



## CASE STUDY

OISD/CS/2021-22/E&P/04

Dt.: 28.12.2021

### **INTRODUCTION**

Title: Accident during calibration of SRV

Location: On-land Production Installation

Loss/ Outcome: Loss of Life

### **BRIEF OF INCIDENT**

In the morning, three personnel assisted by a contractual person started pressure testing of a Safety Relief Valve on the Test Bench of the installation. Suddenly a loud sound emanated and one contractual person found lying on the ground on his back and was bleeding from posterior end of the right side of head due to sustained injuries. He was administered emergency First Aid at the site and then taken to the Hospital. After preliminary examination and treatment at Hospital, he was referred to district hospital where his treatment was started and after about 30 minutes of resuscitation the patient expired. The Post Mortem was conducted same day and cause of death was ascertained due to Haemorrhage and shock as a result of injuries sustained over the body.

### **OBSERVATIONS/ SHORTCOMINGS**

Following observations were found during inquiry carried out by visit of the incident site, interaction with the related officials, their written statements thereof and available documents:

- The Installation is an Oil Collecting Station and this location has locally fabricated pressure Test Bench for annual testing & calibration of various Safety Relief Valves and is being used since many years for testing & calibration purposes. The medium used for pressure testing is compressed natural gas connected to the HP NG header by a high pressure flexible hose, maintained at 80 kg/cm<sup>2</sup>.
- The Field Engineering (FE) Department had a requirement for one SRV of 30-35 kg/cm<sup>2</sup> as a stop-gap arrangement to replace the existing leaking SRV of their newly commissioned Crude Oil Dispatch Pump. To meet the requirement, one spare SRV was collected from Oil & Gas Production Service (OGPS) department.
- The SRV under reference was Resetting type with Reset Handle and can be set to operate over a wide range of pressures. It was last tested at 140 kg/cm<sup>2</sup>. Further it was handed over to OCS with instructions as "The required set pressure is 30-35 kg/cm<sup>2</sup> and if this cannot be achieved then to set at Lowest Permissible Value of the SRV."
- The IM gave the job to the Supervisor who in turn allotted the task to the team of Assistant Operators who regularly carry out such job on Test Bench. One contractual worker was assigned to assist the team.
- As per SOP for testing of SRV available at site, the SRV testing team received Work Permit. JSA was performed along with Shift I/c & Testing team followed by Tool-Box Talk.
- The pressure gauge installed was 0-350 kg/cm<sup>2</sup> range with least count of 5 kg/cm<sup>2</sup> which was last calibrated at 260 KSC (75%).

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- As per the witness statements, after installing the valve on the test bench, one operator was in control of the root valve at the gas header, another operator was in control of the gas inlet valve at the Test Bench; Contractor worker was monitoring the Pressure Gauge and supervisor was in overall coordination. Supervisor directed to open and close both the root valve and the inlet valve at every 10 kg/cm<sup>2</sup> intervals.
- The accident happened with loud sound and Test bench fell on ground with one of the load spring of SRV detached. IP was found lying on ground on his back.
- It appears that no attempt was made to reduce the set pressure of SRV under testing before starting the actual testing. For testing at 55 KSC, the 0-350 KSC PG is too large range to monitor and 5 KSC least count seems to be difficult to read from a distance maintaining the safety zone.
- Although it was mentioned in the Work Permit that flushing and steaming of the valve performed before the test, but it was not conducted. Further, the following was found recorded in the JSA: "Set pressure of SRV at 55 kg/cm<sup>2</sup> adjusting the Spring Tension, Monitor Pressure Gauge, to follow SOP and Potential hazards: Injury to work person due to high pressure leakage at any point". The job mentioned in the 'Toolbox Attendance Sheet' was found to be of generic nature.
- The Testing and Maintenance History of the SRV was not provided to in-house testing team (Ref: Clause 10.2 (ii) of OISD-STD-132).
- Provision for installation of PRV of test bench was provided. However, the same was kept plugged. (Ref: Clause 6.1 of OISD-STD-106).
- The Fluid being used for testing is Compressed Natural Gas taken from the High Pressure NG Header, maintained at 80 kg/cm<sup>2</sup>. Water, air or an inert gas such as bottled nitrogen is recommended to be used as the testing medium (Ref: OISD-STD-132).
- The Operator was the competent person authorized by the company for SRV testing, however, none of the persons engaged in the job had any special training on SRV Testing, Maintenance or Working with Pressurized System. The IP was in a contractual job since long and was an experienced person as informed by the IM.
- The testing team performed following testing sequence: Raised the pressure from 0 to 30 kg/cm<sup>2</sup> in 3 steps of 10 Kg each and observed for 3 minutes after each incremental rise, after attaining 30 kg/cm<sup>2</sup> raised the pressure at 5 kg/cm<sup>2</sup> incremental steps and observed for 3 minutes after each increase. While pressure was gradually being raised as per the above procedure, suddenly there was a loud sound immediately after a few seconds of raising the pressure to 45 kg/cm<sup>2</sup> thereafter observed, the test bench toppled and fell on the ground. The SRV, the PG and the HP hose connection remained fix to the test bench but one of the load springs of the SRV got detached and was lying nearby.
- The SOP for testing of Safety Relief Valve is not in line with OISD-STD-132 recommendations as it doesn't specify the Testing Fluid to be used and there was no depressurization valve as mentioned.
- SOP did not have any step to determine the SRV parameters and history prior to testing.
- Safety aspects and control measures are not properly defined in the SOP.
- It is mentioned in SOP that to change of setting pressure of SRV, adjusting screw provided on the top of spring under depressurised condition only.

#### **CAUSES OF THE INCIDENT:**

- Testing of leaking SRV at high pressure was being attempted to set the pressure at lowest pressure or below the range of SRV at locally fabricated test bench employing high pressure natural gas as test medium at the installation.

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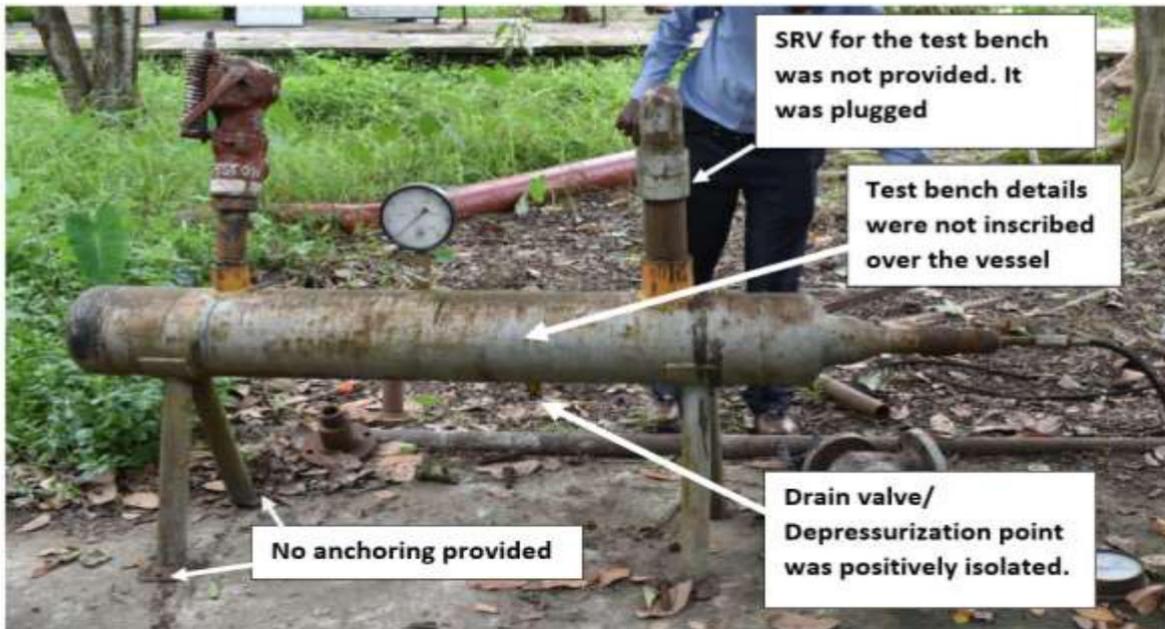
- One of the load spring of defective SRV coming out of spring retainer at high pressure resulting in sudden release of pressure with loud sound causing fall of unsecured test bench assembly and hitting the victim.
- Victim was performing job in the close vicinity of high pressure test bench having inappropriate Pressure Gauge despite the identification of potential hazard of injury to work person due to high pressure leakage in JSA.
- The depressurization point of the unsecured Test Bench was kept blinded.
- The history of SRV under testing, which was earlier set at high pressure and was kept in not-in-use condition due to leakage observed at high pressure, was not made available to testing team.
- SOP was not followed for screw adjustment of SRV in depressurized condition.
- Inappropriate housekeeping without keeping working area cordoned and presence of hard object causing head injury to the person at posterior end of right occipito-parietal region when he fell down on the ground on his back.

#### **RECOMMENDATIONS:**

- To address the causes and to avoid recurrence of such incidents, testing of SRV must be preceded by thorough inspection for any abnormality, defects, or any defective components. In case defective parts are detected, the same should be replaced with genuine OEM spares and shall be calibrated and tested under strict supervision of competent authority as per OEM guideline/ manual.
- Specialized jobs like High Pressure SRV Testing and adjusting of the pressure should only be performed by trained, highly skilled expert personnel at standard test bench set in the proper valve maintenance shops having appropriate test equipment and properly designed test block facilitates having all safety features using appropriate testing fluid only (Ref: OISD-STD-132).
- Under no circumstances Natural Gas shall be used for valve testing. Intermittent release of hydrocarbon during testing not only poses safety hazard but also creates environment and health hazard for persons working in the vicinity due to its discharge at ground level. To avoid any catastrophic failure/ damage in future, this practice should be stopped immediately. Water, air or an inert gas such as bottled nitrogen is generally recommended for use as testing medium for pressure testing of SRV.
- The test bench should always be kept properly grounded / anchored for high pressure tests and area should be properly guarded. Barriers/shielding must be used particularly for high pressure gas tests.
- No safety by-pass like plugging of Depressurization nozzle shall be allowed. Such safety points shall be thoroughly checked prior to testing.
- Only those pressure gauges shall be used, which were calibrated within the previous six months. The selection of Pressure Gauge shall be such that the operating range falls in the middle 1/3rd of the dial. That is, the maximum range shall be double the operating range to enable reading the gauge correctly.
- Working area should be kept free from all trip and slip hazards.
- A 24-hour availability of ambulance should be ensured for emergencies.
- The valve Data-History card must be maintained for all Safety Relief Devices. Any Pressure/ Safety Relieving Devices without past history should not be used unless thorough servicing of the valve is performed.
- No attempt should be made to set any Safety Valve outside the OEM specified pressure range.

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- SOP should cover the Risk Mitigation measures in addition to the step by step procedure of the job and should be in line with the OISD-STD-132 and API-RP-576
- Work permit system should be strictly adhered to at all times and it should be issued only after completing the checklist of the work permit. Judicious implementation of the work permit system can prevent many incidents.
- Job Safety Analysis should be done by a multifunctional team. It should include all hazards associated in performing the job and their mitigation measures.



**Fig: The Test Bench**



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