

# Vanguard Risk & Safety Asia

## Vanguard Risk and Safety Asia Pte Ltd Capability Statement



**SG13201-VRSA-PX-002**

**REV 6**

Revision Record					
Revision	Date	Description	Originator	Checked	Approved
A	May 2014	First Issue	SP	BPF	BPF
0	June 2014	Issued for Use	SP	BPF	BPF
1	Sep 2014	General update	OJG	BPF	BPF
2	Oct 2014	General update	AC	BPF	ZS
3	Nov 2015	General update	AC	BPF	ZS
4	Aug 2016	General update	AC	ZS	ZS
5	Dec 2016	General update	AC	ZS	ZS
6	Mar 2017	General update	AC	ZS	ZS
		[Electronic Copy - A signed copy of this front sheet is held on file in our offices.]			

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## 1. OVERVIEW AND HISTORY

### 1.1. Introduction

Vanguard Risk and Safety Asia (VRSA) is an affiliate of the Vanguard Solutions Group of Companies, a renowned multi-disciplinary engineering consultancy with expertise in the provision of safety and risk engineering and risk management services, including Process Safety Engineering, Risk Management, Safety Case development, reliability engineering and environmental risk management, to industries including oil and gas, petrochemical, defence, mining and public transport infrastructure. Today Vanguard Solutions Group is one of the largest independent safety and risk management consultancies in the Asia Pacific / Indian Ocean Rim region.

Vanguard Solutions Pty Ltd was established in May, 2000 in Perth, Western Australia. Two of the founding partners continue to practice within the company. Since its inception, the company has grown and established affiliated company in UAE, Dubai in 2005.

Vanguard Risk and Safety Asia was incorporated in Singapore in late 2013 as an affiliated Joint Venture Company with an aim of providing high quality, risk-based solutions to business and industry in Asia. As a market leader, delivery of “best in class” service to our high profile portfolio of clients is expected. In order to consistently achieve this goal, we recognise that our people are our most critical asset. We attract and employ the highest quality personnel and provide them with a working environment to match.

Vanguard Risk and Safety Asia is ideally placed to assist clients to achieve their business aims in the oil & gas and mining markets. Recognised internationally, our cutting edge team have a track record of adding value to major projects.

With a local office in Singapore and associated offices in Perth, Western Australia and Dubai, Vanguard Solutions Group of companies provides innovative and cost effective solutions to international clients in a wide range of major industries.

### 1.2. Personnel

While the newly established company in Singapore is still growing, the Vanguard Solutions Group employs some 30 technical personnel, each qualified to tertiary level, many of whom hold a second degree specific to our field. A growing number of our personnel are regarded as leaders in their own right and have key relationships with client companies where their expertise is highly valued.

In addition, there is a small administration team, led by our non-executive Business and Finance Director.

#### 1.2.1. Vanguard Risk and Safety Asia Key Personnel

##### *Zoran Sekulic*

A Director of Vanguard Risk and Safety Asia and resident in Singapore, Zoran has 35 years of professional experience in process safety/design engineering and risk management specialising in Safety, Risk, Loss Prevention, and Process Design for Chemical Process Industry (CPI).

Zoran is a one of the most experienced and sought after HAZOP and SIL studies facilitator in the world. Zoran possesses an extensive experience in Process and Safety Systems Design and Audit (F&G, ESD, PSD, HVAC, EPS, HDS, etc.), Safety Case Development including Quantitative Risk Assessments (QRA/FHA) specialising in Oil & Gas, Petrochem and Chemicals applications.

Zoran is also a qualified trainer for Process Safety Management including Incident Investigation/Monitoring, QRA / PHA / HAZID / HAZOP / FMEA and Modern Safety Management OSHAS 18001 / ISO 14001 Auditor Courses.

Achievements and Past Experience:

- HAZOP and SIL Assessment Studies Leader on a number of major projects in Oil & Gas Industry;
- Team leader providing detailed design input Safety Case development and related QRAs;
- HSE and Loss Prevention Philosophies development for major Oil & Gas Operators in Middle East and South East Asia;
- HSE MS and Procedures Development for new and existing facilities;
- Risk Management, HAZOP, QRA and Modern Safety Management Courses;
- Process and Design Engineering;
- Process simulation and flow systems modelling;

### ***Brendan Fitzgerald***

Managing Director of Vanguard Risk and Safety Asia, Brendan has over 37 years of industry experience. Brendan's specific expertise lies in an ability to apply safety analysis / risk assessment techniques to any operation, activity or equipment, with a pragmatic understanding of the context, whatever the industry. This stems from his wide experience of different industry sectors, including mining/mineral processing, chemical, petroleum refining, oil and gas, nuclear, maritime, manufacturing, and defence. His extensive oil and gas experience includes feasibility and conceptual design, modification, optimisation and safety/risk assessment of new and existing facilities, topsides, FPSO and pipeline systems.

Achievements and Past Experience:

- Chartered Engineer and Fellow of the Institution of Chemical Engineers;
- Team leader providing detailed design input, Formal Safety Assessments and Safety Case development of six major projects in Asia Pacific and Africa;
- Assisted Counsel representing a major equipment supplier at the Piper Alpha Inquiry;
- Liaison with regulators;
- Expert witness;
- Process Engineering and Simulation for Chemshare;
- Risk and Safety groups team member for WS Atkins and Granherne.

## **1.2.2. Perth Office Key Personnel**

### ***Paul Breen***

As Director of Vanguard Solutions Pty Ltd, Paul is our Technical Authority, responsible for the technical knowledge, methodologies and software resources used by the company. Widely respected for his technical expertise, he has been engaged as a risk management consultant on many significant oil & gas projects in the Australasian region and in the North Sea.

Achievements and Past Experience:

- Chartered Engineer and Member of the Institution of Mechanical Engineers
- Has held senior positions as a consultant in safety, reliability and risk management with AEA Technology, Brown & Root and AMEC and project management roles within North Sea operations;
- Managed HSE function within the Woodside Development Engineering Consultancy;
- Served on UK Department of Trade and Industry steering committee for the design of robotic hardware;
- Previous employers include British Nuclear Fuels and Taylor Woodrow in the UK nuclear industry
- Experienced in Land and Marine Engineering, specifically in the design of directional drilling systems, subsea systems and offshore construction equipment.

### *Iain Moir*

Iain has two Engineering Master Degrees, including an MSc in Safety Engineering, Reliability and Risk Management and is both a Certified Functional Safety Expert and Certified Machinery Safety Expert. Iain has worked on Oil & Gas, Nuclear and Mining projects in the UK, Australia, New Zealand, Singapore and India.

He has been involved in offshore platform and FPSO/FSO projects, Vessel Safety Cases as well as onshore processing plants. He has experienced in all areas of Oil and Gas safety, risk and reliability engineering. This experience covers concept, FEED, detailed design, operations, brown-field modifications and existing facility engineering support. He is a highly experienced facilitator e.g. HAZOP, HAZID, Layout Reviews, SIL workshop, Risk and opportunity, bowtie, etc.

Iain has over 20 years industry experience and has significant facilitation, Safety Case and regulatory experience. This includes significant early engagement experience.

Achievements and Past Experience:

- Woodside Browse Safety Case Co-ordinator for the CPF and DTU Early Engagement Safety Cases
- CFSE Lead for SKM and Calibre RTIO Mining project carrying out Functional safety assessments to AS61508 and AS4024.
- Team Leader for development of Safety Cases for Okha FPSO, Woodside Energy Ltd
- Project Manager Lead Engineer on Clough Maari Wellhead Project
- Project Manager and Lead Engineer for Apache-Prosafe Van Gogh FPSO and Safety Cases

### **1.2.3. Additional Personnel**

In addition to the above and other employed personnel, Vanguard Risk and Safety Asia maintains relationships with a number of experienced personnel (associates) who can provide specialist support in key areas. These areas include, but are not limited to, HSE management systems, training, HAZOP and SIL studies facilitation, and HSE/Risk Management. Several of these personnel are semi-retired, but are prepared to provide services to significant projects. This is generally achieved on a part-time basis, at the convenience of the client. In this way, we are pleased to retain the wealth of experience that these personnel possess.

Since the foundation of the company we been continuously in demand to increase our base in particular by looking for opportunities to employ young Singaporean engineering and scientific personnel. Several employment campaigns have been held in a search for graduate staff.

#### 1.2.4. Personnel Training

We provide an active training programme for our personnel, including regular technical presentations, sponsorship of specific courses and targeted on the job training. This programme is accredited by Engineers Australia for Continuing Professional Development. Through this, all of our technical personnel are encouraged to achieve Chartered Engineer status. Several of our personnel have already achieved this.

In addition, since its inception in 2000, Vanguard Solution Group of Companies have contributed significantly to the pool of safety and risk personnel in Perth by recruiting and training young engineers. Several of these engineers remain with Vanguard Solutions in lead positions.

#### 1.3. Corporate Affiliations

In addition to the individual memberships and affiliations that the Vanguard Solution Group of Companies personnel possess a corporate member of a number of industry associations or the group has corporate affiliations with:

- Industrial Foundation for Accident Prevention;
- Australian Petroleum Production and Exploration Association;
- Institute of Engineers Australia;
- Society of Petroleum Engineers
- Australian Institute of Management; and
- Chamber of Commerce and Industry of Western Australia.

#### 1.4. Business Management

Vanguard Solution Group of Companies operate with a set of policies and procedures available for review by our clients on request covering

- Health, Safety and Environment;
- Quality Management;
- Business Ethics; and
- Corporate Governance.

Each of these is aligned with the relevant International/Australian Standard and integrated using the guidance provided in AS NZS 4581-1999 Management system integration - Guidance to business, government and community organisations.

We have a core team of administration support personnel led by our Business and Finance Director.

The group also operate with a full suite of required insurance policies covering:

- Professional Indemnity
- Workers Compensation
- Public Liability
- International Travel and Medical



### 1.5. Company Offices

The Vanguard Solutions Group of Companies maintains several offices globally. Our two largest offices are our main office in Perth, Western Australia and Vanguard Risk and Safety Asia’s office in Singapore.

#### 1.5.1. Singapore Office



Vanguard Risk and Safety Asia is based in Singapore and services clients in the Asia region from this central location. Our offices are located in the Tanjong Pagar area, in a heart of the Singapore business district close to all amenities that the area offers. The location offers easy transport links to Singapore’s other business hubs and shipyards.

The office is shared with Orwell Offshore, a Naval Architecture and Offshore Engineering company originally founded in the United Kingdom in 2006 which has since expanded its operations to the Asia Pacific region. This relationship with Orwell allows Vanguard Risk and Safety Asia to provide services from a central location

within Singapore.

Singapore itself has proved to be an ideal location for Vanguard Risk and Safety Asia, allowing us to service clients locally in Singapore, as well as providing the flexibility to easily reach many parts of Asia.

#### Singapore Office

#### 1.5.2. Perth Offices

The company occupies modern office facilities located on St Terrace, at the heart of the Perth based customer market. central location of our offices was one of the first and most important decisions in our history. Being within walking of the majority of our clients is important, but being able to and greet key industry people on the street was considered from the start.



Georges  
The  
distance  
meet  
essential

Perth is the state capital of Western Australia and is the hub for Australia’s oil and gas industry and mining industry. Perth is also Australia’s gateway to Asia, with short air links to all of Asia’s major centres. Perth also provides direct air links to the Middle East and Africa.

The renowned lifestyle afforded by Perth is a key ingredient in our ability to attract and retain high quality staff on the international market.

#### Perth Office

Our modern office space is leased to 2019 and provides a bright and pleasant working environment with excellent facilities, including room for expansion.

## 2. CUSTOMERS AND MARKETS

### 2.1. Industries Served

The Vanguard Solution Group of Companies have experience in provision of services to a wide range of industries including:

Industry	First work in this sector
Oil & Gas	2000
Mining and Mineral Processing	2000
Defense	2001
Transport & Infrastructure	2001
Environment	2002
Other Industries	2001

### 2.2. Countries & Locations Served

We have served clients in the following countries:

- Azerbaijan
- Australia
- China (Hong Kong)
- India
- Indonesia
- Iraq
- Japan
- Jordan
- Korea
- Kuwait
- Malaysia
- Mauritania
- New Zealand
- Norway
- Oman
- Papua New Guinea
- Philippines
- Qatar
- Russia
- Saudi Arabia
- Singapore
- Taiwan
- UAE
- United Kingdom
- United States of America

Our personnel have carried out assignments in the following locations, e.g.:

- Abu Dhabi, United Arab Emirates
- Amman, Jordan
- Al Khobar, Saudi Arabia
- Baku, Azerbaijan
- Bali, Indonesia
- Bangalore, India
- Copenhagen, Denmark
- Dubai, United Arab Emirates
- Geoje, Korea
- Houston, Texas, USA
- Jakarta, Indonesia
- Kuala Lumpur, Malaysia
- London, United Kingdom
- Manila, Philippines
- Monaco
- Muscat, Oman
- New Plymouth, New Zealand
- Nouakchott, Mauritania
- Oslo, Norway
- Papua New Guinea
- Reading, United Kingdom
- Sakhalin, Russia
- Seoul, Korea
- Singapore
- Taipei, Taiwan
- Tokyo, Japan
- Ulsan, Korea; and
- Many parts of Australia.

### **2.3. Oil & Gas Industry**

Since establishment in mid-2000, Vanguard Solution Group of Companies have established many call-off contracts with blue-chip clients in the oil and gas industry. Examples include:

- Woodside Energy Ltd (Australia)
- BHP Billiton Petroleum (Australia)
- Chevron (Australia)
- INPEX (Australia)
- Shell Todd Oil Services (NZ)
- Shell Philippines Exploration
- Western Mining Corporation (Australia)
- Kuwait Oil Company (Kuwait)
- Petroleum Developments Oman (Oman)

Repeat business was also established from our earliest days with a number of engineering contractors, including:

- Coflexip Stena Offshore (now part of Technip)
- Technip Oceania
- SHI
- Petrofac International
- Frontier Engineering / Mustang (part of the Wood Group)
- Clough Engineering
- JP Kenny (also part of the Wood Group)
- BWO
- Kvaerner Engineers & Constructors
- MODEC, Inc

We enjoy repeat business with many other clients, with whom we have worked since we started in May, 2000.

As the Oil and Gas industry has traditionally been a voracious user of safety and risk related services, a further breakdown is provided below.

### 2.3.1. FPSO Projects

Our expertise in safety engineering design, safety cases and all aspects of risk and HSE management for Floating Production Storage and Offloading (FPSO) facilities is demonstrated by our involvement in many projects. We have also worked with the related Floating Storage and Offloading (FSO) facilities. The clients we have served in this sector include:

- MODEC, Inc
- Prosafe Production Services Pte Ltd / BW Offshore
- Tanker Pacific Offshore Terminals Pte Ltd
- Teekay Shipping (Australia) Pty Ltd
- Australian FPSO Management Pty Ltd
- Maersk FPSOs
- Newfield Australia
- Coogee Resources
- PTT Exploration & Production Australasia Ltd
- Apache Energy
- BHP Billiton Petroleum
- INPEX
- OMV Australia
- BW Offshore
- Bumi Armada
- Petrofac
- BP Angola/North Sea Exploration
- SHI
- SANTOS
- Shell Philippines Exploration B.V.
- Shell Todd Oil Services

- Woodside Energy Ltd

### 2.3.2. LNG Projects

We have provided consultancy engineering and guidance for a number of LNG projects. This has included advice at the earliest feasibility stage of development, through to comprehensive safety/risk engineering and environmental services during front end engineering design and detailed engineering design. The major projects with which we have worked include:

- Browse Development, Woodside Energy Ltd
- Ichthys Project, INPEX
- Pluto Project, Woodside Energy Ltd
- Sunrise Development, Woodside Energy Ltd

We have also provided advice to operating companies and engineering contractors in relation to Floating LNG projects.

### 2.3.3. Construction & Installation Projects

Some of the largest companies in the world involved in offshore construction and installation engineering have used our services. We have provided Safety Case development, regulatory guidance, assistance with liaison with Regulator, hazard identification and risk analysis services. These have related to a number of specific construction vessels, as well as particular construction and installation activities and projects. The following examples are an illustration of this work:

Nature of work	Client
Riser Installation for existing FPSO	Coflexip Stena Offshore
HAZID and work planning for installation vessel activities	Clough Engineering
Pipelaying & Heavy Lift Vessel Safety Case	SAIPEM
Heavy Lift HAZID for Integrated Deck lift (1200 tonnes)	SAIPEM
Crane Barge HAZID & Risk Assessment	McDermott Australia
Installation & Pipelaying Vessel Safety Case	McDermott Asia Pacific
Safety Case Management for complex brownfield development	Woodside Energy Ltd

### 2.3.4. Drilling

We have provided safety and risk engineering services to oil and gas operating companies, when planning drilling campaigns, and to drilling companies, in support of their activities. We have carried out significant work, in particular, for BHP Billiton Petroleum Drilling group and for Woodside Energy Ltd.

Our services have included:

- HAZOP of well test equipment;
- HAZID and risk assessment of proposed well design;
- HAZID and risk assessment of proposed well intervention method;
- Safety Case development support for drill rigs;
- Dropped object risk assessment;
- Drill rig equipment layout risk assessment and planning;

- HAZOP and layout design assessment for subsea facilities and well head arrangements.

### 2.3.5. Other Oil & Gas Projects

Our work has incorporated the whole gamut of oil and gas operations, both onshore and offshore, such as:

- Wellhead platforms – design, installation, risk assessment and staged safety cases;
- Large platforms – including gas platforms, gas/condensate facilities and oil and gas separation facilities;
- Gas /condensate facilities – including floating facilities and an innovative self-installing design by one engineering contractor;
- Pipelines onshore and offshore – including pipeline risk assessment, pipeline management plans, installation, etc.
- Onshore gas plants – including major facilities (Philippines) through to smaller, one-off plants.
- Subsea developments – including tie-backs to offshore facilities and with pipelines ashore.

## 2.4. Mining & Mineral Processing

We have maintained a regular, if small, workload from the mining and mineral processing sector. Our first mining sector work was in 2000. Since that time, our work includes the following mining sector clients:

- BHP Billiton Iron Ore
- Xstrata
- Lihir Gold
- Barrick Gold
- Kalgoorlie Consolidated Gold Mine
- Atlas Iron
- Rio Tinto Iron Ore

Our workload is growing and we are committed to developing further.

### 2.4.1. Mining and Minerals Processing Projects

Our work has covered a variety of commodities from mineral sand to base metals and gold. Projects include:

Nature of work
Risk Assessment for mineral transport to and from wharf.
HAZID / HAZOP and work planning for new mine and crushing facilities
HAZOP for smelter emission control plant
Bowtie studies for major mine risks
Preliminary risk studies and risk register creation for mineral processing plant
Development of Performance Standards for critical controls for major mine risks
Bowtie studies for major mine hazards
Risk assessments of new equipment for truck tyre management
Quantitative risk assessments for trucking movements on public roads

## 2.5. Defence

The defence sector is also one with which we have maintained occasional links. Our work has mainly been associated with the Royal Australian Navy and their “above the line” project organisations.

## 2.6. Transport & Infrastructure

Transport and Infrastructure represents another area where safety, risk and environment services are often used. We have provided risk assessment, human factors engineering and reliability engineering services in this area. Our projects have included:

- Taiwan High Speed Rail Project
- Worley Parsons – mining client
- Port Facilities HAZID
- Rail Crossing Risk Assessment

## 2.7. Environment

Our work in this sector has largely been conducted via our subsidiary company with an environmental focus, Vanguard Enviro. The bulk of our environmental services have been provided in the support of large oil and gas projects. However, the sector is very broad and we have enjoyed a variety of projects, as illustrated by the following examples:

- Telstra Rally Australia – Vanguard Solutions provided the Environmental Management Plan to Events Corp for the Telstra Rally Australia event (part of the World Rally Championship) for five years.
- Halt the Salt – Vanguard Enviro, a subsidiary of Vanguard Solutions, provided environmental assessment to a group of local fisheries and related parties who were objecting to a proposed salt mining and export development in North Western Australia.
- Major oil and gas projects in Australia and Africa – including projects in Mauritania, Kenya and Libya in Africa, as well as projects in various parts of Australia.

We are currently members of the panel of consultants offering services to the Australian Government Department of Agriculture, Fisheries and Forestry.

## 2.8. Other Industries

The majority of industries use safety, risk and environmental assessment at some level. The Major Hazards Industries are an obvious example, although this represents a relatively small market. Despite this, our expertise and reputation has enabled us to carry out work for a diverse range of clients. These include the following examples:

- Chemical, Petroleum Refining & Petrochemical – Methanex – risk assessment and HAZOP services.
- Telephone call centre – we carried out a risk-based contingency planning study for a national telephone call centre (with interesting results!).
- Urban development – pipeline risk assessments and guidance on land use planning, acting for the developer or for the pipeline operator.

## 2.9. Software Products

Vanguard Risk & Safety Asia is the regional distributor for Sphera Solution software products.

Enterprise software includes Process Hazard Analysis (PHA), Management of Change (MOC), Job Safety Analysis (JSA), Security & Vulnerability Analysis (SVA), Fault Tree Analysis (FTA), and Bowtie Analysis.

The Sphera distributorship range also covers Compliance Assurance Solution software packages that help maintaining facilities operation by ensuring accountability for all compliance tasks necessary to meet permit and regulatory requirements throughout your organisation.

With the countries having a Safety Case Regime, like in Singapore, it is even more imperative that a system is in place to demonstrate to the Major Hazards Department you facility is in compliance. We can help with consulting, implementation and training of your staff for Sphera suite of products. Benefit from the experience which other organisations have been known for years.

## 2.10. Client and Job Listing

The following is the client listing for Vanguard Solution Group of Companies.

Note: The following list is not exhaustive.

Client List	
ADNOC	MDE-DUSUP (Dubai)
Aibel	Methanex-New Zealand
Apache Energy	MODEC, Inc.
Atlas Iron	Newfield Australia
Australian FPSO Management Pty Ltd	OMV Australia
Barrick Gold	OMV New Zealand
BHP Billiton Iron Ore	Petrofac International
BHP Billiton Petroleum	Petroleum Development Oman
BP	Phillips Petroleum Company
Bumi Armada Berhad	Prosafe
BW Offshore	QP
Cairn Energy India Ltd	Rio Tinto Iron Ore
Calibre Global Pty Ltd	Salesforce Customer Services
Clough Engineering	Samsung Heavy Industries
Coflexip Stena Offshore	Saudi Arabian Oil Company
Coogee Resources/ PTTEP Australasia	Schlumberger
Crescent Petroleum	Shalamborge
Defense Maritime Services	Shell Philippines Exploration B.V.
Events Corp	Shell Todd Oil Services
Fletcher Challenge Energy	SKM
Frontier Engineering Solutions/ Mustang	Tanker Pacific Offshore Terminals
Iluka Resources Limited	Technip
INPEX	Teekay Shipping (Australia)



Client List	
J P Kenny	Telstra Rally Australia
Kalgoorlie Consolidated Gold Mine	TIGA Joint Venture
KBR	Western Mining Corporation
KOC	Wood Group
Kvaerner E&C	Woodside Energy Limited
Lihir Gold Limited	Worley Parsons
Lloyds Register-Taiwan THSRC	WS Atkins
McDermott Industries (Aust.)	Xstrata

### 3. COMPANY SERVICES, TECHNICAL CAPABILITY AND PRODUCTS

#### 3.1. Principal Services

Our lead personnel have extensive experience of formal safety assessment studies for oil and gas facilities. Our Principals have been involved in this work since the Piper Alpha Inquiry and played lead roles in the development of formal safety assessment study methodologies for several offshore oil and gas operators.

Main clients currently supported from Singaporean office include:

- BP (North sea, Angola, Azerbaijan, Oman)
- MODEC, Inc.,
- BWO
- INPEX
- Bumi Armada Berhad
- Samsung Heavy Industries and
- Engineering contractors such as Aibel (Singapore), KBR (Singapore), Petrofac International (Singapore) and WS Atkins.

In cooperation with Perth office we provide services in the niche areas of safety and risk engineering, risk management, and environmental assessment. Key aspects of these areas are as follows:

Key Service Areas	
Safety Engineering	Risk Based Engineering
Formal Safety Assessment	Quantitative Risk Assessment (QRA)
Hazard Identification	Bow-Tie Analysis
Hazard Analysis	Safety Case/ HSE Case Development
Guidance regarding liaison with regulatory bodies	Accident /Incident Investigation
Workshop Facilitation (HAZOP, HAZID, HAZAN, SIL, LOPA)	Reliability and Availability Modelling
Feasibility and Project Evaluation	Detailed Design Engineering
Conceptual and Front End Engineering Design	Risk and Opportunity Evaluation / Workshops
“ALARP” Studies and Workshops	Environmental Assessment
HSE Management Systems	Environmental Risk Management
Auditing (to national, international or company standards)	Environmental Impact Assessment
Gas Dispersion Analysis	Fire and Explosion Analysis
Computational Fluid Dynamics	Fault Tree Analysis

A significant number of personnel in our Singapore and Perth offices are qualified and experienced HAZOP facilitators (with a range of experience). All have experience of facilitation of other workshops, such as HAZID, risk and opportunity, ALARP, etc.

In addition, many are experienced in facilitating Safety and Integrity Level (SIL) Analysis, in accordance with the international standards IEC 61508 (Ref.1) and IEC 61511 (Ref.2).

We have developed our own methodology for SIL Analysis using the Risk Graph method from IEC 61508. We also have significant experience of application of the Layer of Protection Analysis (LOPA) method and have developed an approach that successfully combines HAZOP and LOPA workshops. Two of our Team Leaders is a Certified Functional Safety Expert (regarding SIL and IEC 61508), whilst other team members have gained related formal qualifications.

The Singaporean company also been approved and registered as a Quantitative Risk Assessment (QRA) consultancy by National Environment Agency (NEA) in Singapore. Currently the company is in a procedure to qualify as approved training provider for newly established Safety Case regime in Singapore under governance of Ministry of Manpower (MoM), Major Hazards Department.

The company possesses licences for use of the top software tools in many of these areas. In addition, the company has developed its own software tools in a number of areas. Some of these are described in the Section 3.2 below.

Vanguard Risk and Safety Asia has been the project holder on the following assignments (in chronological order from January 2014):

Client	Location	Details
MODEC	Singapore	Tullow Oil T.E.N. Project HAZOP and SIL Facilitation
Clough Doris JV	Korea	INPEX ICHTHYS Project Design and Safety Reviews for CPF modifications
Petrofac	Singapore & UAE	BP KHAZZAN CPF, Detail Design HAZOP & LOPA (SIL Assessment) Studies
Samsung Heavy Industries	Korea & Singapore	INPEX ICHTHYS Project Hull HAZOP updates
INPEX	Korea & Singapore	INPEX ICHTHYS Project CPF & FPSO Technical service Contract (HAZOP & SIL) CRM reviews (FEED & Detail design)
Samsung Heavy Industries	Korea	INPEX ICHTHYS Project CRM Pumping & Integration Detail Design HAZOP & SIL Assessment
Bumi Armada Berhad	Malaysia	Kracken FPSO, Turret Detail Design HAZOP
BP-Azerbaijan	Azerbaijan	HAZOP & LOPA (SIL Assessment) for ACG to EOP Modifications
INPEX	Korea	INPEX ICHTHYS Project integrated Pigging HAZOP Facilitation of Workshop
BP Oman	Oman	KHAZZAN Field Gas Plant, Petrofac, Gas/Condensate Export Pipelines IPF & LOPA Studies
Petrofac Offshore	Singapore	RAM Study for a fleet FPSO
DORIS Engineering	Korea & Singapore	INPEX ICHTHYS Project HAZOP & SIL Assessment for CPF Start Up Systems Modifications

Client	Location	Details
JIFF	UAE	A1 FUEL TANK FARM EXPANSION, Dubai Airport - PHASE-III HAZOP
BP	UK	HAZOP and LOPA (Chemical system modifications), for Glen Lyon (Q204) FPSO, UK
GE O&G	UK	INPEX ICHTHYS Project HAZOP & SIL Assessment for Subsea Operation HPU
BP	Singapore & UK	LOPA for Glen Lyon (Q204) FPSO Design Updates, BP, Singapore/South Korea
Petrofac	UAE	BP KHAZZAN CPF Alarm Management & Rationalisation Study
BP	UK	BP Sullom Voe Gas Sweetening Project, FEED HAZOP & LOPA (SIL Assessment)
INPEX	Korea & Singapore	INPEX, Ichthys Project – HAZOP of Initial Start-up procedures (Phase#1&2), Korea
Aibel-Singapore	Singapore & Australia	Woodside GED, FPSO Topside & Subsea FEED HAZOPs
BWO	Singapore	Premier Oil PMO Catcher, FPSO Alarm Management & Rationalisation Study
BP	UK	JOM Safety Review and HAZOP of offloading procedures for Glen Lyon (Q204) FPSO
INPEX	Singapore & Australia	Ichthys Project – Overall HAZOP Review – FPSO Facilities, Perth, Australia
Aibel-Singapore	Singapore	Woodside GED Ngujima-Yin FPSO, Detail Design HAZID
INPEX	Singapore & Australia	INPEX, Ichthys Project – HAZOP of Start-up and Operating procedures for CPF/FPS
INPEX	Australia	INPEX, Ichthys Project – Phase#2a HAZID – New Subsea and CPF Modified Facilities
Aibel-Singapore	Singapore	Woodside GED Ngujima-Yin FPSO, Detail Design HAZOP

### 3.1.1. Services out of Dubai Office

Personnel from our affiliated company in Dubai have provided services to a number of significant clients since the office establishment in 2005. These services have included formal safety assessment studies, such as the QRAs, fire and explosion analysis and various forms of risk assessment, reliability analyses and extensive HAZOP and SIL Analysis services.

Main clients supported in the Middle East include:

- Saudi Arabian Oil Company,
- ADNOC OPCOs (e.g., ADMA-OPCO and ZADCO of Abu Dhabi)
- Shell Iran,

- Kuwait Oil Company (KOC),
- Petroleum Directorate of Oman (PDO),
- Crescent Petroleum (Sharjah) and
- Engineering contractors such as Petrofac International (Sharjah), Technip, etc.

We have also supported clients in London, including Foster Wheeler and Worley Parsons, on major projects such as Shell Sakhalin, Russia and the Harweel project, Oman. Many of these services have included extended duration secondments of key personnel into the client's engineering or project teams.

Personnel in our affiliated companies in Dubai have extensive experience of facilitating workshops including HAZID, HAZOP, LOPA, SIL and others. In addition, the work of these personnel has included many LNG and gas plant related projects. We would be happy to provide further details of this capability on request.

### 3.2. Software Distributorship Services

Enterprise range of SPHERA Solution distributorship includes some of the best industry application software such as Process Hazard Analysis (PHA), Management of Change (MOC), Job Safety Analysis (JSA), Security & Vulnerability Analysis (SVA), Fault Tree Analysis (FTA), and Bowtie Analysis.

Our Risk Assessment solution using PHA-Pro<sup>®</sup> and FMEA-Pro<sup>®</sup> allows you to:

- Improve efficiencies in creating HAZOPs, JSAs, and other risk assessments
- Increase effectiveness in processing of actions to closure
- Enable critical expert knowledge retention & sharing
- Gain a better understanding of your risk exposure across sites with consistent and systematic measurement
- Provide visibility to risk profiles from the enterprise level down to specific categories and groupings
- Improve execution by better allocating resources to higher risk areas

Our EHS solution range covers your facility in areas such as:

- New mobile app empowers field employees to be able to report observations or perform audits and capture data on the spot.
- Maintenance Repair and Operations using Cristal
- EHS Compliance and Task Management covering areas such as:
  - Hazardous Material Management
  - Incident Management
  - Refrigerant Compliance
  - Emissions Management
  - Product Compliance (Material Data Sheet (MDS), quantity, etc.)
  - Management of change
  - Chemical Management
  - Chemical Inventory Management

### 3.3. Validated Software Tools

Vanguard Solutions has experience of a variety of software tools, including recognised industry standard tools. In addition, we have developed models and tools within Microsoft Excel and Microsoft Access for a variety of applications, including project specific. The advantage of the models within these programs is that they are transparent and fully auditable.

The following tables highlight the main software tools used by the company:

#### 3.3.1. Consequence Modelling

Software	Capability	Comment
PHAST, by DNV	Models for fluid release rates, gas dispersion, heavy gas dispersion, pool fire, jet fire, flare radiation, stack dispersion, explosion (empirical and TNT model), etc.	Vanguard Solutions hold an annual license for the PHAST suite of programs. This software has been used on a number of our projects.
FRED, Shell Global Solutions	Models for fluid release, gas dispersion, heavy gas dispersion, pool fire, jet fire, explosion modelling (empirical and congested area methods), blowdown, flare radiation, stack release and dispersion, etc.	Vanguard Solutions have held a license for the FRED suite of programs since June 2000. (N.B. Following a change in policy by Shell in 2008, we are only able to use these programs on projects in which Shell has an interest.)
Shell Shepherd, Shell Global Solutions	Includes models specific to LNG plant for dispersion and explosions, BLEVE, blowdown.	Vanguard Solutions (Middle East) hold a license for the Shell Shepherd suite of programs. We are only able to use these programs on projects in which Shell has an interest.
Cirrus, BP	Models for fluid release rates, gas dispersion, heavy gas dispersion, pool fire, jet fire, flare radiation	Vanguard Solutions are authorised users of the Cirrus suite of programs. We have used Cirrus on many projects since 2000. (N.B. Following a change in policy by BP in 2009, we are only able to use Cirrus on projects in which BP has an interest.)

Software	Capability	Comment
Fire Dynamics Simulator	National Institute of Standards and Technology, US Dept. of Commerce.	Computational Fluid Dynamics model, which we have used to model smoke movement /temperature profiles, gas turbine exhausts dispersion /temperature profiles, cold vent dispersion and the like.
FLACS	Gas dispersion and explosion modelling, GEXCON, Norway.	Computational Fluid Dynamics model which we can use to model explosions, determine exceedence curves, etc. We are able to use FLACS on a per project basis.

### 3.3.2. Scenario Representation / Reliability & Availability Modelling

Software	Capability	Comment
ITEM Toolkit, ITEM Software, Inc.	Fault Tree Analysis, Event Tree Analysis, Reliability Block Diagrams (availability modelling).	Vanguard Solutions have held a license for the ITEM Toolkit suite of programs since 2001 and have used them on a number of projects.
Internal model with Microsoft Excel, Vanguard Solutions	Fault Tree Analysis, Event Tree Analysis, Reliability Block Diagrams (availability modelling).	Vanguard Solutions have developed and used project specific models within Microsoft Excel on a number of projects.
Internal model with Microsoft Excel, Vanguard Solutions	Availability, Deliverability and Security of Supply	Vanguard Solutions have developed and used project specific models. One version was used on previous work with an offshore LNG project.
FaultREASE, Arthur D. Little, Inc	Fault tree modelling package.	Vanguard Solutions are authorised users of FaultREASE, which is occasionally used for simple fault trees.
Logan, RM Consultants Ltd.	Fault tree and event tree modelling package	Vanguard Solutions are authorised users of the Logan program, which is occasionally used for simple fault trees.

### 3.3.3. Risk Calculations

Software	Capability	Comment
Internal model with Excel, Vanguard Solutions	Event Tree based risk model (QRA).	Vanguard Solutions have developed and used project specific models within Microsoft Excel on a number of projects. Models have been produced for various types of offshore facility.
Internal model with Microsoft Excel, Vanguard Solutions	Area based escalation risk model using results from fire modelling via linked spreadsheets.	Vanguard Solutions have developed and used project specific models within Microsoft Excel on a number of projects.
VORTEX – Internal model with Microsoft Access, Vanguard Solutions	Risk contour model for use with onshore plants and pipelines.	VORTEX was developed within Microsoft Access by Vanguard Solutions and has been used on a number of projects. The software and results have been independently validated and subject to rigorous checking.
PHAST Risk, by DNV	Risk calculation suite linked to PHAST consequence analysis – includes risk contouring.	Vanguard Solutions have used PHAST Risk on a number of projects where this method of results presentation has been requested.
Internal model with Microsoft Excel, Vanguard Solutions	Dropped objects subsea risk	Vanguard Solutions have developed a tool to model the impact risk for subsea architecture from dropped objects, based on the DNV FS101 method.
@Risk	Project risk modelling using Monte Carlo simulation	Vanguard Solutions have used @Risk on a number of projects to model project and business risk, in conjunction with field availability.
Internal models with Microsoft Excel and Access, Vanguard Solutions	Bow Tie modelling	Vanguard Solutions have developed a software tool to enable simple input of bow-tie models, with easy graphic output.



### 3.3.4. Other Software Tools

Software	Capability	Comment
PHA Pro, Dyadem, Inc.	Process Hazard Analysis / HAZOP recording tool, incorporating action tracking, etc. Can also be applied to other workshops, such as HAZID, LOPA.	Vanguard Solutions have a license for PHA Pro and have used this on a number of projects, including major HAZOPs, both with and without SIL/LOPA.
Internal tool using Microsoft Access, Vanguard Solutions	Action tracking database for action items arising from any source in a project. Simple transfer of data from Excel spreadsheet records.	Vanguard Solutions developed an action tracking database which has been used by a number of clients on detailed design projects.
Internal tool using Microsoft Access, Vanguard Solutions	Hazard Register database system	Vanguard Solutions developed a tool to enable simple and efficient access to the Hazard Register in facility operations. This has been provided to a number of clients for use on Australian facilities.
TRAC, ABB	LOPA and SIL database package	Vanguard Solutions have used this database system on behalf of a major client on a recent project, carrying out all data input, management and manipulation, including architecture definition and validation of safety instrumented functions.

### 3.4. Failure Rate Data Sources

Vanguard Solutions are subscribers to the UK HSE failure rate and release rate database, which is provided online. This is a development from the stand-alone databases issued by the UK HSE at various times (which we purchased at the time). The on-line database is updated at least once per year and ensures the availability of the latest data. The database can be interrogated to select data from particular years, e.g. data up to January 2006, so that comparisons between recent data and overall rates can be made. This facilitates sensitivity analysis and benchmarking.

We note that the UK HSE database incorporates the older PARLOC (Ref. 7) database for pipeline releases.

In addition, Vanguard Solutions make use of industry standard texts, including WOAD (Ref. 1), OREDA (Ref. 4), CMPT (Ref. 5) and Lees (Ref. 6). We have access to many fire and explosion guidance documents, including that from Oil and Gas UK, which contain a significant amount of failure rate data.

For particular use with Safety Integrity Level (SIL) analysis, we have purchased the SINTEF publications, Reliability Data for Safety Instrumented Systems (Ref. 8) and Reliability Prediction Method for Safety Instrumented Systems (Ref. 9)

### 3.5. Technical Capability and Experience Summary

By the above selection of software and tools, we wish to demonstrate that our core services are all areas in which we have extensive experience and capability. Our personnel are all specialists in these areas. Our leading personnel have made and continue to make contributions to the industry through learned papers to seminars and conferences on directly related topics.

For many of our clients, our services have included assistance with strategic decision-making, using various risk-based approaches, and assistance with development of management systems and engineering standards. We are well used to working with our personnel seconded into our clients' teams. It is through this type of work that we have developed strategic partnerships with these clients, which has enabled us to maximise the effectiveness and outcome of our involvement.

### 3.6. Ongoing Partnerships

Vanguard Solution Group companies have worked with a number of specialist consultancies on projects. This has been achieved with the specialist consultancy as a sub-contractor of Vanguard Solutions, or as a direct contractor of the client, with Vanguard Solutions acting as the managing contractor. Such work is arranged on a project by project basis, so is not subject to ongoing formal arrangements. Companies with whom we have had the pleasure of working in this way include:

AMOG, Melbourne, Australia	Hydrodynamic analysis, ship movement and wave modelling.
Shell Global Solutions, UK	Computational Fluid Dynamics explosion modelling, gas dispersion and smoke dispersion modelling <sup>Note 1</sup>
Mobius Dynamics UK	Computational Fluid Dynamics explosion modelling, gas dispersion and smoke dispersion modelling <sup>Note 1</sup>

If an arrangement is required for work for a client, this can quickly be arranged.

**Note 1:** Vanguard Solutions Group of companies provides explosion modelling and modelling of gas and smoke dispersion using Computational Fluid Dynamics software. We have also managed such work with the specialist providers of such software when requested by our client.

## 4. OUR COMMITMENT

We provide pragmatic engineering and management solutions for our clients. Where others may just provide quantitative or qualitative analysis at an academic level, we place the results of our analyses in the context of the design and, perhaps more importantly, operations of the facilities for our clients. In other words, we consider what happens in the real world and what effect our findings would have when placed in that real world.

In addition, the following features of our company enable us to deliver appropriate solutions for our clients' needs:

- Stable and proven management team, i.e. longevity - ten years with little to no change, only development and growth;
- Highly respected in the region, with outstanding contacts and network with clients and regulators;
- Vanguard Solutions is the only significant, wholly independent consultancy in the region offering safety and risk services;
- We are located in the heart of the business district for our Australian clients' offices;
- Over 100 man years of experience with Safety Cases amongst the management team and key personnel;
- A unique mix of technical leaders and the brightest, young engineers – i.e. mentors, each with more than 25 years experience, leading a vibrant team of bright, young engineers;
- A strong culture of professionalism, based on an ability to communicate and express perhaps complex ideas in a simple, clear and unambiguous form.

## 5. CORE VALUES AND VISION

### 5.1. Ethos and Aims

From the beginning of our company, the Directors of Vanguard Solutions have always espoused the following as our ethos, aims and reason for being:

#### *Why are we here?*

We are here to make a difference. Across all industries, people and the environment are placed at risk in ways that are avoidable and to an extent that could be reduced. The management of those risks is often lacking. The will to improve is hampered by familiarity and acceptance, if not complacency. For some companies, at times, there is a fine line between disaster and continued operation. By providing quality input, in an appropriate, timely and persuasive manner, we aim to assist our clients:

- to avoid and prevent risks where reasonable,
- to manage effectively the risks they endure,
- to achieve continual improvement and, thereby,
- to distance themselves from potential disaster.

#### *How do we go about our business?*

In our view, any company is like a three-legged stool. Without any one of these legs, the company cannot exist. So we need to look after each of them with equal zeal.

One leg is the clients that we serve and the business community in which we operate. We need to ensure that we meet or exceed our clients' expectations and maintain our relationships with them. In addition, we need to play our part in the business community, by furthering knowledge, participating in events and supporting community initiatives in areas related to our business. We also shall conduct our business ethically, in accordance with the company's policy.

One leg is the people in the company. We need to ensure that we meet or exceed their expectations, regarding career, fulfilment and remuneration. We need to help them to further their skills and expertise and to develop new areas of skill. We shall provide a working environment that is pleasant, safe and healthy in which to work. In particular, we must recognise, respect and support their life and their family outside the work environment and be ready to provide whatever support we can at times of stress.

One leg is the investors in our business. We need to ensure that they receive a reasonable return for their investment. We also need to ensure that their values are fulfilled and their requirements are achieved by the way in which we conduct our business.

#### *Why should we come back tomorrow?*

Much of what our company has to offer is encapsulated by the statements above. There is more, however, that we aim to achieve and which forms part of our culture. This includes:

- to provide a workplace and a work atmosphere in which people want to work – it should be fun! We want to nurture a team spirit that makes us greater than the sum of our parts.
- to be an employer of choice – we want people to want to work with us; we want those who work with us to be respected as being at the top of their profession.

#### *We want to lead the way.*

## 5.2. Our Vision

### *Vision*

We aim to provide risk management services in a cost-effective manner that enables our clients to reduce risks to their personnel, the public and the environment effectively. By so doing, we safeguard lives, protect the environment and improve business outcomes.

## 5.3. The Way Forward

The management of Vanguard Solutions recognise that, no matter how successful its past, it is the ability of the company to prosper in the future that represents its attraction as an employer and a service provider. Our experience from our ten years of operation is a key ingredient in our ability to make effective plans for the future.

## 6. REFERENCES

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