In order to limit operational vibrations of large mechanical and electrical equipment, the use of isolation/restraint systems often becomes necessary. The failure of vibration-isolated equipment has been observed in almost every earthquake in the US in the past 40 years. The loss of functionality of essential facilities, such as hospitals, caused by equipment failure creates both life-safety concerns and financial loss. Failure of vibration isolated emergency backup generators resulted in the death of one life-supported patient in the Sylmar hospital during the San Fernando Earthquake in 1971. Without functioning HVAC systems, hospitals can simply not operate efficiently. The unique challenge for vibration engineers is that isolation requirements for equipment often come into conflict with good seismic behavior.

Codes + Implementation + Qualification = Risk Reduction

Jim Carlson, Omaha Public Power District, Member, ASHRAE TC 2.7 Seismic and Wind Restraint Design

Abstract

There are many issues involved with the design and installation of non-structural components that are required to be resistant to earthquakes and high winds. The codes need to be further refined to provide clear guidance to building officials. Without clear guidance, the industry will struggle with different interpretations. Once the codes are comprehensive, the implementation by the building officials must be flexible and include training. The last part of the equation is the performance of the contractors to properly install the seismic devices and the manufacturers to provide qualified equipment. This has been done in the nuclear industry for decades with positive results as shown in their performance in recent earthquakes. Qualification of equipment by testing and analysis is being addressed by industry in the form of standards. All of these combine in reducing the risk associated with the after effects from earthquakes.

Biography

Jim Carlson has 26 years of experience in the HVAC industry and nuclear facilities. He has implemented seismic restraint design for commercial and nuclear applications and is a certified seismic capability engineer for SQUUG applications as identified by the U.S. Department of Energy.

Mr. Carlson is past chairman of ASHRAE’s Seismic Restraint Design Task Group and current chairman of the ASHRAE research oversight committee. He is also the instructor for ASHRAE’s three-hour short course entitled “Seismic Restraint Design.”

He is a member of the ASHRAE consortium, the ASCE 7 TC-8, and Earthquake Engineering Research Institute (EERI). He is working with ARI to develop a seismic qualification standard. And he has been involved in developing the project plan with the UCSD, GOALI research project to test piping, ductwork, conduits and equipment in a full size building.

Mr. Carlson received ASHRAE’s Technical Achievement Award in 2000, and authored three seismic restraint best practice manuals for FEMA (FEMA 412, FEMA 413, and FEMA 414). He also created a 12 hour Professional Development Seminar on “Seismic Restraint Design” and is President of the Seismic Source Company.