

Project title	Class 230 D-Train Safety Approvals
Client name	Vivarail
Completed by	AEGIS Engineering Systems

## Project Overview



Vivarail is the designer and manufacturer of the Class 230 trains. Its fleets are built with new modular power systems using the most modern, green technology. Vivarail has led the development of battery power in the UK and, with the help of AEGIS, now has the only battery and battery hybrid trains fully approved for passenger service.

The Class 230 has many variants including a DEMU; a Diesel-Battery Hybrid; and Battery Hybrid (that utilises lineside charging stations). Vivarail selected AEGIS to support the safety approvals of the Class 230 designs and their operation by Vivarail, all managed following the requirements set out in the Common Safety Method.

## Safety and Approvals Strategy

AEGIS prepared the Safety and Approvals Strategy document at the outset of the project setting out the process for gaining approval of the Class 230 designs and presented it to all stakeholders (including DfT, ORR, Network Rail and the identified Train Operating Company) for endorsement. The strategy detailed the DEMU base unit and set out the progressive development and integration of the battery module and charging unit. The intent of the strategy was to provide a flexible approach to the approvals such that the design and testing is as efficient as possible.

## Common Safety Method - CSM-RA

A key requirement of CSM-RA is to produce and maintain a clear System Definition. AEGIS guided Vivarail through the process and assisted in defining the scope of the system, which due to the different design variants, had to be split according to design and operation as they may require different "actors" under CSM-RA.

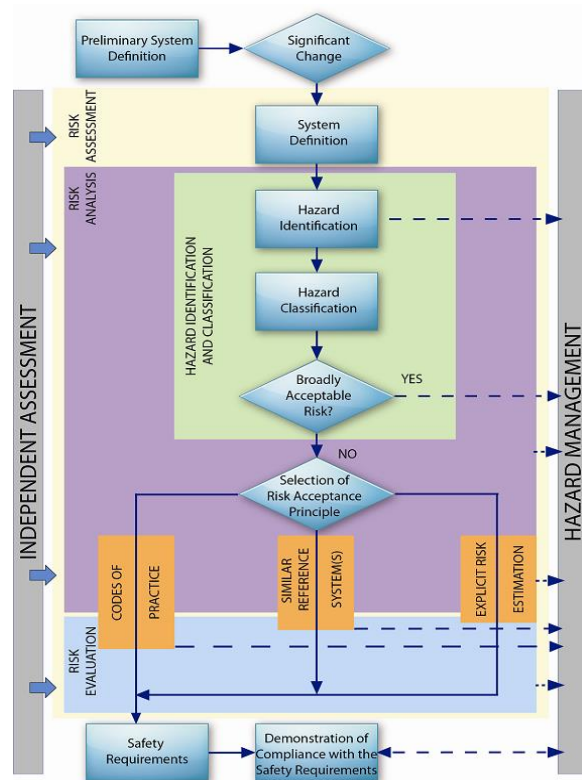


Figure 1 - CSM-RA Process Overview

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## Hazard Identification & Management

We managed a Hazard Identification workshop to permit all hazards associated with the design, installation, operation and maintenance of the Class 230 to be identified. Both generic and specific hazards were identified to cover all Class 230 design variants. AEGIS prepared a complete hazard record, including an initial estimation of the risk classification (frequency, severity) in accordance with an established CSM-RA approved risk classification matrix. We then summarised the process and its outcomes in a Preliminary Hazard Analysis (PHA) Report that advised the Project and its suppliers of the objective evidence required to close out the identified hazards. Risk mitigation leading to hazard closure followed, applying the key Risk Acceptance Principles within CSM-RA.

## EMC & EMF

AEGIS defined and managed all required EMC and EMF activities for the Class 230 development, including:

- Producing all necessary EMC and EMF documentation Strategy
- Battery traction system design
- Creation of the EMC & EMF Requirements document
- Test specification and management
- Longitudinal voltage assessment

AEGIS also managed bespoke EMC testing to provide functional EMC assurance to Vivarail for its Diesel-Genset (DGS) apparatus, which helped mitigate a major risk to project progression. As shown in Figure 2 this was arranged at an Open Area Test Site (OATS) as the apparatus was too large for an anechoic chamber.

**AEGIS Engineering Systems Ltd**  
 29 Brunel Parkway, Derby DE24 8HR  
[www.aegisengineering.co.uk](http://www.aegisengineering.co.uk)  
[info@aegisengineering.co.uk](mailto:info@aegisengineering.co.uk)  
 +44 (0) 1332 384 302

## Forming Lasting Partnerships

The initial work with Vivarail has led to AEGIS supporting several further projects including:

- Route compatibility (EMC, EE&CS and non-EE&CS) of Class 230 Diesel-Battery Hybrid units for Wales & Borders transit and operational routes.
- EMC and safety approvals of Class 484 750VDC 3<sup>rd</sup> rail variant for the Isle of Wight, including the specification and management of all EMC testing.
- EMC and safety approvals of a 25kV EMU variant



Figure 2 - Radiated Emissions Testing of DGS at Vivarail

## The AEGIS Difference

The AEGIS Safety and EMC teams offer an unparalleled combination of expertise in all areas of safety (for EMC, EE&CS and non-EE&CS) with the added ability to provide a full suite of EMC test services.

This gives Vivarail the assurance that it is partnering with a company that has the know how and capability to take ownership of delivering its Safety, Approvals and EMC activities, from start to finish, with continuity and the same high quality of work throughout.

## AEGIS Case Study

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