

CHALLENGES TO CONSIDER WITH OFFSHORE MEASUREMENT

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INTRODUCTION

Gas and oil measurement has a well-documented list of challenges to consider when designing and operating measurement systems for optimum accuracy and repeatability. Offshore measurement should account for these same challenges while factoring in the role that preparation, safety, transportation, and weather play for a technician to perform the job of meter inspections, repair, calibration/proving, and sampling. This paper will address these various topics to help a technician perform the job while ensuring the trip is successful.

PREPARATION

One of the challenges with offshore measurement is due to the technician only being able to carry a limited amount of equipment with him. This challenge makes it imperative the technician be adequately prepared for a trip which may last only a few hours, to several days at a time. Depending on the operator and the number of platforms the technician is required to visit, this may mean the technician must carry a variety of tools, test equipment, and other items to complete all scheduled tasks.

When preparing for an offshore trip, it is advised to contact the operator to confirm if all wells are flowing, if the platform is experiencing any specific measurement issues, or other production issues which could prevent the technician from completing the scheduled work. Preparing in this way may allow the technician to order any additional parts and potentially have them shipped to the platform and reduce the amount of equipment needed to be carried offshore. When contacting the operator, it is also advised to confirm which method of transportation will be used to get the technician to the platform.

TRANSPORTATION

Since offshore platforms, in the Gulf of Mexico, can be located between a few miles off to over 100 miles off the coast, transportation to the platform is only possible by boat or helicopter. Both modes of transportation have unique challenges and different opportunities. Both situations require the technician to be informed, properly briefed, and aware of how to respond in the event of an emergency. Since the technician will not have the convenience of carrying all his tools and equipment in his truck, he must know what he can, and cannot take on the boat or helicopter.

When travelling by boat, the technician can take more equipment since there are fewer (if any) weight or space limitations. The challenges to travelling by boat are the time it takes to get to the platform and how the technician must get himself, and his equipment from the boat. Crew boats vary in size and speed, but all crew boats are considerably slower than helicopters which adds to the time it takes to get to and from the platform. Transferring from the boat to the platform can be done using a crane with a basket lift or swinging from the back of the boat onto the platform using an attached rope commonly referred to as the 'monkey line'. When using a crane and basket lift, the technician load his equipment and self onto the basket and wait for the crane operator lift him up to the platform. If the technician must use the monkey line, he will swing from the back of the boat onto the lower deck of the platform. This method requires timing the jump from the back of the boat so he lands safely. Whether being lifted by the crane, or swinging from the line, the technician must wear a life preserver for safety.

When travelling by helicopter, the technician must be extra diligent with pre-planning the trip and understand the scheduled work to be performed and additional repairs which may be needed. This is because the helicopter is limited with space and weight constraints. While a helicopter is a quicker and more efficient means of transportation, it is limited to the amount of cargo, and people, it can carry. Just like boats, helicopters for offshore transport vary in size and capability. Every person and piece of equipment must be evaluated and approved by the pilot prior to take off. Cargo and personnel must be carefully arranged and loaded to ensure the helicopter's center of gravity is maintained. If a technician is expected to collect and transport hydrocarbon samples, a proper manifest must be completed to comply with Department of Transportation (D.O.T.) requirements. Transportation of hazardous materials in a helicopter is allowed, however, if the proper documentation and labelling to identify the samples is not completed, fines can be issued to the technician and the pilot.

Boats and helicopters are exciting ways to travel to your offshore platform, and both are very expensive to operate. Exact costs will depend on the size and type of vessel or aircraft, but both will run thousands of dollars per day to operate. A

typical crew boat may cost between \$4,000 - \$5,000 dollars per day plus the cost of fuel. This same crew boat may burn between 80-100 gallons of fuel per hour. At the time this paper is written, the range of marine grade diesel was ranging in price between \$3.40 - \$5.10 per gallon across various ports along the Gulf Coast. A helicopter will also cost thousands of dollars per day to operate plus flight time. Flight time is the length of time the helicopter is in use and can cost in excess of \$1,000 per hour.

SAFETY

Safety must be a priority when working on an offshore platform. In most cases, safety training and certifications are required prior to working offshore. This ensures all personnel have the knowledge and skill necessary for safely travelling and working offshore. Only basic medical care is available offshore, and if an accident were to occur the necessary medical attention could be hours away. Being aware of your surroundings, weather, and associated hazards is critical to safe work offshore. The physical demands of the offshore environment (excessive stair climbing, swinging onto boats, heavy loads, heat, cold, high winds, etc.) require the offshore worker to be in good physical condition, flexible, and able to work under difficult situations.

Standard personal protective equipment (PPE) is required when working offshore. This can include fire retardant clothing, hard hat, safety glasses, gloves, and steel toed shoes. One may also need to consider additional safety clothing specific to cold weather, like insulated coveralls or water repellant hypothermia jackets. A measurement technician may also be required to supply his own life jacket for transportation to, from, and between platforms. It is the measurement technician's responsibility to know what PPE is required when working offshore; each platform, and operator, may have different requirements.

Upon arrival at your destination, you must sign in with the person in charge. A platform orientation will be conducted showing the safety hazards, audible alarms, and reporting stations for each individual platform or drilling rig. It is imperative to know where to go on the platform if an alarm sounds. Some platforms require a written step by step description of the work that will be performed, safety hazards, and preventions. This is commonly known as a job safety analysis (JSA) and is a good habit regardless of the work location. Communicate all work being performed to the person in charge so he can let you know if your work could affect the platform's normal operation, personnel safety, or environmental impact. Always notify the person in charge when your work is complete and sign out when leaving the platform.

Safety is everyone's responsibility. Knowing the location(s) of first aid supplies, survival kits, evacuation routes, life rafts, and other emergency procedures is paramount for everyone's survival in an emergency offshore. All personnel should feel comfortable identifying and correcting potential hazards, and always be willing to cooperate in an emergency.

WEATHER

Weather may be the toughest and unpredictable challenge to consider when working offshore. Weather conditions offshore can change rapidly and with little warning. High wind, rain, and other weather patterns can develop quickly and, at times, "out of nowhere". Weather will affect transportation, the ability to perform certain work, and can even shut in all production.

Transportation is greatly affected by bad weather. Fog, high winds, heavy rain, sleet, and lightning will restrict helicopter flight. Even a hot, perfectly calm day can impact helicopter transportation since it will reduce the weight the helicopter can carry! Helicopter flight is regulated the same way as airplanes, and all safety precautions, considerations, and regulations are in place to ensure passenger and pilot safety. Weather can also impede boat transportation. While crew boats and supply boats can travel in the weather conditions previously mentioned, high or rough seas may limit the boat's ability to travel. Weather can be erratic and irregular across offshore environments; the weather at the heliport or boat dock may not be the same as the weather at the destination platform. Patience and flexibility are required when waiting out the weather for transportation.

A measurement technician's work can also be impacted by the weather. High winds can make calibrating chart recorders or pulling liquid samples difficult due to the risk of losing the chart or spilling the liquid. Rain will make working with certain electronics difficult. If a transmitter, remote terminal unit (RTU), flow computer, programmable logic controller (PLC), or other electronic measurement equipment gets wet it may not operate properly or become inoperable altogether. Seasonal weather, like high winds in the winter and high humidity in the summer, can make working conditions difficult and add to the amount of time it takes to complete certain tasks.

In the most extreme offshore weather conditions, like a hurricane, production may be shut in. If there is a risk of high winds and/or high waves damaging a platform, all wells will be shut in to prevent leaks and spills into the environment. In these situations, all personnel will be evacuated from the platform prior to the hurricane entering the area.

DESIGN/INSTALLATION

Measurement system design and installation is an important factor in the overall measurement system performance. Standards exist for measurement equipment and system design, operation, and maintenance, and these standards should be referenced, and followed for offshore measurement applications. However, additional factors should be considered. Space is a premium on an offshore platform and is certainly finite. Weight is also a factor to consider when designing a measurement system for an offshore platform. Like any structure, an offshore platform will have weight limitations in place for each area and level. Space and weight should always be considered, and extra efforts taken to minimize both, in offshore applications. The following table represents a list of considerations for design, installation, and operation of measurement equipment in offshore applications.

1	Design and plan before construction or modifications to the platform begin. Consider the location of tubes, vibrations, paint quality, and probe installation, flanged tubes, inspection end caps, proving requirements, and size.
2	Determine the anticipated fluid flow rate to allow properly sized meters and transmitters to be installed for the most accuracy.
3	Ensure all equipment is accessible for operation, maintenance, and repair. Locate cranks, valves, fittings, etc. in a practical position.
4	Be aware of the corrosion problems in an offshore environment. Install measurement equipment in buildings, or under cover when possible. Using stainless steel fittings, housings, valves, etc. will minimize maintenance and replacement costs.
5	Ensure that there are enough taps located in the upstream and downstream piping to satisfy all users (transducers, samplers, flow controllers, check measurement safety devices, etc.).
6	Ensure the meter tubes are flanged upstream and downstream. The benefits of flanged tubes are ease of inspection, fast installation and less downtime for production.
7	Consider if the orifice fitting will be positioned to roll the plate up (vertical), or roll the plate out (horizontal). Vertical fittings offer ease of repair and additional ports for check metering. Horizontal fittings may prevent liquid freeze in the taps.
8	Inspection ports on each end of the meter tube will allow for periodic inspection with little or no loss of production.
9	Installing flow conditioners will reduce the length of upstream meter tube required, prevent turbulent flow, and give a better fluid profile.
10	Install a check meter to monitor and verify all custody transfer measurement. The check meter is an excellent investment to recover revenue.
11	Avoid liquid traps in gas meter tubes and gas traps in liquid meter runs. Gas/Liquid traps can cause measurement error.
12	Use direct mount manifolds instead of stainless steel tubing, or gauge lines, when possible.
13	During platform inspection or when micrometer readings are taken, operate all meter run valves and orifice fittings to ensure the integrity of the moving parts.
14	Keep a file of all engineered drawings, spec sheets, and meter tube micrometer sheets for future inspections.

Table 1. Design, Installation, Operation Considerations for Offshore Measurement

Without the practical input from experienced measurement personnel, many companies leave themselves open for major production losses and measurement discrepancies if proper design and installation efforts are not made.

CONCLUSION

The same measurement standards, guidelines, considerations, and challenges that apply to onshore measurement also apply to offshore measurement. The additional considerations and challenges of space, weight, transportation, weather, planning, and communication make the measurement technician's job more difficult. Training, experience, and attention to detail will allow a measurement technician to successfully plan his trip offshore, perform the required work, and identify potential measurement issues before the issue turns into a bigger problem.