

# AMMONIA STORAGE EXPERIENCE

In considering American Tank & Vessel's (AT&V's) experience associated with the design, fabrication, and erection of ammonia storage tanks and facilities it is important to categorize our experience under the following:

- Hydrocarbon liquid storage concepts and experience
- Refrigerated and cryogenic storage concepts and experience
- Ammonia as a product experience

In dealing with general storage projects that may be flammable and/or hazardous AT&V has over forty (40) years of experience. (See 40 Year History). Senior members include an engineer that designed the first operating flat bottom LNG tank in the world, as well as other unique structures for hydrocarbon storage as a liquid and/or a compressed gas.

Starting almost thirty (30) years ago AT&V pioneered advanced designs in the storage of LNG, CNG, LIN/LOX, butane, propane, ammonia, and hydrogen technology. AT&V realizes the importance of advancing the technology associated with our industry and participates in committees associated with tanks and vessels under API-650, API-620 and other recognized codes. In addition, AT&V's staff has associations with API, NFPA, AWS, NACE, ASME, ASCE, and other leading organizations.



In addition to participating within industry organizations, AT&V has pioneered technology since 1991. Dozens of designs were developed as proprietary technology and as patented technologies to improve hydrocarbon storage. These improvements involve safety, emissions, life of structure improvements, process, and innovations in energy storage. A separate chart has been attached to this document showing the technology history developed at AT&V. Technologies associated with welding, fabrication, scaffolding, forming, and construction equipment have also been developed at AT&V but are not published within the timeline.

The second component to be considered with the storage of

ammonia is experience associated with API-620. Appendix R and refrigerated products. AT&V has been designing, fabricating, and constructing API-620 tanks for almost thirty (30) years with staff experience exceeding this timeline. Please refer to the AT&V project list provided with this document. AT&V's approach to API-620 tanks often includes aspects of the foundations, insulation, piping, venting, pumps, and painting. Engineering disciplines incorporate thermal performance, process issues, seismic impacts, as well as a variety of traditional operational parameters and customer required design impacts. Attached with this document is a list of some of the API-620 projects that have been designed, fabricated, and built by AT&V.



AT&V's application of API-620 to the storage of refrigerated projects includes single wall and double wall structures, as well as spheres and flat bottom tanks. In addition to the base designs, AT&V's improvements in fabrication resulted in better quality and lower cost of construction.

The third component of experience associated with ammonia deals with the ammonia product itself in reference to storage, as well as processing. AT&V's experience associated with ammonia starts more than fifteen (15) years ago and today. Incorporates knowledge associated with the storage tanks, boil-off compressors, flares, outbound vaporizers/heating systems, insulation systems, instrumentation, submerged pumps, process piping, and more. In dealing with the storage tank, AT&V supports over half a dozen different designs from single containment to full containment. Full containment can incorporate steel or concrete shells and even concrete roofs.

In dealing with ammonia storage AT&V has experience associated with the reactivity and corrosive issues, welding technology and metallurgy, suppression and fire control, risk

assessment, as well as innovative technology to improve construction schedules of ammonia storage tanks and reduce cost. The general description of capacities and experience referenced above are supported by AT&V's corporate history of constructing 4,000 + projects in thirty (30) countries including turnkey terminals. For more general information about AT&V and experience associated with unique structures for the storage of hydrocarbons please refer to AT&V's Global Services 2023 Renewable/Green Energy Presentation.

## FOR MORE INFORMATION

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