

MRI Sound Isolation

Posted on: 5.3.2011 Posted by Benjamin Davenny

Magnetic Resonance Imaging (MRI) systems are capable of generating high sound levels in MRI rooms, which can be transmitted to adjacent spaces. The most prevalent systems contain 1.5 and 3.0 Tesla (T) magnets, which have measured maximum sound levels approximately between 90 and 100 dBA (A-weighted decibels). 7T magnets are beginning to appear in clinical use, but measured sound data for these machines is limited.

The frequency content of the sound generated by MRI systems typically peaks in the mid-frequencies, between 500 Hz and 2,000 Hz. Mid-frequency sounds are easier to attenuate with building constructions than low frequency sounds from building mechanical systems. However, the sound levels and tonal character of MRI sounds require significant building constructions.

Sound isolation measures should be integrated with the radio frequency (RF) and magnetic shielding enclosures to reduce sound transmission to adjacent areas. Concern for adjacent spaces, that is rooms that are not directly connected to the function of the MRI, include spaces vertically adjacent and horizontally adjacent to the MRI suite.

Noise transmission to spaces below the MRI can be reduced with a resiliently suspended gypsum board ceiling above the finished ceiling. Spaces above the MRI can be protected from MRI noise by wrapping the gypsum board of the enclosure walls above the MRI room finished ceiling, creating a gypsum board box inside the RF shielding.

Horizontally adjacent spaces of the MRI suite can be protected by constructing a separate wall outside of the shielding wall with an airspace between the two walls. Spaces within the MRI suite have greater tolerance for MRI sounds and have elements in the building construction that limit the performance of the walls, such as doors, windows, and waveguides.

MRI systems can also transmit sound via structureborne noise transmission. Vibration of the magnet is transmitted to the magnet feet and then to the floor, and is reradiated as airborne sound in spaces below as well as horizontally adjacent spaces. Structureborne noise transmission is much easier to reduce when the magnets are located on slab on grade, where the supporting structure is more stiff and massive than on framed floors.

All MRI magnets should be mounted on the manufacturer's recommended vibration isolation system. Some cases of magnets installed on framed slabs require a two-stage isolation system involving the manufacturers' isolation pads, intermediate stainless steel plates, and a second layer of pads below the steel.

Ben Davenny, INCE Bd. Cert., LEED AP BD+C, EDAC, is a Senior Consultant at Acentech Incorporated. Ben's acoustics consulting focuses on architectural and environmental acoustics, and HVAC noise and vibration control. He is a LEED Accredited Professional with the Building Design + Construction specialty. He has also earned the Evidence-Based Design Accreditation and Certification (EDAC) credential from the Center for Health Design, demonstrating his commitment to using research evidence to inform the design of healthcare facilities. His recent healthcare projects include New 5-story Addition at Woman & Infants Hospital of Rhode Island; Mugar Patient Addition at Cape Cod Hospital; and MRI Suite at the VA Medical Center in Providence, RI.

Contact Ben at 617-499-8039 or bdavenny@acentech.com