



IMSA 3 – Integrity Management System Application

Background:

IMSA is an acronym for Integrity Management System Application. It is an integrated software application which manages all aspects of the integrity management process. Although the current scope of IMSA is pipelines (offshore and onshore) and all underwater assets, it can also be used to apply the integrity management process to any static equipment classes.

IMSA 1 was prototyped as an MS Access application for (SPEX) Shell Philippines Exploration B.V. in 2002 and was later deployed to production as IMSA 2 in 2003. It was then implemented for (SMEP) Shell Malaysia Exploration and Production later in 2003 and for (SEPCo) Shell Exploration and Production Co. in the United States in 2004. The system was then implemented for (SNEPCo) Shell Nigeria Exploration and Production in 2007.

In 2007, with funding from SEPCo, the development of IMSA 3 was started. IMSA 3 was a ground-up re-development using .NET Framework 2.0 as the development platform and Oracle for the backend database.

In March 2008, IMSA 3 went live in SEPCo. This was then followed by SPEX, SMEP and SNEPCo respectively. The system has been in live use since then.

IMSA Philosophy:

IMSA was developed primarily for the management of Technical Integrity with a principal target audience of Discipline Engineers and Technical Authorities.

IMSA is designed to provide key integrity related information to the Asset Integrity Monitoring System (AIMS) and is a key element of the overall corporate Asset Integrity Management System. IMSA is intrinsically linked to the HSE Case developed for Pipelines and Underwater Assets.

Integrity threats and associated risks identified within the HSE Case, supplemented by Design, Operation and Maintenance Manuals, are used as the baseline for the integrity management process and modified as appropriate, based on the performance of the assets as measured by the prescribed inspection and monitoring activities.

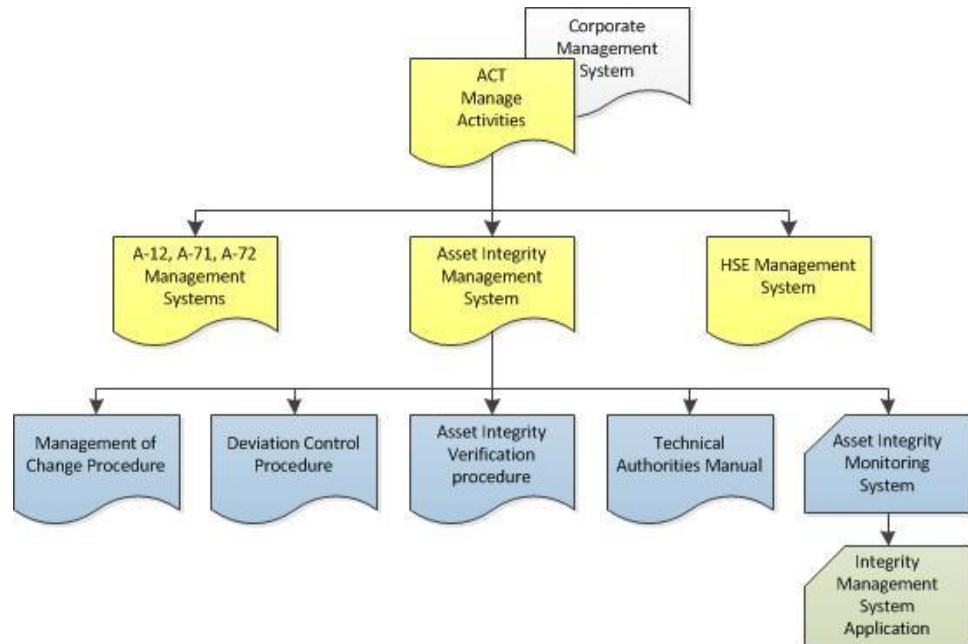


Figure 1 - Asset Integrity Management System



IMSA 3 – Integrity Management System Application

This fundamental relationship enables IMSA users to confirm and demonstrate dynamically, whether integrity risks are at an acceptable level.

A key differentiator is that IMSA enables a holistic approach to integrity management; it is not designed with analytical tools for engineering analysis e.g. internal corrosion modeling, finite element analysis but imports information from such analyses, enables integrity status to be amended as appropriate and includes this information when generating risk based inspection due dates, associated work scopes and recording asset performance history.

IMSA System Summary:

Technical Integrity Management is a process, which varies in detail between operating companies and equipment classes, but is principally generic:

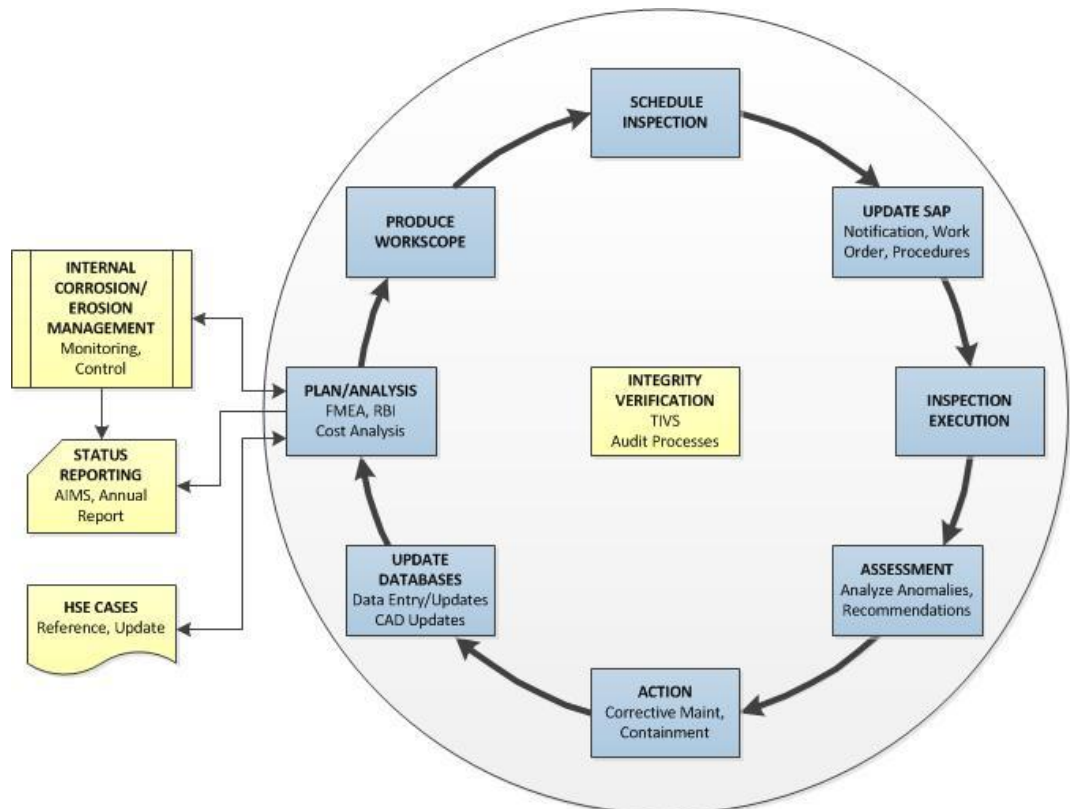


Figure 2 - Technical Integrity Management Process

IMSA has been designed to apply and manage that process by:

- Making data and multimedia easily available (Figure 3)
- Trending on available data (Figure 4)
- Applying RBI rules (Figure 5)
- Managing anomalies (Figure 6)
- Reporting integrity status and risk levels (Figure 7)
- Monitoring Events such as process excursions, seismic events (Figure 8)
- Prompting action parties
- Interfacing with other corporate databases (SAP, PAS, OmniSafe)
- Data integrity auditing and quality assurance



IMSA 3 – Integrity Management System Application

Key Attributes of IMSA

- Not designed for a particular equipment class. Can be used for any equipment to which the integrity management process is applied.
- Can be used in parallel with, (feed data to and apply outputs from) analytical systems which apply detailed corrosion rate or stress analysis calculations.
- Configurable system, most settings can be updated without recoding.
- Aligned to and integrated with SAP.

Potential Cost Savings IMSA Contributes to:

- **RBI and Workscope:** Reduction in inspection costs by applying inspection effectively: *appropriate* inspection, targeted at *high risk threats*
- **Anomaly Management:** Reduction in unplanned outages due to effective management and correction of defects and degradation
- **Data Access:** Reduction in analysis costs due to quick retrieval of inspection data, documents, multimedia
- **Integrity Management:** Increased HSES confidence due to demonstrable risk reduction
- **Integrity Management:** Reduction in planned outage time due to prior identification of anomalies allowing for good shutdown planning
- **Event Monitoring:** Reduction in equipment replacement costs due to instant flagging of events potentially harmful to integrity
- **Integrity Management:** Reduction in data entry, data management, analysis and reporting manpower costs due to single application with automated processes

IMSA System Functionality Summary:

Summarizing the main functionality of IMSA:

- Storage and retrieval of inspection data and multimedia for pipelines and underwater assets
- Electronic or manual inspection data uploading
- Anomaly management
- Integrity management process tracking and reporting
- Risk assessment of multiple failure threats with both time-based and non-time based degradation mechanisms
- Trending and predicted failure dates for time-based threats
- RBI analysis and workscope generation
- Reference file management (documents, drawings, photos and videos) and quick retrieval
- Design data storage and retrieval
- Quality Assurance process
- Seismic activity management and automatic webpage posting

Other key features of IMSA:

- Modular design, navigation of the application by module and sub-module
- Navigation/data filtering by asset trees, with asset coloring by integrity status, current risk or criticality
- User management and access rights allocation by user group and asset group
- Auditable event logging
- Highly configurable and flexible
- Automatic data auditing
- Event-triggered automatic email notification



IMSA 3 – Integrity Management System Application

White Paper

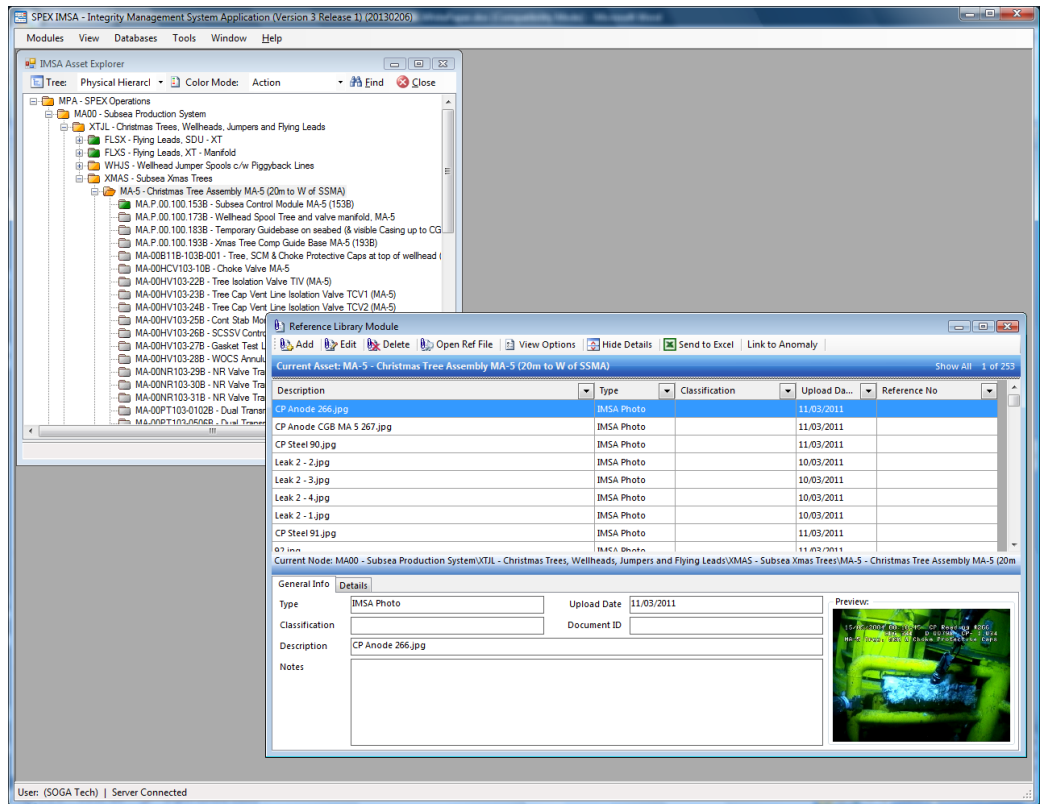


Figure 3 - Easy Access to Data and Multimedia

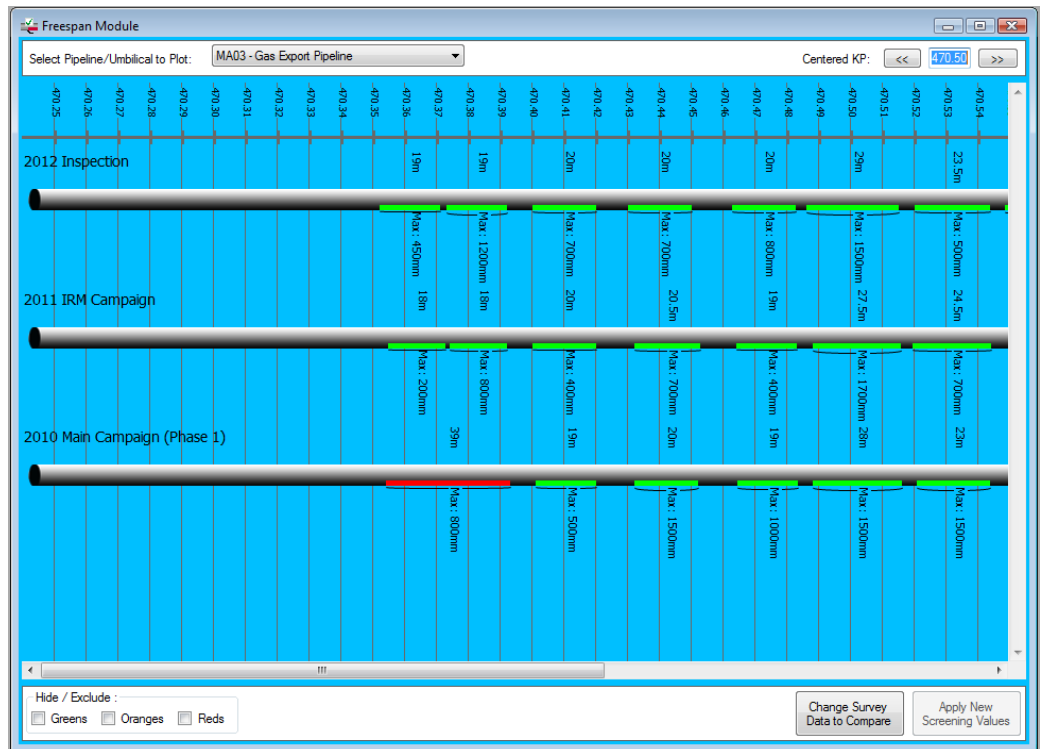


Figure 4 - Trending Functionality



IMSA 3 – Integrity Management System Application

White Paper

RBI Module
Current Asset: MA-5 - Christmas Tree Assembly MA-5 (20m to W of SSMA)

Consequence of Failures (COF) | Probability of Failures (POF) | Risk Matrices | Confidence Updates

Asset Name: UG1 - GEP Riser below MSL

Enable multiple selection

Failure Threat	Failure Threat Type	Status
<input type="checkbox"/> Overstress due to operating outside design envelope - The threat of overstressin...	Causing immediate and complete loss of the Asset's ability to perform	Medium
<input type="checkbox"/> Loss of structural support or restraint - The threat of loss of structural restraint re...	Does not immediately cause performance loss, but can lead to a critical or ...	High
<input type="checkbox"/> Internal corrosion - The threat of technical integrity failure caused by any corrosio...	Gradual, may develop into a critical failure	Medium
<input type="checkbox"/> Internal erosion - The threat of technical integrity failure caused by any erosion m...	Gradual, may develop into a critical failure	Medium
<input type="checkbox"/> External corrosion - The threat of technical integrity failure caused by any corrosi...	Gradual, may develop into a critical failure	High
<input type="checkbox"/> External coating damage - The threat external coating damage leading to external...	Does not immediately cause performance loss, but can lead to a critical or ...	High
<input type="checkbox"/> Failure of CP system (sacrificial anode) - The threat of sacrificial anode CP system fa...	Does not immediately cause performance loss, but can lead to a critical or ...	High
<input type="checkbox"/> Impact damage due to dropped or dragged marine anchor - The threat of mecha...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Impact damage due to dropped objects - The threat of mechanical damage cause...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Damage due to extreme weather event - The threat of any kind of damage caused...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Impact damage due to collision from marine vessels - The threat of mechanical da...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Damage due to marine vessel sinking - The threat of mechanical damage caused ...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Damage due to tectonic activity/earthquake - The threat of any kind of damage ca...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Failure due to latent fabrication defects - The threat of technical integrity failure c...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Debris, foreign objects - The threat of the presence of debris resulting in damage...	Does not immediately cause performance loss, but can lead to a critical or ...	High
<input type="checkbox"/> Damage due to fishing activities - The threat of mechanical damage caused by fis...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Leak (seal failures) at equipment/parts (valves, flanges, branches etc) - The threat ...	Causing immediate and complete loss of the Asset's ability to perform	High
<input type="checkbox"/> Excessive marine growth fouling - The threat of excessive marine growth fouling l...	Does not immediately cause performance loss, but can lead to a critical or ...	High
<input type="checkbox"/> Splash Zone Corrosion - External (an internal) corrosion specific to the Splash Zo...	Gradual, may develop into a critical failure	Medium

Confidence Comment:
No pressure excursions recorded. No Automated pressure monitoring in place, linked to auto-email. Assessed Medium

Confidence Status: Medium | Confidence By: SOGA Tech | Confidence Date: 19/11/2012

Figure 5 - Applying RBI Rules

Anomaly Module - Add/Edit Anomaly Record

Anomaly No: 02-0033 | Revision: 15 | Orig Action Class: Red | Current Action Class: Green

Group/Type: Leak to Environment/Loss c | Leakage - General | Orig Availability: Amber | Current Availability: Green

Asset Ref: MA.P.00.100.154A - Subsea Control Module-MA-7 (LS4A) | Date Identified: 27/01/2004 | Action Status: Closed

Details | Assessment | Recommendations | Risk Ranking | Intervention

Title: SCM LP selector valve functioning fault | FNCR Ref: | Life Term: N/A

Description: Portfolio Application: Equipment Failure: FNCR Required:

Update: 27-Feb-2004
Ma-7R SCM change-out completed (LPA/LPB selector valves open and hydraulic leak-free)

27-Jan-2004
Reported SCM LPA system leaks on Ma-7R. Anomaly raised as Amber

13-Oct-2002

Start Nothing: Start Easting: End Northing: End Easting:

Duplicate | Fields with (*) are required before saving. | Save | Cancel

Control ...	02-0033	08/07/2002	27/01/2004	Leakage - General	15	Closed	3	Green	Green
Control ...	12-0030	25/09/2012	04/03/2012	Leakage - General	6	Open	3	01/03/2013	Amber

Current Node: MA00 - Subsea Production System\XTL - Christmas Trees, Wellheads, Jumpers and Flying Leads\XMAS - Subsea Xmas Trees\MA-7R - Christmas Tree

Attached Reference Files:

Title	Type	Classification	Revision Date
Wellhead MA-6 (MA-6), Leak, (Event No. 2)	IMSA Photo	Image	
MA-7R SCM Replacement - Final Closeout Report	Livelink Document	Report	11/11/2004
Wellhead MA-6 (MA-6), Leak, (Event No. 2)	IMSA Video	Video Clip	

Figure 6 - Managing Anomalies



IMSA 3 – Integrity Management System Application

White Paper

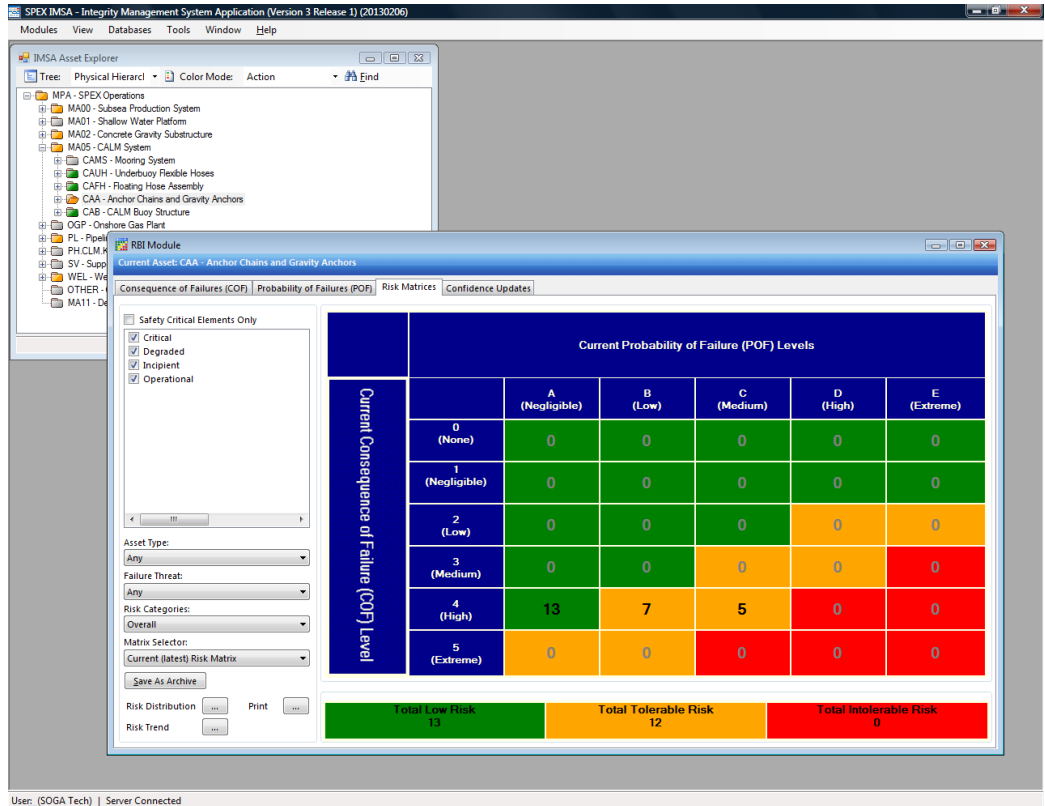


Figure 7 - Reporting Risk Levels

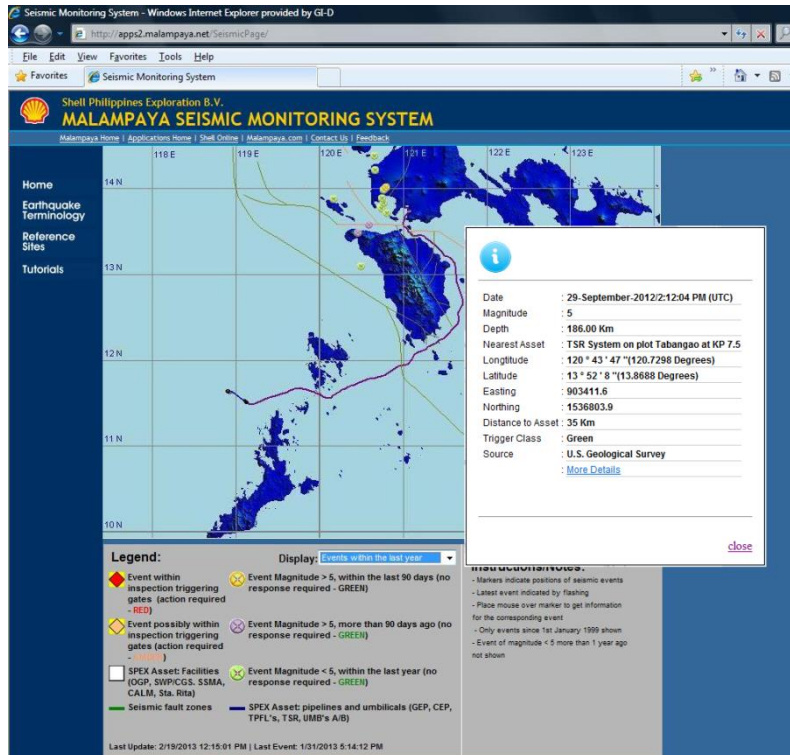


Figure 8 - Monitoring Seismic Events