Developing Sustainability of Asset Integrity Management in Trinidad’s Energy Sector Organisations

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Abstract: This paper focuses on the sustainability created by the implementation of “Applicable Codes and Standards” and “life cycle assessments” as it relates to Energy Sector Organisations in Trinidad. Sustainability is achieved by developing systematic, repeatable behaviours that result in a consistent output. Conformance to Codes and Standards will consistently achieve sustainability, as demonstrated by the Case Study on Atlantic’s implementation of the Asset Integrity Management Standard (AIMS). At the Atlantic CEO’s Sustainability Awards 2014, the AIMS 5 year Implementation Project won the Award in the category - HSSE and Asset Integrity. Significant Risks were identified and removed from the business using the rigorous systems and processes developed in the preceding five years. Immediate benefits were realised in the management and reporting of hydrocarbon leaks that could result in significant loss and/or environmental issues. The implementation of a Competency Management System has brought a marked improvement in the organisation’s human capital. This involved all safety critical personnel covering operations and technical staff. Risk management mitigation plans have led to very visible changes within the organisation including relocation of personnel not directly involved in operating and maintaining the facilities to offsite location and protecting those who are required to remain on the facility to perform their core duties. The implementation of the AIM Standard seeks to achieve safe, reliable, efficient and silent running operations, by ensuring that major risks identified are either eliminated or minimised to as low as reasonably possible. This is achieved by ensuring that competent personnel are available to operate and maintain the facilities (CMAS), supported by competent Technical Support Staff and competent Service Providers, using rigorous Operating and Maintenance Procedures and Engineering Technical Practices (ETPs).

Keywords: Asset Integrity Management, Sustainability, Energy Sector, Trinidad

1. Introduction

One way of creating sustainability is by implementing applicable Codes and Standards and the development and implementation of improvement plans by completing life cycle assessments. This is illustrated through a case study of the implementation of an Asset Integrity Management (AIM) Standard (ALNG, 2007) at one of the leading Energy Sector organisations Atlantic. The period of implementation was from 2009 to 2013, as part of its five year strategic plan.

Implementation and embedding of the Organisation’s AIM Standard ensures that risk is better understood while focus placed on reducing the potential for high consequence low probability events. Better management of Safety Critical Equipment now results in more Uptime and Plant Availability. This has had a significant impact in the company’s returns and competitiveness.

By understanding its risks through the implementation of the AIM Standard, the organisation is in a better position to prevent the likelihood of a Major Accident and ensures that it continues in business, creating value for all its stakeholders. The outcome of adopting the AIM standard has resulted in the organisation being benchmarked in the trend setter group for HSSE and Reliability amongst its peers in the industry (PTA, 2012).

The Engineering and Site Technical Practices and all life cycle Integrity Management strategies and processes developed, foster the integration and support of all the various work groups and the protection of people from harm from the exposure of major accidents. As a prudent operator, Atlantic endeavours to minimise the risks of major accidents. These major risk contributors are communicated to its shareholders.

During the implementation, a significant effort was expended in communicating the importance, value and benefits of Process Safety and Asset Integrity. A major intervention was with the introduction of the first Process Safety Week in the Energy Sector during 2012. This practice has continued and has positively impacted the culture around Process Safety in this organisation.

2. The AIM Journey Begins

Atlantic’s Asset Integrity Management (AIM) Journey started in 2007 when the company recognised that the existing systems in place for the management of Process Safety and Mechanical Integrity were not very robust and contained many gaps. The organisation sought guidance by looking to its shareholders and assessing best practices implemented across their businesses and how effective they were in achieving sound integrity management.

It is out of this quest that the BP Global Integrity
Management Standard was approved for use by the Atlantic Board (Members/Shareholders) (BP, 2007). Following this approval the first Major Accident Risk (MAR) assessment (ALNG, 2008a) was conducted using a cross functional team comprising BP EPTG and Atlantic. Figure 1 is the output from this MAR study, illustrating that Atlantic’s normal operations is under the reporting line. This was quickly followed by a Zoning Study (ALNG, 2008b) conducted by DNV with a cross functional team from Atlantic. To provide assurance to the Shareholders that Atlantic was on the right path with its Process Safety Management, the first Safety and Operational Integrity audit was conducted by a team of auditors comprising of members from all of Atlantic’s shareholders.

With the seed planted for AIM, in 2008, the first Major Accident Hazard Analysis (MAHID) was conducted and risk reduction plans developed and approved by the COO / CEO / Board, for implementation (ALNG, 2008c). The gaps identified around the competency of safety critical persons from the organisation were initiated with the launch of a Competency Management Assurance System (CMAS) as a pilot (ALNG, 2008d). This had a significant impact on all the operations and maintenance personnel in the organisation. Significant effort went into the development of the Asset Integrity Management Standard 5 Year plan that looked at the strategy for implementation of the thirty six minimum requirements of the AIM Standard. This 5 years plan was then approved by the CEO and board for implementation (ALNG, 2009a).

2.1 The AIMS 5 Year Plan Implemented

Ironically, in early 2009 Atlantic suffered what was classified as a Major Accident involving one of its LNG tanks (see Figure 2). Fortunately, there were no fatalities, but this accident did result in major asset loss and the organisation incurred significant costs to repair. This could have been avoided if Atlantic had a strong, rigorously embedded Asset Integrity Management System. This accident revealed gaps in the organisations Management of Change Process, Safety Critical and Protective Systems Management; Crisis Management and Emergency Response Process and a number of other areas just to name a few. This prompted the organisation to begin implementing the AIMS 5 year Plan in earnest, with the intention to avoid loss of primary containment and to maintain structural integrity throughout the lifecycle of the facility. Atlantic was committed to this objective by ensuring that The Engineering Authority, AIMS Element Owners and a Single Point Accountability for Asset Integrity in the capacity of the Chief Operating Officer were all appointed from the leadership and management teams.

Other AIMS activities completed in 2009 included the development and approval of Risk Reduction Plans (ALNG, 2009b) for the MAR and Zoning Study recommendations (ALNG, 2009c). Examples of these were relocation of non-essential staff from the plant, building upgrades to include structural integrity issues and structural assessments of existing building. HAZOP, SIL and LOPA were conducted for all trains and common systems and a Safety Measures Hazard register was developed based on the 2008 MAHID. Atlantic’s top 5 Risks were identified, which included – “Structural Integrity, LOPC, Dropped Objects, Earthquake and Severe Weather” as shown in Figure 3.

Next was the building out the Inspection and Corrosion Team, initially led by a secondee from one of the shareholder companies. It included three plant inspectors, all internal hires and a recruited Inspection Engineer. A
second Inspection Engineer was hired in 2010. A Risk Based Inspection (RBI) Philosophy was adopted and implementation began on Train 1 (ALNG, 2010). One of the first findings from this initiative was the identification of cracking due to acoustic induced vibration on the flare line branch connections (see Figure 4). In 2010 the RBI was extended to other assets (Trains 2 - 4) and uploaded into MAXIMO (Computerised Maintenance Management System or CMMS) with their relevant Job Plans. The RBI assessment was completed with the heritage software TOCA. Another software programme, ACET was implemented to be used as a repository for all inspection and corrosion historical field data.

In 2010 Atlantic also engaged an external consultant to begin implementing the Safety Critical Equipment (SCE) project. The first step involved the definition of the site’s Master Equipment List or MEL. The list of Safety Critical Equipment (SCE) was identified from the MEL and loaded into MAXIMO. Job Plans, Performance Standards and Generic Maintenance Strategies, Backlog and Deferral Strategy (ALNG, 2011a) and a CMMS Policy were also developed. The first attempt of a Simplified Risk Matrix (see Figure 5) was developed to map Atlantic’s Significant Risk Contributors on a four quadrant matrix. The next step involved building out the Organisation Structure to drive the Process Safety initiatives and to support the AIM Standard implementation. This team was led by a Senior HSE professional who completed a secondment at one of the shareholders’ company, before returning to Atlantic to lead the AIM implementation. This team was built out over the next three years to include two Process Safety Engineers, and Integrity Management Engineer, a Management of Change (MoC) Co-coordinator and an AIM Performance Management Analyst.

After two years the progress on the AIMS 5 Year plan stood only at 21%. There were a number of challenges experienced, starting with constraints on resources, and resistance from the organisation, mainly because it was seen as an external initiative rather than one that was developed within. The project was more of a push than a pull from the organisation resulting in a lack of ownership and commitment. The year 2011 was therefore a watershed year, where all stops were pulled to ensure that the right level of engagement and leadership support was given. The COO began chairing the Monthly AIM Steering Committee meetings which were attended by the CEO and other Leadership and Management Team members with the Element Owners called upon to report on progress, challenges and recommendations or recovery plans to ensure milestones against the minimum requirements were achieved. This visibility of leadership propelled the project’s progress remarkably after these measures were implemented.

A Joint Venture agreement was reached between Atlantic and one of its shareholders’ for the use of their Engineering Technical Practices (ETPs) (ALNG, 2011b). Critical ETPs were authored based on consequence and approved for use at Atlantic. This included the adaptation of a new Risk Matrix replacing the previous Simplified Risk Matrix (see Figure 6).
The Technical Authority structure was approved and the appointment of Technical Authorities progressed. The processes for incident investigations and learning and performance management against the AIM Standard were fully developed and implemented.

In 2012, a suite of Risk Management ETPs and Site Technical Practices (STPs) were developed and implemented (ALNG, 2012a), and an Operational Risk Champion was appointed by the COO. An eMoC software tool was procured, installed and piloted for Technical MoCs. The full value of this tool still needs to be realised. The Safety Critical Management System was fully implemented and execution performance managed (ALNG, 2012b). Process safety tools DNV PHAST for use in consequence modelling and the Bowtie software were procured. Crisis Management and Emergency Response Scenarios for Major Accidents developed and drilled.

By the fourth year into implementation, the progress against the AIMS 5 Year Plan had reached 79%, which represented a significant effort averaging approximately 30% annually for the preceding two years. This could only be attributed to the ground swell of support as a result of the higher level of engagement, ownership and commitment demonstrated by Atlantic’s staff and the supporting service providers. A major highlight in 2012 was the introduction of the first Process Safety Week in the local Energy Sector (see Figures 7 and 8).

The year 2013 saw the completion of RBI's across all facilities for pressure vessels. This was a significant achievement and was as a result of RBI interventions in all the major turnarounds across all trains during the period 2009-2013.
The RBI model could now be validated for all pressure vessels across the facility and a detailed RBI plan for pressure vessels with the requisite frequency for inspection over the next 10-15 years could be generated. All modifications to the flare system to address the issues of acoustic induced vibrations were completed.

A full suite of Life Cycle Integrity Management Strategies were now available (ALNG, 2013a). Milestones to achieve all of the 36 minimum requirements of the AIM Standard were completed. The purpose for implementing this standard is to prevent any major industrial accidents. In December 2013 Atlantic completed the implementation of the 36 minimum requirements of this AIM Standard (ALNG, 2013b). Throughout the next year Atlantic maintained focus on ensuring opportunities for reducing and eliminating risk were explored and recommendations implemented.

2.2. Ensuring sustainability with AIMS

The 2014 Atlantic CEO’s Sustainability Awards saw the AIMS 5 year Implementation Project winning the Award in the category HSSE and Asset Integrity. The plan for 2015 and beyond is to continue sustaining the Process Safety Journey by developing and starting to implement a sustainability plan for the next 5 year cycle. More focus will be placed on being more systematic by building out a framework and plan for implementing an overall Atlantic Management System (ALNG, 2014a).

Implementation and embedding of Atlantic’s Asset Integrity Management Standard ensures that the organisation better understand risk and focus on reducing the potential for high consequence low probability events, which will impact negatively on Atlantic’s corporate reputation. Implementing the AIM Standard required Atlantic to identify, assess and develop risk mitigation plans and corresponding monitoring tools. Significant Risk Contributors were defined and Single Point of Authorities identified and assigned responsibilities to address this. This led to very visible changes within the organisation including relocation of personnel not directly related with operating and maintaining the facilities to an offsite location and protecting those who are required to remain on the facility; Developing and Implementation of a Competency Management System for all identified safety critical personnel and Identification and management of Safety Critical Equipment.

A major industrial accident could potentially result in Atlantic having to cease operations. By understanding Atlantic’s risks through the implementation of the AIM Standard, the organisation is in a better position to prevent the likelihood of a Major Accident and ensure that Atlantic continues in business, creating value for all its stakeholders. Another significant value created for Atlantic is the side benefit of an improved reliability and efficiency of operations. The AIM standard requires the development of a Competency Management System (CMAS) for all Operations and Maintenance Staff, inclusive of Technicians and Supervisors, as well as an equivalent system for Engineers and Technical staff that informs their Employee Development Plans. The Engineering and Site Technical Practices and all life cycle Integrity Management strategies and processes developed, fosters the integration and support of all the various work groups and the protection of people from harm from the exposure of major accidents.

3. Implications for Energy Sector

The lessons learned from the implementation of the Asset Integrity Management Standard (AIMS) at Atlantic have significant implications for Energy Sector Organisations in Trinidad and the wider Caribbean. It provides a framework or model for organisations that do not have an AIMS in place that makes them susceptible to major industrial accidents that can result in significant loss of life, assets and damage to the environment.

Its relevance is further strengthened by the fact that a significant proportion of the Energy Sector Organisations have aging plant assets whose integrity needs to be rigorously managed to prevent any major industrial accidents. In fact the Government of Trinidad and Tobago (GORTT) through the Ministry of Energy and Energy Industries (MEEI) has commissioned a National Facility Audit of all the major Energy Sector Organisations across the value chain (upstream, midstream & downstream) to assess the integrity and condition of their assets and the programmes and governance structure that are in place to ensure their safety and integrity. The finding from this audit will then be used to develop a national policy on Asset Integrity Management that would be used to regulate the Energy Sector Organisations.

Methodologies described in the Atlantic Case Study above around Process Safety Management (PSM), Risk Management, Consequence Modeling, Safety Critical Equipment (SCE) Management, Risk Based Inspection (RBI), Backlog & Deferral Strategy, Management of Change, Competency Management Assurance System (CMAS) and so much more can all be adapted for use in the industry, particularly on the heels of the implementation of an impending national policy on Asset Integrity.

4. Conclusions

The implementation of the AIM Standard seeks to achieve safe, reliable, efficient and silent running operations, by ensuring that major risks identified are either eliminated or minimised to as low as reasonably possible. This is achieved by ensuring that competent personnel are available to operate and maintain Atlantic’s facilities (CMAS), supported by competent Technical Support Staff and competent Service Providers, using rigorous Operating and Maintenance Procedures and Engineering Technical Practices. As a prudent operator, Atlantic
endeavours to minimise the risks of a major accident, and these major risk contributors are communicated to our shareholders via Atlantic’s Significant Risk contributors’ matrix. The AIM Standard provides the governance for Atlantic to adopt in its Risk Management System. The Shareholders Safety & Operational Integrity Audit provides assurance and transparency (ALNG, 2014b). The standard also achieves the objectives in meeting the Ministry of Energy statutory and regulatory requirements. Lessons learned from Atlantic’s implementation experience can definitely benefit the wider Energy Sector Organisations to be adapted as best practice in the absence of any current local legislation and regulations.

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Haresh Ramrattan is a practicing engineer, graduated from The University of the West Indies (UWI), 1987 in Mechanical Engineering. Currently the Asset Integrity Manager – at Shell LNG T&T Limited seconded to Atlantic LNG with the responsibility for sustaining Asset Integrity across the Atlantic LNG Assets. Other accountabilities include implementation of the Inspection and Corrosion Management Programmes; Process Safety, Major Accident Risk and Hazards Management. Design and build of an integrated Atlantic Management System to sustain Business Process Improvements and reduce risks. Previous work experience includes Head Maintenance & Integrity - Repsol (April 2006 – December 2013) where his accountabilities included development & Implementation of Asset Integrity Management Strategies for the Organisation’s offshore assets – inclusive of topsides, subsea interfield pipelines, projects management for major turbomachinery, safety systems and inspection and corrosion management programmes. Other positions included Senior Field Engineer - Mechanical Point Lisas Nitrogen Limited and Senior Maintenance Engineer - Caroni (1975) Limited. MBA graduate (2001,) and currently pursuing his DBA at ALJ-GSB.