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Pipe stress — More than you think

Pipe stress is always a consideration and is governed by the ASME Code at industrial facilities. To a great extent it is not known what the range of problems associated with pipe stress really is. It is not well understood what should be included in a pipe stress analysis and the real world details that affect the results. Issues and seminars are available to address pipe stress and discuss the code, but in many cases the details that are present in production that affect the design are not discussed.

Many entities have rules governing when pipe stress should be performed on a particular project, such as, "An evaluation below 250 F or below 3 inch nominal diameter is not required to perform a pipe flexibility analysis for nonlethal services." These statements have good intentions, but can allow problems to go undetected.

Several years ago I worked on a problem concerning a maintenance issue with water circulation pumps. The pumps would misalign and vibration would start, sometimes the pumps would wreck. The temperature was only 180 F and the pressure was only 100 psi. Pipe stress should not be a problem right? Wrong. It was a pipe stress problem and it was simple — the pipe was 48 inches in diameter and it was close coupled to the pumps. There was no room for thermal expansion, and the large pipes would push the pumps around, causing failure and downtime.

A good analysis is fine, but what if it is not installed right in the field? One famous case in the business occurred after all inlet high temperature pump inlet lines were analyzed, constructed and put into service. Pipe supports failed, pumps were misaligned and overall some interesting challenges occurred. The solution was simple — the "locking pins" that should have been removed after construction were left in!

There are other cases where things are not so easy. In some systems, under transient conditions, hot streams can meet colder steams causing low cycle thermal fatigue. In another case, a compressor train worked fine for months, but when a heavy rain occurred, heavy vibration was experienced that would sometimes shut the plant down. The problem was the temperature changes would cause the drive turbine to move enough to cause vibration.

One of my favorite "pets" when we are doing failure analysis is observing the disconnect between the pipe stress and structural designers. Most often pipe stress engineering will incorporate all these theoretical restraints and anchors. Unless otherwise accounted for, the numerical model assumes a numerical valve of "0" displacement at these points. Based on that displacement a load is calculated and given to civil engineering to design supports to meet design specifications. The structural engineers will then use that load but allow deflection. When the unit is installed in the real world, load transformation occurs where the loads may be higher on the equipment nozzles because the supports that were intended to have little displacement move instead of having "0" displacement.

One lack of understanding in the business is the belief that only the normal design conditions should be evaluated and any unusual stuff will be taken care of during operation and startup. This is not always true! One example is acoustical analysis of piping systems. It is known in industry that reciprocating pumps and compressors can cause vibration in piping systems. Ignorance is not an excuse when these systems are installed and fail. The design never met code if it was installed without an acoustical analysis. Another good example is pressure relief systems. In many cases, when a relief valve blows down the transient pressure-momentum conditions cause a dynamic impulse that can break supports or damage equipment. These loads must be calculated and accounted for in the mechanical design.

The load cases that must be considered include but are not limited to thermal, pressure, wind, occasional, earthquake and miscellaneous loading.

The major problem with piping and its connection to rotating equipment is not that the pipe will break, but that equipment nozzles will be overloaded. It is recommended that a qualified pipe stress engineer should review every critical piping system in an industrial environment.

For more information, visit www.knighthawk.com or call (281) 282-9200. ●

Pilot program to allow E&P waste at Type I landfills

BATON ROUGE, La. — The Louisiana Department of Environmental Quality (DEQ) is currently conducting a pilot program to allow exploration and production waste, also known as E&P waste, to be disposed of at three Type I landfills, which are designed to accept industrial solid waste. E&P waste is waste that is produced during oil and natural gas exploration and production. It includes drilling mud and waste derived from cleaning up oil spills.

Louisiana regulations state that E&P waste may be disposed of at facilities approved by the Department of Natural Resources or at a facility designated by DEQ. In July, DEQ issued administrative orders on consent allowing three facilities that are currently permitted to accept industrial solid waste to temporarily accept what is commonly called E&P waste. Those landfills are Riverbirch and CWI-White Oaks in Jefferson Parish, and LaSalle/Grant in LaSalle Parish.

All landfills in Louisiana that are permitted to accept industrial solid waste have liners, groundwater monitoring systems and leachate collection systems. The permits for these facilities have testing parameters in place to monitor the leachate, groundwater and surface water. The areas of contamination require additional parameters to be monitored.

Prior to the administrative orders, there were no landfills in Louisiana that were allowed to accept E&P waste. However, DEQ is allowing the three Type I landfills to accept the industrial solid waste because of the increased oil and gas production in the state, the proximity of landfills capable to accept industrial solid waste and the environmental regulations placed upon these landfills.

Under state regulations, E&P waste is under the jurisdiction of the Department of Natural Resources. However, the Department of Natural Resources regulations provide for the option to dispose of E&P waste in a DEQ-approved landfill. Once E&P waste is disposed in a DEQ-regulated landfill, it becomes subject to DEQ's solid waste regulations.

For more information, visit www.deq.louisiana.gov or call (225) 219-3964. ●