 1) requires the recommendation of practicable mitigation measures to eliminate or minimise negative impacts, enhance benefits and assist project design. If appropriate, specialists must differentiate between:

- Essential: measures that must be implemented and are non-negotiable; or
- Best Practice: recommended to comply with best practice, which reduces impacts, but do not affect the impact rating.

Options for mitigation of the health impact on the public are not evident, since the impact of the TISF on the health of the public is assessed as fully dependent on the potential radiation exposure resulting from the TISF, which is required to be As Low As Reasonably Achievable (ALARA) (SRK 2016). Considering the health status of the surrounding communities, it is clear from the baseline health data presented in Section 5.2 that the communities are not more sensitive to the development of cancer than other Western Cape communities. Public health communications by various government and regional departments and non-governmental organisations regarding the prevention of cancer through lifestyle choices and appropriate medical screening are already in place. Therefore, additional communication strategies are not proposed.

Mandatory radiation control and monitoring measures are already in place in and around the KNPS; therefore, additional radiation control and monitoring measures are not proposed. However, it is essential that such current measures are maintained. Current ongoing environmental radiation monitoring, dose assessment and reporting conducted by the KNPS ESL are mandatory in order to satisfy the requirements of the NNR and will continue in future. The ESL programme will automatically encompass the monitoring and assessment of any potential radiation exposure to the public that might result from the TISF. Therefore, recommendations for additional monitoring are not made and a monitoring campaign as required by the terms of reference for the health study is not applicable.

A quantified radiation dose specific to the TISF is currently not available; therefore, it is not currently possible to quantify the risk associated with the TISF. The Eskom radiological assessment report (Eskom 2016b) states that the specific dose rate will be calculated in the NNR licensing phase of the project and not at present. INFOTOX recommends that the qualitative TISF health risk assessment presented in this report should be augmented with a quantitative assessment when the specific dose rate calculated by Eskom is available.

8 Conclusions

- The main health effect of potential concern regarding nuclear power stations is cancer. An elevated cancer incidence in a population might be an indication of increased sensitivity to cancer and this is considered in the assessment of the baseline health status of the population around the KNPS. The baseline health data do not indicate reasons to believe that the population surrounding the KNPS is more vulnerable to cancer than the other Western Cape districts.

- The baseline radiation dose of the surrounding population was obtained from the 2016 KNPS ESL report and the baseline radiation cancer risk was calculated based on this dose. The resultant baseline cancer morbidity and mortality risks were not significant. Therefore, the current risk associated with the KNPS cannot be viewed as a factor predisposing the surrounding community to sensitivity to cancer.

- Although at present a radiation dose applicable to the TISF is not available, it is concluded from information presented in the Eskom TISF radiological assessment report that the potential risk associated with the TISF should be a fraction of that currently associated with the KNPS. It is unlikely that the operation of the TISF should cause a significantly increased cancer risk in relation to the existing risk. Regarding potential cumulative health impacts resulting from the proposed TISF in relation to existing developments and operations at the KNPS, a cumulative impact is also unlikely.

- Impacts on aspects of health other than cancer are unlikely, since the TISF is not a major addition to the KNPS, which is an existing operational nuclear power station. Potential impacts on the social interface with health, such as usually considered during the construction and commissioning of a nuclear power station, are thus not expected.

- Options for mitigation of the health impact on the public are not evident, since the impact of the TISF is fully dependent on the potential radiation exposure resulting from the TISF, which is by default required to be As Low As Reasonably Achievable (ALARA). Mandatory radiation control and monitoring measures are already in place in and around the KNPS;

therefore, additional radiation control and monitoring measures relevant to the public are not proposed. However, it is essential that the current measures are maintained.

- A quantified radiation dose specific to the TISF is currently not available and is required to be calculated in the NNR licensing phase of the project. The current assessment has been conducted on very conservative assumptions and it is likely that the confirmatory study will indicate even lower health risks.

- The TISF health impact is assessed as of low significance, with a negative impact status and medium confidence in the assessment. Since options for mitigation are not available, the “assuming mitigation” rating is not different from the “without mitigation” rating. Since the human health impact is rated as of low significance, the prescribed interpretation criteria indicates the human health impact as not having any meaningful influence on the decision regarding the construction and operation of the TISF.

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Annexure A

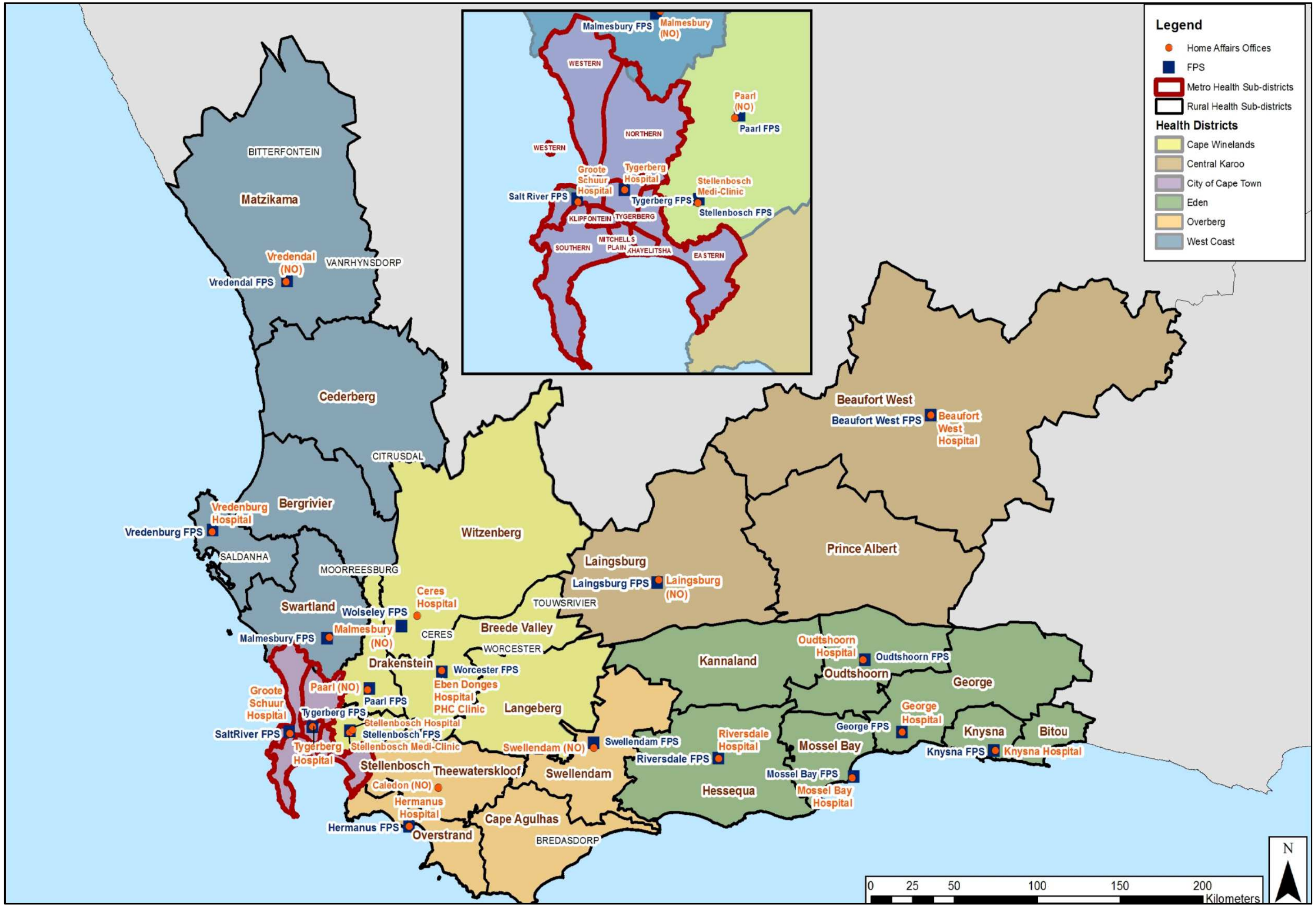

Figure A.1: **Western Cape health districts and sub-districts (Gray and Vawda 2016).**

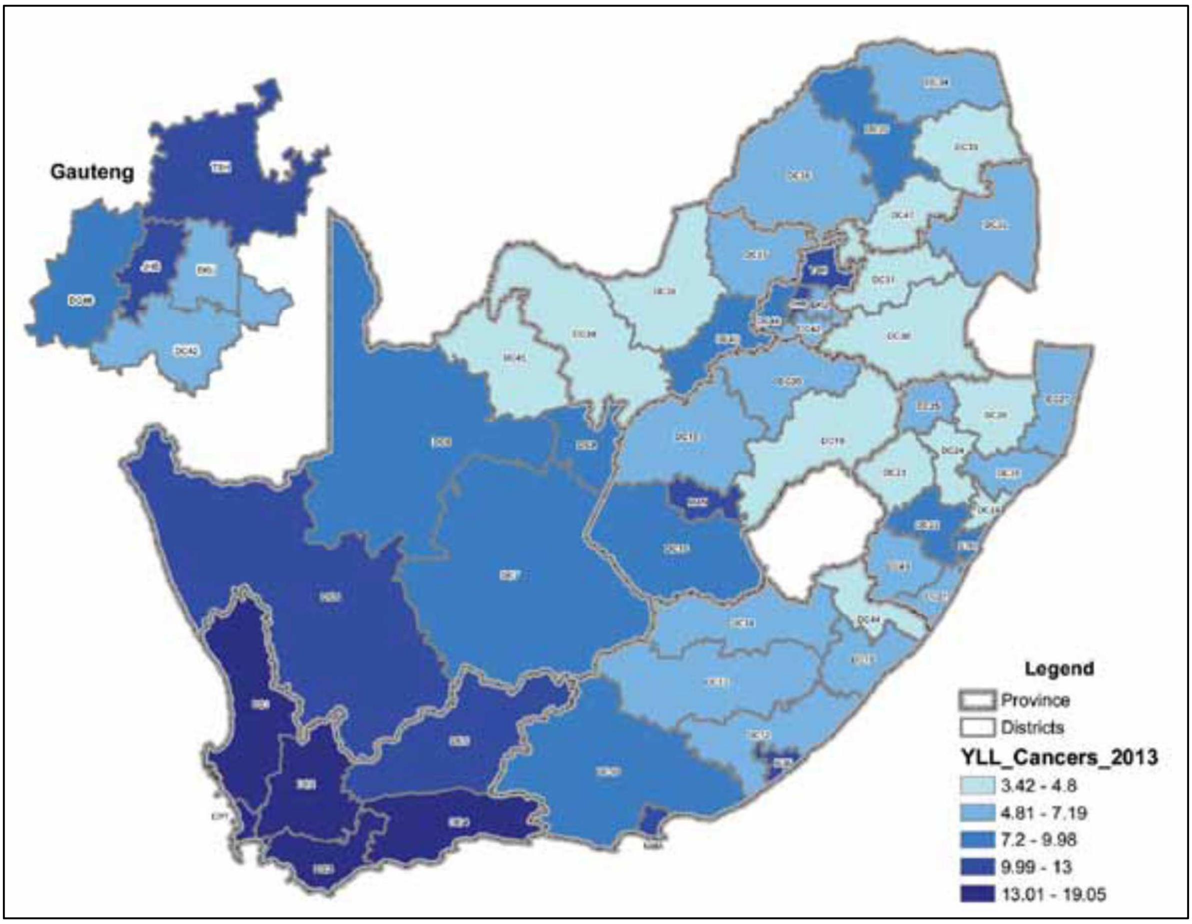

Figure A.2: Percentage of YLLs due to cancers by district, 2013 (Gray and Vawda 2016).

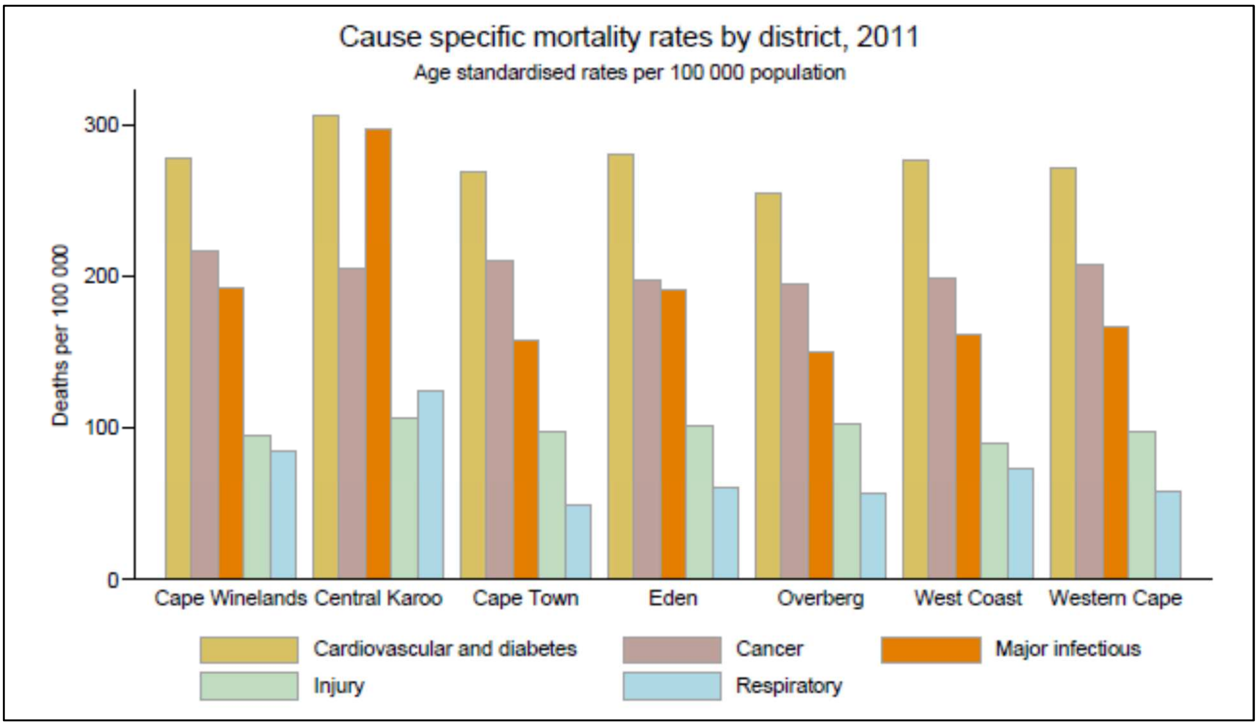

Figure A.3: **Major disease mortality rates by district, Western Cape 2011 (Gray and Vawda 2016).**

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

EIA for the Proposed Used Nuclear Fuel Transient Interim Storage Facility at Koeberg Nuclear Power Station

Specialist:	INFOTOX Pty Ltd		
Contact person:	WCA VAN NIEKERK		
Postal address:	Postnet suite 112 Privatebag x25723 Monumentpark		
Postal code:	0105	Cell:	0824165864
Telephone:	0123464668	Fax:	0865135478
E-mail:	info@infotox.co.za		
Professional affiliation(s) (if any)	SACNASP		

Project Consultant:	SRK Consulting (South Africa) (Pty) Ltd		
Contact person:	Sharon Jones		
Postal address:	Postnet Suite #206, Private Bag X18, Rondebosch		
Postal code:	7701	Cell:	082 876 0638
Telephone:	021 659 3060	Fax:	021 685 7105
E-mail:	sjones@srk.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, WCA van Niekerk, declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

INFOTOX Pty Ltd.
Name of company (if applicable):

16 MAY 2016.
Date: