Safer TANK CLEANING

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Safety procedures and practices related to oil tank cleaning activities have always been precarious. Despite the fact that some recommendations and procedures are available from international bodies and from private companies as well, the real picture is that 'best practice' in tank cleaning safety has not developed in parallel to the technological advancements of the past decades. It is true to say that, generally, safety in tank cleaning practices has always remained far behind the technological progress achieved in other disciplines involving operations for oil storage and transportation.

The present need for handling very large volumes of oil have led to strong demands in terms of safety for the construction, operation and maintenance of large storage facilities. In this regard, tank cleaning is required to be practiced more effectively and more often to secure high availability of storage capacities.

Large steel tanks with long residence time allow small impurities and wax particles to settle. In the early days, tank cleaning was triggered mainly by the need to remove the unwanted buildup of sludge, allowing for the possibility of prescheduled tank cleaning operations. On the other hand, unexpected situations such as tank leakages and other tank mechanical failures called for unscheduled cleaning of tanks in order to avoid accidents. To prevent this problem, international bodies and private companies have issued recommendations and procedures to inspect tanks at specific intervals. Prescheduled tank inspections depend on the nature of the products handled and the operational environment of tank farms. The unavoidable fact is that mechanical inspections require putting the tanks out of service, emptying them and removing the sludge. Furthermore, the internal surfaces have to be cleaned and prepared for inspection before mechanical works can begin.

Figure 1. Unlike manual tank cleaning methods, which involve working inside the oil storage tanks, Oreco's BLABO system is a non-man entry solution. Here the BLABO system is in action at a site in Mexico.

Figure 2. The BLABO system is constructed to operate in potential hazardous areas and meets the highest international safety standards and directives. The BLABO system, shown here operating in Bulgaria, is the first fully ATEX certified tank cleaning system.

Unfortunately, cleaning practices have not really developed in parallel to the theoretical requirements for periodical inspections, and as previously noted, tank cleaning practices certainly lag behind present technological advancements. Improvements have taken place mainly around manually operated automatic or semi automatic tools, for example the utilisation of vacuum trucks and hydroblasters that allow faster emptying of sludge and cleaning of internal surfaces. Regarding safety, improvements have taken place mostly in the field of personnel protection, with measures such as human protective clothing, breathing apparatus and gas measuring devices for personnel working inside oil tanks. Paradoxically, the technology exists today to eliminate the presence of personnel inside tanks prior to and during the cleaning processes.

The situation of safety in tank cleaning

In general terms, all process equipment at refineries and tank farms today have to live up to some of the strictest demands when it comes to operational and maintenance safety. Any accidents are evaluated by safety boards. New regulations are often introduced and no changes to existing processes or introduction of new equipment are completed without a deep and thorough health, safety and environment (HSE) assessment. The specific aspects of safety are intrinsically linked to the concepts of HSE as a whole.

When it comes to tank cleaning, the HSE assessments are based on old information and practices. If those involved were to wipe the slate clean and start over with the technical knowledge of today, they would most probably end up with a very different approach to the practices and safety procedures for tank cleaning.

As an example, present best practice in the handling of safety issues requires the execution of a thorough risk analysis. In theory, one should first do everything possible to avoid human exposure to a specific danger. Personnel should only be exposed to a dangerous environment once it is assessed to be unavoidable, and action should be taken to equip personnel with the best possible physical protection.

In tank cleaning practice, human presence inside tanks is very common, and the fact is that this is only possible by neglecting very basic safety principles such as the one described above. The question could be put as to whether this is done because of lack of knowledge or because investing in protective clothing, breathing apparatuses and personal safety devices to send a crew inside an oil tank to perform manual cleaning is cheaper than investing in a state of the art system based on non-man-entry?

'Creative' safety practices

Whenever a rule is imposed there will always be a 'creative' someone who discovers a way to bypass that rule. This applies in law, accounting, ethics, the environment, and in industrial regulations as well. Safety procedures are no exception. With the development of stringent safety procedures, calling for a specific approach to potentially explosive atmospheres, there will always be 'creative' souls trying to avoid compliance, either by downgrading artificially the potential risk or by deliberately neglecting

it. Tank cleaning practice is not the exception to the rule. Even when the technology is available today to perform tank cleaning without human presence inside the tanks, the most common practice worldwide is still manual cleaning. It could be argued that tanks are ventilated to a specific level, to minimise concentration of hydrocarbon vapours, thereby reducing the human exposure to toxic substances; however, the harsh working environment for those working inside storage tanks can only be described as unacceptable in the year 2007.

The market today offers a number of different tank cleaning processes which claim to be more or less 'non-man entry' and they involve different philosophies for tackling the problem. Some companies perform what is best described as 'sludge reduction' rather than tank cleaning. They employ either nozzles or agitators or introduce chemicals that will hopefully liquefy the sludge. This is a relative improvement because it reduces up to a certain level the need for human presence in the tank, where the working environment is unacceptable.

Specific safety requirements

The following are some of the issues that should be taken into consideration when performing a HSE assessment connected to cleaning crude oil tanks. The approach is based on the fact that safety practices in tank cleaning should be at the same level as those already implemented in the rest of the processing or storage facilities.

Health issues

- All personnel should undergo thorough and comprehensive training in operating the process system and in safety procedures.
- All personnel should undergo thorough training in working within potentially explosive and hazardous environments. Full theoretical and practical understanding of operations under presence of dangerous gases, liquids and solids should be secured through stringent tests and simulations.
- Pollution sources derived from tank cleaning posing a health risk to neighbouring areas should be minimised or eliminated.
- Comprehensible drugs and alcohol policies should be implemented and monitored on personnel working within hazardous areas.

Safety issues

- The tank cleaning system should meet the same regulations and procedures as the rest of the facility, either being a refinery or a tank farm. These include regional or local standards such as ATEX in the European Union, UL in the USA and CSA in Canada. These call for an overall explosion proof installation where all electrical equipment, instruments and control meet the standards in accordance to the area they are positioned. Furthermore, under ATEX regulations, all potential sources of ignition, including heat generation, have to be eliminated or fitted with safety devices.
- LEL and H_2S measuring devices should be positioned in areas where personnel can be exposed to hydrocarbon vapours to warn the operator.
- All process equipment and piping with high temperature surface should be properly insulated.
- The use of fire protective clothing, helmet, gloves, antistatic footwear, safety glasses, etc. should be enforced without exception.
- All moving parts should be protected by mechanical covers that cannot be opened without tools.
- Tank blanketing with nitrogen or another inert gas to reduce oxygen levels below 8% should be practiced without exception. This prevents the risk of explosion, especially if static electricity builds up either when using nozzle jetting, liquid mixers or while pumping liquids. Proven sources of accidents have been identified as sparks produced by buildup of static electricity generated by liquid jet streams, turbulence on liquid surfaces and high velocities of fluids in piping.
- As with other production facilities, the cleaning system should be equipped with a continuous monitoring of the process and automatic shutdown if any sudden dangerous situations occur.
- To eliminate risk from sparks, all external piping and process equipment should be electrically grounded to the same point as the tank in order to ensure that both tank and cleaning equipment have the same electrical potential at all times.

Environmental issues

- Contamination to atmosphere due to venting of oil tanks should be, if not eliminated, reduced to a minimum. One possible way to reduce it is to vent the tanks at a point in time when hydrocarbon concentration is low.
- Contamination to soil, air and underground water caused by the extraction and disposal of oily sludge should be eliminated or minimised through the separation of hydrocarbons and inorganic matter. This will reduce environmental impact and reduce costs for final disposal.
- Contamination by polluted oily water should be eliminated or minimised by removing the presence of hydrocarbons. Further water recycling should be practiced in order to economise the total volume of water used in tank cleaning.

Other important issues

- Recovery of hydrocarbons should be practiced. Furthermore, the recovered hydrocarbons must not cause technical disturbances when introduced to the processing plants. This calls for an evaluation of the quality of the recovered hydrocarbons with regard to BS&W and any possibly added chemicals.

Conclusion

The BLABO® technology developed and produced by Oreco considers all aspects of tank cleaning with the highest focus on safety, environment and health. All of the above HSE requirements are met by the BLABO system. The whole procedure takes place under tank blanketing with an inert gas, eliminating ignition risks at all times. Furthermore, the removal of sludge is effectively achieved with automated systems without requiring the presence of personnel inside tanks. Finally, but not less importantly, the potential polluting streams are reduced to the minimum due to recovery of more than 95% of the hydrocarbons present in the sludge. The BLABO® process is fully built under ATEX regulations and can proudly state that is the first system worldwide to achieve such a distinctive HSE level.