OZZY CONSULTING

HAZARDS AND RISKS FOR BACK-UP POWER SUPPLIES FOR DATA CENTRES AND OTHER LAND USES

Stage D

Prepared for: **NSW Department of Planning, Industry and Environment**

Date: **9 December 2020**
Document No: **R-DPE-20-005-Stage D**
Revision: **1**

OZZY CONSULTING
2 Ross St Epping NSW 2121
Telephone:(02) 8011 3343
Mobile: 0405 083 297
admin@ozzy-consulting.com

Document history

Rev	Date	Description	Prepared by	Checked by	Approved by
0	27/11/20	Working draft	Lilia Donkova		LD
0.1	3/12/20	Working draft for client review	Lilia Donkova		LD
1	9/12/20	Final, including client comments	Lilia Donkova		LD

Table of Contents

List of Tables

List of abbreviations

Abbreviations	Descriptions
DPIE	Department of Planning, Industry and Environment
MHF	Major Hazard Facility
SEPP 33	State Environmental Planning Policy No.33 - Hazardous and Offensive Development
LPG	liquefied petroleum gas
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
DG	Dangerous Good
BPS	back-up power supplies
BESS	Li-ion battery energy storage system
WHS	Work, Health and Safety
PHA	Preliminary Hazard Analysis
UPS	uninterruptible power supply
Li-ion	Lithium-ion

1. Introduction

1.1. Background

The Department of Planning, Industry and Environment (the Department) is undertaking substantial reform programs to improve the NSW planning system and unlock productivity in NSW.

Initiative 4.5 of the reform program will expand complying development provisions in employment zones as well as support emerging industries, such as data centres, so that more activities can be undertaken without the need for a development application. The planning and building standards will need to be such that they are able to be signed off by an accredited certifier.

A project titled *Hazards and Risks for Back-Up Power Supplies for Data Centres and Other Land Uses* is part of *Initiative 4.5.* This project aims to develop appropriate complying development thresholds and specifications for back-up power supplies that support data centres.
The Department has engaged Ozzy Consulting to assist the Department in undertaking the project.

1.2. Scope

The scope of work for the entire project includes four stages:

- A project inception meeting with the Department to agree on a target list of back-up power supply types, as well as project scope, deliverables and timing (Stage A).
- Review existing regulatory requirements to identify relevant statutory thresholds in the context of the existing NSW regulation for Major Hazards Facilities (MHF) and State Environmental Planning Policy No.33 (SEPP 33) - Hazardous and Offensive Development (Stage B).
- Workshop with the Department to short-list potential options (Stage C).
- Develop recommended performance requirements and parameters for back-up power supply operations and specifications for hazards and risks mitigations suitable for complying development pathway (Stage D).

The hazards and risks considered in this project are limited to those arising from storage and handling of hazardous materials in the context of *State Environmental Planning Policy No.33 (SEPP 33)- Hazardous and Offensive Development* (and associated with it Guidelines) [1] and do not include the hazards and risks from continuous or normal operating emissions to air or water.[2]

This report addresses the requirement of Stage D. Due to the innovative nature of many new energy storage technologies and the lack of detailed information on their risks and failures, the information contained in this report is based on the information available at the time of its preparation. The report should be read in the context of the reports prepared in Stages A, B and C.

1.3. Approach

The methodology agreed upon for Stage D [3] involves:

- Develop recommended performance requirements and parameters for back-up power supply operations and specifications for hazards and risks mitigations suitable for complying development pathway.
- Report with recommendations for operational and risk mitigation requirements.

2. Recommended controls

2.1. Background

The hazards and risk mitigation measures included in this report are developed and built upon the work and the consultations undertaken during the stages A to C of this project. The outcomes of Stages A to C are summarised in the Ozzy Consulting reports as follows:
Stage A – Ozzy Consulting report titled *Hazards and Risk for Back-up Power Supplies for Data Centres and Other Land Uses, Stage A*, Doc No R-DPE-20-005-Stage A, Rev. 1, dated 13 Nov 2020
Stage B – Ozzy Consulting report titled *Hazards and Risk for Back-up Power Supplies for Data Centres and Other Land Uses, Stage B*, Doc No R-DPE-20-005-Stage B, Rev. 1, dated 17 Nov 2020
Stage C – Ozzy Consulting report titled *Hazards and Risk for Back-up Power Supplies for Data Centres and Other Land Uses, Stage C*, Doc No R-DPE-20-005-Stage C, Rev. 1, dated 13 Nov 2020

2.2. Recommended controls

The outcome of the workshop undertaken in Stage C was a short-list of potential options, which were separated in two main groups:

- List of hazardous materials used in back-up power supplies to be considered further. The recommended controls for each of the for the hazardous materials used in the back up power supplies are listed in *Table 1: Recommended controls for hazardous materials used in back-up power supplies*.
  General issues related to data centres. The recommended controls related to data centres are listed in
- *Table 2: Recommended controls for data centres*

Table 1: Recommended controls for hazardous materials used in back-up power supplies

Item No	Backup power supply type	Hazardous classification and characteristics	Recommended controls/requitements for complying development	Justification
1.	Valve regulated lead acid (VRLA) batteries	• Historically widely used in data centres[4] • Classified as DG Class 8 under the ADG Code	a) The total quantity of acid electrolyte contained in the lead acid batteries, classified as DG Class 8 under the ADG Code, must be below a. 50 tonnes if the batteries are assigned Packing Group III in the ADG Code; and b. below 25 tonnes if the batteries are assigned Packing Group II in the ADG Code	To ensure that the stored quantity is below the threshold quantity listed in *Applying SEPP 33[5]*, i.e. the development would not be potentially hazardous in respect to DG 8, PG III or PG II.
			b) The storage and handling of lead acid batteries must comply with *AS 3780-2008 - The storage and handling of corrosive substances*	To ensure that the risks from the storage and handling of lead acid batterie is minimised as low as reasonably practicable[6].
2.	Nickel-zinc batteries	• Not classified as DG under the ADG Code • May be used in data centres • The hazard from thermal runway reaction is eliminated [7] • They can work at very high temperatures • Very expensive, used for special applications**Error! R eference source not found.**	A complying development must not be a potentially hazardous industry within the meaning of the *State Environmental Planning Policy No 33—Hazardous and Offensive Development:*	These batteries are safer than other types of batteries as a failure of a battery can't result in a runway reaction[1]. However, the field of rechargeable batteries for data centres is relatively new and rapidly changing. Imposing an overall condition that a potentially hazardous development can't be developed as complying development would ensure that a complying development would not pose unacceptable off-site risks to the surrounding land uses.

[1] This report adopts the definition of *AS IES 62619:2017* for *thermal runway*: uncontrolled intensive increase in the temperature of a cell driven by exothermic reaction

Item No	Backup power supply type	Hazardous classification and characteristics	Recommended controls/requitements for complying development	Justification
3.	Li-ion batteries	• DG Class 9 under the ADG Code • No threshold in *Applying SEPP 33* above which the development will be potentially hazardous • Threshold has not been set by the Department for already approved SSDs for data centres • Safe Work NSW confirmed that it considers them as a "generic hazard" similar to other WHS hazards. • The requirements for testing of batteries and the control measures in data centres are very stringent. • The Hazards Unit of the Department was consulted on the approach and the proposed control measures. It was agreed that it is not appropriate to set a threshold for Li-ion batteries used in data centres.[8] •	a) The storage and handling of Li-ion batteries must comply with *AS/NZS 4681:2000: The storage and handling of Class 9 (miscellaneous) dangerous goods and articles*	To ensure that the risks from storage and handling of Li-ion batteries is kept as low as reasonably practicable.
			b) The Li-ion batteries must comply with *AS IEC 62619:2017: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications*	The Standard states: *It is expected that cells or batteries subjected to misuse may fail to function. However, if such a situation occurs, they **shall not present any significant hazard**.* In the context of the above, compliance with the standard will ensure that manufactured batteries have passed the relevant safety tests, and they do not present any significant hazards. The recommended requirement will also contribute to minimising the likelihood of battery fires caused by manufacturer errors in design and quality control. (It was established that one of the causes for the battery fire in Japan Airlines (JAL) Boeing 787s, in 2013 was by manufacturer errors in design and quality control.[9])

Item No	Backup power supply type	Hazardous classification and characteristics	Recommended controls/requitements for complying development	Justification
4.	LPG	• LPG is classified as DG Class 2.1 under the ADG Code • Threshold quantity in *Applying SEPP 33* is 10 tonnes for aboveground and 40 tonnes for underground storage or mounded • MHF Regulation thresholds are 200 t for MHF; 20 t for notification under MHF.	a. The total quantity of liquified petroleum gas (LPG) at the development must be below 10 tonnes if the storage tank is aboveground or below 40 tonnes if the storage tank is underground or it is mounded.	To ensure that the stored quantity is below the threshold quantity listed in *Applying SEPP 33*, i.e. the development is not potentially hazardous in respect to LPG storage.
			b. The LPG is solely used as fuel for power generation	To ensure that the site is not used for inappropriate storage of LPG not related to the data centre activity
			c. The storage and handling of LPG complies with *AS/NZS 1596:2008, The storage and handling of LP Gas*	To ensure that the risks from the storage and handling of LPG is kept as low as reasonably practicable
5.	Diesel	• C1 combustible liquid • Standby diesel power generators are currently the most used power generators for data centres	a. The total quantity of diesel at the development must be below 2,000 tonnes, b. A tank storing diesel must not be located within 40 metres of a natural waterbody or wetland.	Storage of more than 2000 tonnes or locating a tank within 40 meters of a of a natural waterbody or wetland classifies the development as a designated development.
			c. Diesel storage tanks must not share a bund with a storage tank containing a liquid, classified as DG Class 3 under the ADG Code.	*Applying SEPP 33 Guidelines* classifies diesel as combustible liquid, class C1. The Guidelines states that if class C1 liquids are present on site and stored in a separate bund[2] they are not considered to be potentially hazardous. DG Class 3 liquids are flammable liquids.
			d. The storage, handling, and use of diesel complies with *AS 1940:2017, The storage and handling of flammable and combustible liquids*	To ensure that the risks from the storage, handling and use of diesel are kept as low as reasonably practicable. AS 1940 defines quantity below 500 L as a minor storage.

[2] Bund – a raised, impermeable barrier forming the perimeter of a secondary containment area. The bund is designed to contain spillages and leaks from liquids used, stored or processed above-ground, and to facilitate clean-up operations.

Item No	Backup power supply type	Hazardous classification and characteristics	Recommended controls/requitements for complying development	Justification
			e. A diesel storage tank with capacity of more than 500 L must be provided with manufacturer's certification of compliance with AS 1940:2017. This requirement **does not** apply to a diesel tank within a diesel generator.	
			f. If the diesel bunded tank is installed underground (excluding bunded tanks situated below ground level, but not in the ground, such as those in a basement, cellar or tunnel[3]), the Underground Petroleum Storage System must: ○ be appropriately designed, installed and commissioned by duly qualified persons. Duly qualified person is a person defined as such under *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* ○ have minimum mandatory pollution protection equipment installed, consistent with the Regulation, comprising non-corrodible secondary containment tanks and associated pipe work and overfill protection devices ○ comply with *AS4897-2008 The design, installation and operation of underground petroleum storage systems*	Protection of environment. This conditions has been already imposed as condition of approval of data centres by the planning authorities. The suggested requirements are listed in the Protection of the Environment (Underground Petroleum Storage Systems) Regulation 2019 It is recommended to be confirmed with EPA as they are the regulatory body administrating this Regulation.

[3] These are outside the scope of AS4897-2008

Item No	Backup power supply type	Hazardous classification and characteristics	Recommended controls/requitements for complying development	Justification
			○ have a certificate showing that an equipment integrity test (EIT) has been carried out in line with the written directions of duly qualified persons ○ A certificate from a duly qualified person that all requirements have been met shall be submitted to the Principal Certifying Authority	
			g. The diesel fuel stock must be fully turned over at least once a year	Long-term storage of diesel results in microbial growth, which can clog filters, pipes, and fuel injectors. Diesel fuel that is not replaced every 6-12 months to maintain quality can increase the probability of system failure (CSRIC, 2014). Diesel fuel has a useful life, and fuel suppliers typically recommend fully turning over backup diesel stocks each year to help ensure continued fuel quality[10][10].

Table 2: Recommended controls for data centres

	Issue	Notes	Outcome	Justification
1.	Potentially hazardous development	• The Department has developed an integrated assessment process for safety assurance of development proposals, which are potentially hazardous.	a. Potentially hazardous developments should not be developed as complying developments.	Potentially hazardous developments can pose unacceptable risks to the surrounding land uses if appropriate control measures are not implemented and maintained. The control measures are developed as a result of undertaking a number of highly specialised technical studies pre- and post- approval. This process is not applicable to complying developments. Based on the information, provided by the DPIE on the approved data centres developments in NSW, these developments do not generally reach the threshold quantities to be considered potentially hazardous. Nevertheless, this control is vital to ensure that a potentially hazardous development is not built using inappropriate planning pathway.
			b. The quantities of dangerous goods stored and handled at the site must be below the threshold quantities listed in the *Hazardous and Offensive Development Application Guidelines – Applying SEPP 33* (DoP, 2011) at all times	This requirement will assist to confirm the development won't be potentially hazardous.
2.	MHF	• High-hazard facilities • Potential for major incident • High impacts in event of a major incident	Major hazards facilities should not be developed as complying developments	Such a development is associated with high risks and it is not consistent with the complying development definition. Based on the information, provided by the DPIE on the approved developments in NSW, and the research undertaken as part of this project, the data centres generally do not reach the thresholds to be classified as MHF.

	Issue	Notes	Outcome	Justification
				Nevertheless, this requirement is recommended to ensure that the complying development pathway won't be used for developing a MHF.
3.	Data centres with high population in the vicinity of MHF	• Challenging to set max. number of employees or minimum distance of the development from existing MHF as these will vary depending on the actual number of population and the actual risks from the MHF	A complying development with high population cannot be located in the vicinity of an existing MHF	The risks from MHF can't be eliminated, they are minimised "so far as reasonably practicable". Therefore, a MHF will pose minimal residual (and acceptable) risk to the surrounding land uses. Significantly increasing the population in the vicinity of a MHF increases the exposure to the residual risks and this results in an increase of the societal risk from the MHF.
4.	Protection of the environment from hazardous materials		All liquid chemicals, fuels and oils used on site must be stored in accordance with the *Storing and Handling of Liquids: Environmental Protection – Participants Manual'* published by The Department of Environment and Climate Change NSW, May 2007, ISBN 978 1 74122 435 1	Minimising the potential of harm to the environment resulting from a spill of liquids. It is recommended this requirement be confirmed with the EPA as they are the regulatory body.
5.	Loss Prevention	• Risk mitigation from a property protection and business continuity perspective.	The data centre must comply with *FM Global Property Loss Prevention Data Sheet 05-32 - Data Centers And Related Facilities*	The data sheet contains property loss prevention recommendations for data centres and their critical systems and equipment. This data sheet also identifies the hazards associated with these facilities and recommends risk-mitigation solutions from a property protection and business continuity perspective. Compliance with FM Global Data Sheets would be required by some Insurance companies to insure a business. Compliance

	Issue	Notes	Outcome	Justification
				with Data Sheet 05-32 will contribute to reducing the overall risk from a data centre.

3. References

[1] https://www.legislation.nsw.gov.au/view/html/inforce/current/sl-2000-0557#sch.3

[2] Department of Planning, January 2011, Hazardous Industry Planning Advisory Paper No 6, Hazard Analysis, ISBN 978-0-73475-862-0

[3] Ozzy Consulting, 19 October 2020, Proposal *Hazards and risk for back-up power supplies for data centres and other land* uses, Doc NoQ-DPE-20-005-01.docx

[4] https://www.facilitiesnet.com/powercommunication/article/UPS-Energy-Storage-Option-1-Lead-Acid-Batteries--18091?source=part

[5] Department of Planning, January 2011, *Hazardous and Offensive Development Application Guidelines, Applying SEPP 33,* ISBN 978-1-74263-154-7

[6] Australian Standard AS IEC 62619:2017: *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

[7] https://www.facilitiesnet.com/powercommunication/article/UPS-Energy-Storage-Option-3-Nickel-Zinc-Batteries--18093?source=part

[8] Email from Doris Yau, DPIE to Lilia Donkova, Ozzy Consulting, dated 2 December 2020

[9] Uptime Institute, RISK MANAGEMENT FOR IT INFRASTRUCTURE, Executive Handbook, Volume

[10] Energy Infrastructure Assurance Advisory Group, National Oil Supplies Emergency Committee, December 2009, *Diesel Fuel & Back-Up Generation*