

## Predicting Root Cause of a Fire Incident through Transient Simulation

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**Abstract :** In a fire incident involving a Nitrogen storage tank that over-pressured and exploded, resulting in a fire in one of the units in a refinery, lack of data and evidence hampered the investigation to determine the root cause. Instrumentation and fittings were destroyed in the fire. To make it worst, this incident occurred during the COVID-19 pandemic, making collecting and testing evidence delayed. In addition to that, the storage tank belonged to a third-party company which requires legal agreement prior to the refinery getting approval to test the remains. Despite all that, the investigation had to be carried out with stakeholders demanding answers. The investigation team had to devise alternative means to support whatever little evidence came out as the most probable root cause. International standards, practices, and previous incidents on similar tanks were referred. To narrow down to just one root cause from 8 possible causes, transient simulations were conducted to simulate the overpressure scenarios to prove and eliminate the other causes, leaving one root cause. This paper shares the methodology used and details how transient simulations were applied to help solve this. The experience and lessons learned gained from the event investigation and from numerous case studies via transient analysis in finding the root cause of the accident leads to the formulation of future mitigations and design modifications aiming at preventing such incidents or at least minimize the consequences from the fire incident.

**Keywords :** fire, transient, simulation, relief

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