Case Study: Diffuser Optimization
High Performance Vent & Blow-off Silencers

PROJECT DESCRIPTION
A research facility operated a noisy, high pressure relief system in support of their testing activities, venting to atmosphere several times throughout the day. The facility was located in a mixed land-use area, with adjacent residential receptors on two sides of the property. The vent outlet was approximate 30 ft. above grade, and of particular concern given the location and importance of the facility.

APPLIED RESEARCH
VAW initiated a study in order to assess the potential diffuser options. Key components of a vent and blow-off silencer include: a high pressure flanged diffuser assembly (single or multi-stage diffuser), expansion plenum, and a sound absorbing baffle section with an abrupt termination into atmosphere. VAW Systems has continually focused on the optimization of both the diffuser and the sound absorbing section in order to provide the industry with a high performance silencer package. The diffuser’s openings (e.g., small holes or slots) and orientation deliver a level of porosity in order to disperse the impulsive pressure load in a safe, acceptable manner into the plenum section. VAW Systems’ diffuser technology helps reduce the need for large absorber sections, resulting in smaller and lighter product installations in the field. Size and weight are key design components, in terms of minimizing the structural support and wind loading concerns. The aerodynamically enhanced internals help avoid system efficiency issues. The study involved both applied testing in the field and research within the VAW Noise Control Applications Laboratory. The field measurements defined the actual sound power radiation of the source, under the facility’s worst case operating condition. In addition, the field work delivered real-life pressure relief conditions for the diffusers under study. The controlled laboratory work ensured that the optimal diffuser design approach was used, correlating the noise reduction values obtained in the field.

ENGINEERED SOLUTION
Using both the field data and the laboratory testing, VAW Systems obtained reliable and repeatable results as part of a comprehensive aero-acoustic study. The optimal design package met the noise criteria for the applicable installation using a compact silencer package. Overall, under a range of diffuser porosities, VAW Systems’ derived the corresponding acoustic performance for these novel designs. With relatively low back-pressure applied to the stack system, the diffuser was optimized, and will support the complete vent silencer package.