HIGH-LEVEL SAFETY, HEALTH AND ENVIRONMENT RISK ASSESSMENT
- SPECIALIST SCOPING REPORT INPUTS:

Scoping and Environmental Impact Assessment (EIA) Processes for the Proposed Development of the Dalmuntha Wind Energy Facility and Dalmuntha West Wind Energy Facility and associated infrastructure, near Belfast, Mpumalanga Province

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List of Abbreviations

S&EIA	Scoping and Environmental Impact Assessment
BA	Basic Assessment
BESS	Battery Energy Storage System
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
EMPR	Environmental Management Program
GPS	Geographic Positioning System
MW	Mega Watt
PV	Photo Voltaic
RA	Risk Assessment
SHE	Safety Health and Environment

This report serves as the High-Level Safety and Health Risk Assessment for the Battery Energy Storage Facilities Scoping Report input that was prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) for the proposed development of the Dalmuntha Wind Energy Facilities with associated infrastructure, near Belfast, Mpumalanga Province.

Figure 1 Map showing the location of the proposed ENERTRAG Dalmuntha Wind Energy Complex

1. Introduction

1.1. Scope, Purpose and Objectives of this Specialist Input to the Scoping Report

To provide a high-level safety and health risk assessment of the battery energy storage systems (BESS).

1.2. Details of Specialist

This specialist assessment has been undertaken by Debra Mitchell of ISHECONcc. Debra Mitchell is a registered Professional Engineer and with the Engineering Council of Southern Africa (ECSA), with Registration Number 72291 in the field of Chemical Engineering. A curriculum vitae is included in Appendix A of this specialist input report.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist input report.

1.3. Terms of Reference

The Terms of Reference for the desktop assessment that will be completed during the EIA Phase of the project include:

- A description of the region and local features.
- A study of the battery technologies to be used.
- Identification of sensitive receptors in the area.
- Assessing (identifying and rating) the potential impacts on the health and safety of employees, contractors and public persons.
- Identification of relevant legislation and legal requirements; and
- Providing recommendations on possible preventative and mitigation measures for inclusion in the Environmental Management Program (EMPR).

The BESS Risk Assessment will serve as a technical report, and Appendix 6 (Specialist Study Requirements) of the EIA Regulations will thus not be applicable.

2. Approach and Methodology

The following approach will be used:

The Project Developer will provide technical information, EIA information for the wind energy facilities and the proposed BESS, GPS coordinates to locate the site on Google maps etc.

The Health and Safety specialist will do the following:

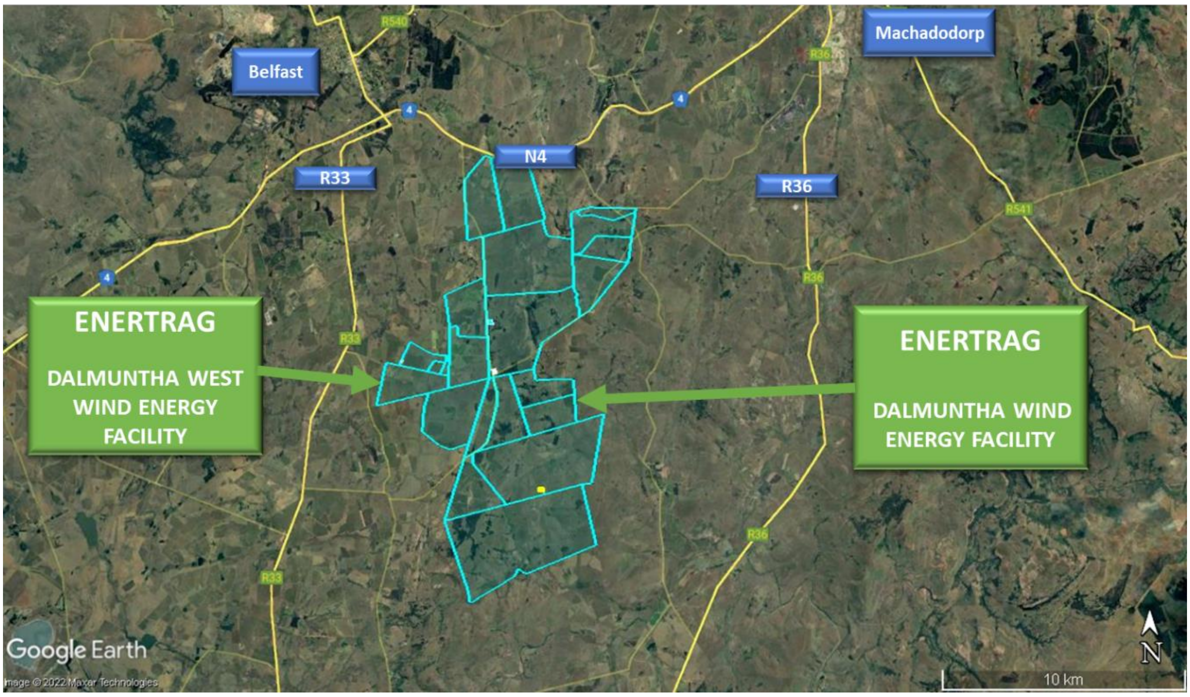
- Gather all relevant Safety Health and Environmental (SHE) information e.g.
  - ~ locations, surroundings, topography, types of activities surrounding the sites, vulnerable receptors (this will be based on Google Earth and information provided from other specialist reports).
  - ~ material listings (details of the types of batteries – only lithium-ion or vanadium redox flow batteries will be considered), inventories (battery sizes and numbers), design drawings (possible layouts), process conditions (the client will be expected to provide this design information).
  - ~ maps, weather data; and
  - ~ key operating instructions and emergency procedures (if available from the client).
- Using the checklist in section 2.1 below and a guideline, identify potential SHE hazardous events associated with the installation, during construction, operation and eventual decommissioning phases.
- Using a suitable risk assessment matrix (see section 2.1 below) dimension each of the hazardous events in terms of potential consequences and likelihood.
- From this determine the raw risk and determine which items may need further attention.
- Suggest risk reduction measures- (mitigation) that should typically be applied, e.g. National Standards, best practices, and monitoring requirements. Preventative measures will be to reduce the likelihood and mitigative measures to reduce the consequences. These measures should be incorporated into the EMPR.
- Calculate, and document, the residual risks.

- Determine if any of the risks require further non-standard risk reduction measures, e.g. suggested separation distances from vulnerable receptors.
- For the proposed installations compile all the information, analysis, assessments and conclusions as detailed above into a technical risk assessment report.
- Provide electronic responses and report updates for relevant issues raised.

2.1. Information Sources

Study of the area to determine sensitive receptors will be based on satellite images available on Google earth. The satellite images below show the area of study.

Figure 2 Satellite Image of the area showing the general area of the proposed facilities



The following list of generic SHE issues will be considered for each phase of the project:

TABLE 1 – SHE Checklist

NO	RISKS
	HEALTH RISKS
H1	Chronic Chemical or Biological Toxic Exposure
H2	Noise
H3	Environmental
H4	Psychological
H5	Ergonomics
	SAFETY RISKS
S1	Fire
S2	Explosion
S3	Acute Chemical or Biological Toxic Exposure
S4	Acute physical Impact or violent release of energy
S5	Generation impact
	ENVIRONMENTAL RISKS
E1	Emissions
E2	Pollution
E3	Waste of resources
	GENERAL RISKS
G1	Aesthetics
G2	Financial
G3	Security
G4	Emergencies
G5	Legal compliance

The following Risk Matrix will be used:

TABLE 2 – RISK MATRIX

a) The magnitude of impact on ecological processes, quantified on a scale from 0-5, where a score is assigned.

SCORE	DESCRIPTION
0	small and will have no effect on the environment.
1	minor and will not result in an impact on processes.
2	low and will cause a slight impact on processes.
3	moderate and will result in processes continuing but in a modified way.
4	high (processes are altered to the extent that they temporarily cease).
5	very high and results in complete destruction of patterns and permanent cessation of processes.

b) The physical extent.

SCORE	DESCRIPTION
1	the impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international;

c) The duration, wherein it is indicated whether the lifetime of the impact will be:

SCORE	DESCRIPTION
1	of a very short duration (0 to 1 years)
2	of a short duration (2 to 5 years)
3	medium term (5–15 years)
4	long term (> 15 years)
5	permanent

d) Reversibility: An impact is either reversible or irreversible. How long before impacts on receptors cease to be evident.

SCORE	DESCRIPTION
1	The impact is immediately reversible.
3	The impact is reversible within 2 years after the cause or stress is removed; or
5	The activity will lead to an impact that is in all practical terms permanent.

e) The probability of occurrence, which describes the likelihood of the impact actually occurring.

SCORE	DESCRIPTION
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

The final assessment of the risk, i.e., the significance, of a particular impact is determined through combination of the characteristics described above (refer formula below)

Risk	=	Consequence	x	Likelihood
Significance	=	(Extent + Duration + Reversibility + Magnitude)	x	Probability

The risk (significance) can then be assessed as low, medium or high as follows:

OVERALL SCORE	SIGNIFICANCE RATING (NEGATIVE)	SIGNIFICANCE RATING (POSITIVE)	DESCRIPTION
< 30 points	Low	Low	where this impact would not have a direct influence on the decision to develop in the area
31 - 60 points	Moderate	Moderate	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	High	High	where the impact must have an influence on the decision process to develop in the area

2.2. Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations apply:

- No detailed site visit will be undertaken, although a general visit to the area will be undertaken. The level of detail required for assessment of SHE impacts of the BESS SHE RA does not necessitate a detailed inspection of the exact area.
- Only lithium-ion or vanadium redox flow type batteries will be considered.
- As they have been more widely used there is more information readily available in the literature on lithium type batteries as opposed to vanadium redox flow batteries.
- Lithium BESS facilities are assumed to be containerized.
- The Vanadium redox batteries may be containerized (in which case the issues will be similar to lithium containers), but the more significant case is if the battery is installed a one large, centralized utility scale facility.

3. Description of Project Aspects relevant to BESS SHE RA

The following aspects are relevant to the High-Level BESS safety, health and environmental assessment:

- Lithium-ion BESS:
    - the proximity to occupied residences,
    - the layout prevents domino effects of fires/explosions between facilities,
    - suitable emergency response during all phases of the project,
    - suitable end of life plan to be in place.
- Vanadium redox flow BESS:
    - proximity to water courses,
    - suitable secondary spill containment for large tanks of electrolyte.
    - suitable emergency response during all phases of the project,
    - suitable end of life plan to be in place.

4. Baseline Environmental Description

Within the Dalmuntha Wind Energies development ENERTRAG propose one 100MW/400MWh BESS with up to four hours of storage at Dalmuntha West WEF and another similar sized facility at the Dalmuntha WEF, i.e. two BESS installations.

There is currently only one preferred location for the Dalmuntha West WEF BESS while there are three possible locations for the Dalmuntha WEF BESS, i.e. north, central or south.

5. Issues, Risks and Impacts

The following issues are of consideration:

- Lithium-ion BESS:
    - noxious smoke,
    - fires/explosions.

- Vanadium redox flow BESS:
    - suitable secondary spill containment for the large volume of electrolyte.

- General:
    - extremely isolated arid area – no commercial locations of interest.
    - location of isolated farmsteads and watering holes.

Ideally, due to the possibility of noxious smoke from fires, lithium BESS should be located over 500m from residential areas, in this case isolated farmhouses. If this is not possible, it is noted that the risks are low and advice of mitigative measures should be provided to the farm occupants, e.g. shelter in place indoors.

The dominant wind directions in the area are likely to be from the north, but this would need to be confirmed. Any noxious smoke would likely blow from the proposed BESS installations towards and farming developments on the southern side.

Figure 3 – Some Wind Rose Information for the broader area

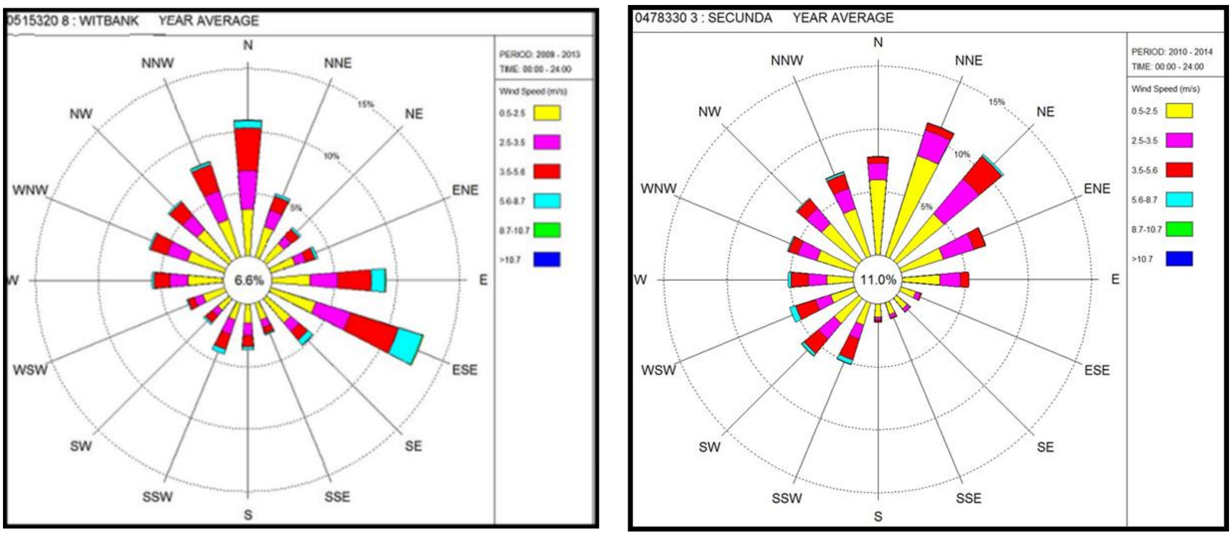
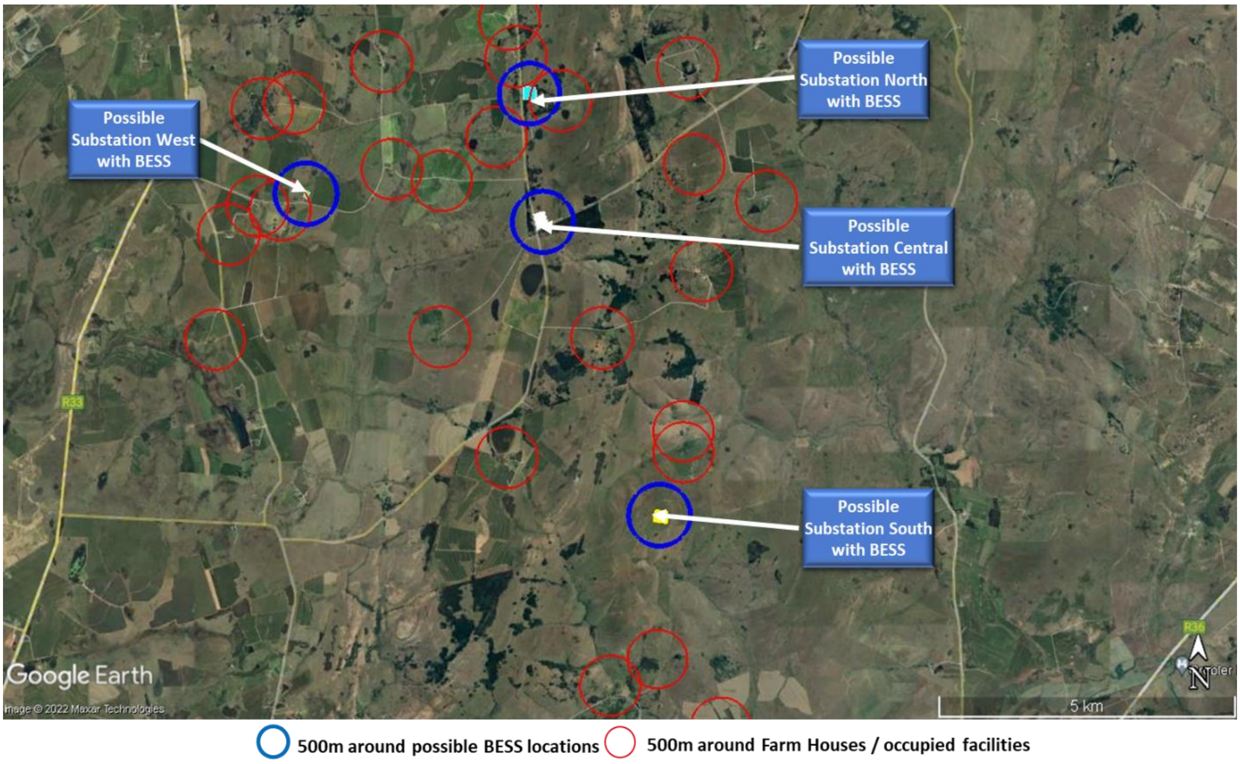


Figure 4 below shows the location of the various BESS installation with a 500m blue circle around the BESS. It also shows the location of near-by farmhouses / occupied facilities with a 500m red circle around each.

Figure 4 - Satellite Image of the area showing the location of farmsteads / buildings (red circles) in relation to the proposed Dalmuntha BESS infrastructure (blue circles)



Health and Safety - Dalmuntha WEF

There are three options for the location of the BESS facilities at Dalmuntha WEF, i.e. north, central and south. From Figure 4 it is clear that there are numerous farmstead facilities in proximity to the northern location. This location would therefore not be the preferred options from the SHE RA point of view. The central and southern locations are suitable, although the southern location is very remote possibly making it difficult to access the BESS to deal with emergencies. This may exacerbate the emergency situation.

Health and Safety - Dalmuntha West WEF

There is currently only one option for the location of the BESS at Dalmuntha west WEF.

From Figure 4 it is clear that there are numerous farmstead facilities in proximity to the west BESS location. This location would therefore not be a preferred location from the SHE RA point of view. The western BESS should possibly be relocated at least 500m from farmhouses.

Environment - Dalmuntha WEF and West WEF

Supplies of water should be protected from possible chemical contamination. Should vanadium redox flow batteries be the chosen technology, it is suggested that the facilities be located a suitable distance away from water courses/sources. With lithium containers, this would only occur in the event of battery fire and emergency services applying fire water to a container which is extremely unlikely in such a remote location.

It is suggested that the BESS facilities be located a suitable distance away from water courses/sources. Refer to other aquatic specialist studies for specific details of separation distances.

6. Scoping Level - Impact Assessment

The BESS SHE RA is not expected to raise any unacceptably high-risk issues, i.e. the BESS facilities of either technology type are not likely to be a No-Go option.

The safety and health risks associated with vanadium redox flow batteries will likely be lower than for the lithium-ion battery type for both employees and members of the public outside the facility. Lithium batteries pose a higher fire and explosion risk as well as the possibility of generating noxious smoke under these circumstances. However, they are easier to install, i.e. containers as opposed to formal brick and mortar structures, and probably will not require as many permanent staff as vanadium redox utility scale operations.

The environmental risks of aquatic contamination with the vanadium type batteries will likely be higher than for solid state batteries, due to the presence of liquids.

As lithium batteries pose a possibility of generating noxious smoke, there may be a need to slightly adjust the proposed location the Dalmuntha West WEF BESS installation to mitigate the risks of noxious smoke from possible fires on near-by facilities, i.e. ideally the BESS facilities should be 500m from the closest farmsteads / private businesses etc. Similarly, in choosing between the northern, central and southern locations of the Dalmuntha WEF, the central option presents lower SHE RA risks as it is further from farmhouses while still be accessible for emergency response.

7. Legislative and Permit Requirements

The BESS must be designed, operated, maintained and decommissioned according to the requirements of Occupational Health and Safety Act 85 of 1993. The BESS installation is unlikely to be classified as a Major Hazard Installation.

Appendices

Appendix A - Specialist Expertise

CONSULTANT CURRICULUM VITAE

NAME: **DEBRA MITCHELL**

EDUCATION :

BSc Chemical Engineering (Cape Town) 1985
BA Psychology, Economics (UNISA) 1995
MSc Process Safety & Loss Prevention (U. Sheffield UK) 2004 (Distinction)

AFFILIATIONS :

Professional Engineer
Member of SA Institute of Chemical Engineering
ISHECONcc is an Approved Inspection Authority for Major Hazard Installations and for Explosives
SANAS ISO 17020 Technical Auditor
Chairman of SABS TC292 Sub-committee for compilation of SANS1461- MHI RA Standard

WORK EXPERIENCE:

1999 - 2021	Formed Ishecon c.c. with two partners as a management-buy-out of the SHE Consulting Group of AECI Engineering.
1997 - 1999	AECI Engineering Pty (Ltd), Modderfontein. Senior Process Safety Engineer. Risk assessments and Hazard Studies for AECI projects. Also involved in development of safety and risk related training programs.
1996 - 1997	Sasol Synthetic Fuels, Secunda, Senior Environmental Engineer, responsible for initiation of projects and statutory reports.
1991 – 1996	Sastech, Secunda, Lead Process Engineer, Steam and Water Utilities Department, responsible for a team of process engineers compiling process engineering designs and feasibility studies. Seconded to Foster Wheeler UK for 6 months.
1987 – 1991	SAPPI, Ngodwana, Technical Superintendent, responsible for management of a team on an applied research and development effluent recovery pilot plant.
1986 - 1987	Atomic Energy Corporation, Engineer-in-training, process engineering design.

PROCESS SAFETY EXPERIENCE :

1997/2021 *Quantitative Major Hazard Installation Risk Assessments (Initial assessment and updates as required over the years)*

Gauteng:

Holfontein Hazardous Landfill site, Akulu Marchon Sulphonation, Nissan LPG, SAB Rosslyn and Chamdor, Protea Chemicals Wadeville, African Explosives Modderfontein Complex, Sappi Enstra peroxide, Rosslyn Township Development, Crest Midrand, Revlon Isando, Plaaskem, AECI Chloorkop, NECSA.

Natal:

Umgeni water treatment plants, Blendcor, Clairwood Logistics Park, Crematorium gas supply, Crest Chemicals Jacobs, Durban Metro LPG; All chorine installations at swimming pools and sewage plants throughout the Durban area. Ezimbodekweni Township formalisation, Illovo Sugar Merebank, Assmang Cato Works, Shu Powders, Metalichem, Plascon, Unitrans, Transnet Port operations, Back of Port–new harbour, FFS PMB. Umbogintwini Industrial complex: Chemical Initiatives, Experse, Ineos Acrylics, Dulux Paints, Alliance Peroxide, Resinkem, Improchem, Marshalling Yard, Effluent treatment and sea disposal, Bio-products Lysine plant, review composite integrated site risk assessment.

Freestate and Others:

Midland Industrial Complex: Chlorine production, Polyethylene production (old and new plants), Cyanide plant, Peroxide plant, Chlorine derivatives, bulk chlorine road transport, Integrated composite site risk assessment, Omnia Sasolburg complex. Omnia ammonia depots (5). New Hydrogen Peroxide Installation, De Beers Micro Diamond HF facility, Shell fuel depot Kimberly, BHP Billiton LPG Steelpoort.

Cape:

BESS and fuel turbine power generation plant, Fine Chemicals Corporation, Aspen Pharmacare, Protea Chemicals, Kohler Versapac Paarl, Kynoch Milnerton, Johnson Controls PE, Protea Chemicals, Vissershoek hazardous landfill, Crest new chlorine and sulphur dioxide packaging facility, Shell fuel depot Mossel Bay, AECI Coatings, AFROX PE, Gas Turbines and various expansions at PetroSA Mossel Bay, NCP Atlantis.

Integrated Safety, Health and Environmental Risk Assessments

2021 Various (10) Battery Storage facilities in the Northern and Western Cape.

2001 Tzaneen Municipality; all municipal operations (e.g. roads, parks etc).

2001 Dulux Paints; all operations at Alrode Site and at Umbogintwini Site.

2000/2003 Somerset West Industrial Site, Kynoch Gypsum Pipeline

2005/6 Illovo Sugar Merebank Bund Study, Enviroserv Shongweni

2010 - 19 AEL various explosives manufacturing facilities in South Africa and the region.

Hazard and Operability Studies (HAZOP)

2000/2014 SASOL/NATREF Cleans Fuels II,VCM Upgrade, TNP Ex, Skeletal Isom Plant

2005 / 2014	Fine Chemicals Corporation Cape Town – API Expansion. CISA; effluent treatment, chrome concentrator, Vanadium Recovery
1997/2019	African Explosives; nitrates, bulk emulsion and detonators etc
2000/2019	Rand Water and Biwater – chlorination, ammonia, poly, lime, RO facilities
1997/2019	Other hazops for ERWAT, Industrial Urethanes; Mhlume Sugar, Zinchem, Kynoch Feeds, AEL, ammonia plants, Element 6 HF plant, Omnia HEF, GSK Nairobi and Lagos etc.

Emergency Response Studies

2006	SA Mint Company in Midrand Emergency Plan Evaluation
2006	A1 Grand Prix for 2007 Emergency Plan Evaluation
2015	Atlantis Leather Crusting

Explosives Risk Assessments

2008/2019	AEL – Emulsion Manufacturing Plants in RSA, Tanzania, Zambia & DRC (6 plants)
2009/2010	AEL - Detonator/shock tube assembly plants Indonesia, UK and South America
2015	SteinMuller Explosive Welding, Wits Explosive Piling

Hazardous Area Classification Studies

2012	Aspen Pharmacare Olifantsfontein
2011	AEL – Ammonia Plant
2019	Royal Swaziland Sugar Corporation - Distillery

Auditing

2018	Ferro Dispersions, NCS Resins and FCR Process Safety Management Audits
2019	Puregas Alrode Process Safety Management Audit
2017/2019	ISO 17020 Technical auditing for MHI AIAs at Sasol, AFROX, BIRA, ERM

Appendix B - Specialist Statement of Independence