Assets Planning and Delivery Group
Engineering

HA-ST-02

Electrical Equipment in Hazardous Areas (EEHA)
Hazardous Area Classification Standard

VERSION 1
REVISION 5

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FOREWORD

Electrical Equipment in Hazardous Area (EEHA) Standards are prepared to ensure that the Water Corporation's staff, consultants and contractors are informed as to the Water Corporation's EEHA standards and recommended practices. EEHA standards are intended to promote uniformity so as to simplify selection, installation and maintenance practices; their ultimate objective is to provide safe and functional plant, at minimum whole of life cost.

The Water Corporation EEHA standards and recommended practices described in this EEHA standard have evolved over a number of years as a result of capital project delivery, plant operation and maintenance experience gained through the selection, installation and maintenance of electrical equipment in our hazardous area facilities.

Deviation, on a particular project, from the EEHA standards and recommended practices maybe permitted in special circumstances but only after consultation with and endorsement by the Senior Principal Electrical Engineer, Mechanical & Electrical Assets, Engineering.

Users are invited to forward submissions for continuous improvement to the Senior Principal Electrical Engineer, Mechanical & Electrical Assets who will consider these for incorporation into future revisions.

Head of Engineering

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REVISION STATUS

The revision status of this standard is shown section by section below:

REVISION STATUS						
SECT.	**VER./ REV.**	**DATE**	**PAGES REVISED**	**REVISION DESCRIPTION (Section, Clause, Sub-Clause)**	**RVWD.**	**APRV.**
All	1/0	30/04/12	All	Original (First) Version	FL	RC
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HA-ST-02
Electrical Equipment in Hazardous Areas (EEHA) Hazardous Area Classification Standard

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1 INTRODUCTION

1.1 Scope

This Standard details the hazardous area classification standards and philosophies to be applied when classifying hazardous areas at Water Corporation facilities. It also provides guidance on the recording of hazardous area classification data, including the production of the hazardous area classification drawings and schedules.

This Standard applies to the design of all modifications and upgrades to the existing Water Corporation facilities and the design of new facilities. It shall not be applied retrospectively to modify the initial hazardous area classifications of existing facilities, unless the Technical Integrity Custodian deems that the initial hazardous area classification poses a safety concern.

Each Water Corporation plant will have one HAC report and drawing set. Changes to the HAC including the addition of new equipment will require the updating of the existing documentation, rather than the production of project specific HAC documentation.

1.2 Exclusions

Nil

1.3 Abbreviations

EEHA	Electrical Equipment in Hazardous Areas
EPL	Equipment Protection Level
HA	Hazardous Area
HAC	Hazardous Area Classification
LEL	Lower Explosion Limit
TIC	Technical Integrity Custodian

1.4 Technical Integrity Custodian

The Technical Integrity Custodian (TIC) for this Standard is the Senior Principal Electrical Engineer, Mechanical & Electrical Asset.

1.5 Referenced Documents

The following documents are referenced in this Standard. If a referenced standard has been superseded, the user shall notify the TIC and utilize the latest edition of the standard unless advised otherwise in writing by the TIC.

AS/NZS IEC 60079.10.1:2022	Explosive atmospheres Part 10.1: Classification of areas – Explosive gas atmospheres
AS/NZS 60079.10.2:2011	Explosive atmospheres Part 10.2: Classification of areas - Combustible dust atmospheres
AS/NZS 60079:20.1:2012	Explosive atmospheres - Material characteristics for gas and vapour classification - Test methods and data
HA-ST-04	Electrical Equipment in Hazardous Areas (EEHA) - Competency Standard

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Energy Institute - Model Code of Safe Practice - Part 15 (2005 edition)	Area Classification Code for Installations Handling Flammable Fluids
API RP505:1997	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2

2 GENERAL

The aim of hazardous area classification is to avoid the ignition of releases of flammable materials that can be reasonably expected to occur in normal and abnormal situations. The approach is to reduce to an acceptable minimum level the probability of coincidence of an explosive atmosphere and an ignition source. The ignition of major releases of flammable material due to catastrophic equipment failure is beyond the scope of hazardous area classification.

3 CODES AND STANDARDS

Hazardous area classification of Water Corporation facilities shall in general be undertaken in accordance with the requirements of the Australian and Industry HAC standards, stated in Section **Error! Reference source not found.** as modified and enhanced by this Standard.

In accordance with good engineering practice and risk minimisation philosophy, plant shall be designed and operated so that the frequency and size of potentially explosive atmospheres is as low as is reasonably practicable, thereby ensuring that the resultant hazardous areas are reduced in quantity, size, and severity.

3.1 Modification of HA Classifications on Existing Facilities

The hazardous area classification of modifications and upgrades to existing Water Corporation facilities shall, whenever possible be compatible with both the existing site HAC methodology and this Standard. Where this is not possible, the discrepancy shall be resolved by an engineering assessment applying a risk-assessment method aligned with Water Corporation methodology.

3.2 New Facilities

The hazardous area classification of new facilities shall be in accordance with this Standard.

3.3 Application of the HAC Standard

The preferred method of classifying a gas hazardous area is to use the examples of hazardous area classification from AS/NZS 60079.10.1 Annex ZA. The 'first principles' methodology in AS/NZS 60079.10.1 should be used only when there are no examples of hazardous area classification contained in Annex ZA that are relevant to the installation, or when the examples of classifications give unacceptably conservative hazardous areas. Prior to resorting to classifying from 'first principles', the TIC may approve in writing the use of the area classification examples in other internationally recognised standards such as The Energy Institute, Model Safe Code of Practice, Part 15 (commonly known as EI15), or API RP505.

For adequately ventilated areas with numerous sources of gas release, the most efficient method of classification is usually as follows:

- Apply a 'blanket' Zone 2 hazardous area around the whole area up to the distance of the hazardous area extent applicable for a flange/valve, then

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- Identify secondary grades of release with larger hazardous area distances than a flange/valve, and using the relevant examples from AS/NZS 60079.10.1 Annex ZA, assess their impact upon the blanket Zone 2 boundary, then
- Identify any continuous or primary grade release points, and classify those areas as Zone 0 or Zone 1 respectively, using the relevant examples in AS/NZS 60079.10.1 Annex ZA, then:
- Review the area for locations where the ventilation could be less than adequate. The classification of these inadequately ventilated areas should be determined using a suitable methodology from AS/NZS 60079.10.1.

For dust hazardous areas, the preferred method of classifying a dust hazardous area is to use AS/NZS 60079.10.2. However, where specific industry accepted classifications exist in industry codes, or international standards, these may be accepted by the TIC.

The following items listed in this clause shall be considered in addition to the Australian and Industry HAC standards.

3.3.1 Areas Required To Be Non-Hazardous Areas

The facility design shall ensure that the following areas are classified as non-hazardous areas:

- All areas where hot work is regularly performed or where non-certified electrical equipment is used constantly (e.g. workshops, electrical equipment rooms, crib areas, administration buildings, etc.)
- Areas designated as vehicle thoroughfares and parking areas

3.3.2 Areas Surrounded By Hazardous Areas

All small non-hazardous areas surrounded by hazardous areas on at least three sides (unless separated from the hazardous area by an impervious barrier) shall be ‘filled in’ and deemed to be a hazardous area of the same Zone as the surrounding area.

3.3.3 Dispersion Modelling

Dispersion modelling can be used instead of the examples of gaseous hazardous area classification when the source of release is not adequately covered by the examples in AS/NZS 60079.10.1 Annex ZA, or when the hazardous area classification determined by the examples is not tolerable. The hazardous area boundary shall be taken as the 25% LEL contour for continuous and primary grades of release, and the 50% LEL contour for secondary grades of release.

3.3.4 Group and Temperature Class

The group and temperature class of a gas hazardous area shall be determined by the products in the area. Facilities should not be assigned a generalised gas group and temperature class based upon the ‘worst-case’ product(s).

For dust hazardous areas, the following parameters of combustible dusts in the area shall be determined:

- Layer and Cloud ignition temperatures
- Ignition energy
- Electrical conductivity

3.3.5 Equipment Protection Levels

In general, the Water Corporation will not conduct a risk assessment as defined in AS/NZS 60079.10.1 Annex ZC to adjust the Equipment Protection Levels (EPL) required for electrical equipment in hazardous areas. Therefore, Table 1 of AS/NZS 60079.14 shall be applied, resulting in the following assignment of minimum EPLs.

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Zone	EPL
0	Ga
1	Gb
2	Gc
20	Da
21	Db
22	Dc

The EPLs shall be marked on the hazardous area classification drawings.

3.3.6 Degree of Ventilation

The degree of ventilation of a room or other enclosed space shall not be determined using the hypothetical volume (Vz) methodology in AS/NZS 60079.10.1:2009 Annex B due to the well documented fact that this methodology is flawed, and will be removed in the next edition of AS/NZS 60079.10.1. Other suitable methodology (e.g. Computational Fluid Dynamics, or IEC 60079.10.1:2015) shall be used for the analysis.

3.3.7 Provisional Classifications

When provisional or similar 'interim' classifications have been used to expedite design work, prior to concluding the electrical installation and commencing the initial detailed inspections of the electrical equipment associated with those areas:

- the provisional classifications in the Hazardous Area Report and drawings shall be formally reviewed and revised to reflect the final classifications associated with the 'as built' plant, and
- the electrical design shall be reviewed to ensure that it complies with the final classifications.

4 HAZARDOUS AREA COMMITTEE

The TIC has overall responsibility for hazardous area classification. However, to ensure that all relevant parties have the necessary input to hazardous area classification, the TIC shall consult with personnel from other disciplines and departments, as required.

For large or complex situations, the hazardous area classification process may require significant input from various disciplines. In such cases, the formation of a hazardous area committee should be considered to ensure that the classification is actioned with due regard to all of the relevant factors. Refer to Appendix A of this Standard.

The Design Manager shall have responsibility for ensuring that the data required for the HAC is provided in a timely manner.

5 DOCUMENTATION

The following documents shall be produced/ revised during the design phase of any new development or modification to the existing facilities:

- Hazardous Area Report (including release schedule)
- Hazardous Area Drawings

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The HA classification shall be reviewed and the documents shall be as-built when the construction phase is completed.

Detailed requirements pertaining to these documents follow.

5.1 Hazardous Area Report

The purpose of the Hazardous Area Report is to capture the high level decisions and philosophies that apply to the hazardous area classification. It shall contain all the relevant classification information that is too general to include in the Hazardous Area Release Schedule, but too specific to be included in this Standard. For example, it might include reasons why assessment of classification using 'first principles' per AS/NZS 60079.10.1 was used for a particular classification rather than the examples in AS/NZS 60079.10.1 Annex ZA.

The Hazardous Area Release Schedule shall always be included as an appendix to the hazardous area report. The purpose of the hazardous area release schedule is to ensure that all potential sources of release have been identified, and to provide a basis for the development of the hazardous area classification drawings.

5.1.1 Gas Hazardous Area Release Schedule

The hazardous area release schedule for gases shall, as a minimum, contain the information shown in Table 1. A pro-forma layout for the schedule is contained in Appendix B.

The hazardous area release schedules should be produced as soon as possible so that Zone 0 and Zone 1 areas can be identified and possibly be removed by re-design. Also, facility layouts can be modified if required to ensure that areas where hot work is regularly performed or where non-certified electrical equipment is used constantly (e.g. workshops, electrical equipment rooms, administration buildings, etc.) can be deemed to be non-hazardous areas.

NOTE: Provided that clarity will not be lost, for facilities with a small number of hazardous areas, the details relating to the releases may be included in the main body of the Hazardous Area Report.

Table 1: Information Required in a Gas Hazardous Area Release Schedule

Parameter	Example of Parameter
Source Number	A unique number. Typically starting at 001 and continuing 002, 003, 004, etc.
Equipment	
Description/Tag No.	Gas Compressor CP71001, Gas Engine Room
Location	Gas Engine Room #3, Gas Storage Tank, Digester, etc.
Process Fluid	
Fluid	Biogas, natural gas, sludge, etc.
Process Pressure	1000kPa
Process Temperature	60°C
Flashpoint of Liquid	63°C
Auto-ignition Temperature	>200°C
Density to Air at STP	Lighter, Heavier, or Neutral
Release Point	
Containment System	Process piping
Source of Release	Valve, flange, pump, etc.
Grade of Release	Continuous, Primary, or Secondary

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Degree of Ventilation	High, Medium, Low (AS/NZS 60079.10.1), or Adequate or Inadequate (AS/NZS 60079.10.1 Annex ZA)
Availability of ventilation	Good, Fair, Poor (AS/NZS 60079.10.1)
Type of Ventilation	Natural, Artificial
Hazardous Area	
Zone	0, 1, or 2
Group	IIA, IIB, or IIC
Temperature Class	T1 to T6
Horizontal extent	3m
Vertical extent upwards	3m
Vertical extent downwards	3m, grade, etc.
Other	
Standard Reference	AS/NZS 60079.10.1 Annex ZA 6.2.2.2
Note/Comments	Sample valve is only used annually at shutdowns.

5.1.2 Dust Hazardous Area Release Schedule

The hazardous area release schedule for dusts shall, as a minimum, contain the information shown Table 2. A pro-forma layout for the schedule is contained in Appendix B.

The hazardous area release schedules should be produced as soon as possible so that Zone 20 and Zone 21 areas can be identified and possibly be removed by re-design. Also, facility layouts can be modified if required to ensure that areas where hot work is regularly performed or where non-certified electrical equipment is used constantly (e.g. workshops, electrical equipment rooms, administration buildings, etc.) can be deemed to be non-hazardous areas.

Table 2: Information Required in a Dust Hazardous Area Release Schedule

Parameter	Example of Parameter
Source Number	A unique number. Typically starting at 001 and continuing 002, 003, 004, etc.
Equipment	
Description/Tag No.	Bin BN71002
Location	Sludge Treatment Facility
Degree of Confinement	Indoors or outdoors
Process Fluid	
Fluid	Bio-solids, powder activated carbon, etc.
Cloud Ignition Temperature	300°C
Layer Ignition Temperature	200°C
Electrically Conductive	Yes
Group	IIIC
Dust Ignition Energy	30 mJ
Release Point	
Containment System	Process piping

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Source of Release	Conveyors, bio-solid bins, etc.
Grade of Release	Continuous, Primary, or Secondary
Level of Housekeeping	Good, fair or poor
Hazardous Area	
Zone	20, 21, or 22
Horizontal extent	1 metre
Vertical extent upwards	1 metre
Vertical extent downwards	3 metre, grade, etc.
Other	
Standard Reference	AS/NZS 60079.10.2 cl. 5.3
Note/Comments	Manway is only used annually at shutdowns.

5.2 Hazardous Area Drawings

The purpose of the hazardous area drawings is to show diagrammatically the location of the hazardous areas on the facility.

Each hazardous area classification drawing shall contain at least the following information:

- The main items of equipment
- Openings between areas of the facility (e.g. doors, windows)
- The extent of the hazardous areas, using hatching to symbolise the zones
- A legend showing the zone, gas group, temperature class for each type of hazardous area 'hatching'
- References to the relevant hazardous area schedules
- The source numbers of the release points
- The dimensions of the hazardous areas
- Any conditions upon which the hazardous area classification is dependent upon (e.g. operation of artificial ventilation)

There shall be sufficient drawings produced: plans, elevations, sections, and details, so that the hazardous area classification at any point on the facility can be unambiguously determined.

6 COMPETENCY

All persons – including non-Water Corporation personnel - classifying hazardous areas shall comply with the relevant requirements of the Water Corporation's Electrical Equipment in Hazardous Areas (EEHA) - Competency Standard: HA-ST-04.

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APPENDIX A: HAZARDOUS AREA COMMITTEE

(Informative: This appendix is provided for information only)

OVERVIEW

For large or complex situations, the hazardous area classification process may require input from various disciplines. In such cases, the formation of a hazardous area committee should be considered to ensure that the classification is actioned with due regard to all of the relevant factors. If a hazardous area committee is formed, the following disciplines should be responsible for the major duties:

- The electrical discipline, represented by the TIC, is responsible for leading and co-ordinating the hazardous area classification process, and to arrange production of hazardous area drawings and schedules.
- The process discipline is responsible for producing the data relevant to the flammable materials (e.g. flashpoint, category, ignition temperature, etc.) for inclusion in the hazardous area schedules.

In addition, the relevant disciplines such as instrumentation; mechanical; HVAC; safety; loss prevention; operations; drilling and architectural are required to provide review inputs on aspects such as pressurisation, ventilation, exhausts, duct locations, air locks, operability, fire and gas tight walls, etc.

PROCEDURE

The hazardous area release schedule should be completed by the process and electrical disciplines. Using this information, the electrical discipline should produce hazardous area drawings, including plans, elevations, sections and details, for formal discipline review. The following disciplines should be involved in the review process, as required:

- Electrical
- Instrumentation
- Process
- OS&H
- Operations
- Loss Prevention
- Telecommunications
- HVAC
- Architectural
- Mechanical

After discipline review, the comments should be collated by the TIC, and a meeting of the hazardous area committee should be convened. The committee should review the comments and approve modifications to the hazardous area drawings and any other relevant documents. All committee members should be issued with a set of minutes of the meeting which shall be signed as accepted, and returned to the TIC.

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APPENDIX B: HAZARDOUS AREA REPORT TEMPLATE

(Informative: This appendix is provided for information only)

This Appendix states the Water Corporation's requirements for content and structure of a HAC Report.

1.0 INTRODUCTION

The following text should be included:

This report covers the hazardous area classification (HAC) philosophy and details for the XXXXXX located at the Water Corporation's XXXXX site.

This document should be included in the hazardous area verification dossier for the site. The HAC should be reviewed and all relevant documents updated with any changes in relation to:

- Plant operations
- Locations of flammable and combustible materials
- Types of flammable and combustible materials
- Process and equipment data
- Building construction and ventilation

2.0 BACKGROUND & HA CLASSIFICATION HISTORY

This section should contain what is being classified, and the methodology being used (e.g. the examples in AS/NZS 60079.10.1 Annex ZA). It shall contain the history of the HA classifications. When the HA classification is reviewed due to process changes, new plant being added, etc. a new paragraph shall be added to this section.

Existing text in this section shall never be removed. In this way, a full history of the changes to the HAC is recorded herein.

3.0 OVERVIEW OF 'XXX' PLANT

Provide a brief introduction to the plant being classified. This section shall be updated if new plant is added.

4.0 FLAMMABLE MATERIALS

Text similar to the following should be included to list the products that were considered during the classification process:

The flammable materials transported, processed or stored in the 'XXX' Plant are:

- ***AAAAA***
- ***BBBBB***

AS/NZS 60079:20.1-2012 deems AAAAA to be group IIX temperature class TX, and BBBB to be group IIZ temperature class TZ.

5.0 HAC STANDARDS AND PHILOSPHY

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Text similar to the following should be included to list the standards used and EPLs assigned for the classification process:

The hazardous area classification was actioned using AS/NZS 60079.10.1:2009 as the base standard. All referenced clauses are contained in this standard, unless stated otherwise.

The HAC methodology applied has specifically excluded a risk assessment as defined in Annex ZC. Therefore, Table ZC.1 of AS/NZS 60079.10.1 has been applied, resulting in the following assignment of equipment protection levels (EPL).

Zone	*EPL*
0	*Ga*
1	*Gb*
2	*Gc*

6.0 HAZARDOUS AREA CLASSIFICATION

The content of this section will depend upon the complexity and size of the classification.

Typical text may include the following:

A site meeting and plant tour with XXXXXX was used to collect information relevant to the hazardous area classification.

The following points are relevant to the hazardous area classification:

- ***List any relevant major points here in bullet form***

The following P&IDs were supplied by XXXXXX who advised that they showed all the equipment, which contain flammable products in the XXXXX Plant:

- ***List drawings and revisions***

Break the plant down into areas or logical systems and assess each for hazardous areas. Record the items analysed, and record these in the Hazardous Area Release Schedule.

7.0 HA CLASSIFICATION DRAWINGS

Record a list of all HAC drawing produced and their current revision. All drawings should refer to this report by document number (but without revision number so that all drawings do not have to be updated when this report is updated).

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END OF DOCUMENT

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