Initiation & Installation HazOpS Report

Project ID:

Project Title: CONSORT Bruny Island Battery Trial

22nd & 23rd August 2016

Strictly Commercial in Confidence

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Document Authorisation

	Name/Title	Signature/Artifact	Date
Prepared by:	Derek Jones		
Reviewed by:	Elizabeth Allan		
Approved by:			

EXECUTIVE SUMMARY

HazOpS process is to apply risk management, safety in design of structures and construction risk assessment for projects undertaken by TasNetworks. HazOpS shall apply to both internal and external projects and be used for modification of existing assets and infrastructure. HazOpS shall also set the minimum standard for contracted services undertaking projects on TasNetworks behalf.

The HazOpS process is a systematic detailed study to identify potential hazards and avoid the introduction of new hazards as an integral part of projects, modifications to assets, like for like replacements without extensive and costly last-minute modifications, followed by trouble free operation.

HazOpS is intended to provide the following benefit to the business:

- Reduce costly last minute modifications
- Ensure trouble free operations
- Improve safety and no introduced hazards.
- Apply risk treatment hierarchy in initiation and development stages to reduce the effect of hazards.
- Provide improved operability, reliability and maintainability.
- Ensure minimum life cycle costs.
- Identify construction hazards.
- Cost benefits – including like for like replacements.
- Comply with work place health and safety regulations 2012 obligations for Safety and Design and safety management plans.

HazOpS Report was completed on 22nd & 23rd August 2016 covering the following:

a) Battery Installation
b) Overview
c) Safety in Design Checklist
d) Construction Risk Assessment

Elizabeth Allan will manage the HazOpS Register Excel electronic document until all actions are completed.

Thank you to the participant's contribution in the HazOpS process that will ensure the project success.

Version Control

Version Number	Creation Date	Description of Change
01	22nd & 23rd Aug 16	Initiation & Installation HazOpS's

Distribution

Issue Date	Team Member Name	Position in Project Team	Company (if external to TasNetworks)
22nd August 2016	Elizabeth Allan	Project Manager	
	Derek Jones	Innovation Engineer	
	Bruce Hill	HSE Investigation Officer	
	Ross Jongejans		
	Paul Pockett		
	Andrew Fraser	Network Innovation team leader	
	Mark Newman	Facilitator	CES
23rd August 2016	Elizabeth Allan	Project Manager	
	Derek Jones	Innovation Engineer	
	Bruce Hill	HSE Investigation Officer	
	Mark Newman	Facilitator	CES

Contents

1 HazOpS Process

A HazOpS is a systematic detailed hazard and operability problem identification process, carried out by a team. HazOpS deals with the identification of potential deviations from the design intent, examination of their possible cause and assessment of their consequences.

Key features of the HazOpS examination include the following:

- The examination is a creative process. The examination proceeds by systematically using a series of guide words to identify potential deviations from the design intent and employing these deviations as "triggering devices" to stimulate team members to envisage how the deviation might occur and what might be the consequences.
- The examination is carried out under the guidance of a trained and experienced study leader (facilitator), who has to ensure comprehensive coverage of the system under study, using logical, analytical thinking. The hazard study leader is preferably assisted by a recorder to complete the HazOpS minutes.
- The examination relies on specialists from various disciplines with appropriate skills and experience who display intuition and good judgement.
- The examination should be carried out in a climate of positive thinking and frank discussion. When a problem is identified, it is recorded for subsequent assessment and resolution.
- Solutions to identified problems are not a primary objective of the HazOpS examination, but if made they are recorded for consideration by those responsible for the design.

HazOpS's consist of five basic sequential steps, shown in figure 2.

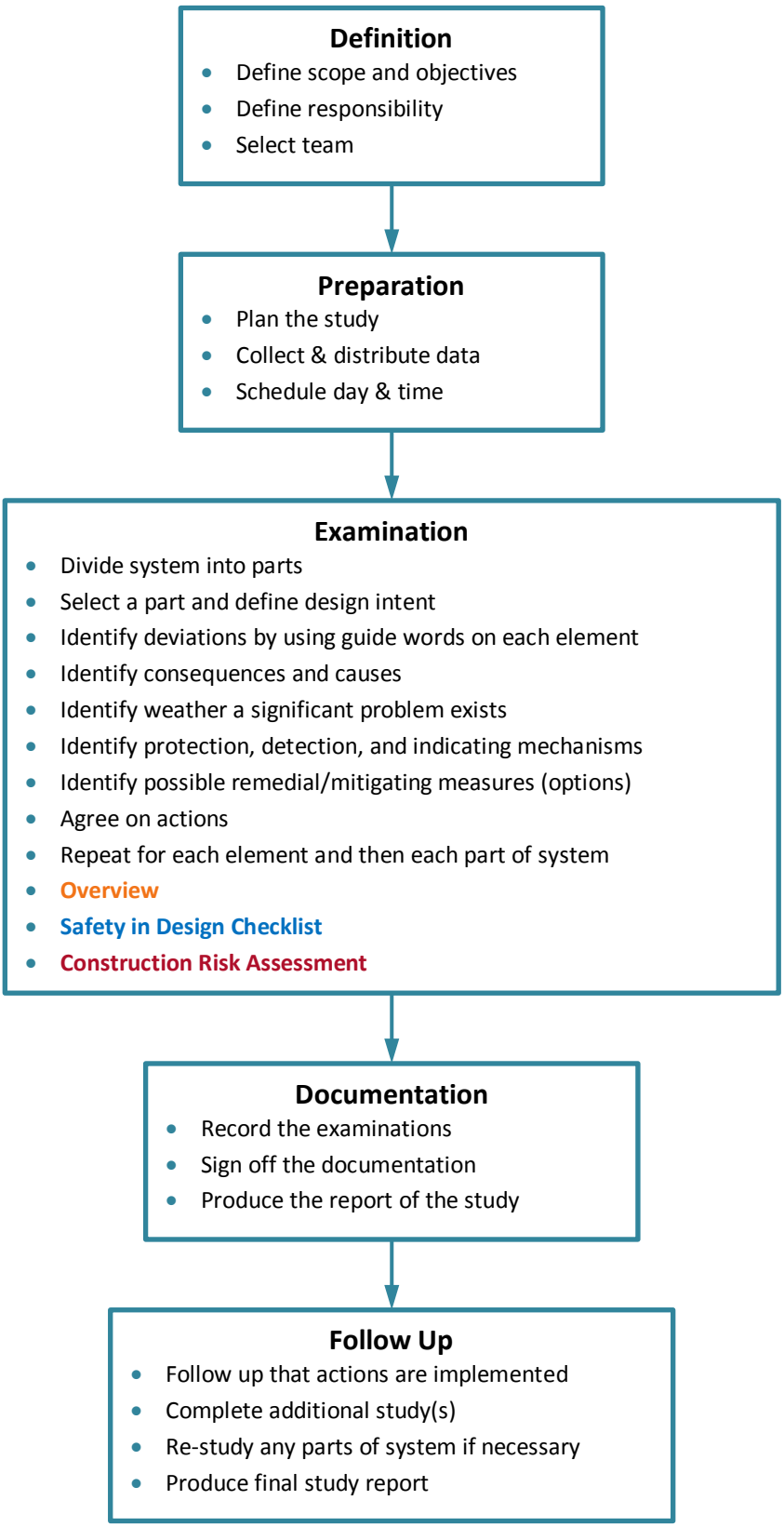

Figure 2 – The HazOp study procedure

1.1 DRAWING SECTIONS

The HazOpS Prompt Cards used for all Drawing Sections were:

> Flow, Level, Load, Temperature, Pressure, Speed, Timing, Reaction Rate, Control, Quality, Protection, Location & Direction.

1.2 DRAWING OVERVIEW

Once all drawing sections have been investigated, the group reviews the project overview prompt cards to further identify hazards and deviations in operations documented in the HazOpS Register.

The HazOpS Prompt Cards used for the Drawing Overview were:

> Services Needed, Materials Handling, Packaging, Materials of Construction, Access, Shutdown, Breakdown, System Losses, Physical Damage, Output, Emergency, Plant Safety, Safety Equipment, Manual Handling, Fire and Explosion, Environmental Control, Toxicity, Lighting, Testing, Commissioning & Startup.

1.3 SAFETY IN DESIGN CHECKLIST

Once drawing overview have been investigated, the group reviews the safety in design checklist prompt cards to further identify hazards and deviations in operations documented in the HazOpS Register.

The HazOpS Prompt Cards used for the Safety in Design Checklist were:

> Electrical Safety, Fire and Emergencies, Movement of People and Materials, Working Environment, Plant, Amenities and Facilities, Earthworks, Structural Safety, Manual Tasks, Substances, Falls Prevention, Specific Risks & Noise Exposure.

1.4 CONSTRUCTION RISK ASSESSMENT

Once safety in design checklist have been investigated, the group reviews the construction risk assessment prompt cards to further identify hazards and deviations in operations documented in the HazOpS Register.

The HazOpS Prompt Cards used for the Construction Risk Assessment were:

> Approvals, Mobilisation, Traffic Management, Security, Personnel, Emergency, Construction, Mobile Plant, Underground Services, Demolition & De-Mobilisation.

1.5 HAZOPS REGISTER

Elizabeth Allan will manage the HazOpS Register Excel electronic document in APPENDIX 'A' until all actions are completed.

2 HazOpS Documents

Elizabeth Allan and others have compiled the following HazOpS documents used in the HazOpS with copies in APPENDIX 'B'.

Document Title	Version	Link//Location
HazOpS register	01	
CONSORT HazOpS Process	01	
CONSORT Subsidy process & checklist	1.0	
CONSORT Technical Specification and subsidy design	2.0	
CONSORT Phase 1 – Design: Subsidy application form	1.0	
CONSORT Phase 2 – Installation commissioning checklist	1.0	
Bruny Island – Map		
Bruny Island – Typical House		
Bruny Island – Typical Wall arrangement		
Clean Energy Council – Accredited Installers	28-April-16	

3 Future HazOpS

Elizabeth Allan shall organize the future Commissioning HazOpS after first installation and repeated again at the completion of all the installations to be completed on date(s) to be nominated.

APPENDIX 'A'

HAZOPS REGISTER

STUDY TITLE:	**Bruny Island Battery Trial**	**SHEETS:**	1 of ?
Drawing No.:	Bruny Island Map, Typical House and Typical wall arrangement	**DATE:**	22nd & 23rd August 2016
INITIAL HAZOPS TEAM COMPOSITION:	Elizabeth Allan, Derek Jones, Bruce Hill, Paul Locket, Andrew Fraser, Alysia Garrard (minutes)	**FACILITATOR:**	Mark Newman
INSTALLATION HAZOPS TEAM COMPOSITION:	Elizabeth Allan, Derek Jones, Bruce Hill, Chris Wembridge	**FACILITATOR:**	Mark Newman
SECTION CONSIDERED:	**Battery Installation**		
DESIGN INTENT:	**Storage of energy**	**Material:** Electricity	**Activity:** Storage
		Source: Solar Panels	**Destination:** House or Network

No	HazOpS Section	Guide Word	Element	Description of Problem	Deviation	Possible Cause	Consequences	Safeguards	Comments	Actions Required	Action Allocated to	Status dd/mm/yy	Status dd/mm/yy
1		Flow	Battery	leak from battery	leak	fault	burns, corrosion			ensure designed according to the CEC and manufacturer's guidelines (being suitable) and MSDS	Contractor		
2		Level	Battery	electrolyte level damaging battery - either high or low	evaporation or gassing	normal operation	battery damage			installer to advise customer on battery maintenance	Contractor		
3		Load	Battery	consideration of wiring design and protection	damage to batteries	poor design of wiring	battery damage or arc		AS3000 and other standards	installer to consider as part of design and installation	Contractor		
4		Load	Battery	weight of battery supported by wall	wall not structurally sound	structure	battery falls off			installer to consider structural integrity of wall	Contractor		
5		Temperature	Battery	over or under optimal temperature of battery reduces life	sun or cold	location	reduced battery life			installer to consider as part of design and installation	Contractor		
6		Pressure	Battery	battery generating gas	gas generation	normal operational or fault	explosion			enclosure ventilation to be considered as part of the design	Contractor		
7		Speed											
8		Timing	Battery	operating outside customer expectations	strange operation	project consort team	phone call to installer or TasNetworks			education of installers and customers	Derek Jones		
9		Reaction Rate	Battery	arc flash and explosion	third party tampering	uneducated parties accessing batteries	burns, electrocution	most batteries enclosed		installed to manufacturers and CEC guidelines (and locked)	Contractor		
10		Control	Reposit	internet down and customer gets alert	loss of internet	fault	Reposit controls stop working			ensure customer knows Reposit helpline	Reposit		
11		Control	Battery	open of enclosure while still live	opening enclosure	unauthorised person	shock			installer to ensure appropriate interlocks	Contractor		
12		Quality	System	possible incorrect or unsafe install	dodgy install	installer not aware of requirements	non functioning or unsafe system			education of installers, CEC accredited installers and consort inspectors	Derek Jones		
13		Protection	Battery	customised battery enclosure - acid battery - lithium?	unauthorised people accessing - lack of protection	type of enclosure	burns, electrocution		different enclosures for different batteries	CEC guidelines and appropriate Australian standards	Contractor		
14		Protection	Battery	battery installation can be hit by vehicle	vehicle hits	location	fault			location away from vehicle path or install bollard	Contractor		
15		Protection	Battery	flood	battery gets wet	flood	fault			location suitable height above flood level	Contractor		
16		Protection	Battery	battery installation gets wet	no enclosure or not outdoor rated	weather	fault		protection from sun also	install to IP rating of equipment	Contractor		
17		Protection	Battery	internal fault	fault	fault	fire and shock			install protection as per CEC guidelines and Australian standards	Contractor		
18		Protection	Battery	unauthorised access to enclosure	enclosure opened	unauthorised person	burns, electrocution			CEC (tool to open) - or locked - tamper-proof	Contractor		
19		Location	Battery	indoor installation	battery installed in living area	customer preference	fire, shock		building code defines area	install in accordance with CEC guidelines and manufacturers instructions	Contractor		
20		Location	System	scammers - via phone and in person	theft	scammer	loss of battery or money			customer education	Shannon Stennings		
21		Location	System	remote location - installer support	lack of service/support	remote location	poor support			ongoing management and review of considerations	Liz Allan		

22		Location	Battery	battery location next to emergency exit point	fire	fault	emergency exit path blocked			consider location during design	Contractor		
23		Location	Battery	battery location in a safe and easy position to maintain	maintenance	routine	unsafe access			consider location during design	Contractor		
24		Location	Battery	theft	theft	robber	loss of battery		requirement for customer to get appropriate insurance?	customer to consider insurance	Liz Allan		
25		Location	Battery	nearby hazards - gas, hot water, firewood etc	transfer of hazard	location	fault			installer to consider location in respect to all hazards	Contractor		
26		Direction											
OVERVIEW			**Battery Installation**										
DESIGN INTENT:			**Storage of energy**		**Material:**	Electricity	**Activity:**	Storage					
					Source:	Solar Panels	**Destination:**	House or Network					
No	**HazOpS Section**	**Guide Word**	**Element**	**Description of Problem**	**Deviation**	**Possible Cause**	**Consequences**	**Safeguards**	**Comments**	**Actions Required**	**Action Allocated to**	**Status dd/mm/yy**	**Status dd/mm/yy**
27		Services Needed	Customer	electricity grid connection	not connected to grid	customer choice, payment issues, preference	lose research and won't get network support			customer agreement states must remain connected to grid	Liz Allan		
28		Materials Handling											
29		Packaging	Battery	no labelling or indication of live parts	fault	uneducated parties accessing batteries	burns, electrocution		signage should be understandable by an uneducated person. Possibly Bruny Island Battery Trial sign might be useful	install suitable labelling - CEC guidelines and manufacturer's recommendations - investigate CEC guidelines.	Contractor - but decision by Liz Allan		
30		Packaging	Battery	disposal of packaging material	packaging incorrectly disposed of	incorrect disposal	environmental impact and community backlash			installers to correctly dispose of packaging materials - recycling where possible (removal from island)	Contractor		
31		Packaging	Battery	fire brigade unaware of battery presence	fault	fire brigade attending	unware of battery			location of labelling - investigate labelling in CEC guidelines	Derek Jones		
32		Materials of Construction	Building	wall mount contains asbestos	battery installation	disturbing asbestos	may contain asbestos			installer to follow all asbestos management guidelines	Contractor		
33		Access											
34		Shutdown	Battery	no isolation of battery	no isolation	not installed	incident		all in one units use AC isolator	install isolator if DC link - CEC guidelines	Contractor		
35		Shutdown	Battery	location of isolation switch	not accessible or easily identified	installed location	incident		next to solar array isolator	as per CEC guidelines	Contractor		
36		Shutdown	Battery	shutdown procedure not clearly identified	no procedure	no signage	incident		similar to solar	ensure standard shutdown procedure includes battery - CEC guidelines	Contractor		
37		Shutdown	Battery	no labelling on battery breaker (differing from solar)	shutdown	fault	no indication on circuit breaker			label breaker as per CEC guidelines in switchboard	Contractor		
38		Shutdown	Battery	inverter and battery in one enclosure	can't get to DC bus	all in one unit	incident			install an AC isolator	Contractor		
39		Breakdown											
40		System Losses	Inverter	Cable PI alarms while isolated from TasNetworks	no longer connected to network	not connected	possible exposure to electric shock			discuss with Cable PI people	Derek Jones		
41		Physical Damage	Battery	physical damage by vandalism	damage to batteries	vandal	battery inoperable			evaluate during trial	Liz Allan		
42		Output	Battery System	battery overloading the system	all batteries are discharging	demand	fault to grid			evaluate during trial	Derek Jones		
43		Emergency	System	customer not aware of actions to take in emergency	emergency	fault	customer to take action			customer education	Contractor		
44		Plant Safety											
45		Safety Equipment	Battery	safety equipment not supplied	incident	fault	no safety equipment available			installer to provide MSDS and necessary safety equipment	Contractor		

46		Manual Handling											
47		Fire and Explosion	Battery	battery catches on fire	getting hot	sun or house on fire	death, loss of house	battery management system		maker's recommendations on location and storage and CEC guidelines	Technician/Contractor		
48		Fire and Explosion	Battery	chemistry - battery differing chemistry at different sites	getting hot	sun or house on fire	battery on fire	battery management system		appropriate signage (on switchboard) and notify TasFire on types of batteries installed	Derek Jones		
49		Fire and Explosion	Battery	fire detection for batteries installed indoors	fire	fault	owner has no indication of fire			installer to consider as part of design and installation	Contractor		
50		Fire and Explosion	Battery	indoor fire rating for commercial buildings and should be considered for domestic buildings	fire	fault	rapid spread of fire			installer to consider as part of design and installation	Contractor		
51		Fire and Explosion	Battery	owner tries to fight fire	spray water on battery	fire	injury		might be special fire extinguishers required - danger for inexperienced user	owners to be aware of what they should do in event of fire	Contractor		
52		Fire and Explosion	Battery	battery exposed to fire	fire close to battery	bushfire	battery will explode	battery management system	clear area around battery	bushfire mitigation plan	Contractor		
53		Fire and Explosion	Battery	battery catches on fire and starts house fire	getting hot	sun or house on fire	death, loss of house	battery management system	standard signage - something on switchboard cover?	notify fire brigade	Shannon Stennings		
54		Environmental Control	Battery	coolants and chemicals leak	battery leaks	fault damage	environmental damage or injury		supplied with battery	HAZCHEM sign - MSDS	Contractor		
55		Environmental Control	Battery	end of life disposal	battery end of life	battery dumped	chemicals into environment			notify customer what to do at end of life	Contractor		
56		Toxicity	Battery	ventilation if located in a building	battery vents	normal operation	build up of vapours			ensure cabinet and building has adequate ventilation	Contractor		
57		Testing	System	customer unaware that system has failed or an alarm	system failure or alarm	fault	fault remains for extended period			externally visibly alarm and Reposit app	Contractor		
58		Testing	System	inadequate ongoing testing of system	non-complaint testing	unaware home owner	system is non-functional			installers to advise customers what to do	Contractor		
59		Commissioning & Start-up	System	system not functioning	system failure	poor installation	system is non-functional			installation and commissioning checklist	Contractor		

SAFETY IN DESIGN CHECKLIST		**Battery Installation**											
DESIGN INTENT:		**Storage of energy**			**Material:**	Electricity	**Activity:**	Storage					
					Source:	Solar Panels	**Destination:**	House or Network					
No	**HazOpS Section**	**Guide Word**	**Element**	**Description of Problem**	**Deviation**	**Possible Cause**	**Consequences**	**Safeguards**	**Comments**	**Actions Required**	**Action Allocated to**	**Status dd/mm/yy**	**Status dd/mm/yy**
60		Electrical Safety											
61		Fire and Emergencies											
62		Movement of People and Materials											
63		Working Environment											
64		Plant											
65		Amenities and Facilities											
66		Earthworks											
67		Structural Safety											
68		Manual Tasks											
69		Substances											
70		Falls Prevention											

71		Specific Risks											
72		Noise Exposure											
CONSTRUCTION RISK ASSESSMENT:				**Battery Installation**									
DESIGN INTENT:				**Storage of energy**	**Material:**		**Activity:**						
					Source:		**Destination:**						
No	**HazOpS Section**	**Guide Word**	**Element**	**Description of Problem**	**Deviation**	**Possible Cause**	**Consequences**	**Safeguards**	**Comments**	**Actions Required**	**Action Allocated to**	**Status dd/mm/yy**	**Status dd/mm/yy**
73		Approvals	System	apply to TasNetworks to connect	new installation	reduced power bills	disconnection by TasNetworks			installers to be aware to follow standard solar installation process	Contractor		
74		Approvals	System	building permit	new installation	council requirements	homeowner fined by council			installer to check with council for any approvals	Contractor		
75		Mobilisation											
76		Traffic Management											
77		Security	System	installer goes bust	installer no longer trades	bankruptcy, bad management	incomplete installation and ongoing maintenance issues			TasNetworks to make assessment on requirements	Liz Allan		
78		Security	Cyber security	breach of TasNetworks' cyber security	breach	hacker	loss of infromation, loss of control, possible equipment damage			TasNetworks to maintain security systems	Liz Allan		
79		Security	Cyber security	breach of Reposit cyber security	breach	hacker	loss of infromation, loss of control, possible equipment damage			Reposit to maintain security systems	Liz Allan		
80		Personnel											
81		Emergency											
82		Construction											
83		Mobile Plant											
84		Underground Services											
85		Demolition											
85		De-Mobilisation											

APPENDIX 'B'

HAZOPS DOCUMENTS