HSEP0304 – Hazard and Operability Study HazOps Procedure

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1. DOCUMENT CONTROL

Document Information

	Information
Document ID	HSEP0304
Document Administrator	WHS & HSE Systems Manager
Document Name	Hazard Study Procedure
Issue Date	1 October 2015

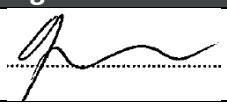
Document History

Rev No	Date	Description	Approved by
0	May 2010		Manager SAM, Manager PD.
1	Dec 2010	Training requirements clarified, Development Committee Role removed to reflect move to 'Business as Usual', minor clarifications and changes to roles.	Paul Molnar
1.1	May 2011	Change of format. No content change. Supersedes document ID: GP-AM-495	Mick Cuppari
1.2	July 2013	HSE document number added and checklists updated with HSE references.	Mick Cuppari
1.3	Mar 2014	Include Construction Hazard Study Revised competency for Study Leader	Mick Cuppari
1.4	July 14	Include safe design, review responsibilities, clarification on requirement of Risk Assessment. Review of responsibilities.	Andrew Rumsby
2	Jun 2015	HSE Review	WHS & HSE Systems Manager

Document Change Summary

Date	Section	Change Description
June 2015	All	Roles and Responsibilities updated. Minor updates throughout document to reflect current business processes and document linkages.

Document Approvals

Role	Name	Signature	Date
WHS & HSE Systems Manager	Darren Pegram		18/9/15

Related Documents

Document Name	Author

2. PURPOSE

Identifying and managing Risk from existing and potential Hazards, and avoiding introduction of new Hazards, is an integral part of the development, design, construction and implementation of new equipment and modifications to existing equipment.

This procedure formalises six opportunities to identify and manage Risk through a development lifecycle, and is intended to provide the following benefits to the Business:

- improved safety and no introduced Hazards;
- allow elimination, substitution, modification, isolation or introduction of engineering controls at the design stage to reduce the effect of Hazards;
- ensure equipment delivered functions as expected;
- provide improved operability and maintainability;
- ensure required reliability is delivered and failure to safe conditions considered;
- ensure minimum life cycle cost for required features;
- ensure equipment specifications match required Risk profile; and
- identify construction Hazards

This procedure outlines the methodology to be followed to achieve these objectives. The methodology is based on the ICI methodology for Hazard Studies for Safety Health and Environmental protection.

3. SCOPE

This procedure applies to:

- all generation assets; and
- all modifications to assets or changes of operating modes of those assets.

4. DEFINITIONS

Term or Acronym	Meaning
	See *HSEREF0801.2 – Work Safe Roles and HSE Glossary*
HazOpS	**Haz**ard and **Op**erability **S**tudy
CHazOpS	Controls Hazard and Operability Study
CHS	Construction Hazard Study
SIL	Safety Integrity Level

5. ROLES AND RESPONSIBILITIES

Work Requestor	Work Planner	Work Authoriser	Work Supervisor	Specialist Worker Roles	Workers	Advice / Support
Risk Manager Asset Owner (officer) = Prod Mgr		HT Job Manager Manager Major Works	Project Manager	Hazard Study Leader Commissioning Manager	Work party members	HSE Team Manager Asset Strategy and Risk

Note: A Project, Outage or other HT Job Manager shall only facilitate a Hazard Study for their own work with the approval of the Project Director or Line Manager

Work Requestor
shall:

- request work be done

Manager Asset Strategy and Risk
shall:

- have overall responsibility for the procedure as a component of the governance and Risk management function in the Assets and Infrastructure space.

HT Job Manager
shall:

- authorise the work to be done

Manager Major Works
shall:

- have the responsibility for implementation of the procedure in the Assets and Infrastructure major works space.

Project Manager
shall:

- be responsible for implementing this procedure within the project;
- ensure facilitators and required team members are appointed;
- ensure Hazards Studies are conducted as required by this procedure; and
- ensure actions arising are tracked and implemented.

Hazard Study Leader (appointed by Project Manager)
shall:

- be responsible for ensuring the Studies required by this procedure are implemented to the standards and thoroughness required by this procedure;
- design the Hazard Study process in conjunction with the Production Manager, Project Manager and Technical Expert (e.g. principal asset engineer) including selection of Hazard Study style and guidewords appropriate for the type of work being studied.

As the end user for the project and the Hazard Studies, Production Manager
shall:

- have final acceptance of the process selection (Study types and stages), relying on endorsement of principal engineers, portfolio Risk Managers, and the Hazard Study Leaders; and
- be the client for reports and action lists generated from each stage.

Commissioning Manager (nominated by Project Manager)
shall:

- have a specific role as defined within this procedure in Hazard Studies 4, 5 and 6.

Workers
shall:

- follow this procedure

HSE Team
shall:

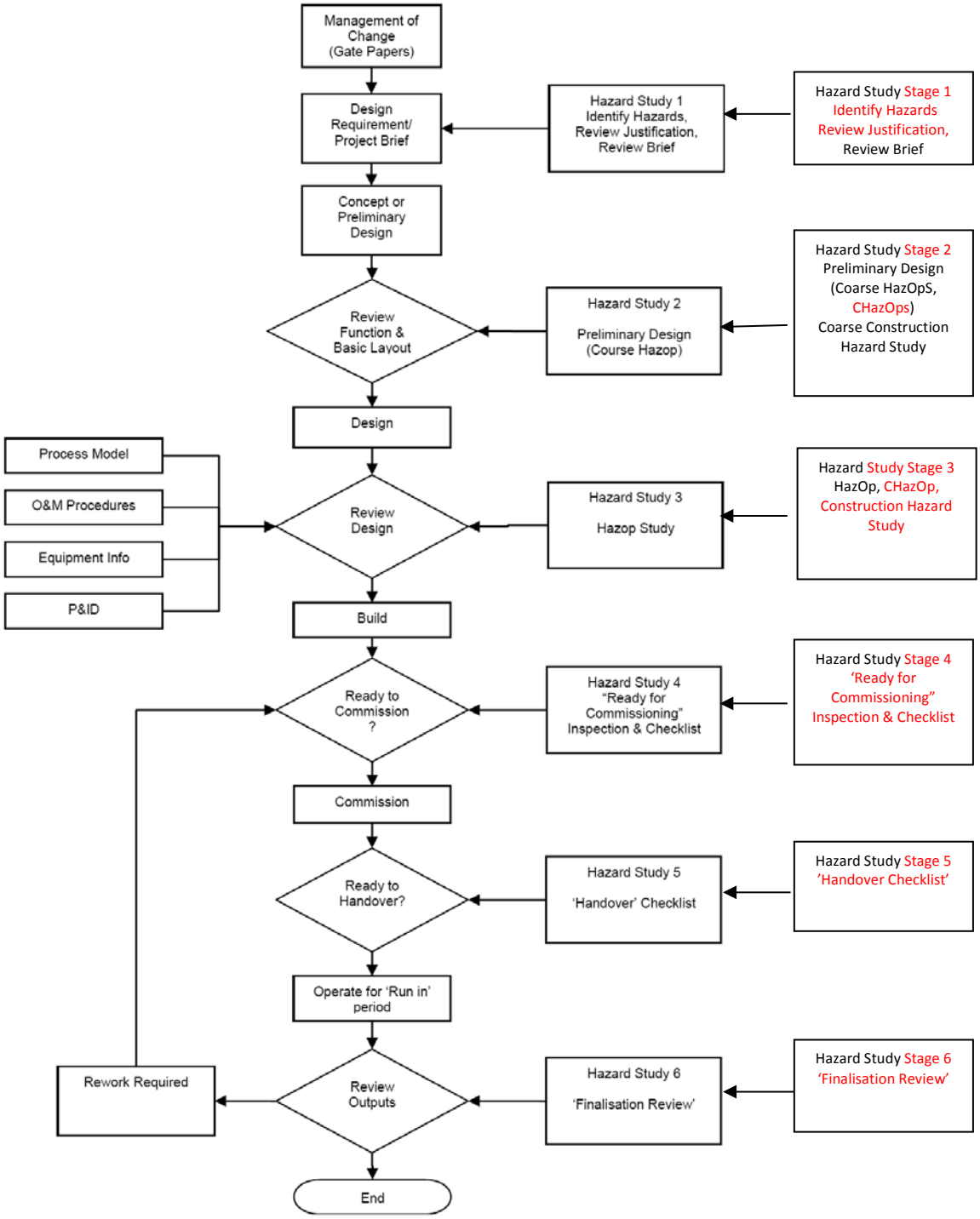
- train and maintain a sufficient pool of Hazard Facilitators (see Section 6.2.3 Hazard Study Leader Accreditation);
- coordinate the HSE Risk Assessments;
- maintain and review HSE documentation; and
- communicate and provide training in the application of HSE processes

6. PROCESS DETAILS

Hazard Identification and Management opportunities occur at six distinct phases of a project. The process of managing Hazards therefore spans the whole project and requires consideration at all of the six stages. Dependent on the nature and complexity of the project these may or may not be formal Studies. The extent and type of Study will need to be determined for each project.

Note: Multiple workshops, including HazOpS, CHazOps and CHS may be required to complete a Hazard Study Stage

Figure 1: Hazard and Operability Study HazOpS Process



6.1 Risk Management Context

This procedure is one component of the Business' Risk Management function and must therefore fit within the *Integrated Business Risk Management (IBRM) Procedure* and *IBRM Standard*.

The Hazard Study process provides a formal process for identification of Risks, and an ideal opportunity to assess and propose mitigating actions. Where mitigation actions are not obvious to implement, deciding whether they are justified e.g. redesign, addition of redundancy, determination of SIL level etc. shall be done in accordance with the IBRM procedure and IBRM standard and with consideration of the effort required to implement the action (ALARP).

Note: Risk Assessment is generally not necessary or achievable during a Hazard Study but may be warranted when it is not absolutely clear that mitigation is justifiable

Acceptance of Risk as identified in Hazard Studies, i.e. where recommendation is 'no action', shall be reviewed by the Production Manager, and, as necessary, approvals sought in line with the Delegation Manual.

Refer to the *IBRM Procedure* and *IBRM Standard* for details.

It can be difficult to prioritise Risk mitigation activities at an individual asset and project level if all Risks are assessed on the IBRM scale. The following are some guidelines for how this differentiation might be achieved at the Hazard Study / project level.

6.1.1. Individual Risk Level

If after assessing an individual Risk it rates Moderate or above on the IBRM scale, the Risk must be mitigated by elimination or reducing consequence or likelihood.

6.1.2. Aggregation

If the Hazard is common to the portfolio of generating plant, the Risk Target for an individual machine or system should be such that the aggregation of Risk from all such machines or systems is acceptable to the business.

For example; for a Risk scenario common to all 52 machines (e.g. protection function), the reliability target per machine will need to be approximately 50x the reliability at which an individual machine would rate on the IBRM scale as Moderate.

> *A 'what if' HazOpS Study identifies that if a protection system fails to detect a fault, it has potential to allow destruction of an alternator. The recommendation is to determine a SIL rating (i.e. reliability target) for the protection system. The potential consequence is estimated at $10M. The IBRM Standard states the Business will accept an exposure of no greater than 0.05 to this consequence.*

*With an estimated probability of the fault of 1 / 80 years / alternator (.0125 / alternator), and 50 large alternators in the system, the reliability of the protection must be at least 0.05 / (.0125*50) = 0.08 i.e. 1 failure in 12.5 operations (SIL1).*

6.1.3. ALARP Principle

ALARP means 'As Low As Reasonably Practicable'.

The ALARP principle is applied to the middle range of 'tolerable' Risks where the expectation is that Risk Mitigations will be applied to reduce the Risk to lower levels unless the costs of doing this are disproportionate to the benefits gained.

*In the previous example, the residual Risk cost per alternator can be calculated at 0.08*0.0125*$10M = $10k / year. (NPC ~$80k) If for $20k the protection can be upgraded to more than halve the Risk cost, it should be done. If it were more like $40k, it shouldn't and the business will accept the Residual Risk.*

6.1.4. Other Risk Scales (JHA, Project, Water To Wire(W2W))

Other Risk scales may be used in preference to IBRM if clearly designated in the Hazard Study records. Screening and prioritisation of actions are then reviewed on ALARP or financial principals.

Screening by consequence only can also be a useful approach.

6.1.5. Safety

Refer to the IBRM Standard. Again Risks of injury or deaths should be considered from an aggregated business standpoint, therefore necessitate a lower tolerance for individual machines or systems to result in an acceptable aggregated business Risk.

6.1.6. Safe Design

The *Model Work Health and Safety (WHS) Act* includes the concept of Safe Design. This is also included in the *Guide to the Model Work Health and Safety Act*.

Safe design means the integration of Control Measures early in the design process to eliminate or, if this is not reasonable practicable, minimise Risks to health and safety throughout the life of the structure being designed.

The safe design of a structure will always be part of a wider set of design objectives, including practicability, aesthetics, cost and functionality. These sometimes competing objectives need to be balanced in a manner that does not compromise the health and safety of those who work on or use the structure over its life.

Safe design begins at the concept development phase of a structure when making decisions about:

- the design and its intended purpose;
- materials to be used;
- possible methods of construction, maintenance, operation, demolition or dismantling and disposal; and
- what legislation, codes of practice and standards need to be considered and complied with.

This Procedure can be used to achieve safe design if Studies are extended to consider demolition, dismantling, decommissioning and disposal. Prompts need to be added according to the scope of the design and a starting point is the *Code of Practice for Safe Design of Structures* (currently in draft form) and the prompts included.

6.2 Study Leader / Facilitator Training and Accreditation

6.2.1. High Value, High Risk Projects

Complex, multidiscipline projects with a high degree of innovation or uncertainty, or of high value of (e.g. $5M), shall have an internal Hazard Study Leader appointed to oversee the overall process. Facilitation of the Stage 2 and Stage 3 HazOpS shall however be done by an external provider with appropriate experience.

6.2.2. Other Projects

Accredited Hazard Study Leaders shall facilitate.

6.2.3. Hazard Study Leader Accreditation

Hazard Study Leaders shall be undergoing the following training before individually acting as Hazard Study Leader:

- familiarisation with this procedure;
- familiarisation with Hazard Study tools, facilitation tips, checklists and documentation as referenced in Section 7 Reference Materials;
- attendance at sufficient Hazard Studies to be confident in the application of this procedure;
- completed HazOpS or Hazard Study Facilitator training; and
- acted as Hazard Study Leader for a project under guidance of a previously accredited Study Leader.

Training and maintaining of a sufficient pool of facilitators is the responsibility of the HSE team, a list of trained facilitators will be available on the *HSE website*.

6.2.4. Facilitation by Job Manager

A Project, Outage or other Job Manager shall only facilitate a Hazard Study for their own work with the approval of the Project Director or Line Manager.

7. REFERENCE MATERIALS

The following manuals and references are used to provide a safe system of work. These requirements are a minimum standard and shall not be compromised under any circumstances.

- *AS IEC 61508 Supp 1-2012 Functional Safety of Electrical / Electronic / Programmable Electronic Safety Related Systems*
- *AS IEC 61882-2003 (R2013) Hazard and Operability Studies (HAZOP Studies) – Application Guide*
- *Code of Practice for Safe Design of Structures*
- *Connection Process for Tas Generators*
- *Model Work Health and Safety (WHS) Act*
- WMS-FRM-23

The following is a list of commonly referenced material used on Hydro Tasmania sites.

- *HSEREF0801.2 – Work Safe Roles and HSE Glossary*
- *Constraints Management Procedure GP-AM-233*
- *HSE website*
- *HSEF0304.1 Hazard Identification Checklist Library*
- *HSEF0304.2 HazOpS Guidewords*
- *HSEF0304.3 What If Study (Controls HazOpS) Prompt Library*
- *HSEF0304.4 Hazard Study Stage 4 Commissioning Readiness Checklist*
- *HSEF0304.5 Hazard Study Stage 5 Handover Readiness Checklist*
- *HSEF0304.6 Hazard Study Finalisation Review Checklist*
- *HSEF0304.7 Hazard Study Causes of Failure*
- *HSEF0304.8 Hazard Study Record Sheet*
- *HSEF0304.9 Construction Hazard Study CHS Guidewords*
- *HSEF1101.1 Job HSE Requirements*
- *HSEP0301 – Hazard Identification and Operational Risk Management Procedure*
- *IBRM standard*
- *Integrated Business Risk Management (IBRM) procedure*

8. ATTACHMENTS

Appendix A: Hazard Study Stage 1 – Identify Hazards (HAZID)

Who	• Risk Manager / Project Manager (if appointed)	**When**	• When the need for the project and / or modification is identified, and prior to the design or project brief being finalised and conveyed to the concept team
Why	• To ensure the project is justified and has the right priority; • to ensure the Risk 'drivers' for the project are understood and communicated in the project brief (why are we doing it?); • to initiate a register of Hazards and operability requirements for inclusion in the project brief (what Hazards are we trying to eliminate by doing the project or strike along the way); • to set the standards appropriate for the project (what does success look like); and • to select the appropriate Hazard Study process.	**How**	• Small team review (e.g. kick off meeting): o Strategy and asset management (principal or nominee and Risk Manager) o Project Manager if appointed o Production (PM, operator and engineering) o Major outage team or Contractor rep if appropriate (Implementation methods). • checklist; • state objectives; • list Hazards and operability requirements; • define standards and metrics; and • incorporate in project and / or design brief

A.1 Purpose

To ensure the understanding of the project, the process, the operating environment and the Hazards involved are sufficiently understood to allow safety, health and environmental issues to be assessed. It allows key Hazards to be documented for elimination, management or control at the earliest stage in the project cycle. It also contributes to key policy decisions and ensures contacts are established between the functional groups involved.

Key aspects shall include:

- ensuring there is a clear understanding of the objective and scope of the project;
- reviewing information on previous Incidents on the plant, process or operation being studied;
- collecting information on the safety, health and environmental Hazards involved and providing a broad appreciation of the Hazards of fire, explosion and harmful release;

- reviewing onsite and offsite transport of materials, products and wastes;
- considering the human and organisational aspects of the project;
- reviewing the applicability of legislation and regulatory approvals;
- setting criteria for safety, health and environmental aspects of the project;
- reviewing relevant codes of practice and internal standards; and
- agreeing the extent and timing of further Hazard Studies.

A.2 Team

The Hazard Study Leader shall have received recognised training and be independent from the project team. The team should normally include:

- Hazard Study Leader (if appointed);
- Risk Manager;
- Production Manager;
- Project Manager (if appointed);
- Appropriate Functional Engineer (e.g. Principal Engineer(s) or nominee(s)); and
- Major Outage Team or Contractor representative where major disassembly / reassembly or construction demolition work is involved.

A.3 Responsibilities

Hazard Study Stage 1 may be performed prior to Project Manager being appointed. The Study is useful input for the project brief or customer requirements definition. In this case Hazard Study Stage 1 should be initiated by any of the Risk Manager, Strategic Engineer or the Production Manager.

The Project Manager is responsible for ensuring that Hazard Study Stage 1 has been undertaken, documented and completed.

The Project Manager is responsible for ensuring all actions identified in Hazard Study Stage 1 are completed.

The Hazard Study Leader is responsible for the thoroughness of the Study and the standard of documentation produced.

A.4 Timing

The completion of Hazard Study Stage 1 at an early stage in the project is essential. Hazard Study Stage 1 shall be completed prior to any concept design and is usually completed when the project idea is first conceived.

Since Hazard Study Stage 1 defines the key parameters for the project on safety health and environmental issues, it shall be completed prior to Gate 3 completion on every project.

A.5 Documentation

The checklist used shall be retained for the project file.

Appropriate notes / minutes / memo shall be prepared and issued as soon as possible. Outstanding actions shall be reviewed at the commencement of Hazard Study Stage 2.

Note: It is envisaged that the output of Hazard Study Stage 1 will be of relevance to the preparation of concept designs and specifications

A.6 Curtailment (Deletion)

In some cases where there are no Hazards inherent in the process, equipment, operations or their environment, or it may be considered that Hazards can be adequately documented at an early stage.

Where it is decided that the procedure can be safely curtailed, this shall be agreed by the Production Manager responsible.

A.7 Method

Checklist based Study.

Appendix B: Hazard Study Stage 2 – Preliminary Design

Who	• Project Manager / Hazard Study Leader	**When**	• As soon as required documentation is available.
Why	• To Study the proposed design / process to ensure it achieves the aims and considered the Hazards identified at Stage 1; • complements but is not a design review; and • significant changes can be implemented here that cannot at a later stage.	**How**	• Course HazOpS, CHazOpS or checklist: o design / project engineering; o production (operators and engineering); o strategic / asset engineers (principal or rep); and o safety and environmental as appropriate; • review project brief, Hazard Register; • Construction Hazard Study; • assess and document Hazards; • propose Improvements; and • lock in – review impact of proposed changes and lock in those of net benefit.

B.1 Purpose

The purpose of Hazard Study Stage 2 is to identify significant Hazards, providing the opportunity for their elimination by redesign. Where this is not practicable, protective measures may need to be incorporated.

Key aspects shall include:

- Review of Hazard Study Stage 1 documentation and how the proposal addresses the Hazards and objectives stated at that stage;
- consideration of any impact (either safety, health or environmental), which the project may have either onsite or offsite;
- identification of significant Hazards with special attention being paid to loss of containment;
- a review of the measures proposed to prevent Workers being exposed to Hazards;
- definition of unsafe conditions, fail safe and fail to safe modes;
- definition of Isolation requirements; and
- production of information which can be used in other related Studies (e.g. SIL) and design procedures e.g. trips and alarms, pressure relief etc.

B.2 Team

The Leader of Hazard Study Stage 2 shall have received recognised training and / or accreditation and should normally be independent from the project team. The team composition shall be proposed by the Project Manager and agreed by the Hazard Study Leader. It should normally include:

- Hazard Study Leader;
- Project Manager;
- Appropriate functional engineer(s) (e.g. principal or nominee);
- Production (operators and engineering);
- Design engineers;
- Outage Manager as appropriate (e.g. complex or unusual installation methods); and
- one or more HSE specialists may join the team as required.

B.3 Responsibility

The Project Manager is responsible for ensuring that Hazard Study Stage 2 is initiated, documented and that all the actions are completed.

The Hazard Study Leader is responsible for the thoroughness of the Study and the standard of the documentation produced.

B.4 Timing

Hazard Study Stage 2 shall be carried out prior to detailed design and as soon as a proposed P&ID, MPOLD, logic block diagram, or the preliminary layout, arrangement, assemblies and / or services distribution, are available.

To ensure that proper provisions are made for dealing with any significant Hazards, Hazard Study Stage 2 shall be completed prior to the finalisation of Gate 3 papers wherever practical.

B.5 Documentation

HSEF0304.8 Hazard Study Record Sheet shall be included in the project folder summarising the Hazards identified, together with any quantified assessments necessary for screening of actions.

B.6 Method

Course HazOpS, Construction Hazard Study, team review and checklist, FMECA, SIL Studies may be appropriate alternatives or tools.

Appendix C: Hazard Study Stage 3 – Detail Design HazOpS

Who	Project Manager / Hazard Study Leader.	**When**	• To Study the design to ensure it achieves the aims and considered the Hazards identified at Stages 1 & 2; • to formally challenge the design, using the HazOpS, CHazOpS and / or CHS processes; • complements but is not a design review; and • includes a prioritisation & justification of recommendations identified during the HazOpS.
Why	• All documentation required for the HazOpS must be available. As a minimum this includes: o P&ID's; o Logic Block Diagrams; o MPOLD; o accurate assembly or arrangement drawings; o Functional Specifications; and o outline operating instructions and maintenance procedures.	**How**	• Team review (HazOpS): o design / project engineering; o production (operators and engineering); o installation and / or Commissioning Manager or rep; o strategic / asset engineers (principal or rep); and o safety and occupational health as appropriate; • review project brief, Hazard Register, Stage 1 & Stage 2 recommendations; • HazOpS; • CHazOpS; • Construction Hazard Study; • propose Improvements; and • Lock in – review impact of proposed changes and lock in those of net benefit.

C.1 Purpose

The purpose of Hazard Study Stage 3 is to review the design and / or procedures to identify any Hazards or obstacles to operability which could arise, particularly through deviations from the design intent. In the case of mechanical and electrical equipment and control, this will be based on the Study of firm engineering diagrams and outline operating procedures. In the case of civil structures, this will be based on civil / structural drawings and a summary of the design basis. The consequences of deviations are identified and where necessary appropriate corrective actions initiated.

The Study also provides an opportunity to review potential maintainability and quality problems. Key aspects shall include:

- a detailed, systematic Study of the design and outline operating and maintenance procedures to identify the consequences of deviation from design intent;
- consideration of transient operating conditions during start-up, shutdown, trips and Emergencies; and
- consideration of potential exposure of Workers to harmful effects during routine operations including maintenance.

C.2 Team

The Leader of Hazard Study Stage 3 shall have received recognised training and / or accreditation and should normally be independent from the project team. It is key to a successful HazOpS that sufficient breadth of experience and independence from the project team (fresh eyes) is included in the team. The team composition shall be agreed by the Hazard Study Leader and should normally include:

- Hazard Study Leader;
- Project Manager;
- appropriate functional engineer(s) e.g. principal engineer or nominee;
- Production (operators and engineering);
- Project and design engineers;
- Installation and / or Commissioning Manager or chief of tests (as appropriate); and
- one or more HSE specialists may join the team as required.

C.3 Responsibilities

The Project Manager is responsible for ensuring that Hazard Study Stage 3 is initiated, documented and that all the actions are completed. The Project Manager shall also be responsible for ensuring that all changes to the design arising after completion of Hazard Study stage 3 are examined for possible Hazards, and the results documented in the same way as the original Hazard Study Stage 3.

The Production Representative is responsible for implementing any changes to operating and maintenance procedures, instructions or training which may be required as a result of the Study (even if delivered by the project).

The Hazard Study Leader is responsible for the thoroughness of the Study and the standard of the documentation.

C.4 Timing

Hazard Study Stage 3 shall be completed before the commencement of Site works. Hazard Study stage 3 shall be carried out when firm design drawings (i.e. MPOLD, P&ID's, control block diagrams, accurate arrangement and / or assembly drawings) are available and outline, operating and maintenance procedures are available.

C.5 Documentation

HSEF0304.8 Hazard Study Record Sheet summarising the Hazards identified, together with any quantified assessments necessary for screening of actions, plus other supporting documents together with evidence of the completion of all actions, shall be included in the project folder.

In addition it may be necessary for assessments carried out as part of Hazard Study Stage 2 to be amended.

C.6 Method

- Review of Stage 1 & Stage 2 actions and checklists;
- formal HAZOP;
- Construction Hazard Study; and
- a large number of actions can be generated by Hazard Study Stage 3. It is important that the Project Manager initiates a cost / benefit review and formal review meetings to monitor progress on these.

C.7 Risk Screening of Recommendations

A Risk Screening process is required to evaluate those for action and also to ensure high level actions are tracked through the process and not multiple minor issues.

C.8 Changes

Following the completion of Hazard Study Stage 3 any modification made to the design, including those made during the commissioning stage will need to be controlled. Established Change Control Procedures shall be used, the changes being approved by the Principal Engineer and Commissioning Manager and referenced in the project records.

Appendix D: Construction Hazard Study

Who	Project Manager / Hazard Study Leader.	**When**	• To Study proposed construction / Site activities to ensure controls are in place and manage Hazards; • to formally challenge the proposed construction techniques, using the CHS process; and • complements but is not a HazOpS.
Why	• A high level and early Risk Assessment using the experience of a team to ensure all Hazards are identified for all phases of construction. For a large construction job, the phases will be: 1. Pre-mobilisation; 2. Mobilisation; 3. Early Works & Site Setup; 4. General Works; 5. Scope of Works; and 6. Demobilisation. • The CHS does not replace existing safe work practices of PTW, JHA, SWMS, Take 5, toolbox meeting, environmental plans, Site safety management plans etc.	**How**	• Team review (CHS): o Hazard Study Leader; o design / project engineering; o production representative; o installation / Site Manager or rep; o representatives from key Site contractors; o key supervisors; o Health and Safety advisor; and o Environmental advisor as appropriate. • review each phase of construction to identify Hazards and controls to manage Risks to an acceptable level; • record all Hazards and controls using the *HSEF0304.8 Hazard Study Record Sheet* or other Risk / Hazard Register as appropriate to the work; • minutes to include attendees, information reviewed, codes or standards referenced and records of Hazards and recommended Controls; and • Significant Hazards and Controls to be included in the Project Site Safety Management Plan

D.1 Purpose

The purpose of CHS is to carry out a high level Risk Assessment to identify construction Hazards and Risks associated with construction or other Site work. A team including all key Site Contractors shall review each phase of construction to identify Hazards and Controls necessary to reduce the identified Risks to an acceptable level.

D.2 Team

The Leader of the CHS shall have received recognised training and / or accreditation according to this Procedure and should ideally be independent from the project team. It is key to a successful CHS that sufficient breadth of experience and independence from the project team is included in the CHS team to ensure a broad enough view of the Risk Assessment. The team members shall be agreed by the Hazard Study Leader and should normally include:

- Hazard Study Leader;
- Project Manager;
- Site Manager;
- Production representative;
- Project and / or design engineers;
- key Contractor Representatives;
- key Supervisors; and
- one or more HSE specialists may join the team if required.

D.3 Responsibilities

The Project Manager is responsible for ensuring that CHS is carried out, documented and that all the actions are completed / implemented.

The Project Manager is also responsible for ensuring the CHS documentation is included in the Project Site Safety Management Plan.

The Hazard Study Leader is responsible for the thoroughness of the Study and the standard of the documentation.

Site Managers will ensure that the CHS records are made available to the entire Workforce and updated as new situations / requirements arise.

D.4 Timing

CHS shall be completed before the commencement of Site works with sufficient time to manage identified Hazards.

Project Manager or client may decide to complete a CHS as part of Hazards Studies Stage 2 and / or Stage 3.

D.5 Documentation

The CHS minutes to include the following:

- List of attendees;
- reference or copy of construction drawings and documents reviewed; and
- record all Hazards and Controls using *HSEF0304.8 Hazard Study Record Sheet* or other Risk / Hazard Register as appropriate to the work.

Significant Hazards and controls are to be included in the Project Site Safety Management Plan.

All Risks should be included in the Project or Site Risk Register.

D.6 Method

CHS is best carried out on Site, or as a minimum, after a Site inspection to ensure all participants understand the Site

Preparation

- Conduct pre outage site condition inspection (*WMS-FRM-23*);
- collate station Hazard Register and previous Hazard Study records;
- distribute all information e.g. drawings, construction methods, schedule etc.; and
- review prompt words for any additions.

Workshop

- Outline scope of construction / Site works to be covered, ideally through a walk around the Site;
- describe the work methodology to be followed during the construction / Site work;
- for a large construction or Site work project the CHS records may be divided into 6 phases:
    1. Pre-mobilisation (offsite planning and preparation for works);
    2. Mobilisation;
    3. Early Works & Site Setup;
    4. General Works (setting up scaffold and other preparatory works);
    5. Scope of Works; and
    6. Demobilisation.
- discuss in detail each component of CHS (Pre-mobilisation, Mobilisation, Early Works & Site Setup, General Works, Scope of Works & Demobilisation, or other grouping of phases as is appropriate for the scale of construction / Site works)

Whenever an activity requires the installation of temporary equipment / structures / facilities / plant / hardware / scaffolding etc. the CHS must include the activities to tear-down and remove the temporary equipment and assess the associated Hazards in recognition that these activities may not be exactly opposite steps to their installation.

The number of CHS meetings will depend upon the project size and for a small project all 6 phases can be completed together.

D.7 Communication

- All Hazards should be included in the Project or Site Risk Register;
- Site Managers shall ensure that the Site Risk Register is made available to the entire Workforce and updated as new situations / requirements arise; and
- Hazards may be used to populate *HSEF1101.1 Job HSE Requirements*

Appendix E: Hazard Study Stage 4 – Commissioning Readiness Inspection and Checklist

Who	Commissioning Manager	**When**	Prior to commissioning
Why	• To ensure the build is complete; • to review the pre-commissioning and commissioning plan; • to ensure that the 'As-built' is as intended in the design; • to check that previous Hazard Study actions have been implemented; and • to check that operating instructions and Emergency procedures are satisfactory for safe operation of the plant.	**How**	• Team inspection: o project; o build; o commissioning; and o asset engineers • Production (operators and engineering); • Strategic / asset engineers (principal or rep); • check plant and systems against checklist; • issue punch list; and • lock In – accept or reject the plant for commissioning.

E.1Purpose

To check that the plant or building has been constructed to the intended design and that actions from previous Hazard Studies have been completed, and implemented in the design and installation.

To check that the operating instructions and Emergency procedures comply with any requirements identified by previous Hazard Studies and are satisfactory for safe operation.

Key aspects shall include confirmation that:

- actions agreed at earlier Hazard Studies have been completed or that any changes are justified;
- all actions have been documented;
- changes made following Hazard Study Stage 3 have been studied and recorded;
- operating instructions are available for normal operation, start-up, planned and Emergency shut-downs and, where appropriate, for maintenance of plant;
- Emergency procedures are available;
- Commissioning documentation is available and appropriate and commissioning Workers are suitably prepared; and
- an opportunity has been provided for those responsible for personal safety, employee health and environmental protection on the Site to satisfy themselves that the detailed implementation of the project meets the business and legislative requirements.

E.2Team

The Study takes the form of a pre-commissioning inspection of the plant.

The Commissioning Manager is responsible for arranging the inspection, by the following or their representatives:

- Project Manager;
- Site Manager;
- Commissioning Manager and chief of tests;
- Engineering representatives (strategic and / or project);
- Production (manager and / or operator); and
- one or more HSE specialists may join the team as required

E.3Responsibilities

The Commissioning Manager is responsible for the completion of Hazard Study Stage 4.

If any outstanding actions from this or previous Hazard Studies have not been completed, the Commissioning Manager and Project Manager shall organise the rectification of those. If the Commissioning Manager recommends that, although there are departures from design, operations can commence, then approval from the Production Manager is required.

E.4Timing

Hazard Study Stage 4 shall be completed prior to the commencement of commissioning, or 'water on', whichever is the sooner.

E.5Documentation

The checklist used shall be retained for the project file.

Commissioning ITP should include signoff that this activity has been completed.

E.6Method

Team inspection & checklist.

E.7Safety, Environment and Hazard Documentation

Copies of all the records, reports, drawings and other documentation called for in this procedure together with any necessary support documentation shall be assembled by the Project Manager and provided to the Commissioning Manager.

The Commissioning Manager shall return copies of documents relating to Hazard Studies Stage 4 and Stage 5 to the Project Manager for inclusion in the project files.

Appendix F: Hazard Study Stage 5 – Handover Readiness

Who	• Commissioning Manager.	**When**	Between three months and six months after commissioning.
Why	• Check design has been constructed as intended and is safe to put into service; • ensure plant limits and any operational restrictions as a result of commissioning are documented and approved; and • check production are in a position to accept handover	**How**	• Team inspection: o project; o production; and o commissioning; • check plant against checklist; • issue punch list; and • lock in – handover certificate

F.1 Purpose

To check that the plant or building has been constructed to the intended design and that actions from previous Hazard Studies have been completed, and implemented in the design and installation.

To check that production have clear understanding of the status of the plant, are knowledgeable of operating instructions, restrictions and outstanding work.

Duty of care passes to production with handover.

To check that the operating instructions and Emergency procedures comply with any requirements identified by previous Hazard Studies and are satisfactory for safe operation.

To review any punch list items arising from commissioning and ensure they do not compromise safe operation.

To review operating restrictions recommended by the Commissioning Manager.

Key aspects shall include confirmation that:

- actions agreed at earlier Hazard Studies have been completed, or that any changes are justified;
- all actions have been documented;
- operating instructions are available for normal operation, start-up, planned and Emergency shut-downs and, where appropriate, for maintenance;
- Emergency procedures are available; and
- plant limits and temporary constraints are documented and communicated.

F.2 Team

The Study takes the form of a review of the commissioning ITP, in particular assessing the effect of unresolved issues on safe operation during normal and Emergency situations.

The Commissioning Manager is responsible for arranging the inspection by the following:

- Project Manager;
- Commissioning Manager and chief of tests;
- asset engineering (principal or representative); and
- production (Manager and / or operator)

F.3 Responsibilities

The Commissioning Manager is responsible for carrying-out Hazard Study Stage 5.

If any outstanding actions from previous Hazard Studies have not been completed, the Commissioning Manager shall justify to the Production Manager, the basis on which operation can commence.

F.4 Timing

Hazard Study Stage 5 shall be completed prior to equipment being placed in service.

F.5 Documentation

The Commissioning Manager shall be responsible for updating the project files with documents demonstrating that the procedure has been satisfactorily completed.

A list of any outstanding actions which need to be completed shall be produced and added to the files.

Plant limits operational restrictions shall be formally registered through the relevant procedures. *Constraints Management Procedure GP-AM-233* and *Connection Process for Tas Generators* as required.

F.6 Method

Team review and checklist.

Appendix G: Hazard Study Stage 6 – Finalisation Review

Who	Project Manager.	**When**	Between three months and six months after commissioning.
Why	• To ensure that the requirements of Hazard Studies stages 1 to 5 have been completed; • to ensure that 'As-built' documentation is completed; • to ensure that performance is adequate or actions initiated to rectify deficiencies; and • to take learning into future projects and Hazard Studies	**How**	• Team inspection: o project; o production; o commissioning; o asset engineers • check plant against checklist; • actions to rectify deficiencies; and • close the gate –sign off.

G.1 Purpose

To check that Hazard Studies Stages 1 to 5 have been completed and all actions resulting have been finalised.

To review early operation to ensure that it is consistent with the design intent with regard to safety, health and environmental issues, and that assumptions defined in earlier Hazard Studies are borne out in actual operation.

To identify and record operating and maintenance difficulties and ensure feedback to project delivery, ASR. designers and others responsible for the project i.e. knowledge capture for future projects.

G.2 Team

The Study team shall include:

- Commissioning Manager;
- production (Manager and / or operator);
- designer;
- previous Hazard Study Leaders;
- engineering (strategic and production); and

G.3 Responsibility

The Project Manager is responsible for organising Hazard Study Stage 6.

G.4 Timing

Timing is most important for the successful completion of Hazard Study Stage 6. Although it is important that this Study is based on operating experience, a long delay can mean that the project and commissioning teams have been dispersed.

The Study shall take place not earlier than three (3) and not later than six (6) months following the commencement of production.

G.5 Documentation

The Project Manager is responsible for the addition of a note to the project file confirming that Hazard Study Stage 6 took place and summarising any actions identified and the responsibility for completion.

G.6 Method

Team inspection and checklist.