



---

Title: SOL Petroleum Cayman Limited Tank Incident Investigation Report  
Jackson Point Terminal (JPT)  
South Sound, George Town  
Cayman Islands

Document No: OF-IR-001/17

Rev: NA

Document Category: Fuel Sector Incident Investigation

Date: 2018 – 02 - 16

**Distribution: Internal to Government, Industry Stakeholders and Interested Parties**

Intentionally Left Blank

---

## SOL DIESEL FUEL TANK INCIDENT INVESTIGATION REPORT

---

Report ID: OF - 001/2017

Date of Incident: 23 July 2017

Incident Description: Diesel Tank No. 8 Internal Fire

Incident Location: SOL Jackson Point Terminal (JPT), South Church Street, George Town



Investigation Team:

OfReg (Fuels) - Principal Investigators  
Cayman Islands Fire Service  
(Royal Cayman Islands Police Service)

Names and designation of Investigation Team Members are outlined in Appendix 1

Date Investigation Commenced:

24 July 2017

Date Investigation Completed:

11 January 2018

Date of Report: 25 March 2018

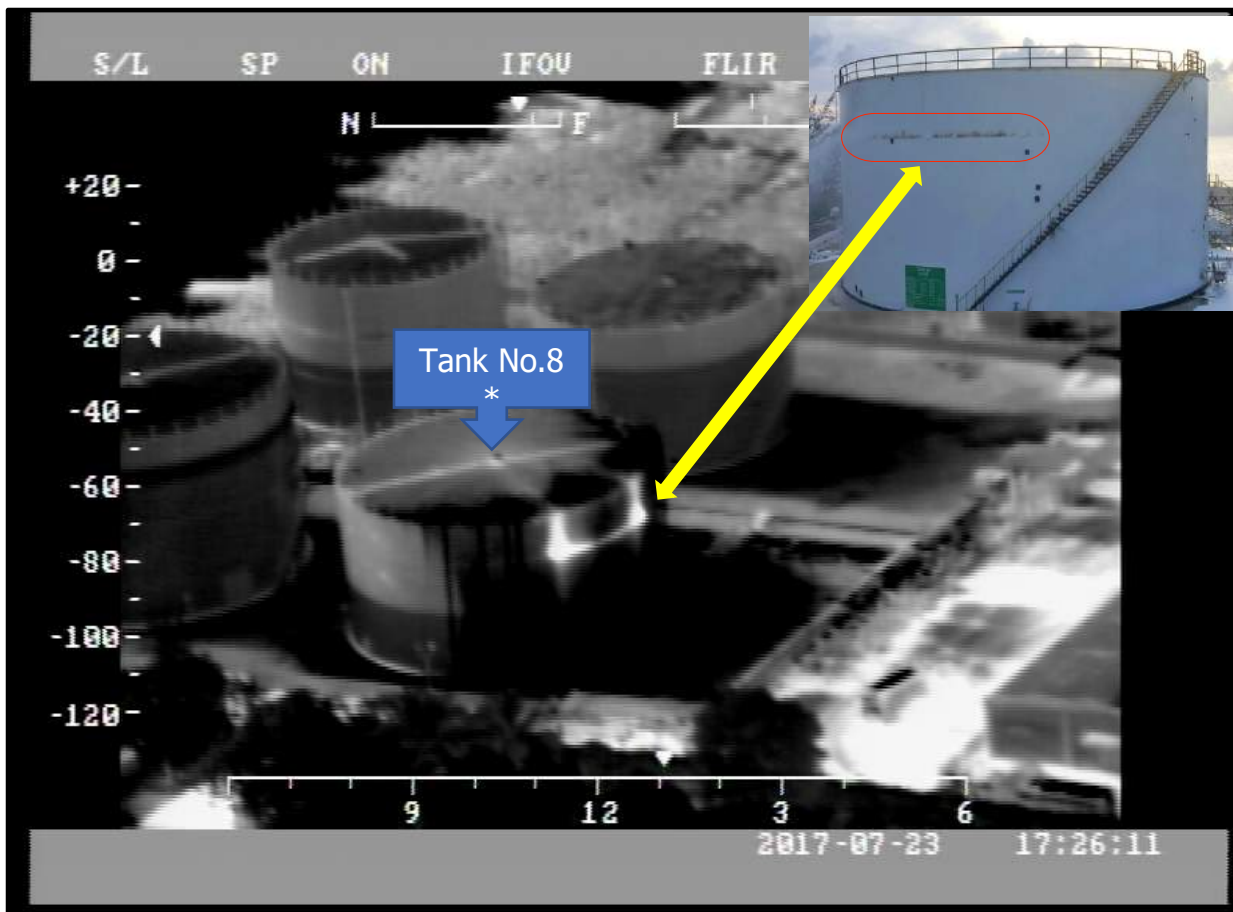


Photo Showing Aerial Image of Heat Source Inside Tank # 8 Courtesy of RCIPS Air Support Unit. Inset shows the Scorching as Observed on Tank No. 8.

## KEY ISSUES:

### Internal Operational Safety & Compliance Programs at Major Fuel Terminal Facilities:

- Consistent Application of API, NFPA and other relevant Codes & Standards
- Organisational Safety Culture
- Contractors Certification and Capability Gaps
- Reassessment of Regulatory Oversight of Bulk Fuel Terminal

## Table of Contents

<b>1.0 EXECUTIVE SUMMARY .....</b>	<b>7</b>
<b>2.0 INTRODUCTION AND BACKGROUND.....</b>	<b>9</b>
<b>3.0 INCIDENT DESCRIPTION .....</b>	<b>12</b>
<b>4.0 INCIDENT RESPONSE .....</b>	<b>14</b>
<b>5.0 APPLICABLE CODES &amp; STANDARDS .....</b>	<b>15</b>
<b>6.0 INVESTIGATION &amp; FINDINGS.....</b>	<b>16</b>
6.1 SOL’s Corporate Strategy and Commitment to Safety & Operational Excellence.....	16
6.2 SOL’s Contractors Engagement.....	17
6.3 Training and Certification of Personnel .....	18
6.4 Welding on In-Service Tanks.....	19
6.5 Inadequacies in Relation to API RP 2009.....	20
6.6 Documentation and Processes.....	21
6.7 Job Safety Analysis Breaches .....	23
6.8 Hotworks on Tank .....	24
6.9 Tank Internal Design.....	25
6.10 Method of Repair/Welding .....	25
<b>7.0 LIKELY ORIGIN OF FIRE .....</b>	<b>26</b>
<b>8.0 OTHER KEY FINDINGS .....</b>	<b>29</b>
<b>9.0 REGULATORY REGIME.....</b>	<b>30</b>
<b>10.0 INDEPENDENT THIRD-PARTY API 653 TANK INSPECTION.....</b>	<b>31</b>
<b>11.0 IMMEDIATE POST- INCIDENT MEASURES .....</b>	<b>31</b>
<b>12.0 RECOMMENDATIONS.....</b>	<b>32</b>
<b>13.0 CONCLUSION.....</b>	<b>33</b>
<b>APPENDICES .....</b>	<b>35</b>
Appendix 1: Names and Designation of the Investigation Team.....	36
Appendix 2: SOL Terminal.....	37
Appendix 3: Tank No. 8 Design and Construction Details.....	38
Appendix 4: Extract of Annual Inspection (2016) .....	39
Appendix 5: Typical Material Safety Data Sheet Diesel No.2 Low Sulfur Diesel and Ultra Low Sulfur Diesel.....	43
Appendix 6A.1: SOL Risk Assessment Matrix & Overview .....	45
Appendix 6A.2: Job Safety Analysis .....	48
Appendix 6A.3: Method Statement.....	50
Appendix 6A.4: Work at Height Certificate .....	51
Appendix 6A.5: Permit to Work.....	52
Appendix 6A.6: Hot Work Certificate .....	53
Appendix 6B.1: Photographic Exhibits of Epoxies .....	54
Appendix 6B.2: Photographic Exhibits of Mild Steel Plate (Patches) .....	55



**Appendix 6C.1: MSDS for Devcon Flow-mix Cold Weld Epoxy ..... 56**  
**Appendix 6C.2: MSDS for JB Weld Epoxy Putty Steel Stick ..... 58**  
**Appendix 7: Incident Time Line ..... 59**  
**Appendix 8: SOL Contractor Evaluation Form..... 60**  
**Appendix 9: Typical API Decision Process for Work on In-Service Equipment..... 63**

## **1.0 EXECUTIVE SUMMARY**

On 22 and 23 July 2017, SOL Petroleum Cayman Limited (“SOL”) commissioned their 3<sup>rd</sup> party contractor - J&R Industrial Services (“J&R”) to carry out repairs to the roof of Tank No. 8 at its Jackson Point Ocean Terminal. The work undertaken entailed patching pre-identified areas on the roof where the extent of metal loss resulted in severe thinning and/or perforations of the roof plates. The patches were made of mild steel plates which were welded in place by a certified welder and the work scheduled for Saturday 22 July was completed without any reported incident.

On Sunday 23 July 2017 at approximately 16:40 hrs, it was reported to Public Safety and Communication Department - Emergency Services (911) that there was a potential fire inside Tank No. 8 at the SOL Jackson Point Terminal. The only positive indication of the fire was the evident scorching on the external surface and paint on the outside of the tank upper shell. This was subsequently confirmed as a persistent heat source along a localised area of the inner shell (wall) of the tank. At the time of the incident Tank No.8 contained approximately 15,000 barrels or 524,550 imperial gallons (IG) of Ultra Low Sulphur Diesel (ULSD).

At or around the time Emergency Services were notified, SOL’s personnel activated the Terminal’s internal fire suppression system (“FSS”) which operated for a short period before the fire monitor in the area of Tank No. 8 failed at its base causing the entire Fire Mains (piping) system to lose pressure, and remained inoperable throughout the incident response.

The relevant emergency services were dispatched by 911 and the Cayman Islands Fire Services (“CIFS”) were on scene within twelve minutes of notification. The relevant first responders promptly attended the incident, however OfReg Fuels Response Team, which was not included in the initial rounds of notifications, responded at approximately 18:10 hrs. immediately after becoming aware of the situation. The incident was at the time under the command of Chief Fire Officer D. Hails. A command center was activated at which senior emergency responders held an initial meeting to discuss progress and further response strategies at approximately 19:15 hrs. The command center was subsequently moved to Sunset House and all the key emergency services personnel were represented at the briefing which was coordinated by Hazard Management Cayman Islands (“HMCI”) Director and Team. In addition to the standard notification protocols observed, media personnel on site were also briefed.

During the first 3 – 4 hours of the response efforts, the situation was assessed as “moderately stable but not contained.” The Fire Service with support from SOL and J&R representatives continued relentlessly to contain the heat source while monitoring same and applying boundary cooling to the tank until the situation was brought under control. While it was subsequently

confirmed that SOL's foam injection system was deployed upon activation of their FSS (which ideally would have significantly limited the development of a full engulfment within the tank), no substantial evidence was obtained by the investigation team at the time to confirm this. Throughout the response efforts, the tank was being monitored primarily by Fire Services' thermal imaging device, occasionally supplemented by Royal Cayman Islands Police Service ("RCIPS") Air Support Unit, and there was no indication of an incipient conflagration. Periodically however, elevated temperatures were observed in the primary areas of interest along the tank shell, but were confirmed to be relatively lower than the flash point of diesel. It is relevant to the investigation to highlight that the images which were being circulated on social media on the date of the incident were misleading as the tank was never engulfed in flames.

The incident was brought under control at approximately 02:40 hrs. on (Monday) 24 July 2017, after a combination of approaches which included continuous boundary cooling with water and the application of fire suppressant powder and foam by the CIFS rescue and firefighting teams. The latter was accomplished through a hatch on the tank roof which was strategically located to enable this intervention by the team. Having conducted a review of the first stage response efforts and status of the Terminal, access (approval) was granted for the rest of the operations to resume at approximately 03:00 hrs. 24 July 17 by OfReg, except for the subject tank, its auxiliaries and appurtenances. This was granted to facilitate the second phase clean-up efforts prior to full resumption of SOL's commercial operation as an important service provider in the Cayman Islands. Tank No. 8 was officially taken out of service by OfReg and remains out of operation until approval is granted by OfReg to reintroduce this equipment into service, subject to the findings in this report.

As a result of the intervention approaches used to contain the incident, the quality of diesel product in the tank would have necessarily been affected. An analysis was carried out on the product, and SOL took the decision to re-export the fuel to avoid any (perceived) fuel quality issues for consumers.

There were no direct or indirect injuries to personnel arising from the incident, and further, no consequential damage to third party property or equipment were noted during the investigation. Importantly also, no product was released to the environment. The Terminal is currently operating, albeit with significantly reduced storage capacity, however OfReg continues to monitor the availability of fuel inventory across all terminals on Island to ensure supply (versus demand) remains adequate.

The primary investigation was conducted over a period of four (4) months and concludes that SOL, through its employees and contractors did not take all reasonable precaution as required by relevant code, standards and best practices to which it subscribes or mandated under the



Dangerous Substances Law (“DS Law”) for the prevention of the incident which occurred at their facility on 23 July 2017.

The incident location is a regulated premise which is under the full operational control of SOL.

## **2.0 INTRODUCTION AND BACKGROUND**

SOL Jackson Point Bulk Oil Storage Terminal Facility is located at 512 South Church Street, George Town, Grand Cayman. The operation commenced in January 2014 as part of the SOL Group acquisition of ExxonMobil (ESSO) operations in the Caribbean and other regions. Prior to the acquisition, ESSO operated in the Cayman Islands since in the 1960’s. This Ocean Terminal is sited on a 3.6-acre land parcel (Block & Parcel 6D-63) in a *Light Industrial and Beach Resort Residential (split)* zone as per the Development Plan (1997 Revision) of the Cayman Islands. The surrounding parcel of lands are zoned *Beach Resort Residential (Iron-shore/Beach side)* and *Low Density Residential* within the neighbouring vicinity of the Terminal.

The terminal current storage capacity is in excess of four million gallons in its four (4) aboveground bulk storage tanks of varying dimensions and capacities. The map shown in Appendix 2 provides some additional details of the Terminal location. The bulk tanks are designated as follows:

- Tank #6 – Motor Gasoline (Mogas);
- Tank #7 – Aviation Fuel (AvJet);
- Tank #8 – Diesel: Ultra Low Sulfur Diesel (ULSD/ADO)
- Tank #9 – Diesel: Ultra Low Sulfur Diesel (ULSD/ADO)

These aboveground bulk oil storage tanks are made of steel and are used to store various types of fuels including the above-mentioned and other compatible types of fuels, at atmospheric pressure and temperature. There are generally three types of atmospheric tanks for storing combustible or flammable liquid hydrocarbons permitted by OfReg (as classified by the Institution of Chemical Engineers): Fixed or Cone Roof Tanks, Open Top Floating Roof Tanks, and Fixed Roof Tanks with Internal Floating Roof/Pan. The first and latter types are most commonly used in the Cayman Islands. The logistics and supply chain is such that fuel is delivered by Tankers at the sole, SOL owned and controlled Sea berth facility, and discharged via a redundant system of subsea pipelines to the shore tanks for storage/handling and subsequent distribution to the retail network of gas stations, and other commercial and distribution channels for local consumption.

In the region, steel fuel storage tanks are manufactured and maintained to various engineering standards, codes and practices as established and promulgated by: American Petroleum Institute (API), Underwriters Laboratories (UL), American Institute of Chemical Engineers (AIChE), American Society of Mechanical Engineers (ASME), and National Fire Protection Association (NFPA) among others. These internationally recognised and established organisations all have strict engineering guidelines, design and construction requirements, codes and standards, policies and best/recommended practices designed to ensure safety, environmental stewardship, efficiency and reliability are continually achieved in the Oil and Gas industry. Since its establishment in 2003, the former Petroleum Inspectorate (“PI”), now OfReg (Fuels) has adopted a number of relevant sections and excerpts from these organisation, and these were incorporated by reference as part of the DS Law. SOL and its predecessor, ESSO, have also independently adopted, and SOL continues to subscribe to and comply with various aspects of these standards & guidelines as part of their corporate mandate across their regional operations. These are utilised for the construction, operation and maintenance of their storage tanks and also their general operations. These standards form part of the basis which OfReg (Fuels) uses to structure its annual inspection regime to ensure: relevant systems and processes are in place, safety and compliance continue to be paramount at regulated premises, and for validation that the industry in general meets the requirement of the DS Law.

Tank No. 8 was constructed in 1988 by Tampa Tank Inc. (Florida Structural Steel), an approved internationally recognised and certified tank manufacturing, installation and repair company based in the USA. Additional details of the subject tank are provided in Appendix 3. OfReg, through the former PI department, is aware of at least two API Inspections since the department was established, and these inspections are typically conducted on a 5 - 15year cycle depending on number of technical considerations. Additionally, there are other inspections carried out by SOL’s internal engineering & audit teams, as well as by OfReg on an annual basis as previously outlined. Appendix 4 includes a redacted version of a recent inspection done by the PI (now OfReg) at SOL’s Terminal.

The Terminal/tanks operate in what is considered an ‘aggressive’ marine environment given its proximity to the sea. While an equally aggressive corrosion resistant (Cathodic Protection) system is in place and functioning, supplemented by corrosion inhibiting primer/paint on the tanks (internally and externally in some cases), metal losses due to corrosion is expected, albeit much less pronounced than a tank without similar protection systems in place. The Terminal serves all segments of the fuel sector (markets) on Grand Cayman and has been designated as a critical national infrastructure. This elevates its importance over and above ensuring its operations are in compliance with the DS Law, to ensure that as part of OfReg’s broad mandate, it continues to safely and reliably support the ongoing economic development of the Islands.

The ultra-low sulfur is the only grade of diesel which SOL markets in the Cayman Islands. This product is considered a premium non-renewable fuel grade globally, due to its low sulfur content and the associated environmental benefit it accrues. While there are other minor variations in its specification when compared to other diesel fuel, this primary parameter – the low-sulfur content remains a neutral consideration for the purpose of this investigation. That is, the fuel in itself was ruled out as a contributing factor to the incident in that whether it was ULSD or ‘regular’ diesel, the circumstances during the incident would not have materially changed. The investigation however acknowledges that having fuel of any quantity, quality, grade or type in a tank on which hot works are to be carried out, requires a calculated, meticulously planned and deliberate decision-making process, prior to execution. A typical ULSD specification sheet along with that of ‘regular’ diesel is included in Appendix 5. It should be noted that diesel has a relatively lower volatility than other bulk fuel imported under normal storage conditions; the investigation team noted that volatility is an important factor in promoting the rapid development of a fire.

The terminal was not doing normal business, that is, in full commercial operations on the dates the repair works were scheduled. Only aviation deliveries and related activities were anticipated during the period due to SOL’s supply obligations in this regard. It was confirmed by SOL that only works related to the scheduled tasks were being performed at the facility. The Terminal is equipped with CCTV and Infra-red fire detection (and security) system to alert in the event of fire and related incident within the Terminal. Additionally, there are security personnel who man the facility from dusk to dawn on a daily basis.

***During a scheduled operational maintenance exercise on Tank No.8, a heat source which was suspected to be a small but sustained deflagration, was discovered.*** The effects of the fire were primarily observed along the upper eastern contour of the external shell of the tank while heat related activities were also periodically observed along the southern portion of the tank. The latter was sporadic and subsequently stabilised to ambient temperature consistent with the temperature of other parts of the tank shell after cooling was applied. On conclusion of the incident response and control efforts, an investigation was immediately launched to determine the contributing factors and root cause(s) of the incident.

The purpose of this incident investigation report is to summarise the finding based on the investigation which was carried out by OfReg. A number of other agencies with jurisdiction for the fuel industry/sector have commissioned similar investigations to arrive at conclusions which will inform recommendation and action to be taken as required by their respective policies, protocols and laws. While there may be common findings in some respects, it is required under the DS Law that such an investigation be commissioned in order to determine breaches and violation of the Law, so that appropriate steps are taken, then subsequent implementation of measures to remedy breaches and enforce compliance with the Law. The facility is owned and

controlled by SOL and is regulated under the DS Law for safety and operational compliance purposes. Accordingly, fines and penalties are provided under the Law for infractions.

This report should not be wholly construed as a 'fire incident investigation', as that is the remit of the Cayman Islands Fire Services. However due to the inseparable nature of unsafe conditions such as these, and code requirements which are primarily established to prevent these very incidents, the investigation at times, will interchangeably place heavy focus on the circumstances of the fire, and alternatively on the requirements of the Law and its respective codes and standards in relation to the fire.

The investigation was not without unanticipated delays, particularly arising from the uniqueness of extracting evidence from inside the tank under the circumstances. Taking into consideration the quantity of fuel in the tanks at the time of the incident, and the requirement to empty and prepare the tank for entry by investigation personnel utilising equipment tailored and compatible for the purpose, a delay of approximately two (2) months due to the need to secure a safe and reliable mechanism to enter and obtain evidence from the tank. Further, it was necessary that after the primary evidence was obtained by the investigation team, the information and findings from the subsequent independent API inspection should be taken into consideration, as this would reflect important supplemental information after the tank was comprehensively cleaned. These two factors were major contributors to the delay in finalising the report.

SOL cooperated with the investigation, and details relating to concerns and issues which arose during the investigation have been included under the various sections of this report, with relevant details.

### **3.0 INCIDENT DESCRIPTION**

J&R Industrial Services (J&R), a SOL third-party local contractor was engaged on 22 and 23 July 2017 to weld a total of eleven (11) patches on various previously identified areas of the conical fixed roof of the No. 8 Ultra Low Sulfur Diesel Tank. The patches were made of mild steel and of varying sizes.

Due to the nature of the work, which involved working at height as well as hot work among other risks, the job was planned over a period of two days. A high-level description of the work which was to be performed, Risk Assessment Matrix (general overview provided), Job Safety Analysis, Permits and other relevant documentation are provided in Appendix 6A.1 – 6A.6.

In short, the work was intended to be carried out on an *in-service tank*, that is, a tank which is in use and has a (significant) quantity of usable fuel. Preparation for the work as outlined by SOL entailed 'drawing down' (transferring some of the product into another tank) as part of their inventory management and general operation as a major fuel supply facility on Island. Key personnel involved were in some cases assigned very specific tasks, such as the Welder, consistent with works of this nature, but in other cases roles were not explicitly assigned, or fully understood it appeared. Execution of tasks of this nature also depend on some external factors such as weather conditions, wind speed and time of day when work can reasonably be done, all of which are typically taken into account as part of the job planning, risk assessment and mitigation.

The job was executed as planned on 22 July to the satisfaction of SOL, as reported. The investigation team briefly reviewed the likelihood of the fire being caused by activities on this date and concluded it was highly unlikely. When work resumed on Sunday 23 July 2017, SOL recognised there were additional areas on the tank roof which needed attention that were not previously identified as part of the original scope. Based on the (contractual) arrangements which exist, the scope change was acknowledged by the parties involved, but without any apparent alteration to the work-related documents. As part of the preparation process, steel plates were cut into various predetermined sizes/templates, cleaned and polished to remove corrosion and other foreign materials on its surface, then set in place once welding was to commence. The receiving surface (corroded section of tank roof) was treated and prepared in a similar manner and a layer of the *Steel Stick Epoxy Putty* was applied to the surface for sealing and filling areas heavily pitted/corroded (craters) as necessary, after which the Patch was secured and continuous-seam welded in place.

In areas where metal losses resulted in perforations, SOL explored alternative approaches utilising some other options with epoxies they evaluated for the application. While samples of similar epoxies were provided to the investigation team, the specific names and types of epoxies utilised were not confirmed, with the exception of the Steel Stick Epoxy Putty mentioned previously. This approach however proved unsuitable (incompatible) to accomplish the task and was abandoned, after which the team, under the direction of SOL's Supervisors reverted to the process outlined in the foregoing paragraph. However, one of the other epoxies remained on the job site and was inadvertently used on 23 July, coincidentally on the particular area/Patch which was the 'location of interest' for this investigation. Several pieces of evidence were obtained and reviewed in relation to the various aspects of the task, such as the metal plates used, the electrode (and flux), and the welding method, all of which were not generally inconsistent with typical practices in the industry. What became evident to the investigation team however were apparent gaps in key aspects of the decision-making process, as well as certain consideration and key assumptions made in relation to the execution of the task.

Photographic exhibits of the epoxies and mild steel plate provided by SOL are included in Appendix 6B.1 – 6B.2.

On conclusion of day 2 activities, the Welder, upon closing off his activities for the day, observed the paint on the upper portion of the tank shell was scorching and partially discoloured, consistent with the effect of a reaction. A source of heat inside the tank was heating the metal in that area causing the paint coating to smoulder as a consequence. J&R personnel who were the only persons on site at time alerted the SOL site representative, who was not on site at the time the incident was discovered. SOL's Site Emergency Procedure is essentially as follow:

- Activate the Terminal Automated emergency response system
- Start the Fire Suppression System.
- The system is so designed that upon activation, it also triggers the foam injection system which deploys through the inlet pipe of Tank No.8.
- Through their internal protocol, procedure & guidelines, the General Manager and the Terminal Manager among others are to be accordingly notified, if not already aware.

What precisely transpired in the moments after the discovery of the fire was not very clear, however one of SOL's supervisors was confirmed to be the person who alerted 911 of the incident via his mobile phone.

Efforts immediately commenced to control the situation by applying jets of water to the external wall of the tank for cooling purposes. Extinguishment of the fire could not be tackled immediately due to the inherent constraints at the time, as such 'boundary cooling' as it is referred, continued throughout the incident response, and it was effective to mitigate against other potential issues, such as a phenomenon called Boil-Over. The Investigation team considers it also greatly assisted in limiting further propagation of the internal fire.

#### **4.0 INCIDENT RESPONSE**

A number of approaches were contemplated by emergency responders on scene to 'contain' the internal fire, with the foremost objective being the extinguishment of the flame. As outlined previously, surface cooling of the tank continued throughout the response efforts and was effective in maintaining the shell temperature at or slightly above ambient temperature. The primary response efforts were led by CIFS personnel utilising their fire equipment, and once the temperature of the tank shell was stabilised, the response teams were allowed to interact directly with the tank, that is, access the roof, hatches, and other access points on the tank to try to extinguish the flame. The situation at that stage was not considered to be less risky than

previous, however it was assessed to be more stable and relatively predictable to support the direct intervention of the response team.

Between 22:00 – 23:00 hrs, CIFS responders with support from J&R personnel, accessed two hatches along the eastern and south eastern perimeter of the tank roof to inject both a foam and fire suppressing powder which proved effective in blanketing the fire. Once the suppressant was applied, the tank continued to be monitored using the thermal imaging device, while boundary cooling continued.

The response efforts encountered some challenges which included not having ready access to tank construction details/drawings (from both SOL and OfReg Fuels) to validate some of the earlier assumptions made in seeking to develop an appropriate response strategy. Some minor conflicting information and reports of the actual work done on the tank earlier in the day was reviewed to assess any impact that could have had on the response strategy/efforts, but it was agreed that emphasis should be placed on reinforcing emergency response guidelines and expectations across the industry in this area.

The status of the SOL foam injection system could not be confirmed during the incident and CIFS supplied the foam which was utilised during the response efforts. SOL reported that further checks on the following day by their technical personnel revealed that their system had purportedly deployed into the tank as intended, however this could not be easily validated by the investigation team given that CIFS also deployed foam (powder) into the tank. SOL implemented immediate improvements to this system to supplement real-time conventional confirmation on the status of deployment in future.

A log of the incident timelines as captured by the investigation team is included in Appendix 7. This was compiled by the Fuels team despite some conflicting information from witness statements, interviews and other evidence collected during the investigation.

## **5.0 APPLICABLE CODES & STANDARDS**

The investigation relied on certain key technical considerations as part of its investigative strategy to arrive at its conclusion, foremost of which is the code to which the tank was constructed and should be maintained.

The tank was constructed to the American Petroleum Institute (API) 650 standard - *Welded Steel Tanks for Oil Storage*. As such, repairs to this tank should comply with the API 653 standard - *Tank Inspection, Repair, Alteration and Reconstruction*. Further, API 653 references

a number of other standards and practices, more specifically API Recommended Practice (RP) 2009 - *Safe Welding, Cutting, and Hot Work Practices in the Petroleum and Petrochemical Industries*, which was a focal point during investigation meetings and deliberations by the team.

## **6.0 INVESTIGATION & FINDINGS**

The investigating team reviewed the sequence of events leading up to and during the incident and the following sub-sections provide the relevant details and findings which were identified during the investigation. All personnel who were directly involved in the project/task were either interviewed in person or they provided written statements. A few investigation meetings were held within the first month of the incident while evidence was being gathered. A sworn statement was also obtained from an independent witness who lives within the vicinity of the Terminal and observed welding being done on the tank earlier on the date of the incident.

Additionally, information and evidence were obtained and reviewed from several other sources also, primarily SOL as it relates to their processes, terminal logs, safety statistics including an overview of their Safety management system, CCTV footage, API reports, OfReg inspection reports, DPSC Event report, along with the physical evidence – samples and photographs obtained from within the tank.

### **6.1 SOL's Corporate Strategy and Commitment to Safety & Operational Excellence**

SOL articulates its vision and mission for safety and compliance quite emphatically via its logo and slogan - "Goal Zero" - to attest to its commitment to ensure no one gets hurt and zero incidents within its operations. A review of SOL's safety programs, records and systems confirms their corporate commitment in this regard. There is evidence of their ongoing efforts to ensure a pervasive culture of safety, and initiatives aimed at the continual assessment and mitigation of risks, manifested in the form of their Risk Assessment Matrix ("RAM") and other key processes and protocols they have in place. The RAM for instance, among other decisions it supports, is a critical tool which is used to evaluate the likelihood and consequences of events during the execution of tasks, so as to implement adequate mitigation measures. The investigation noted some concerns regarding clarity of the use and application of the RAM tool in particular at SOL, however it was determined that a holistic industry approach should be considered in addressing the concerns noted. Further, the drive for safety was also observed to be visually reinforced in and around the Head office and Terminal facilities. While there are always opportunities for improvement in any operation or system, the investigation did not find



any significant issues with SOL's *intent* regarding their Health, Safety and Environmental (HSE) strategies, through their programs and initiatives to realise incident-free operations.

Interaction with their internal safety programs in terms of input or recording of information, and treatment of information/data generated by these safety management systems did not form part of the detailed investigation. While the investigation did not heavily interrogate the proprietary safety management system SOL utilises, evidence was sought in relation to the way the data was used to reinforce conformity among their workforce and contractors. Based on reports provided and other key safety statistics reviewed, it was not immediately clear whether any of its employees or contractors had been sanctioned in recent times for workplace safety infractions. Ultimately, the investigation team is of the view that the way in which information is captured and the extent to which the information is used to ensure compliance and drive meaningful behavioural change is instrumental to provide opportunities for the achievement of their safety objectives, and as such continual efforts to further exploit these tools will deliver consistent desirable results. SOL outlined and provided information on its exemplary safety record as it relates to incidents at its facility since 1960. OfReg further confirmed there are no official report or investigation on file since its inception in 2003 for incidents of this nature at this facility.

## **6.2 SOL's Contractors Engagement**

The means by which SOL engaged their contractor J&R for **this specific task** was not clear. While a 5-year contract between SOL and J&R was in effect at the time the work was executed, a document setting out the specific parameters such as a written scope or alternatively a method statement was not available for review by the investigation team. It was confirmed that this contractor performs a wide variety of tasks at the Terminal and is therefore not unfamiliar with the SOL's work environment and ethics. SOL confirmed that the contract agreement which is in place covers general works performed by J&R at their Terminal facilities.

Basic "Work Order" systems present opportunities for breakdown in compliance with safety and operational purposes unless they form part of a robust contractor management system. It was acknowledged that this often times can be cumbersome and requires significant paperwork to accomplish same if not automated. For instance, earlier in the investigation, one of J&R's (management) representatives indicated their management was not aware of **the extent of this particular task being undertaken**, suggestive that they (J&R Management) may have likely intervened so that the execution of the work may have been done differently. This, the investigation believes can be effectively achieved though formal rules of engagement such as having detailed Contract Annex, or supplement Contract Agreements, to allow the parties to ensure tasks such as those undertaken on 23 July 2017 are not viewed as a routine undertaking. Further, the investigation notes this sets administrative boundaries for effective

working relationship and lines of responsibilities. The investigation team acknowledge that amiable relationships between SOL employees and those of their contractors is necessary. However, if not effectively managed (through contractual obligations), these can be equally detrimental to safety, as the tacit reliance on each other (SOL and their Contractor employees) can lead to renegeing on obligations and/or situations of professional compromise, which put lives, property and the environment at risk. One notable instance on the date of the incident, it appears unreasonable reliance was placed on the contractor's employees to self-supervise the work during a certain stage of execution. There was no indication from the interviews or evidence gathered that any of the persons directly involved with the task had any concerns that the job supervisor was periodically offsite during the execution of work.

### **6.3 Training and Certification of Personnel**

In order to ensure its vision and corporate strategy is achieved, SOL invests in the training and development of its employees, as outlined during the investigation and training information provided to OfReg. They also have a system in place to screen and ensure its contractors or any person performing work at its facilities receive adequate training for tasks in which they are typically or routinely involved. A copy of SOL's contractor evaluation template was reviewed to assess its effectiveness in identifying gaps in capability and competency of their contractors, and was generally found to be satisfactory. This is provided in Appendix 8.

Employees and contractors alike are usually provided mandatory safety training in the industry, the two most common of which are: Comprehensive Safe Work Practice (SWP); and Confined Space Entry Training. Depending on roles, training is also provided in the areas of Hazardous Operation Emergency Response, which is critical for the effective management of incidents such as these. A host of other broader trainings are generally made available ranging from Safety Awareness & Mitigation; Slips, Trips & Falls prevention; Energising and De-energising systems; Ergonomics; Defensive Driving, and others which cover the various aspects of their full operations.

Training (lack of) was considered a contributing factor to the incident, as information on refresher training or other awareness initiatives was not readily available to assess how learnings are reinforced, and to ensure they are consistently applied during execution of tasks. Evidence shows that personnel involved in the task and reported to have been assigned critical safety roles, may not have utilised trainings received or simply lapsed during the initial period the fire was suspected. Based on the evidence provided, upon receiving the call from J&R's employee alerting the SOL supervisor who was offsite at the time of the incident, the supervisor's initial response was that it was indeed a "fire", however the personnel on site were not in a position to make this determination immediately, hence take requisite action. One

troubling observation during a review of the evidence shows one of the personnel on site 'gauging' the temperature of the tank with his (presumably) bare hands. This was a few minutes after the scorching on the tank was observed, and the person was not outfitted with HazMat or any other form of fire resistant clothing or additional appropriate Personal Protective Equipment (PPE) to attempt such a manoeuvre. The circumstances were sufficient to warrant that all persons vacate the immediate area of the tank, as per SOL's emergency response procedure or as generally required in any emergency situation.

#### **6.4 Welding on In-Service Tanks**

At the time of the incident, Tank No. 8 at SOL Terminal was considered an In-Service Tank, which basically meant the tank was not taken out of normal operation at the time work was being performed. SOL advocated that the provisions of the API Code was relied upon, and complied with, in effecting the repairs to the tank. API RP 2009 is the primary code under the API body of knowledge which has relevance to the work which was undertaken on Tank No. 8.

***OfReg Fuels and its predecessor entity - Petroleum Inspectorate - is not aware of the adoption of this operational practice (hot works on in-service tanks) across the industry in the Cayman Islands as it is inherently extremely risky and should have been endorsed by OfReg and CIFS as two key agencies having jurisdiction for matters of this nature. Nonetheless, even without the explicit approval of the authority having jurisdiction, strict adherence to this code provision is guaranteed to limit the occurrence of an incident, including the SOL tank fire on 23 July 2017.***

Section 12 of API RP 2009 covers *Work on Equipment In-Service* and provides the following conditions under which this is acceptable:

- A. *Hot work is performed while the hydrocarbon is contained in an oxygen deficient atmosphere. This can be achieved when a pipe, vessel or tank volume is inerted to exclude oxygen during the welding operation, or*
- B. *Hydrocarbon vapour or gas concentrations within the equipment are controlled to remain within a predetermined percent of the Lower Flammable Limit (LFL), too rich or too lean to burn, or*
- C. *The equipment is in a well-ventilated area, and precautions have been taken to ensure that, in the event of leakage, there is no accumulation of hydrocarbon vapours or flammable gases to create an explosive atmosphere or major fire hazard, and*
- D. *Precautions are taken to prevent burn-through to the hydrocarbons.*

Further, Section 12.3 (renumbered below for emphasis) provides that:

*If welding is to be done on the outside surface of a vessel, and if the area is otherwise safe for the use of an open flame, the vessel need not be gas freed if one of the following procedures is employed or conditions maintained:*

*E. The vessel is not pressurised.*

*F. In a vessel that is partly filled with liquid, welding may be done 3 ft. or more below the level of the liquid if adequate precautions have been taken to prevent burning through the tank or vessel wall.*

*G. Welding may be permitted if chemical analysis or other reliable evidence indicates that the petroleum-product vessel contains an atmosphere incapable of being ignited because it is too rich or too lean or is non-combustible or non-reactive and that adequate precautions have been taken to prevent burning through the vessel wall.*

In order for welding on in-service tanks to be considered acceptable, only one of conditions A, B, C must be met along with D. Based on the information collected and reviewed by the investigation team, conditions A, B and D above were not met. Condition C was sparingly met but was inadequate on its own to allow for hotworks to take place. Additionally, the investigation found no information to validate any attempt made by SOL to comply with conditions B and D above.

*Condition F is generally a more practical and acceptable approach for work on tanks (shell) which store certain fuel types, while taking into account other precautions, but this was not appropriate in the circumstance, given that the work was being done on the tank roof which is never in contact with the liquid in the tank.*

## **6.5 Inadequacies in Relation to API RP 2009**

### **Condition B**

SOL job supervisor was in possession of a MSA ALTAIR 5X Multigas Detector on site which allowed them to monitor the LFL in the area where hotworks were being performed. In areas where repairs were being done on “holes” with the likelihood of an increased concentration of vapors or gases, the holes were filled with one of the epoxies previously mentioned, before welding commenced. However, the investigation finds that the Devcon Cold Weld Epoxy as reported, was not designed for this application. Altogether, these efforts by SOL and their Contractor were not aimed at controlling the LFL **within** the tank on which the work was being performed.

### **Condition D**

SOL utilised an appropriate method of welding which was done by a certified welder. The welder further confirmed, having worked in a similar environment previously, he was aware of the various general requirements for the welding work which was being undertaken. However, while it may have been implied, the investigation considers that the particular requirement set out in Condition D above, should have been much more clearly set out in the method statement and JSA documents, so that the welder, while performing the work, would alert the job supervisor where, based on his experience, there were instances of suspected burn-through.

**Critical to the application of this code provision and the consideration of the relevant conditions contained therein, is the requirement that a written procedure be in place documenting the process and setting out all the relevant requirement for such a task.** This was repeatedly requested by the investigating team but was not provided by SOL. An example of a decision authorization process is included in Appendix 9, reproduced courtesy of the internet.

## **6.6 Documentation and Processes**

The following documentation were provided and reviewed by the investigation team in relation to the work being performed:

1. Permit to Work
  - Lists the work to be done, equipment to be used, start and end dates and time and safety precautions to be taken and is required for all works in the terminal, whether they are hotworks or not.
  - Requires the signatures of both SOL and their Contractor representative.
2. Hotwork Certificate
  - Required only when the Permit to Work includes hotworks. This document serves as an additional safety checklist and a log of concentration of hydrocarbon vapor in the environment. It records the percentage of lower flammability ranges of certain gas in the atmosphere in and around a designated work area.
  - Requires the signature of SOL representative only.
3. Work at Height Certificate
  - Required for works that take place at more than five (5) feet above grade and provides an equipment safety checklist, location of works and precautions to be taken.
  - Requires the signature of SOL representative only.
4. Method Statement

- Supplemental information for a Permit to Work that includes details of the work to be done, equipment used, potential hazards, hazard controls and emergency response numbers.
  - Requires the signature of the Contractor only.
5. Job Safety Analysis (JSA) Form
- Supplemental information for the Permit to Work and the Method Statement, providing a sequence of works, potential hazards that could be encountered at every step and mitigation methods.
  - Requires the signatures of both SOL and their Contractor representatives.

Documents 1 through 5 above are all internal SOL documents which are required, as applicable to be prepared prior to conducting tasks at any of their facilities or any dangerous substances equipment or vehicle. These documents are usually verified by OfReg during annual inspection pursuant to Section 14 of the DS Law, but does not require OfReg's sign-off for daily/routine use.

A few inconsistencies were observed among the documents, including measurements taken, time records, personnel signature who were not on site, and job requirements which were not regarded during execution. One explanation given was that the original documents were destroyed (with water) during the incident response and that the available documents were replacement copies. This was particularly concerning for the investigation team given that the permits in particular, are completed in duplicate or triplicate, and the process requires these documents to be safeguarded and properly secured given that copies are required to be kept/displayed at the job site in varying weather conditions.

Further concerns were noted on the documents provided (by SOL) ranging from incomplete or missing critical information such as detailed method statement and sequencing of task, and other anomalies which points to other gaps, some of which were unverifiable at the time of the investigation. The JSA was substantially completed when compared to the other documents provided, documenting key information such as hazards and mitigation methods, roles required, and it contained signatures corresponding to all the parties who were understood to be on site.

None of the documents however clearly defined the roles of the persons involved in the task other than their obvious day to day roles such as Supervisor, Welder or Labourer. During the interviews conducted separately with both SOL and their contractor personnel revealed that the person responsible for the post of "Fire Watch" was unclear. This was a fundamental concern for the investigation team given the critical role and duties of the Fire Watch which include:

- a. *Watching for fires in all exposed areas.*
- b. *Trying to extinguish a fire only when obviously within the capacity of the equipment available.*

- c. Sounding the fire “alarm” when available equipment is not sufficient to suppress a minor fire; in accordance with facility procedures this may include activating the Emergency Response System using a handheld radio or other communications device.*
- d. Maintaining a watch for at least 1/2 hour after completion of welding, cutting or other hot work until the area has been inspected and found to be free of fires or smoldering materials.*

It was noted that the person assigned this task may do other safety-related tasks if the primary fire watch responsibility is not compromised. Considering this provision, the investigation took the position that the SOL job supervisor reasonably fits this role based on the responsibilities, and the suitability of persons listed on the JSA. There were deviations (detailed in following section) from this requirement that the investigation found, a situation which lends itself to the concern raised in relation to SOL managing its (employees and) contractor relationships especially in regard to their respective safety and compliance roles and obligations.

### **6.7 Job Safety Analysis Breaches**

There were two notable breaches relating to the safety controls listed on the Job Safety Analysis Form completed for the works on 22 July 2017.

1. At the time the incident was discovered, there was no SOL job supervisor, hence no “Fire Watch” personnel on site. SOL personnel were notified by the Contractor employees that there was a potential fire, by phone. Based on SOL safety management systems which include the JSA signed by all parties involved, there was to be a Fire Watch personnel on site at all times. The prohibition on the use of Cell phones within the Terminal was not adhered to in some instances, based on evidence reviewed.
2. During welding, the Gas Detector was reported to have alarmed indicating an abnormal condition, but was ignored and subsequently silenced (reset). This critical device is kept within close proximity to the works at all times and monitors key gases, mainly Oxygen, combustible vapours, Hydrogen Sulphide and Carbon Monoxide levels. Where concentration levels are detected outside the permissible (safe) range, the device gives off an audible alarm (>95 dB) which continues until it is checked and silenced. The requirement under such condition is that the work must stop immediately and investigated, to ensure the cause of the alarm is identified and remedied, after which work may resume. The investigation team was made aware of two instances on the date of the incident the detector alarm sounded, but only in one case attempts were made to investigate same. Work was not halted as required in the second instance during the course of works after noon. The investigation team considered that, given the Fire Watch was not continually on site, and that the timing of the alarm event was not logged, it is

not unreasonable to presume that it was around that time the burning paint on the shell or possibly faint fumes from the internal flame was detected. A thorough check of the surrounding area of the work was essential, but this was not done based on evidence provided.

## **6.8 Hotworks on Tank**

Hotworks were conducted on both days on the subject Tank at SOL's Terminal. At the time of the repairs the tank contained approximately 15,000 barrels of ULSD, which represents about 42% of its total operating capacity. These maintenance works were part of a larger project which included similar repairs to the tank shell on the previous weekend. Evidence of sandblasting and welding on the said tank shell were observed during the investigation. OfReg was not aware of any incidents or near-incidents arising from these previous activities.

The original eight (8) locations along with the additional three (3) areas subsequently identified were all understood to be assessed based on visual inspection. No Non-Destructive Testing (NDT) or other scientific method were employed to identify the extent of the work to be done or to assess the general condition of the roof. Under the circumstances, the investigation finds that this was a significant gap considering that not only the tank (roof) was to be subjected to hotworks, but that it involved personnel and equipment being supported by the (integrity of the) roof. Further, given the subjectivity of welding activity in terms of Welder's skill, material being welded, condition of equipment and tools, etc., a review of possible and likely scenarios (JSA and RAM) would be required before a decision was taken to carry out the work as planned. There was no indication during the investigation that this was done.

The investigation acknowledged the limitation SOL operations faced in having to take one of its (four) tanks out of service for repairs. This however is not unique to operation in a relatively small jurisdiction such as the Cayman Islands, given some of the obvious constraints. The small number of tanks meant that the unavailability of any of these equipment will have a significant impact on their business operations. Nonetheless, OfReg is also aware of options which exists to address such situations and is also mandated by legislation to establish guidelines for infrastructure optimization and sharing where necessary.

To further clarify, hotworks are typical and necessary within the industry, but a number of conditions must be met before such works can be approved for execution. For instance, welding on pipes, erecting a new tank, or installing metal brackets within a fuel terminal are normal activities and are categorized as hot works. As such, the performance of hotworks on Tank No.8 is not a violation of the DS Law, however the conditions under which the works were performed did not appear to accord with the provisions of Section 12 of the DS Law. Having considered the decision tools and technology to which SOL has access, as well as their



expertise and resources in keeping with the requirement of the Law and relevant codes, the investigation found that the decision to carry out the work in the way it was planned could have been greatly enhanced, likely avoiding the incident altogether.

It was confirmed that the Welder was in good physical condition to carry out his specific task and this was ruled out as contributing factor to the incident. However, given the evidence of an actual burn-through (discussed later), indicates there were factors under his influence and/or control which reasonably could have averted the incident. The investigation could not ascertain what influence, if any, the welder would have had on the decision to proceed as planned, however the investigation team considers that blindly executing task as instructed points to concerns of systematic management issues, accountability and training, which will form part of the post-investigation reviews.

### **6.9 Tank Internal Design**

Entry to the tank by one of the certified investigation team members confirmed that the internal design of the tank allowed a small quantity of fuel to be ‘trapped’ on the top of one of the stiffening (reinforcement) rings on the upper shell courses of the tank. These rings are installed to ensure the structural integrity of the tank. As the volume of product in the tank cycles, diesel product collects on the top of the ring which was evident in the location of interest, along with metal particles and slag from welding activities.

The investigation team however found that the design of the tank, including its auxiliaries and appurtenances, did not contribute to the cause of the incident, despite the fact that there may be design considerations which would limit the ‘accumulation’ of fuel in unsuspecting areas of the tank. The (job) Planner would have been intimately aware of the technicalities relating to the tank design and construction to effectively structure the work to generally avoid incidents. Hypothetically, if this ring were not in place, the source of ignition would have fallen unimpeded directly into the body of fuel with possibly much more dire consequences. Notwithstanding, the investigation team affirmed that, given there are “tried and proven” safe methods for works of this nature on the various design of tanks which exist, further review of the impact of the tank design on the incident is not warranted at this time.

### **6.10 Method of Repair/Welding**

Steel plates used to reinforce areas of thinning on the roof were welded in place utilising Shielded Metal Arc Welding, commonly known as Stick Welding. The investigation found that the welder was certified and experienced in performing works of this nature. Some of the areas which required repairs were heavily corroded, resulting in perforations as significant as 1/8 to 3/8 inch in diameter in the tank roof, as was reported. Considering this and other foregoing

information, the investigation found it odd that SOL proceeded with the in-service repairs, given that the extent of the repairs necessitated the tank be taken out of service to effectively, adequately and safely effect the repairs per code requirement. This was further reinforced by the post-incident independent API 653 inspection report which notes that some of the work done was not technically sound nor does it comply with the primary code to which the tank was built.

API 653 specifies a minimum size of metal plates (typically 5mm x 305mm x 305mm) to be used as patches to effect such repairs, as well as the acceptable types of welding to be used based on the circumstances. SOL appeared to have complied with the foregoing for most of the patches installed in this instance, but other pre-existing patches showed inconsistencies.

The investigation found that the repair work, whilst necessary, should **not** have been carried out using the chosen procedure due to the extent of the degradation of sections of the roof observed by SOL. The scope ideally should have entailed the replacement of select roof plates which necessitated that the tank be taken out of service, cleaned and gas-freed to execute the repairs. This is also reinforced in the recent independent API 653 report.

The epoxy putties used were not mentioned in any of the documentation prepared for the execution of the task. Further investigation revealed that the epoxy putties used were not considered suitable to be exposed to welding or environment with elevated temperatures. The Safety Data Sheets (SDS) for the epoxy liquid also states, "Excessive heat" is one of the conditions to avoid when using this product. Under the "Physical and Chemical Properties" stated on the SDS, it is outlined that the epoxy is flammable in the presence of the following conditions: open flames, sparks and static discharge.

The inconsistencies reported, lack of details provided in some instances, and absence of key steps in the Method Statement outlining the prescribed use and application of the epoxies, made it considerably difficult for the investigation team to pronounce on the extent the epoxies may have contributed to the incident. The absence of any reference to this product suggests the RAM may not have taken the associated risk into consideration. Taking these factors into account, this aspect of the investigation remains inconclusive at this time. This will however be revisited when the roof plate is subsequently removed for replacement, once OfReg approves the commencement of repair work on the tank. The SDS of the epoxies referenced in this report are included in Appendix 6C.1 & 6C.2.

## 7.0 LIKELY ORIGIN OF FIRE

Of the eleven (11) locations where repairs were carried out during 22 and 23 July 2017, the weld nearest to the location of the fire was completed on the date of the incident. This location was one of the three additional areas identified for repairs during the execution of the planned work and was essential because there was a perforation in this particular location. SOL personnel confirmed during the interview, that this was the only location where the Devcon flow-mix epoxy which was inadvertently left on the work site, was used. It was further confirmed that this was also the only location where a flow-mix epoxy was used to fill the hole rather than the Steel Stick epoxy putty. Research shows that the product used in this location is rated for temperatures up to 200°F, whereas the epoxy putty used in the other locations where holes were found, were rated for temperatures up to 300°F.

*During the internal tank inspection carried out on 14 November 2017 as part of the investigation, photographic evidence revealed an area of burn-through on the steel roof plate (see Photo #1 below) directly above the location of interest where the fire started, and evidence of external smouldering was observed. In addition, the upper reinforcement ring of the tank was found to have approximately a one (1) inch thick deposit of loose corrosion material layered with a slag-like substance consistent with a material which was exposed to heat (see Photo #2). The build-up and materials found in this area still contained diesel residue, and was distinguishable from the other areas sampled in that a mix of sandblasting and welding residue, along with a noticeable metal bead were also found on the top of the build-up. (see Photo #3).*



Photo #1 - Underside of Tank Roof Where Burn-Through Occurred



Photo #2 - Corrosion Material Build-Up on Upper Reinforcement Ring

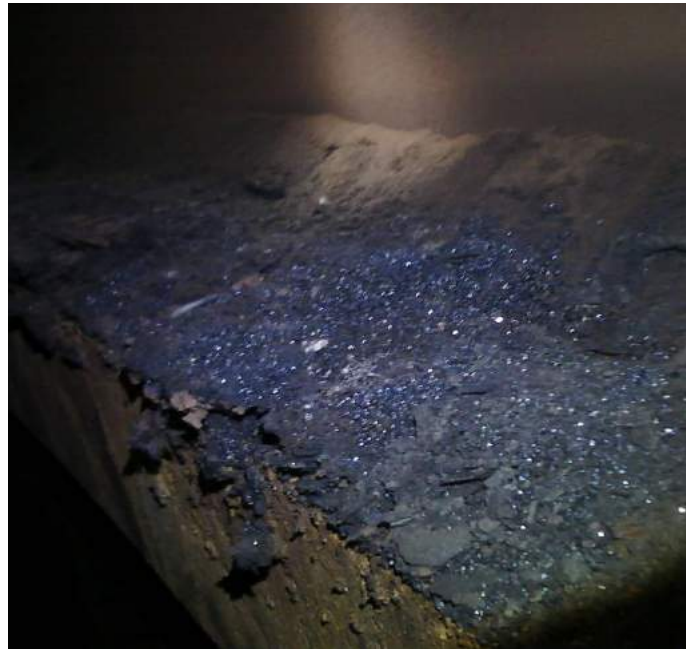


Photo #3 – Sandblasting/Welding Residue and Metal Bead.

The liquid level in the tank at the time of incident was approximately 15 feet from the bottom of the tank while the fire occurred at a height of 30 feet from the bottom. Based on this, the investigation considers that the most likely source of ignition would have been droplet(s) of molten metal from the steel roof plate as illustrated in the photographs referenced above, which came into contact with the likely warm fuel on the upper reinforcement ring leading to the fire.

None of the evidence collected by OfReg suggests that the mass of the liquid (fuel) in the tank was ignited at any stage during the incident.

Ultimately, this investigation continues to rely on the CIFS to inform the precise origin of the fire given their expertise in this area. The team however acknowledged for the purpose of this investigation that a fire or heat source of any kind in a combustible environment such as within a tank with fuel, or in the vicinity of spilled fuel, etc. is extremely risky with significant loss potential. In the event such circumstances arise as a consequence of activities which contravenes the DS Law, the extent to which the law was violated has to be determined in order to take action as required under the relevant provisions of the Law. There were instances, most of which are covered under various sections of this report, which points to a high probability and likelihood of this incident occurring, the investigation finds.

## **8.0 OTHER KEY FINDINGS**

As outlined in the introduction, the investigation focussed on a number of areas to systematically assess and validate conformity to established processes, policies and best practices during and prior to the incident to determine whether there were lapses which unavoidably led to fire on the inside wall of the Tank No.8 at SOL's Jackson Point Terminal. The Oil & Gas sector, like many other sectors, have an extensive body of knowledge on wide and varying topics to safeguard both the industry and the public. As such, incidents such as these are preventable.

Further to the investigation and findings in the foregoing section, the investigation team also notes the following key findings:

1. Given it may have been the first such incident of this nature, there were some delays in obtaining some relevant information to get underway with the investigation. The investigation team was deliberate in outlining that the purpose of the investigation and timely provision of key information was to identify and urgently remedy gaps to prevent recurrence in order to save lives, properties and the environment. Additional bits of evidence such as CCTV footage from other (strategically) located cameras were not available. This was due to those equipment being out of service as reported by SOL.
2. There was a significant delay of approximately 35 minutes from the time personnel on site first observed the scorching to the time an appropriate response was taken. Emergency Services responded within a fraction of this time personnel on site observed the incident and alerted 911.
  - The only two persons on site were not thoroughly familiar or properly trained to adequately respond to an incident of this nature.

3. The critical role of Fire Watch was extremely ineffectively executed in some instances while hot-work (welding and grinding) were being performed. The Fire Watch ideally should have been the first to observe the scorching.
  - In some instances, no one was at ground-level monitoring the planned hotworks which were being performed on top the tank (working at height) which made the persons on the tank vulnerable during those periods.
4. Documentation was lacking; all forms which required renewals for continuation of work on the second day were not completed as required or was not available to the investigation team. In one instance a permit was signed off that “the job was completed, and the site was left in a safe condition” on 23 July 2017.

## **9.0 REGULATORY REGIME**

OfReg is the Authority Having Jurisdiction (AHJ) under the DS Law and is therefore responsible for ensuring the industry meets its obligation for the safe handling and storage of dangerous substances. Historically the focus of the former Petroleum Inspectorate was only on fuel products. This remit entails a systematic annual inspection and review of all sites (including vehicles) across the Islands which store, handle or transport ‘*dangerous substances*’ as defined under the Law, in aggregate quantities of two hundred and fifty (250) imperial gallons or more. This corresponds to an average of four hundred (400) sites with an accumulated total of approximately seven hundred and fifty (750) equipment requiring inspection by the Office on an annual basis.

These inspections generally cover the provisions as set out under Sections 14 and 15 of the DS Law which include visual checks, NDT testing as appropriate, pressure testing in case of new installation, and calibration checks of measuring devices/equipment used in the industry. Other activities covered include: checks on associated appurtenances; auxiliaries and control; emergency response and environmental management systems; and ensuring standard operating procedures, among other requirements are in place. Inspections are primarily aimed at ensuring adequate systems, processes and controls are in place to ensure safety remains a priority at all regulated premises. In this context, the investigation considers that the extent of regulatory oversight for day-to-day operational activities, especially at major fuel storage depots, should be revisited in light of some of the findings here. Currently, OfReg does not issue or authorise permits for daily activities at any regulated premises, but periodically review these to ensure they are adequate to protect life, property and the environment.

SOL’s Terminal inspection is typically scheduled and carried out during November-December of each year. At the time of the incident, there were items which were being actioned arising

from the 2016 inspection report, however none of these were directly related to the incident under investigation. Interim inspections are typically done to validate specific gaps previously identified were remedied, or in cases where significant issues may have arisen subsequent to the last full inspection by the Office.

## **10.0 INDEPENDENT THIRD-PARTY API 653 TANK INSPECTION**

An independent inspection was carried out on the tank following the extraction of internal evidence by the investigation team. Given the nature of the incident, it was a requirement for the structural integrity to be re-evaluated to determine the tank's suitability for continued service. SOL therefore engaged a certified API third-party inspection company to conduct a complete internal and external inspection of the subject tank, the report of which was submitted to the Office.

Inspection and testing conducted during this independent inspection found that the fire did not impact the structural integrity of the tank. However, other findings during the inspection relating to the general condition of the tank lead the third-party inspectors to conclude that the tank is not currently suitable for service and requires (substantial) repairs before it can be re-certified for use. The investigation team findings were substantiated in several areas with the results of the third-party inspection company in terms of the approach taken to execute the works, weld quality, and general state of the roof which did not meet the appropriate condition for in-service welding to be done.

The investigation team will further discuss the independent report and findings with SOL to determine, for operational purposes only, the next best course of action including the possibility of having further evaluation done on the tank. Ultimately the decision to refurbish or replace the tank rests with SOL, depending on the extent of remedial work required.

## **11.0 IMMEDIATE POST- INCIDENT MEASURES**

Immediately following the incident, the following measures and interim works were implemented:

- All hot works at bulk terminals were placed on hold subject to review by OfReg Fuel to ensure safety and compliance with requisite procedures and requirement were in place.
- Repairs were conducted to the Fire Monitors at the SOL Terminal to ensure the tanks which continued in service were adequately protected.

- Fuel Samples were taken from Tank No.8 for testing to verify the extent of any contamination following the incident (response).
  - The product was subsequently re-exported based on the results obtained.

## **12.0 RECOMMENDATIONS**

Arising from the investigation and findings, the following are the recommendations of the investigation team:

1. In the interim, OfReg will continue close monitoring and supervision of hotworks for all premises regulated under the DS Law. SOL will continue to notify OfReg of all hotworks, working in confined spaces, and work-at-height being performed at facilities under their control across the Island.
2. As an immediate follow-up to this investigation, conduct a review/audit of key processes which are in place across the industry to identify gaps in execution and re-establish bench marks based on consistent best practices observed. Additionally, SOL will be required to conduct a full emergency (multi-jurisdictional exercise) within six (6) month from the date of this report.
3. Fast track the implementation and rollout of Certification program for persons to perform work in the industry (similar to electrical and plumbing license regime).
4. Apart from Code compliance, OfReg to collaborate with the industry to enhance risk assessment capability, and promote conformance to recognised and generally accepted engineering standards and practices. If not yet undertaken, SOL to carry out refresher training for their employees and relevant contractor (OfReg will attend also) on the use of the various safety tools and systems employed, and share any improvement considered with OfReg.
5. Explore options to shift sole reliance on penalties and fines to drive compliance (which are reactive measures), to proactive measures aimed at ensuring internal procedures and policies within the industry are more streamlined to safeguard the public, are adhered to at the level of the organisations within the industry
6. Consider increased inspection frequency at both Jackson Point Terminals.
7. Given SOL's limitations as it relates to taking critical equipment out of service to effect preventative or corrective maintenance/repairs, OfReg to fast track its review of infrastructure sharing as a national priority and advise guideline and protocols by Q2.
8. **Acknowledging efforts which have already commenced in this area, for completeness and as part of OfReg's role in National Emergency Response efforts, collaborative efforts will continue to evaluate and implement other appropriate emergency notification systems for major sites involved in the**



**handling and storage of dangerous substances. The Siren implementation is well underway, however protocols to incorporate these into the national emergency system is being finalized. This for instance, will involve educating the public on what actions to take, routes to use for evacuation, etc. if or when the sirens are activated, to ensure a coordinated response.**

- a. Further, this action should include a review of the risk and vulnerability matrix for communities which are adjacent to these sites to establish mitigation measures including the re-establishment of evacuation zone and buffer zones for siting future operations.
9. Review and overhaul existing processes and procedures in place by the Industry for Hotworks, Non-Routine and Work-at-Height at all facilities storing and handling dangerous substances. While it is not practical or feasible for OfReg to supervise all high-risk task at key dangerous substances sites, a robust system of audit, reporting and disclosures would impose a proactive requirement on the industry to identify and address potential gaps in any of their internal **practices** which could potentially lead to undesirable consequences.
10. Review and re-establish the threshold for execution of various types of work within hazardous environments which are subject to DS Law.

### **13.0 CONCLUSION**

The investigation finds the incident was as a consequence of a number of factors which converged in this instance to result in the circumstance of a heat source within the combustible environment of a fuel tank. The investigation identified some breaches in the management and execution of key tasks under SOL's control. Training and process improvements will be required in some key areas of SOL's operations, specifically focusing on attaining full compliance by its employees and contractors. The adoption and application of relevant Codes and Standards were found to be incomplete, inconsistent or misinterpreted in some cases. There were cases where the disregard for SOL's internal policies and protocols were evident.

Based on the foregoing, and the evidence and information gathered and analysed during the Investigation, the investigation concludes that SOL, through its employees and agents did not take all reasonable precautions for the prevention of the fire in the ULSD Tank No. 8. A few opportunities arose for an objective re-evaluation of the work, and based on their tools, processes and procedures, the job should have been suspended or the decision "recycled" subject to altering the conditions under which the work was to be performed, given SOL's unwavering commitment to safety throughout the "rank and file" of the organisation. Key elements during the planning stage through to the actual execution of the job were either ignored or overlooked. The code which SOL relied upon to carry out the work was not found to

be supported by any internal policy or document, nor was there any adequate indication that attempts were made to meet the minimum requirement of the relevant code sections. Further, the investigation observed that this was likely a repeated deviation, whether circumstantial or unintended, based on the evidence of previous work done on the tank. Paradoxically, it was not unreasonable for the investigation to presume that such a situation was tending toward a normal internal practice. This will be addressed at both the level of the regulator and operators (licensees and permit holders) within the industry, otherwise it will inevitably lead to catastrophic incidents.

The investigation finds that SOL, as an established and important service provider in the Cayman Islands was not lacking in having adequate safeguards in place to preserve its operations, taking into consideration its relative location as well as how crucial its services are to the Islands among other factors. Notwithstanding, the general finding points to the equally critical importance of ensuring their systems, policies and resources are at all times, fully aligned with both their internal and external commitment and obligations due to the nature of their operations.

OfReg will therefore exercise the regulatory interventions and powers at its disposal to take appropriate action arising from the finding of this investigation.



## **APPENDICES**

(N.B. Materials were reproduced in some instances courtesy of the Internet.)

## **Appendix 1: Names and Designation of the Investigation Team**

### **OfReg Fuels (Principal Investigators)**

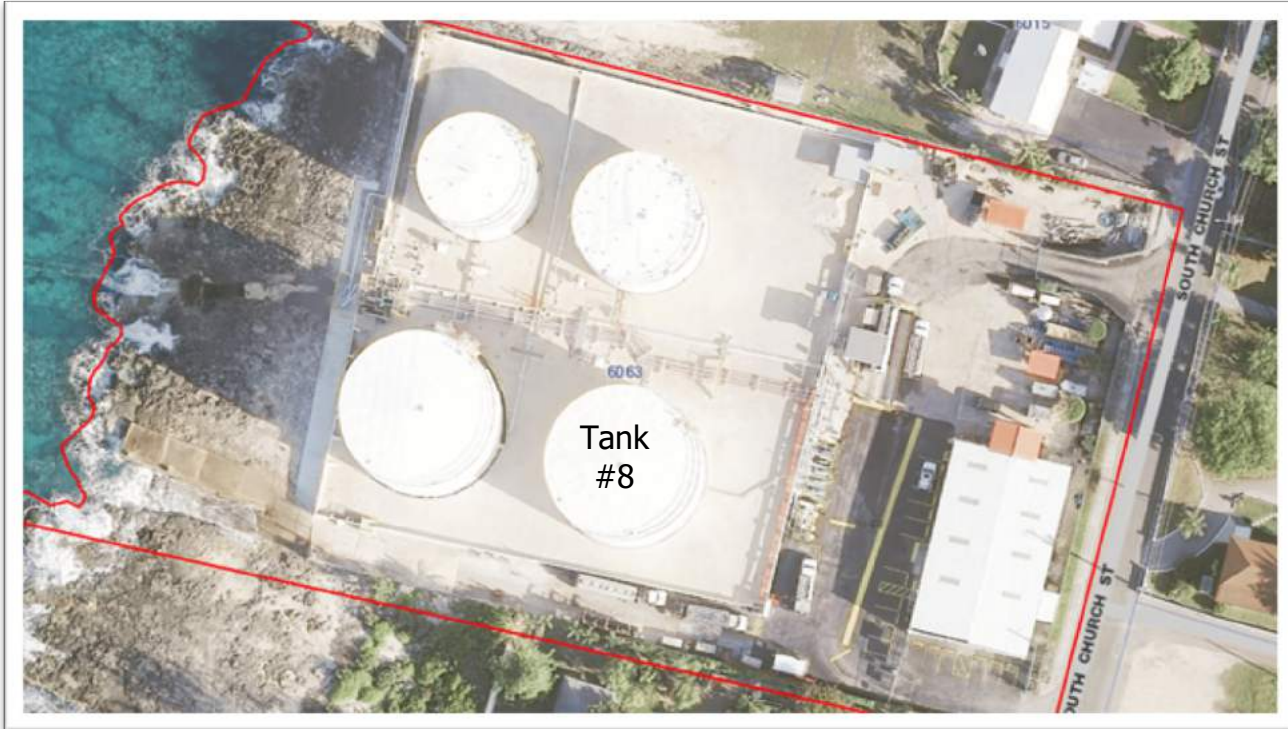
Duke Munroe	Chief Fuels Inspector & Director of Fuel Market
Robert Tatum	Fuels Inspector
Dwayne Ebanks	Fuels Inspector
Dwayne Tucker	Fuels Analyst

### **Cayman Islands Fire Service**

David Hails	Chief Fire Officer
Tina Choy	Deputy Chief Fire Officer (Acting) Domestic

The support from the RCIPS at various stages of the investigation is hereby acknowledged.

## Appendix 2: SOL Terminal



**Aerial View of SOL Petroleum (Cayman) Ltd, Jackson Point Terminal**

## Appendix 3: Tank No. 8 Design and Construction Details

The following is a summary of design and construction of Tank No. 8 (Diesel):

Tank Number/Identification	8
Owner	SOL Petroleum Cayman Ltd.
Tank Location	Grand Cayman, Cayman Islands
Type of Facility	Terminal
Manufacturer	Tamp Tank Inc.
Design Standard	API 650
Product Prior to Incident	Diesel
Design Specific Gravity	Data not available
Product Specific Gravity	Data not available
Design Pressure	Data not available
Operating Temperature	Ambient
Cathodic Protection & Type	Yes (Deep Bed Anodes)
Name Plate Present	Yes
<b>Dimensions</b>	
Diameter	80.00 feet
Height	40.25 feet
Capacity Gross	36,034 Barrels
Operating Height	37.19 feet
<b>Geometry</b>	
Foundation	Concrete Ring wall
Bottom	Lap Welded
Shell	Butt Welded
Material of Construction	Carbon Steel (Grade not known)
Fixed Roof	Lap Welded Cone w/Framing
<b>Dates</b>	
Year of Construction	1988
Second bottom & Date Installed	
Last Coated	2000
API Inspection (Prior to 23 July 2017 Incident)	2014 (Out-of-Service)
Last API Inspection	2017 (Out-of-Service)

# Appendix 4: Extract of Annual Inspection (2016)

SOL TERMINAL INSPECTIONS				Petroleum Inspectorate 133 Elgin Ave Grand Cayman, Cayman Islands Tel: (345) 244 3457	
Contacts: Myron Blair  Date: Nov. 30, 2016				Ministry of Planning, Lands, Agriculture, Housing and Infrastructure	
<b>TRADE &amp; BUSINESS LICENCE CURRENT</b>					Y
<b>INTEGRITY OF STORAGE VESSELS</b>					
<b>TANK NO. 6 MOGAS</b>	<b>API 650 / NFPA 30</b>	<b>API 653</b>	<b>COMMENTS</b>		
Has tank been evaluated before contemplating a change of service?	21.7.4	4.2.4 / 5.2.3	N/A		
Are routine in-service inspections conducted and documented monthly?		6.3.1	Y		
Is construction, inspection and repair history record documented?		6.8 & 6.9	Y		
Does tank shell meet min. allowed thickness & is it in serviceable condition?		4.3.2 / 4.3.3.1	API Documents Requested		
Is structural integrity / thickness maintained for the roof and support structure?	min 0.09 in 100gal	4.2.1	API Documents Requested		
Are tank stairs, hand rails and rooftop per API 650 5.8.10 / NFPA 30 21.8.17	Tbl 5-17 TO 5-19	C.1.4 & 5	N		
Are external inspections conducted at least every 5 years by authorised insp?		6.3.2.1	Y		
Has corrosion rate been established?		6.2.2/6.4.1.1	N		
Is int. insp. interval set by corr. rate, RBI, ultrasonic data or a max. 20yr int?		6.3.3.2a/6.4.1.1b	Decided by API Recommendations		
If bottom corrosion rate is unknown, can it be anticipated from experience?		6.2.2/6.4.1.2/6.4.2.1	Y		
If roof & shell corrosion rates are unknown, is ultrasonic interval < 5 years?		6.3.3.2a	Y		
If corrosion rate is known, is interval determined by RCA/ZN followed - max. 15?		6.3.3.2.b / 4.4.1.1	N/A		
Have tank bottom evaluations taken place additionally if no leak detection installed?		4.4.1 / 6.4.1.2	Y		
Has min. projected bottom thickness been calculated - is it > value Tbl 6-1?		4.4.5 / Tbl 6-1	Decided by API Recommendations		
Is thickness of the projection of the bottom plate > 0.1" beyond shell min. 3/8"?		4.4.5.7	?		
Is min. bottom thickness in the critical zone 0.5 original thickness or 0.1"?		4.4.5.4	API Documents Requested		
Has foundation exhibiting cracking/spalling been repaired to excl. moisture?		4.5.2.2	Y		
Is tank devoid of evidence of bottom, shell, roof or valve leaks?		4.3.1/ App1	Y		
Is emergency venting installed - floating or frangible roof per API 650 5.10.2.6?	22.7.1		Floating Roof		
If emerg. venting is via frangible roof, is cont. bead max. 3/16", slope max 2/12?	22.7.1	API 650 5.10.2.6	N/A		
Do gasoline tanks w/out floating roofs have PIV vents?	4.2.5.1.7		N/A		
Do tanks have ground reading gauges or automatic gauging?	21.7.1.1		Y		
Are high level alarms installed and checked before transferring product?	21.7.1.3		Y		
Do openings thru' which product may flow have labeled valves adj. to shell?	27.10 / 22.13.1		Y		
Is installation, ground & sealing of electrical equipment per N.E.C standards?	6.5.4		Y		
Are cathodic protection surveys conducted and system functional?	21.4.5 / A23.3.4	6.3.4.1	Y		
Is water draw-off design and grounding adequate?	6.5.4	6.3.2.3	Y		
Is thermal expansion relief provided at valves per ASME B31.222.6?	27.3.1		Y		
Can tanks be ballasted with water in event of hurricane or bottom leak?	21.7.3.1		Y		
Is there capability of a foam blanket if tank fire is a hazard to adjacent owner?	4.5.5		Y		
<b>TANK NO. 7 AVJET A1</b>	<b>API 650 / NFPA 30</b>	<b>API 653 (2008)</b>	<b>COMMENTS</b>		
Has tank been evaluated before contemplating a change of service?	21.7.4	4.2.4/5.2.3	Y		
Are routine in-service inspections documented monthly?		6.3.1	Y		
Are inspection and repair history records maintained?		6.8/6.9	Y		
Are API Grade markings clearly displayed on tank?			N		
Does tank shell meet min. allowed thickness & is it in serviceable condition?		4.3.2/5.4.3.3.1	API Documents Requested		
Is structural integrity maintained for the roof and support structure?	min 0.09 in 100gal	4.2.1	Y		
Are tank stairs, hand rails and rooftop per API 650 5.8.10 / NFPA 30 21.8.17	Tbl 5-17 TO 5-19	C.1.4 & 5	Y		
Are external inspections conducted at least every 5 years by authorised insp?		6.3.2.1	Y		
Has corrosion rate been established?		6.2.2/6.4.1.1	N		
Is int. insp. interval set by corr. rate, RBI, ultrasonic data or a max. 20yr int?		6.4.2.1/6.3.3.2a	API Documents Requested		
If bottom corrosion rate is unknown, can it be anticipated from experience?		6.4.2.1	Y		
If roof & shell corrosion rates are unknown, is ultrasonic interval < 5 years?		6.3.3.2a	Y		
If corrosion rate is known, is interval determined by RCA/ZN followed - max. 15?		6.3.3.2b	N/A		
Have tank bottom evaluations taken place additionally if no leak detection installed?		4.4.1/6.4.1.2/ App1	N		
Has min. projected bottom thickness been calculated - is it > value Tbl 6-1?		4.4.5/ Tbl 6-1	API Documents Requested		
Is thickness of the projection of the bottom plate beyond shell > 0.1"?		4.4.5.7	API Documents Requested		
Is min. bottom thickness in the critical zone 0.5 original thickness or 0.1"?		4.4.5.4	API Documents Requested		
Has foundation exhibiting cracking/spalling repaired to excl. moisture?		4.5.2.2	Y		
Is tank devoid of evidence of bottom, shell, roof or valve leaks?		4.3.1/ App1	N		
Emergency venting method - floating or frangible roof per API 650 5.10.2.6?	22.7.1	API 650 5.10.2.6	N/A		
If emerg. venting is via frangible roof, is cont. bead max. 3/16", slope max 2/12?	22.7.1	API 650 5.10.2.6	N/A		
Are gooseneck or free vents and wire mesh per API 650 3.8.10?	21.4.3	C.1.5	Y		
Is floating suction checked for buoyancy weekly?			Y		
Do tanks have ground reading gauges or automatic gauging?	21.7.1.1		Y		
Are high level alarms installed and checked before transferring product?	21.7.1		Y		
Are valves installed adjacent to shell & labeled?	27.10 / 22.13.1		Y		



Is installation, ground & sealing of tank & electrical per N.E.C standards?	6.5.4			Y
Are cathodic protection surveys conducted and system functional?	21.45/A23.34	6.3.41		Y
Is water draw-off design and grounding adequate?	6.5.4	6.3.23		Y
Is thermal expansion relief provided at valves per ASME B31 322.67	27.3.1			Y
Capability to ballast tanks with water in event of hurricane or bottom leak?	27.3.1			Y
Is there capability of a foam blanket if tank fire is a hazard to adjacent owner?	4.5.5			Y
Is flush tank interior maintained clean and white with secure cover?				Y
<b>PRODUCTS - DIESEL / USED OIL - Tank diameter 80'</b>	<b>API 650 / NFPA 30</b>	<b>API 653 (2008)</b>	<b>TANK NO. 8</b>	<b>TANK NO. 9</b>
Has tank been evaluated before contemplating a change of service?	21.7.4	4.24/5.2.3	N/A	N/A
Are routine in-service inspections conducted and documented monthly?		6.31	Y	Y
Are inspection and repair history records maintained?		6.8/6.9	Y	Y
Does tank shell meet min. allowed thickness & is it in serviceable condition?		4.3.2/4.3.3.1	Y	Y
Is structural integrity / thickness maintained for the roof and support structure?	min 0.09 in 10ways	4.2.1	Y	Y
Are tank stairs, hand rails and rooftops per API 650 5.8.10 / NFPA 30 21.8.17	TB 6-17 TD 5-19	6.14.6.5	Y	Y
Are external inspections conducted at least every 5 years by authorised insp?		6.3.2.1	Y	Y
Has corrosion rate been established?		6.2.2/6.4.1.1	N	N
Is int. insp interval set by corr. rate, RBI, ultrasonic data or a max. 20yr int?		6.3.2.2a/6.4.1.1b	API Recommendations	API Recommendations
If bottom corrosion rate is unknown, can it be anticipated from experience?		6.2.2/6.4.1.2/6.4.2.1	Y	Y
If roof & shell corrosion rates are unknown, is ultrasonic interval < 5 years?		6.3.2.2a	Y	Y
If corrosion rate is known, is interval determined by RCAN followed - max. 15?		6.3.2.2b	N/A	N/A
Have tank bottom evaluations taken place additionally if no leak detection installed?		4.4.1/6.4.1.2/Api1	Y	Y
Has min. projected bottom thickness been calculated - is it > value Td 6.5?		4.4.5/19.6.1	API Documents Requested	API Documents Requested
Is thickness of the projection of the bottom plate beyond shell > 0.1" for 3/8"?		4.4.5.7	API Documents Requested	API Documents Requested
Is min. bottom thickness in the critical zone 0.5 original thickness or 0.1"?		4.4.5.4	API Documents Requested	API Documents Requested
Has foundation exhibiting cracking/spalling repaired to excl. moisture?		4.5.2.2	Y	Y
Is tank devoid of evidence of bottom, shell, roof or valve leaks?		4.3.1/Api1	N	Y
Emergency venting method - floating or frangible roof per API 650 5.10.2.6?	22.7.1		No F/R, normal vents used	No F/R, normal vents used
If emerg. venting is via frangible roof, is cont. bead max. 3/16", slope max 2/12?	22.7.1	API 650 5.10.2.6	N/A	N/A
Are goodstack or free vents and wire mesh per API 650 3.8.10?	21.4.3	C.15	Y	Y
Do tanks have ground reading gauges or automatic gauges?	21.7.1.1		Y	Y
Are high level alarms installed and checked before transferring product?	21.7.1		Y	Y
Do openings thru/ which product may flow have labeled valves adj. to shell?	27.10/22.13.1		Y	Y
Is installation, ground & sealing of tank & electrical per N.E.C standards?	6.5.4	6.3.41	Y	Y
Are cathodic protection surveys conducted and system functional?	21.45/A23.34	6.3.41	Y	Y
Is water draw-off design and grounding adequate?	6.5.4	6.3.23	Y	Y
Is thermal expansion relief provided at valves per ASME B31 322.67	27.3.1		Y	Y
Can tanks be ballasted with water in event of hurricane or bottom leak?	27.3.1		Y	Y
Is there capability of a foam blanket if tank fire is a hazard to adjacent owner?	4.5.5		Y	Y
<b>INTEGRITY OF PIPELINES</b>	<b>NFPA 30</b>	<b>API 650 / 653</b>		<b>COMMENTS</b>
Is general condition and maintenance adequate?	5.2.1			N
Is condition of distribution manifold and system design adequate?	5.2.1/5.5.6			Y
Is appropriate containment provided below manifold area?	7.7.19			Y
Is piping protected against settlement, vibration and thermal effects?	5.5.1			Y
Is Cathodic protection functional on all buried pipelines into and throughout JP?	5.5.4			N
Are piping and flush tanks adequately grounded?	4.5.3.4 / 5.8	6.3.2.3		Y
Are pumps bonded and grounded?	5.8			Y
Are check valves installed to prevent backflow to vessel per Fire Code 903.2?	5.5.6			Y
Is Receiving pipeline tested - sea to Sol boundary fence?	5.6.3			Y
Are all piping & fittings liquid-tight welded steel?	5.4.1			Y
Is all piping inside dike essential?	4.3.2.3.4			Y
Are pressure relief valves tested annually?		452.2(a) / 437.1.4(c)		Y
<b>SAFETY, SECURITY &amp; GENERAL HAZARDS</b>	<b>NFPA 30</b>	<b>FIRE / UL / Law</b>		<b>COMMENTS</b>
Are copies of all applicable laws, codes, regulations, standards on file?	4.6.2.2	DGH&S Law 15(2)(viii)		Y
Is facility entry restricted?				Y
No Smoking signage at entry gates and loading rack	1.2	906.5.1.3		Y
Is Terminal lighting adequate and functional?	1.2	ISGOTT 4.5		Y
Are flashlights & radios intrinsically safe	1.2			Y
Is a Drug & Alcohol Policy in force?	1.2	DSHS 15(2)(vi)		Y
Are all chemical hazards supported by MSDS or health & safety data?				Y
Are paint and low flash solvents stored in approved cabinets?	6.6			Y
Is a contractor orientation/training program maintained?				Y
Are formalized maintenance programs with schedules documented?		DSHS 15(2)(vi)		Y
Are monthly safety meeting conducted?				Y
Is orientation and training record maintained for all operations staff?	4.5.6.1	ISGOTT 14.2.17		Y
Are high noise areas posted with signs requiring hearing protection?				Y
Is forklift operator training conducted annually?				N
Is procedure followed for SCBA breathing apparatus?				Rented as needed
Does tank farm drainage prevent accumulation of hazardous fuel?	4.3.2.3.4.2			Y
Are non-combustible ramps/stairs provided if height of dike wall > 6'?		UL 142 28.2.1		Y
Are combustible materials located outside dyked area?	4.3.2.3.4.5			Y
Are all circuit breakers clearly identified?				Y



Are hot work permits being used?	4.5.3.3		Y
Are sparkproof tools appropriate and available?	4.5.3.1		Y
Are safe work permits issued?			Y
Is confined space entry required for all tank, valve and containment pits?			Y
Are protection requirements posted at additive handling areas?			Y
Is an explosimeter available and calibration records kept for each use?			Y
<b>PERSONAL PROTECTIVE EQUIPMENT</b>			
Are appropriate respirators available?	NFPA 30	STATUS	COMMENTS
Are safety harnesses available?		Good	
Are hard hats used in posted areas?		Good	
Are hazardous materials handling procedures and training conducted?		Good	
Is protective clothing available appropriate to the materials used?		Good	
Is an emergency deluge shower / eyewash available?		Good	
Is life preserver and spill response equipment stored waterfront?		Good	
Is a mechanical air blower available for confined entry?			Rent as needed
<b>ENVIRONMENTAL</b>			
Is an oil spill preparedness plan available?	NFPA 30	ISGOTT / Law / UL	COMMENTS
Are all releases on land sea or vessel reported to the CPI?	4.5.7.2	6.9.1 / DSH&S 13	Y
Oil spill drills conducted annually		14.1	Desktop every year, field every 3
Is bund area sound and impermeable to prevent accidental releases?	4.3.2.3 / 4.5.7.2		Y
Is bottom of bunded area free of vegetation and combustible materials	4.3.2.3.4.5		Y
Is diked capacity around the tank a minimum 110% tank capacity?		UL 142.27.2.1	Y
Does loading rack have adequate containment and spill protection?	7.6.4 / 4.7.6.4 / 28.9		Y
Is a procedure written for the oil separator system?			Y
Is discharge ann. API tested, verified < 30ppm at independent lab?			N
Are containment drain valves normally closed, operated by procedure?	4.5.7.2		Y
Is all waste stored in a contained area and properly labelled?	4.5.7.2		Y
Is a disposal log maintained for all waste material removed from site?	4.5.7.2		Y
<b>EMERGENCY RESPONSE PREPAREDNESS</b>			
Are written pre-planned response procedures, detailing staff responsibilities contact telephone numbers, and emergency equipment etc, available and prominently displayed for:	NFPA 30	ISGOTT	COMMENTS
Is a fire response procedure available?	4.5.6. & 7.12.2	14.2	Y
Is a hurricane procedure available?	4.6.3.2 & 3	14.2	Y
Is an earthquake response procedure?		14.2	Y
Is terrorist activity (civil unrest, bomb threat, kidnap) procedure ready?		14.2	Y
Is tank wagon rollover response prepared?		14.2	Y
Is procedure for serious injury to staff or third parties on site available?			Y
Is procedure for product spills & overfills at tanks/loading rack planned	7.3.7.2		Y
Was security drill (civil unrest, terrorism) conducted <3 years?			Y
Has natural disaster drill been conducted within last 3 years?			Y
Are emergency phone numbers posted outside the terminal?			Y
Are personnel aware of facility evacuation routes & assembly points?	7.12.4	14.2	Y
<b>FIRE SYSTEM</b>			
Is layout posted for fire equipment and emergency shut-off locations?	NFPA 30		COMMENTS
Is fire pump and fire mains fully operational tested weekly and recorded?	4.5.6.1		Y
Are adequate unobstructed fire lanes provided	4.5 & 7.12. 4		N
Are fire monitor, blanket, 20LB BC extinguisher <25' loading rack?	7.3.3.6		Y
Is fire foam system operating procedure posted?	4.5.6.1		Y
Are foam reservoir, frangible discs and foam lines inspected annually?	4.5.6.1 & 2		Y
Are foam reservoir and control equipment located outside dyke wall?	4.5 & 7.12. 4		Y
Is a foam deluge incorporated into the sprinkler system loading rack?	4.3.2.3.4.4		Y
Is fire foam type known and stock maintained in storage?	4.5.5 & 4.5.6.1		Y
Are fire extinguishers inspected monthly?	6.9 / 4.5.7.1		Y
Are fire alarms monthly test for functional & audibility?	4.5.6 & 4.5.7		Quarterly
Has a major drill been held annually with the fire department?	4.5.6. & 7.12.4		To be scheduled with CPI and Fire
<b>Octane Injection System</b>			
Is injection metering pump Class 1 Div 1?	NFPA 30	API 650 / 653	COMMENTS
Are Octane enhancement tanks secured?			Y
Are Nitrogen tanks secured?			Y
Are Octane enhancement tanks labeled?			Y
Are Nitrogen tanks labeled?			Y
Is safety signage present regarding toxicity and respiratory system?			Y
Are empty cylinders returned according to chemical manufacturer's spec?			Y
Has identifying signage been conspicuously posted on tank or dike?	4.6.2.1		Y
<b>LOADING FACILITIES AND PROCEDURES</b>			
Is THE ROADS ( PROHIBITED VEHICLES) REGULATIONS followed?	NFPA 30	NFPA 407 / Fire / Law	COMMENTS
Is the loading facility min. 25' from AST's and buildings		Roads Regulations	Y
Are loading points grade-marked and colour coded to API Bulletin 1542	7.6.3 / 28.4.1/2	906.5.1.1	Y
Are methods in place to prevent incorrect product loading of IMO's etc.	7.6.8	A.4.3.21.4	Y

Is jet fuel loaded via a filter water separator meeting API 1581		API 1581	Y
Are bottom loading facilities fitted w/wmeter preset and automatic shut off?	28.11.1.7		Y
Is a heat-actuated shutoff valve immediately upstream of the loading hose.		4.3.19.2	IR System
Is the dry break coupling unopenable until engaged & vice versa?	28.11.1.7.2	4.3.21.3	Y, control loading valve
Are loading rack & pumps properly grounded & periodically tested?	7.6.7 / 27.9		Y
Are loading hoses fitted with dry break couplings?	7.6.10.6		System in place
General condition and maintenance of counterbalance and arm support		4.3.21.2 / 6	Good
Do loading arm records show date of manu., in service & 6 month check?			Y
Are fuelers bonded before loading hoses are connected?	27.9		Y
Is bond wire, in good condition & maintained until hoses are disconnected?			Y
Are initial flow rates reduced when bottom loading?	28.11.1.9		Y
Start/stop pump switch accessible, adjacent to loading, functional, conspicuous?		4.3.22.2	Y
Is remote vapour venting at loading racks w/o vapour recovery system?	7.6.10.7 / 28.11.1.8		Vapour Displacement System used
Is truck grounding & overflow system installed and functional?	7.6.10.6	906.5.1.2	Y
Are bond wire test records regarding electrical continuity maintained?			N
Emergency shut-off and secondary systems clearly marked & functional	4.5.6.1		Y
Is explosion proof electrical system at rack per N.E.C standards?			Y
Are product loading instructions posted	7.6.10		Y
Are procedures written and meter calibrations conducted annually?			Y, bi-annually
Is meter in-line filter/strainer maintained periodically?			Y
Is safe switch loading procedure posted?	7.6.12		Y
Signage indicating "No Smoking or Ignition sources" to be posted at rack		906.5.1.3 / 906.7	Y
<b>TANKER DOCKING, UNLOADING AND DEPARTING</b>			
Is a Pilot used for terminal buoy moorings?	3.6.1		Y
If tug used, are ballast and ullage ports closed prior to drawing alongside?	3.3.2		Y
Have emergency shutdown/release procedures been agreed with vessel?	3.7.1 / 7.6.8 / 14.1		Y
Does Terminal convey local conditions, safety & pollution regs to vessel?	4.1.1 & 4 / 6.8		Y
Is vessel access provided with backups such as safety nets, lifebuoys?	4.6.1		Y
After dark, is access and manifold area sufficiently illuminated?	4.6.3 / 6.5.4		Y
Are persons prohibited, w/o legitimate business, smoking or intoxicated?	4.6.4 & 5		Y
Do vessel and Terminal communicate method of discharge (incl. interpreter)?	5.1 & 5.2 / 4.5		Y
Are berth acceptance criteria available, draft, tonnage, etc?	3.1		Y
If an electrical storm is imminent, is discharge/ballasting ceased & secured?	6.8.3		Y
Is water left in the submarine line after receipt?	7.11.1		No, product is left in the line
Was annual check performed on the submarine line and hose sections?	6.6.4		Y
Has anchor buoy chain inspection been conducted in last 5 years?	3.2.3		Y, annually
Are date and test pressure (W/P x 1.5) stencilled on each hose?	6.6.4		Y
Are intrinsically safe radios provided per ANSI / UL 913	4.5		Y
Are product samples performed hourly & prior to product acceptance?	5.1 & 5.2		Y
<b>General Comments</b>			
<p>1) Distribution pump closest to the loading rack has a chinese name plate and does not appear to be UL Listed. Please send us the literature on this pump or remove it from service.</p> <p>2) Confined space entry signage needs to be placed on all tanks after painting.</p> <p>3) Fire suppression monitors corroded, need repair.</p> <p>4) Inventory reconciliation documentation needed for 2016.</p> <p>5) With the new tank installing looming, please advise on all plans to upgrade and/or change the service of any of the existing tanks.</p> <p>6) Please provide the latest cathodic protection assessment reports.</p>			
<b>Tank 6</b>			
<p>1) Tank vent is corroded and needs to be repaired the next time it is taken out of service.</p> <p>2) Latest API report on file is 2006. Please provide the newest on available or advise if this was the last one.</p> <p>3) Various locations of coating failure are evident and the areas need to be cleaned and recoated.</p>			
<b>Tank 7</b>			
1) API report (2014) found this tank to not be in suitable condition. Have repairs been carried out? Please provide list of repairs conducted or future plans?			
<b>Tank 8</b>			
1) The latest API report furnished to the department (2014) suggested bottom replacement, was this done or is it planned for the near future?			
<b>Tank 9</b>			
1) The latest API report furnished to the department (2013) suggested bottom replacement, was this done or is it planned for the near future?			

## Appendix 5: Typical Material Safety Data Sheet Diesel No.2 Low Sulfur Diesel and Ultra Low Sulfur Diesel



# U. S. Oil & Refining Co.

3001 Marshall Avenue, Tacoma, Washington, 98421 (253) 383-1651

### Diesel #2

Property	ASTM Method	Specifications	
		Min	Max
Color, ASTM	D 1500		1.5
Doctor Test	D 4952		Negative <sup>3</sup>
Sulfur, mass %	D 4294		0.050
Distillation - 90% recovered, °C	D 86	282	338
Flash Point, °C	D 93	52	
Density, Kg/m <sup>3</sup>	D 4052		876
Viscosity @ 40°C, mm <sup>2</sup> / S (cSt)	D 445	1.9	4.1
Cold Filter Plugging Point (CFPP), °C	D 6371		
Summer <sup>1</sup>			-6
Winter <sup>2</sup>			-12
Cetane Index	D 976	41	
Corrosion, Copper Strip, rating 3h@50°C	D 130		1B
Carbon - Residue on 10 % distillation, % mass	D 4530		0.35
Ash, mass %	D 482		0.01
Water & Sediment, Volume %	D 2709		0.05
Haze Point	D 4176	Clear and Bright @ ambient temperature	
Conductivity, pS/m	D 2624	50	
Lubricity, High Frequency Reciprocating Rig (HFRR) @60°C, micron	D 6079		520

Conforms to ASTM D 975, Grade No. 2-D S500 Specification

1) Summer - March 1 - October 31

2) Winter - November 1 - February 29

3) If Doctor Test is positive then Mercaptan sulfur must be less than 30 PPM



# U. S. Oil & Refining Co.

3001 Marshall Avenue, Tacoma, Washington, 98421 (253) 383-1651

## ULTRA LOW SULFUR DIESEL

Property	ASTM Method	Specifications	
		Min.	Max
Color, ASTM	D 1500		1.5
Doctor Test	D 4952		Negative <sup>3</sup>
Sulfur, ppm	D 5453		15
Distillation – 90% recovered, °C	D 86	282	338
Flash Point, °C	D 93	52	
Density, Kg/m <sup>3</sup> , °C	D 4052		876
Viscosity @ 40°C, mm <sup>2</sup> /S (cSt)	D 445	1.9	4.1
Cold Filter Plugging Point (CFPP), °C	D 6371		
Summer <sup>1</sup>			-6
Winter <sup>2</sup>			-12
Cetane Index	D 976	41	
Corrosion, Copper Strip, rating 3h @ 50°C	D 130		1B
Carbon – Residue on 10% distillation, % mass	D 4530		0.35
Ash, mass %	D 482		0.01
Water & Sediment, Volume %	D 2709		0.05
Haze point	D 4176	Clear and bright @ ambient Temperature	
Conductivity, pS/m	D 2624	50	
Lubricity, High Frequency Reciprocating Rig (HFRR) @60°C, micron	D 6079		520

Conforms to ASTM D 975, Grade No. 2-D S15 Specification

1) Summer: March 1 – October 31

2) Winter: November 1 – February 29

3) If Doctor test is positive then mercaptan sulfur must be less than 30 ppm

## Appendix 6A.1: SOL Risk Assessment Matrix & Overview



### What is the Risk Assessment Matrix (RAM)?



- Tool to standardise qualitative risk
- Facilitates the categorisation of threats to:
  - Persons
  - Assets
  - Environment
  - Reputation

## Risk Assessment Matrix

www.solpetroleum.com

www.solpetroleum.com

### Description of the RAM



Risk

Severity	Consequences				Probability				
	Persons	Environment	Assets	Reputation	A	B	C	D	E
					Never heard of in..... Industry	Heard of in..... Industry	Incident has occurred in our Company	Happens several times per year in our Company	Happens several times per year at a Location
0	No health effect/injury	No effect	No damage	No impact	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="background-color: #0070C0; color: white; padding: 5px;">Low Risk</div> <div style="background-color: #FFD700; color: black; padding: 5px;">Medium Risk</div> <div style="background-color: #FF0000; color: white; padding: 5px;">High Risk</div> </div>				
1	Slight health effect/injury	Slight effect	Slight damage	Slight impact					
2	Minor health effect/injury	Minor effect	Minor damage	Limited impact					
3	Major health effect/injury	Localised effect	Localised damage	Considerable impact					
4	PTD or 1 to 3 fatalities	Major effect	Major damage	National impact					
5	Multiple fatalities	Extensive effect	Extensive damage	International impact					

www.solpetroleum.com

www.solpetroleum.com

### Consequences



- Incremental
- For Assessments use Potential Consequences
- For Incident Investigation use Actual Consequences
- Determine the Potential Consequences for an Specific Scenario, Then...

### Probability



- Based on the likelihood of Consequences occurring
- Also Incremental:
  - From Rarely occurring to
  - Happening several times per year
- It is the Probability of the Consequences Occurring
- Not the Probability of the Hazard being Released

www.solpetroleum.com

### RAM for Risk Management



- Consequences: Potential consequences of an incident
  - Likelihood: Previous occurrence of this consequence due to this type of incident
- RED AREA:
- Investigate alternate ways to carry out the operation
  - If there are no alternative ways:
    - Reduce Risk to ALARP
    - Decide if proceed or not
- RED AND YELLOW AREAS:
- Document Reduction of Risk to ALARP

www.solpetroleum.com

## Risk Determination



- Locate the cell where Consequences and Probabilities meet
- Use Characters:
  - First: Indicates the likelihood of the event (A through E)
  - Second: Indicates the Consequence level of the event (0 through 5)
  - Third: Indicates the area where the consequences are located (P,A,E or R)
- Every area (P,E,A,R) will have different consequences
- Overall Risk will be the Highest Risk Consequence
  - D5(P)
  - D3(A)
  - D2(E)
  - D4(R)
  - Overall Risk= D5(P)

www.solpetroleum.com

## Use of the RAM in Incident Investigation



- To decide on:
  - Depth of the Investigation
  - Composition of the Investigation Team
- Investigation Based on:
  - Potential Consequences
  - What could have realistically happened
  - Likelihood based on actual occurrence of the potential consequences

www.solpetroleum.com

## RAM in Incident Investigation



### Group Recommended Investigation Team Composition and Reporting Level:

Risk Rating	Investigation Team Composition	Reporting / Discussion
Low Risk (Blue shaded area)	First line of supervision + HSE focal point	Reporting to Department Head
Medium Risk (Yellow shaded area)	Asset holder + other line staff as required + HSE advisor	Reporting to OU management
High Risk (Red shaded area)	Member of Operating Unit Management Team + asset holder + HSE Advisor + independent person and/or specialists as required	Reporting to CEO and voluntary reporting to Service Companies

### SOL Reporting Procedures as Described in Incident Reporting Procedures

www.solpetroleum.com

## Use of the RAM for Chronic Effects



- Health and Environmental Hazards:
  - Overlooked
  - Inadequate Potential Consequence Category
- For Health and Environmental Hazards:
  - Consequence based on known effects
  - Likelihood based on Occurrence of Excess Exposures although effects take many years to appear

www.solpetroleum.com

## Consequences - Persons



- 0: No Injury or Damage to Health
- 1: Slight Injury or Health Effects
  - First Aid and Medical Treatment Cases & Occupational Health
  - Not Affecting Work Performance or Causing Disability
- 2: Minor Injury or Health Effects
  - LTI, RWC, Occ. Illness, Lost Workdays
  - Minor Reversible Health Effects

www.solpetroleum.com

## Consequences - Persons



- 3: Major Injury or Health Effects
  - Permanent Partial Disability & Occ. Illness
  - Prolonged Absence
  - Irreversible Health Damage w/o Death
- 4: Permanent Total Disability or 1-3 Fatalities
  - Includes small population exposure to carcinogens
- 5: Multiple Fatalities
  - Includes large population exposure to carcinogens

www.solpetroleum.com

## Consequences - Assets



- Based on 100% of Costs
- 0: Zero Damage
- 1: Slight Damage - No Disruption to Ops. & <10K USD
- 2: Minor Damage - Brief Disruption & <100K USD
- 3: Local Damage - Partial Shutdown & <1M USD
- 4: Major Damage - Partial Operation Loss, 2 Week Shutdown & <10M USD
- 5: Extensive Damage
  - Substantial or Total Loss of Operation
  - Costs >10M USD

www.solpetroleum.com

## Consequence - Environment



- 0: Zero Effect
  - No Damage, No Financial Consequences
- 1: Slight Effect
  - Slight Damage, Within Fence & Systems
  - Negligible Financial Consequences
- 2: Minor Effect
  - Contamination Damage w/o Lasting Effect
  - Single Breach of Limits (Statutory or Prescribed)
  - Single Complaint
- 3: Localised Effect
  - Discharges Affecting the Neighbourhood and Damaging the Environment
  - Repeated Breaches of Limits
  - Many Complaints

www.solpetroleum.com

## Consequence - Environment



- 4: Major Effect
  - Severe Environmental Damages
  - Extended Breaches of Limits
  - Widespread Nuisance
- 5: Massive Effect
  - Persistent Severe Environmental Damages or Nuisance on Large Area
  - Loss of Commercial, Recreational and Natural Use
  - Major Financial Consequences
  - Breaches well Above Limits

www.solpetroleum.com

## Consequence - Reputation



- 0: No Impact
  - No Public Awareness
- 1: Slight Impact
  - Public Awareness, No Public Concern
- 2: Limited Impact
  - Local Public Concern
  - Local Media / Political Attention

www.solpetroleum.com

## Likelihood Scale Interpretation



Type and Size of Operation or Installation	Increasing Likelihood →				
	Never heard of in industry	Heard of in industry	Incident has occurred in our Company	Happens several times per year in our Company	Happens several times per year at a Location
<b>Standards &amp; Major Installation</b>	Never heard of in industry	Heard of in industry	Incident has occurred in our Company	Happens several times per year in our Company	Happens several times per year at a Location
<b>Road Transport Operations</b>	Has not Occurred in industry	Has Occurred in industry in Last 5 Years	Has Occurred in Company in Last 3 Years	Has Occurred in Company in Last 12 Months	Has Occurred more than once in Company in Last 12 Months
<b>Retail Stations</b>	Not heard of in Retail Business	Has Occurred in Retail Business in Last 5 Years	Has Occurred in Our Country	Happens Several Times per Year in Our Country	Happens More than Once per Year per Station
<b>See all Ventures (including typical OP Marketing Companies...)</b>	Never heard of in industry	Heard of industry	Incident has Occurred in this Venture or Similar Ventures in Our Group of Companies	Happens Several Times per Year in Our Country	Happens more than Once per Year in this Venture or has happened more than once a year in a similar venture

www.solpetroleum.com

## Consequence - Reputation



- 3: Considerable Impact
  - Regional Public Concern
  - Extensive Adverse Attention of Local Media
  - Slight National Media / Political Attention
  - Adverse Stance of Local Government / Action Groups
- 4: National Impact
  - National Public Concern
  - Extensive Adverse Attention of National Media
  - Effect on Regional / National Policies
  - Mobilisation of Action Groups
- 5: International Impact
  - International Public Attention
  - Extensive Adverse Attention on International Media
  - National / International Policies with Potentially Severe Impact

www.solpetroleum.com

## Appendix 6A.2: Job Safety Analysis



### JOB SAFETY ANALYSIS (JSA) FORM

Site/Project: Jackson Point Terminal (JPT)		
Name of Employee/Contractor/Subcontractor: J&R Industrial Services	Date: 22-07-2017	Weather: Sunny with some overcast skies
Task/Activity: Tank Shell Welding - Plates		
<b>Check applicable anticipated or potential hazards:</b> <input type="checkbox"/> Demolition <input checked="" type="checkbox"/> Underground tank removal/disposal/high vapours <input type="checkbox"/> Excavation <input type="checkbox"/> Activities in or near traffic areas <input type="checkbox"/> Concrete cutting / coring <input type="checkbox"/> Mobile heavy equipment activity (excavators, dump trucks, vacuum and hydrovac trucks) <input type="checkbox"/> Pile driving / Shoring <input type="checkbox"/> Diving <input type="checkbox"/> Work affecting integrity of critical controls <input checked="" type="checkbox"/> Welding, cutting, grinding <input type="checkbox"/> Hydroblasting / sandblasting <input type="checkbox"/> Radiography / X-ray testing <input type="checkbox"/> Pressure testing <input type="checkbox"/> Other: <u>Dispenser placement</u> <small>(includes clearing brush/trees, reactive chemical handling, working in proximity to deep water, etc.)</small>		<b>CRITICAL PROCEDURES:</b> <small>Where work involves any of the following hazards, applicable Critical Checklists must be incorporated into the JSA</small> <input checked="" type="checkbox"/> Work at heights above 1.5 m (5 ft- includes excavations) <input type="checkbox"/> Confined Space Entry (Diving / Includes tank cleaning) <input type="checkbox"/> Electrical/Mechanical Lockout (live, isolation, lock out/tag out) <input type="checkbox"/> Heavy Equipment Lifting (cranes, boom trucks, excavators) <input type="checkbox"/> Drilling/borehole/excavations (sub-surface clearance, locates) <input type="checkbox"/> Entry into excavations/trenches > 1.2 m (4 ft) deep <input checked="" type="checkbox"/> Hot Work (in a potentially explosive atmosphere) <input type="checkbox"/> Tank field Sump Entry <input type="checkbox"/> Vacuum Truck use

- Each job or operation consists of a set of tasks/ steps. Be sure to list all the steps needed to perform the job.
- A hazard is a potential danger. Break hazards into five types:  
 Contact - victim struck by or strikes object (e.g. wrench falls from a scaffold) - look for protruding objects loose objects, someone working overhead, etc.;  
 Caught - victim is caught on, caught in or caught between objects - look for pinch points, crane movements, moving materials from one place to another, other work going on in adjacent or same area (e.g. construction work in an operating plant);  
 Fall - victim falls to the ground or from one level to lower level (slips) - look for work at heights, slippery areas (e.g. oil in tank being cleaned, loose sand making a slippery surface, tripping hazards, etc.);  
 Exertion - excessive strain or stress / ergonomics / lifting techniques;  
 Exposure - inhalation hazards, fire / explosion hazards (e.g. burn, cold exposure, etc), welding flash, lead in tanks (previous product, lead based paint used previously), etc.
- Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk.  
 - List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift."  
 - Avoid general statements such as, "be careful."

### JOB SAFETY ANALYSIS (JSA) FORM

Ensure that all hazards identified are addressed in JSA below		
Sequence of Basic Job Steps <small>(Order in which the work will be carried out and brief details of how tasks will be performed)</small>	Potential Hazards <small>(Examples: underground services, hazardous zone area, impeded soil, overhead power lines, adjacent works, etc)</small>	Safety Controls to Reduce or Eliminate Hazard <small>(Describe the precautions that will be taken)</small>
1. Sign-up for work being performed	N/A	<ul style="list-style-type: none"> <li>Acquire signed work permit / Review JSA / review SDS / Sign all Documents / NO cellular phones</li> <li>Keep clear of pressure hose while pressurizing</li> <li>Ensure clear working area underfoot</li> </ul>
2. Complete Safe Performance Self Assessment (SPSA)	N/A	<ul style="list-style-type: none"> <li>Identify all hazards and Assess the Risk / Analyze how to reduce the risk / Act to ensure safe operations.</li> <li>Do not proceed until everything is safe</li> <li>FULL PPE AT ALL TIMES</li> </ul>
3. LOTO - SAAB, HI & HI-HI Level Alarms	Exposure - Electrical Equipment	<ul style="list-style-type: none"> <li>Ensure all electrical equipment current to tank is isolated.</li> <li>Follow LOTO Procedure - ISOLATE SOURCE FROM MAIN</li> </ul>
4. Put up warning cones and warning tape around area	Trips & falls - loose material (Gravel surface)	<ul style="list-style-type: none"> <li>Place warning cones and warning tape so others can see clearly the work area.</li> <li>Use signs if deemed necessary</li> </ul>
5. Set up for work to be performed	Contact - Strain Slip / Trip / Fall Exertion Caught	<ul style="list-style-type: none"> <li>Keep work area tidy</li> <li>Watch for pinch points</li> <li>Secure Spider-Lift to Center tank support</li> <li>Check ropes and lanyards, Secure Life line</li> <li>Set Spider lift in place, check stability, ensure proper and secure hose connection</li> <li>Test lift before proceeding to heights</li> </ul>
6. Gas test work area	Exposure - Product vapours	<ul style="list-style-type: none"> <li>Ensure gas tester bumped prior to use and continuous monitoring performed.</li> <li>STOP works if sensor alarm goes off immediately and Inform Supervisor</li> <li>FIRE WATCH ON SITE AT ALL TIMES</li> <li>2 Fire Extinguishers on site at all times</li> </ul>
7. Grinding and welding related tasks: welding, grinding, buffing, cleaning welds etc.	Contact - Hot material	<ul style="list-style-type: none"> <li>Ensure Welding PPE used - Leather apron, Welding hood and welders gloves, welding helmet</li> <li>Concentrate on work to be done / lift with correct technique</li> <li>Stand back from welding arc and grinder</li> <li>Ensure that no personnel in the line of fire</li> </ul>



**JOB SAFETY ANALYSIS (JSA) FORM**

Ensure that all hazards identified are addressed in JSA below		
Sequence of Basic Job Steps <i>(Order in which the work will be carried out and brief details of how tasks will be performed)</i>	Potential Hazards <i>(Examples: underground services, hazardous zone area, impacted soil, overhead power lines, adjacent works, etc)</i>	Safety Controls to Reduce or Eliminate Hazard <i>(Describe the precautions that will be taken)</i>
	Fall - over discarded material Exertion	<ul style="list-style-type: none"> <li>Keep work area clean and organized / do not leave tripping hazards lying around</li> <li>Take water breaks</li> <li>Keep work area tidy</li> <li>Watch for pinch points</li> </ul>
8.	Exposure: welding smoke, arc flash, flying sparks, hot welds, heat of the day	<ul style="list-style-type: none"> <li>Welding smoke - watch for wind direction when welding. Do not breathe welding smoke, stand up wind. Use dust mask if needed - arc flash - wear safety glasses at all times</li> <li>Flying sparks - protect yourself and coworkers make sure of surroundings, wear proper pipe at all times, use fire blankets when needed to contain sparks</li> <li>Hot welds - do not brush up against or lift pipe on hot welds, use gloves at all times</li> <li>Newly completed welds should be marked as "hot" or placed in safe area</li> </ul>
6. Complete job / Clean-up	Fire - hot material Trips & Falls - Discarded material Exertion Exposure - heat and hard work	<ul style="list-style-type: none"> <li>Ensure recent welds are free of debris that can cause smoldering or burning</li> <li>Ensure welding unit has cooled down sufficiently before covering with tarp</li> <li>Be aware of your surroundings, work together to clean up area</li> <li>Be aware of co-workers, if someone looks like they can succumb to exertion or exposure make them aware, take a break, get a water.</li> <li>Do not carry to much in one load, do not rush, make sure work stops with sufficient time left to perform a proper clean up</li> <li>Keep work area tidy</li> </ul>

**JOB SAFETY ANALYSIS (JSA) FORM**

**Tools / Equipment:** *(List of tools/equipment to be used and their storage on site including ladders, steps, mobile scaffold, harness etc., if relevant to safety at the site)*  
 Welding machine, Grinder, Compressor, Hand tools, Fire Extinguisher, Fire Blanket, Spider-Lift

**Personal Protective Equipment:** *(Minimum requirement: safety shoes / hard hat / visor-vest / safety glasses / gloves fit for use)*

**Additional PPE:**

<input checked="" type="checkbox"/> Eye Protection (specify)	<input checked="" type="checkbox"/> Other (e.g. fire retardant coveralls, breathing apparatus, etc.)
<input type="checkbox"/> Hearing Protection (double)	• Hard-hat / chin strap
<input checked="" type="checkbox"/> Fall Protection	• Welder's Jacket
<input type="checkbox"/> Rubber footwear and gloves if in damp area	• Welder's Helmet / Mask
<input checked="" type="checkbox"/> Portable Gas Monitor	

**Outside Authorities:** *(Any authorities who need to be advised including site operator)*  
 N/A

**Disposal of designated substances, surplus or impacted materials:** *(Disposal details, e.g. when, where to, how, etc)*  
 N/A

**Consultant on site:**

Prepared By: Myron Blair Wayne Cole Position: Operations Facility Supervisor Date: 22 July 2017

Names of person(s) Carrying out work: Michael Kirlew Signed: M. Kirlew Date: 22-7-17

Jalon Linton \_\_\_\_\_ Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Cash King P.P. \_\_\_\_\_ Signed: CK Date: 22-7-17  
N Linton \_\_\_\_\_ Signed: \_\_\_\_\_ Date: 22-7-17

JSA Approved By (Site Supervisor): \_\_\_\_\_ Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Note: For tasks/activities that extend beyond a single day, use attached DAILY RENEWAL form for review of JSA with current crew and weather.

### Appendix 6A.3: Method Statement

METHOD OF STATEMENT																																																							
This Method Statement must be attached to the corresponding PTW certificate																																																							
Valid only when attached to PTW number ..... 20170721-GEO-1																																																							
Job location: <u>SP1 around tank # 8 in tank farm</u>																																																							
Work description: <u>batch welding on tank # 8</u>																																																							
<b>Equipment and tools</b> <u>Welding Equipment</u> <u>Grinder</u> <u>Hand tools</u> <u>Spider lift</u>	<b>Barriers and Isolation</b> <table border="0"> <tr><td>temporary demarcation</td><td>Yes</td><td>No</td></tr> <tr><td>warning signs</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>road closure</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>physical separation</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>spades/blinds</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>double block and bleed</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>lockout/tagout</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>other precautions</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> </table>	temporary demarcation	Yes	No	warning signs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	road closure	<input type="checkbox"/>	<input type="checkbox"/>	physical separation	<input type="checkbox"/>	<input type="checkbox"/>	spades/blinds	<input type="checkbox"/>	<input type="checkbox"/>	double block and bleed	<input type="checkbox"/>	<input type="checkbox"/>	lockout/tagout	<input type="checkbox"/>	<input type="checkbox"/>	other precautions	<input type="checkbox"/>	<input type="checkbox"/>																														
temporary demarcation	Yes	No																																																					
warning signs	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
road closure	<input type="checkbox"/>	<input type="checkbox"/>																																																					
physical separation	<input type="checkbox"/>	<input type="checkbox"/>																																																					
spades/blinds	<input type="checkbox"/>	<input type="checkbox"/>																																																					
double block and bleed	<input type="checkbox"/>	<input type="checkbox"/>																																																					
lockout/tagout	<input type="checkbox"/>	<input type="checkbox"/>																																																					
other precautions	<input type="checkbox"/>	<input type="checkbox"/>																																																					
<b>Sequence and Method of Work</b> 1) ..... 2) ..... 3) ..... 4) ..... 5) ..... 6) ..... 7) ..... <small>Identify the hazards for each step For complex jobs each sequential task may require its own permit and Method Statement</small>	<b>Hazards</b> <table border="0"> <tr><td>fire</td><td>Yes</td><td>No</td></tr> <tr><td>explosion</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>contamination</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>falling</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>landslide/cave-in</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>spills</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>lifting heavy objects with crane</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>asphyxiation</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>overhead/underground utilities</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>health</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>security</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>others (describe)</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> </table>	fire	Yes	No	explosion	<input checked="" type="checkbox"/>	<input type="checkbox"/>	contamination	<input checked="" type="checkbox"/>	<input type="checkbox"/>	falling	<input checked="" type="checkbox"/>	<input type="checkbox"/>	landslide/cave-in	<input checked="" type="checkbox"/>	<input type="checkbox"/>	spills	<input checked="" type="checkbox"/>	<input type="checkbox"/>	lifting heavy objects with crane	<input checked="" type="checkbox"/>	<input type="checkbox"/>	asphyxiation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	overhead/underground utilities	<input checked="" type="checkbox"/>	<input type="checkbox"/>	health	<input type="checkbox"/>	<input type="checkbox"/>	security	<input type="checkbox"/>	<input type="checkbox"/>	others (describe)	<input type="checkbox"/>	<input type="checkbox"/>																		
fire	Yes	No																																																					
explosion	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
contamination	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
falling	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
landslide/cave-in	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
spills	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
lifting heavy objects with crane	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
asphyxiation	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
overhead/underground utilities	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
health	<input type="checkbox"/>	<input type="checkbox"/>																																																					
security	<input type="checkbox"/>	<input type="checkbox"/>																																																					
others (describe)	<input type="checkbox"/>	<input type="checkbox"/>																																																					
<b>Personal protection equipment</b> <table border="0"> <tr><td>safety helmet</td><td>Yes</td><td>No</td></tr> <tr><td>safety spectacles</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>safety goggles</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>full face visor</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>dust mask</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>light fume mask</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>Respirator</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>HEPA respirator</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>SCBA</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>safety shoes</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>rubber boots</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>fire extinguishers</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>hearing protection</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>leather gloves</td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>neoprene gloves</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>safety harness</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>first aid kit</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> <tr><td>lifting aids</td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> </table>	safety helmet	Yes	No	safety spectacles	<input checked="" type="checkbox"/>	<input type="checkbox"/>	safety goggles	<input checked="" type="checkbox"/>	<input type="checkbox"/>	full face visor	<input type="checkbox"/>	<input type="checkbox"/>	dust mask	<input type="checkbox"/>	<input type="checkbox"/>	light fume mask	<input type="checkbox"/>	<input type="checkbox"/>	Respirator	<input type="checkbox"/>	<input type="checkbox"/>	HEPA respirator	<input type="checkbox"/>	<input type="checkbox"/>	SCBA	<input type="checkbox"/>	<input type="checkbox"/>	safety shoes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	rubber boots	<input type="checkbox"/>	<input type="checkbox"/>	fire extinguishers	<input checked="" type="checkbox"/>	<input type="checkbox"/>	hearing protection	<input type="checkbox"/>	<input type="checkbox"/>	leather gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>	neoprene gloves	<input type="checkbox"/>	<input type="checkbox"/>	safety harness	<input type="checkbox"/>	<input type="checkbox"/>	first aid kit	<input type="checkbox"/>	<input type="checkbox"/>	lifting aids	<input type="checkbox"/>	<input type="checkbox"/>	<b>Hazard controls</b> <u>Gas testing</u> <u>PPE</u> <u>Fire watches</u> <u>Fire Extinguishers</u> <u>Harness / Lift Line</u>
safety helmet	Yes	No																																																					
safety spectacles	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
safety goggles	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
full face visor	<input type="checkbox"/>	<input type="checkbox"/>																																																					
dust mask	<input type="checkbox"/>	<input type="checkbox"/>																																																					
light fume mask	<input type="checkbox"/>	<input type="checkbox"/>																																																					
Respirator	<input type="checkbox"/>	<input type="checkbox"/>																																																					
HEPA respirator	<input type="checkbox"/>	<input type="checkbox"/>																																																					
SCBA	<input type="checkbox"/>	<input type="checkbox"/>																																																					
safety shoes	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
rubber boots	<input type="checkbox"/>	<input type="checkbox"/>																																																					
fire extinguishers	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
hearing protection	<input type="checkbox"/>	<input type="checkbox"/>																																																					
leather gloves	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																																					
neoprene gloves	<input type="checkbox"/>	<input type="checkbox"/>																																																					
safety harness	<input type="checkbox"/>	<input type="checkbox"/>																																																					
first aid kit	<input type="checkbox"/>	<input type="checkbox"/>																																																					
lifting aids	<input type="checkbox"/>	<input type="checkbox"/>																																																					
<b>Method for waste disposal or treatment</b> <u>N/A</u>	<b>Other authorization / permits</b> <u>PTW / HAZ / WORK</u>																																																						
<b>Emergency response and recovery</b> <u>911 Emergency // 916.4387 FS</u> <u>925-4916 TM // 916.0771 FF</u>																																																							
Name and signature of the applicant	Date																																																						

## Appendix 6A.4: Work at Height Certificate

<span style="margin-left: 20px;"><b>WORK AT HEIGHT CERTIFICATE</b></span>	
<p><b>Certifies that all activities at height (defined as above 1.50 m.) are carried out taking into considerations all precautions to avoid fallings</b></p>	
<p>Valid only when attached to PTW number ..... <span style="float: right;">20170721-GEO-1</span></p>	
<p><b>All items to be checked</b></p> <p><b>Scaffolding</b></p> <p>Firm foundation <input checked="" type="checkbox"/></p> <p>Surface leveled <input checked="" type="checkbox"/></p> <p>Bracing and connections in good conditions <input checked="" type="checkbox"/></p> <p>Adequate platforms <input checked="" type="checkbox"/></p> <p>Handrail <input checked="" type="checkbox"/></p> <p>Lifeline <input checked="" type="checkbox"/></p> <p><b>Control and Handover process</b></p> <p>Log book available at working area <input type="checkbox"/></p> <p>Status tags available <input type="checkbox"/></p> <p><b>Others</b></p> <p>Life jackets (if working above water) needs JHA</p>	<p><b>All items to be checked</b></p> <p><b>Ladders</b></p> <p>Firm foundation <input checked="" type="checkbox"/></p> <p>Surface leveled <input checked="" type="checkbox"/> <i>2-92</i></p> <p>Adequate inclination <i>(65-75)</i> degrees <input checked="" type="checkbox"/></p> <p>Properly fastened at the top. <input checked="" type="checkbox"/></p> <p>Side rails extend at least 0.90m above the upper landing surface <input checked="" type="checkbox"/></p> <p>A person is 'Footling' the ladder to ensure it does not slip. <input checked="" type="checkbox"/></p> <p>Adequate distance between steps (0.25-0.30m) <input checked="" type="checkbox"/></p> <p>Adequate distance between bars (0.28m internal as min) <input checked="" type="checkbox"/></p> <p>Bar and steps in good conditions <input checked="" type="checkbox"/></p> <p>Restricted access <input checked="" type="checkbox"/></p> <p>Keep areas clear around top and bottom <input checked="" type="checkbox"/></p>
<p>Name of responsible supervisor: <i>Wayne Cato</i> Company: <i>Sol Petroleum Cayman</i></p> <p>Exact location: <i>Bank # 8 AT Jackson Point terminal</i> <i>Bank form</i></p> <p>Other Precautions to be taken <i>make sure lift is securely fasten to</i> <i>The bank top, make sure person in lift is secure</i> <i>With separate line from lift, make sure tools</i> <i>are secure in lift</i></p> <p>I have checked the working area and certify that the activities proposed under Permit to Work Number ..... dated <i>2/9/17</i> can be carried out in a safely manner.</p> <p style="text-align: right;">Signature: <i>[Signature]</i></p>	
<p><b>Situation Sketch / Indication of Hazards</b></p>          	
<p><b>Notes</b></p> <p>Not for suspended scaffolding, for this type a JHA will be required</p> <p>Wood and aluminum scaffolds are forbidden. (fire vulnerability). Working at Zone 1 requires PTW</p> <p>If the total length of the climb on a fixed ladder equals or exceeds 7.30m, the ladder must be equipped with ladder safety devices or self retracting lifelines and rest platforms at intervals not to exceed 45.70m.</p>	



### Appendix 6A.5: Permit to Work

<b>PERMIT TO WORK</b>		PTW No. 20170724-GEO-1																													
Permit Applicant: Name: <u>Michael Kirkew</u> Job to be Done: <u>Welding</u> Date: <u>22-07-2017</u>		Contractor Company: <u>SK Industrial Services</u> Tools to be used: <u>Welding, Plasma, Grinders, Hand tool</u> Exact Location: <u>Talking to tank farm</u> Number of people on the job: <u>3 in 20 Co</u>																													
The "administrator of the site" has been informed of the scope of work to be carried out under this permit. Site administrator signature: <u>[Signature]</u> Date: <u>21-07-2017</u>																															
<b>Certificates Required for this Permit</b> 1. Method Statement <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 2. Clearance Certificate (see below) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 3. Hot Work Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 4. Confined Space Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 5. Excavation Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 6. Electrical Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 7. Work at height Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 8. Traffic control Certificate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<b>Safety Precautions to be Taken</b> <b>Personal:</b> safety helmet <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No safety spectacles <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No safety goggles <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No full face visor <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No dust mask <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No light fume mask <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No breathing apparatus <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - self contained <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - compressed air line <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - air line with blower <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No hearing protection <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No leather gloves <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No neoprene gloves <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No safety shoes <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No rubber boots <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No safety harness <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No fluorescent vest <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No antistatic bracelet <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No																													
<b>Clearance Certificate</b> Equipment is isolated: by spades or blinds <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No by physical separation <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No by closed valves <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No from motive power <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Equipment has been: depressurized <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No drained <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No flushed with water <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No blown with air/nitrogen <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No steamed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No All other required certificates have been issued <input checked="" type="checkbox"/> Yes		<b>Workplace:</b> temporary demarcation <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No cones <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No barricades <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No warning signs <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No road closure <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No lighting <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No fire extinguisher ABC type <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No powder cannon <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No tags and locks (elec. panels) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <b>Possible Hazards:</b> <u>Explosion</u> <u>Expansion</u> <u>Slip-trip-Fall</u> <u>Falling from Lift</u> <u>Fatigue</u>																													
I have personally checked the equipment, and confirm that it is isolated as defined above. Signed AS: <u>[Signature]</u> Date: <u>21/7/17</u>		<b>Other Precautions:</b> <u>Make sure person on lift give safe with separate line from lift basket</u>																													
I certify that I am aware of my responsibilities and have read, understood, and will establish and maintain the precautions detailed above. I shall ensure that all persons under my control are also aware of the safety requirements and responsibilities. Signed Permit Applicant: <u>[Signature]</u> Date: <u>21/7/17</u>		Use the back of the permit to add other necessary precautions I certify that I have fully considered the implications of the work in line with the responsibilities given overleaf and confirm that I am authorized to issue this Permit To Work and that the above precautions are adequate for the work to be carried out provided they are established and maintained. Signed ASI/ERDS: <u>[Signature]</u> Date: <u>21/7/17</u>																													
Permit Validity: The work may be undertaken between the times specified here, extensions beyond this time must be re-authorized.		<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">From</th> <th colspan="2">To</th> <th rowspan="2">Sign</th> <th rowspan="2">Date</th> </tr> <tr> <th>Date</th> <th>Time</th> <th>Date</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>21/7/17</td> <td>08:00</td> <td>21/7/17</td> <td>17:00</td> <td>[Signature]</td> <td>21/7/17</td> </tr> <tr> <td>21/7/17</td> <td>08:00</td> <td>21/7/17</td> <td>17:00</td> <td>[Signature]</td> <td>21/7/17</td> </tr> <tr> <td>21/7/17</td> <td>08:00</td> <td>21/7/17</td> <td>17:00</td> <td>[Signature]</td> <td>21/7/17</td> </tr> </tbody> </table>		From		To		Sign	Date	Date	Time	Date	Time	21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17	21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17	21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17
From		To		Sign	Date																										
Date	Time	Date	Time																												
21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17																										
21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17																										
21/7/17	08:00	21/7/17	17:00	[Signature]	21/7/17																										
<b>Daily sign on</b> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Date</th> <th>Time</th> <th>Clearance to Start (ROS, ASI/AE)</th> <th>Certify (Permit Applicant)</th> </tr> </thead> <tbody> <tr> <td>21/7/17</td> <td>08:00</td> <td>[Signature]</td> <td>[Signature]</td> </tr> <tr> <td>21/7/17</td> <td>08:00</td> <td>[Signature]</td> <td>[Signature]</td> </tr> <tr> <td>21/7/17</td> <td>08:00</td> <td>[Signature]</td> <td>[Signature]</td> </tr> </tbody> </table>		Date	Time	Clearance to Start (ROS, ASI/AE)	Certify (Permit Applicant)	21/7/17	08:00	[Signature]	[Signature]	21/7/17	08:00	[Signature]	[Signature]	21/7/17	08:00	[Signature]	[Signature]	<b>Daily sign off</b> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Time</th> <th>Site in safe condition (Permit Applicant)</th> </tr> </thead> <tbody> <tr> <td>5:30pm</td> <td>[Signature]</td> </tr> <tr> <td>4:30pm</td> <td>[Signature]</td> </tr> </tbody> </table>		Time	Site in safe condition (Permit Applicant)	5:30pm	[Signature]	4:30pm	[Signature]						
Date	Time	Clearance to Start (ROS, ASI/AE)	Certify (Permit Applicant)																												
21/7/17	08:00	[Signature]	[Signature]																												
21/7/17	08:00	[Signature]	[Signature]																												
21/7/17	08:00	[Signature]	[Signature]																												
Time	Site in safe condition (Permit Applicant)																														
5:30pm	[Signature]																														
4:30pm	[Signature]																														
<b>Hand back</b> I certify that the work has been completed* and the site left in a safe condition. (*If not completed, describe reason) Signed Permit Applicant: <u>[Signature]</u> Date: <u>23-07-17</u> Accepted by ASI: _____ Date: _____																															

## Appendix 6A.6: Hot Work Certificate

	<b>HOT WORK CERTIFICATE</b>						
<p>To be used for work involving actual or potential sources of ignition, including welding, flame cutting, spark-producing tools, non-intrinsically safe tools.</p>							
Valid only when attached to PTW number .....		20170721-GEO-1					
Name of Gas Tester: <u>Wayne Cab</u>		Company: <u>SOL Petroleum Cayman</u>					
Exact location of Test: <u>Tank #2 in tank farm</u>							
Date of Test: <u>22-02-2017</u>		Time of Test: <u>8:30AM</u>					
<b>Safety Checklist</b>							
Workplace checked for absence of combustible material			Yes / No <input checked="" type="checkbox"/> / <input type="checkbox"/>				
Sewers and drains near workplace are free of hydrocarbons			<input checked="" type="checkbox"/> / <input type="checkbox"/>				
Sewers and drains near workplace are covered against sparks			<input checked="" type="checkbox"/> / <input type="checkbox"/>				
Fire extinguishers placed for easy use			<input checked="" type="checkbox"/> / <input type="checkbox"/>				
Other checks for prevailing hazards: <u>Stop Welding when tanks are at the loading rack</u>			<input type="checkbox"/> / <input type="checkbox"/>				
Required gas test frequency: every <u>2</u> hours* / <u>once-only</u> *Continuous monitoring Area around tank #2							
<b>GAS TEST - Initial Result</b>							
Gas test taken and found satisfactory (not more than 1% LEL)	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Date: <u>22-02-2017</u>	Time: <u>8:30AM</u>				
Gas test meter used: Make: <u>Alair</u>							
Model: <u>SX</u>							
Date last tested / calibrated: <u>2016</u>		Signature: <u>CK</u> Gas Tester					
<b>GAS TEST - Subsequent Checks</b>							
Date	<u>22/2/17</u>	<u>22/2/17</u>	<u>22/2/17</u>	<u>22/2/17</u>	<u>22/2/17</u>	<u>22/2/17</u>	
Time	<u>8:30AM</u>	<u>10:30AM</u>	<u>1:00PM</u>	<u>3:15PM</u>	<u>4:05PM</u>	<u>5:30PM</u>	
Gas Meter Reading	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	
Checked by (initials)	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	
Date	<u>23/2/17</u>	<u>23/2/17</u>	<u>23/2/17</u>	<u>23/2/17</u>	<u>23/2/17</u>	<u>23/2/17</u>	
Time	<u>7:30AM</u>	<u>9:45AM</u>	<u>11:15AM</u>	<u>1:05PM</u>	<u>3:00PM</u>	<u>4:30PM</u>	
Gas Meter Reading	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	
Checked by (initials)	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	<u>CK</u>	

Continuous Gas Monitoring was done while welding is performing. CK

## Appendix 6B.1: Photographic Exhibits of Epoxies



**Appendix 6B.2: Photographic Exhibits of Mild Steel Plate (Patches)**



## **Appendix 6C.1: MSDS for Devcon Flow-mix Cold Weld Epoxy**

### **8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

#### **Engineering controls:**

#### **Ventilation:**

Use ventilation that is adequate to keep employee exposure to airborne concentrations below exposure limits (or to the lowest feasible levels when limits have not been established). Although good general mechanical ventilation is usually adequate for most industrial applications, local exhaust ventilation is preferred (see ACGIH - Industrial Ventilation). Local exhaust may be required for confined areas (see OSHA CFR29 1910.146).

**Other engineering controls:** Have emergency shower and eye wash available.

#### **Personal protective equipment**

**Eye and face protection:** Chemical goggles if liquid contact is likely, or safety glasses with side shields

**Skin protection:** Chemical-resistant gloves (Neoprene, nitrile) and other gear as required to prevent skin contact.

**Respiratory protection:** With good ventilation, none required. In poorly ventilated areas use NIOSH-approved organic vapor cartridge respirator for uncured resin, dust/particle respirators during grinding/sanding operations for cured resin, or fresh airline respirator as exposure levels dictate (see OSHA CFR29 1910.134).

### **9. PHYSICAL AND CHEMICAL PROPERTIES**

**Specific Gravity:** 1.13

**Boiling Point:** n/d

**Melting point:** n/d

**Vapor Density (Air=1):** n/d

**Vapor Pressure:** <1 mmHg @ 70°F

**Evaporation Rate:** n/d

**VOC:** 0

**Solubility in water:** Negligible

**pH (5% solution or slurry in water):** 9.5

### **10. STABILITY AND REACTIVITY**

This material is chemically stable. Hazardous polymerization will not occur.

**Conditions to Avoid:** Open flame and extreme heat.

**Incompatibilities:** Strong oxidizers, Amines

**Hazardous Products of Combustion:** Acid and toxic fumes with organic amines, ammonia, oxides of carbon and nitrogen, Oxides of sulfur

**Conditions under which hazardous polymerization may occur:** Heat is generated when resin is mixed with curing agents; Run-away cure reactions may char and decompose the resin, generating unidentified fumes and vapors which may be toxic.

### **11. TOXICOLOGICAL INFORMATION**

**Eye Contact:** Rabbit: Severe irritant. Result = 4.8 (Scale 0-8).

**Subchronic effects:** No data available.

**Carcinogenicity, tertogenicity and mutagenicity:** No data available.

**Other chronic effects:** None known.

#### **Toxicological information on hazardous chemical constituents of this product:**

Component	Oral LD50 (rat)	Dermal LD50 (rabbit)	Inhalation LC50 4hr (rat)
MERCAPTAN AMINE BLEND MIXTURE	n/d	n/d	n/d





ITW Consumer - Devcon/Versachem

## 6. ACCIDENTAL RELEASE MEASURES

**Spill Control:** Avoid personal contact. Eliminate ignition sources. Ventilate area.

**Containment:** Dike, contain and absorb with clay, sand or other suitable material

**Cleanup:** For large spills, pump to storage/salvage vessels. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly. Flush area with water.

**Special procedures:** Prevent spill from entering drainage/sewer systems, waterways and surface water.

## 7. HANDLING AND STORAGE

**Handling precautions:** Avoid contact with the skin and the eyes. Wash thoroughly with soap and water after using and particularly before eating, drinking, smoking, applying cosmetics or using toilet facilities. Launder contaminated clothing and protective gear before reuse. Discard contaminated leather articles. Handle mixed resin and hardener in accordance with the potential hazard of the curing agent used. Provide appropriate ventilation/respiratory protection against decomposition products (see Section 10) during welding/flame cutting operations and to protect against dust during sanding/grinding of cured product.

**Storage:** Store in a cool, dry area. Store away from heat. Keep containers closed when not in use.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### Engineering controls:

#### Ventilation:

General; local exhaust ventilation as necessary to control any air contaminants to within their exposure limits (or to the lowest feasible levels when limits have not been established) during the use of this product.

**Other engineering controls:** Have emergency shower and eye wash available.

### Personal protective equipment

**Eye and face protection:** Chemical goggles if liquid contact is likely, or safety glasses with side shields

**Skin protection:** Chemical-resistant gloves (i.e. butyl) and other gear as required to prevent skin contact.

**Respiratory protection:** With good ventilation, none required. Use NIOSH-approved organic vapor cartridges for uncured product and dust/particle respirators during sanding/grinding operations of cured product as exposure levels dictate.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Specific Gravity:** 1.17

**Boiling Point:** >500°F

**Melting point:** n/d

**Vapor Density (Air=1):** >1

**Vapor Pressure:** 0.03 mmHg @ 171°F

**Evaporation Rate:** <1 (butyl acetate = 1)

**VOC:** 0

**Solubility in water:** Negligible

**pH (5% solution or slurry in water):** Neutral

## 10. STABILITY AND REACTIVITY

This material is chemically stable. Hazardous polymerization will not occur.

**Conditions to Avoid:** Open flame and extreme heat.

**Incompatibilities:** Strong Lewis or mineral acids, strong oxidizing agents, strong mineral and organic bases (especially primary and secondary aliphatic amines)

3 of 5

Full SDS Available at: [DEVCON.COM](http://DEVCON.COM)



## Appendix 6C.2: MSDS for JB Weld Epoxy Putty Steel Stick

1184188 - Epoxy Putty - Steel

Revision Date 15-Oct-2014

### 9. PHYSICAL AND CHEMICAL PROPERTIES

#### Physical and Chemical Properties

<b>Physical State</b>	Solid		
<b>Appearance</b>	Dark gray	<b>Odor</b>	Pungent, Sulfurous.
<b>Color</b>	Dark Gray / Black	<b>Odor Threshold</b>	Not available.
<b>Property</b>	<b>Values</b>	<b>Remarks/ Method</b>	
<b>pH</b>	No data available	None known	
<b>Melting / freezing point</b>	No data available	None known	
<b>Boiling point / boiling range</b>	No data available	None known	
<b>Flash Point</b>	Closed cup: 93.3°C (>199.9°F) [Setflash.] [Product does not sustain combustion.]	None known	
<b>Evaporation Rate</b>	No data available	None known	
<b>Flammability (solid, gas)</b>	Flammable in the presence of the following materials or conditions: open flames, sparks and static discharge.	None known	
<b>Flammability Limit in Air</b>			
<b>Upper flammability limit</b>	No data available		
<b>Lower flammability limit</b>	No data available		
<b>Vapor pressure</b>	No data available	None known	
<b>Vapor density</b>	No data available	None known	
<b>Specific Gravity</b>	2.247	None known	
<b>Water Solubility</b>	No data available	None known	
<b>Solubility in other solvents</b>	No data available	None known	
<b>Partition coefficient:</b>		None known	
<b>n-octanol/water</b>	No data available	None known	
<b>Auto-ignition temperature</b>	No data available	None known	
<b>Decomposition temperature</b>	>200° C (>392°F)	None known	
<b>Kinematic viscosity</b>	No data available	None known	
<b>Dynamic viscosity</b>	No data available		
<b>Explosive properties</b>	No data available		
<b>Oxidizing Properties</b>	No data available		
<b><u>Other Information</u></b>			
<b>Softening Point</b>	No data available		
<b>VOC Content (%)</b>	0		
<b>Particle Size</b>	No data available		
<b>Particle Size Distribution</b>			

Full SDS can be found at: [JBWeld.com](http://JBWeld.com)

## Appendix 7: Incident Time Line

Date	Time	Event	Source	Discrepancies	Comments
July 22 2017	7:00 AM	Welder & Welder's Mate arrive at Sol and start cutting patch plates	Statement from Neville Linton (Welder's Mate)		Hot Works performed prior to first Gas Test
July 22 2017	8:30 AM	Initial Gas Test Performed by Carl King	Hot Work Certificate		
July 22 2017	10:38 AM	2nd Gas Test Performed by Carl King	Hot Work Certificate		
July 22 2017	1:00 PM	3rd Gas Test Performed by Carl King	Hot Work Certificate		
July 22 2017	3:15 PM	4th Gas Test Performed by Carl King	Hot Work Certificate		
July 22 2017	4:05 PM	5th Gas Test Performed by Carl King	Hot Work Certificate		
July 22 2017	5:30 PM	6th Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	7:30 AM	Initial Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	9:45 AM	2nd Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	11:15 AM	3rd Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	12:30 PM	Work Management turned over to Carl King from Wayne Cato	Sol Employee Interviews		
July 23 2017	1:05 PM	4th Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	2:00 PM	Gas Tester Alarm went off	Statement from Neville Linton (Welder's Mate)		Not mentioned in the Welder's Statement nor was it recorded anywhere as to its occurrence or reason for its occurrence, it was ignored and work continued, against the JSA
July 23 2017	3:00 PM	5th Gas Test Performed by Carl King	Hot Work Certificate		
July 23 2017	3:00 PM	Carl King Left the Site to get food	Sol Employee Interviews		Who was Fire Watch when he left?
July 23 2017	4:00 PM	Welding Work was completed	Statement from Michael Kirlew (Welder)		
July 23 2017	4:30 PM	6th Gas Test Performed by Carl King	Hot Work Certificate		Unlikely to have occurred based on other known events
July 23 2017	4:39 PM	Welder Called Carl King to Notify of Potential Fire in Tank	Sol Initial Incident Report		Where did 4:39 come from?
July 23 2017	4:44 PM	Carl King Returned to the Site	J&R Near Miss Incident Report (based on Carl King's return time and J&R estimate of Carl King's Response Time)	Sol Employee interviews state that Carl King was away from 3pm to 4 pm & Gas Test was listed as performed by Carl King at 4:30 pm	
July 23 2017	4:40 PM	Carl King Placed call to 911	911 Call Centre		
July 23 2017	4:44 PM	911 Contacted the Fire Service	Fire Service Control Room Log		
<b>Key</b>					
Red Text	Does not appear accurate/possible				
	Known Time (Absolute Fact)				

## Appendix 8: SOL Contractor Evaluation Form

<b>Contractor or Supplier Evaluation Form</b>	
Contractor's or Supplier's Company Name:	
Company/Contractor's Representative	
Date	

**Ratings:** Excellent -5, Very Good -4, Good -3, Fair -2, Unacceptable -1

Please indicate the most relevant choice by placing the score in the appropriate cell below. Whenever scores of 2 or less are given, a comment is required to explain the rationale behind the score.

		Rating/ Score	
1	<b>Product/ Service</b>	Conformance to Specifications	<b>Additional Comments</b>
		General quality of products	
		Lead Time	
		On Time Delivery	
		Responsiveness to Queries	
		<b>Total</b>	
2	<b>Associated Services</b>	Ability to Respond to Emergency Requirements	<b>Additional Comments</b>
		Skills of Support Personnel	
		Accessibility of Support Personnel	
		Availability of technical documentation	
		<b>Total</b>	
3	<b>Commercial</b>	Competitive Pricing	<b>Additional Comments</b>
		Minimum Purchase Quantities	
		Payment Terms	
		Negotiable Terms	
		<b>Total</b>	
4	<b>Administrative Service</b>	Invoicing and Paperwork	<b>Additional Comments</b>
		Written Order delivery	
		Accessibility to administrative personnel	
		Dispute Resolution	
		<b>Total</b>	

Completed By:

COR-PRO-01- F-04

Rev 1

Date Issued 23/06/2016

Classified: "Internal Use"

\*\*\*\*

<b>Contractor or Supplier Evaluation Form</b>	
Contractor's or Supplier's Company Name:	
Company/Contractor's Representative	
Date	



Ratings: Excellent -5, Very Good- 4 Good - 3 Fair -2, Unacceptable - 1

Please indicate the most relevant choice by placing the score in the appropriate cell below. Whenever scores of 2 or less are given, a comment is required to explain the rationale behind the score.

Description of Job Performed or Service Provided:

DELIVERY		Additional Comments
1	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Timeliness of Performance</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> All work was completed in advance of the agreed timeframe. <input type="checkbox"/> <b>3</b> <b>Good:</b> The job was completed on schedule with the agreed timeframe. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> The majority of work was completed satisfactorily within the agreed timeframe. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> The work was completed in a time period well past the agreed timeframe. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
QUALITY		Additional Comments
2	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Quality of Work</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> Workmanship is superior and exceeds requirements. <input type="checkbox"/> <b>3</b> <b>Good:</b> Minimal problems, the majority of workmanship is good. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> The majority of work is satisfactory. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Contractor was made to redo several tasks repeatedly due to substandard workmanship. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
HSE		Additional Comments
3	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Adherence to the Company's Rules (Quality, HSE and Food Safety Standards &amp; Local Regulations)</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> Fully understands and complies at all times with all requirements, no problems. <input type="checkbox"/> <b>3</b> <b>Good:</b> Complies with regulations, minimal problems. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> In general, complies with company's standards and local regulations. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Lack of concern for safety - disregards agreed contract, not responsive to directives. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
SERVICE		Additional Comments
4	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Response to Requests/ Queries</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> All requests/queries responded to immediately. <input type="checkbox"/> <b>3</b> <b>Good:</b> All requests/queries responded to in a reasonable and timely manner. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> Most requests/queries responded to in a timely manner. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Generally non-responsive to requests/queries. If any responses, there are slow. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
5	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Quality of Housekeeping/ Project Cleanliness ( for contractors only )</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> Job area was consistently kept clean and free of trash and debris. <input type="checkbox"/> <b>3</b> <b>Good:</b> Most trash, debris cleaned up on a daily basis. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> The contractor periodically cleans up job site with minimal directives. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Non-responsive to repeated directives to clean up job site. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>Impact to Operations</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> There was no impact on the daily operation of the plant. <input type="checkbox"/> <b>3</b> <b>Good:</b> There was minimal impact on the daily operation of the plant. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> There was impact on the daily operation but downtime was not significant. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Repeated impact on daily operations or major impact resulting in extensive downtime. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
COMMERCIAL		Additional Comments
7	<b>Score</b> <input type="checkbox"/> <b>5</b> <b>The Accuracy &amp; Timeliness of the billing</b> <input type="checkbox"/> <b>4</b> <b>Excellent:</b> No errors; accurate representation of work completed. <input type="checkbox"/> <b>3</b> <b>Good:</b> A small quantity of billing errors, quickly corrected and re-submitted. <input type="checkbox"/> <b>2</b> <b>Satisfactory:</b> Some billing errors, corrected and resubmitted in a reasonable time. <input type="checkbox"/> <b>1</b> <b>Unacceptable:</b> Too many errors, frequent misrepresentation of completed work, not submitted timely. <input type="checkbox"/> <b>0</b> <b>N/A:</b> Does not apply to this job.	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

Completed by:  Date Issued 23/06/2016

QOR-PROC01- F-04

Rev 1

Date Issued 23/06/2016

*Rating: Excellent -5, Very Good -4 Good -3, Fair -2, Unacceptable -1*

Supplier Evaluation				
SECTION	SCORE	SCORE %	WEIGHTS	FINAL SCORE %
Product/ Service	0		3.5%	
Associated Services	0		2.5%	
Commercial	0		20%	
Administrative Services	0		20%	
			<b>TOTAL</b>	<b>0%</b>

IF A SUPPLIER/ CONTRACTOR SCORES 75% OR LESS THEY SHOULD BE INFORMED THAT IF THEIR SCORE IS NOT IMPROVED DURING THE NEXT THREE MONTHS, THEY MAY BE REMOVED FROM THE APPROVED LIST.

Contractor Evaluation				
SECTION	SCORE	SCORE %	WEIGHTS	FINAL SCORE %
Delivery	0	0%	30%	0%
Quality	0	0%	30%	0%
HSE	0	0%	1.5%	0%
Service	0	0%	20%	0%
Commercial	0	0%	5%	0%
			<b>TOTAL</b>	<b>0%</b>

IF A SUPPLIER/ CONTRACTOR SCORES 75% OR LESS THEY SHOULD BE INFORMED THAT IF THEIR SCORE IS NOT IMPROVED DURING THE NEXT THREE MONTHS, THEY MAY BE REMOVED FROM THE APPROVED LIST.

## Appendix 9: Typical API Decision Process for Work on In-Service Equipment

