Economics Of Ferromagnetic Detection

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Major projectile events (floor polishers, medical gas cylinders, large equipment) jeopardize the safety of patients and staff, as well as millions of dollars of MRI equipment.

The most comprehensive peer-reviewed paper that quantifies these projectile accident risks (Chaljub, Kramer, et al) identified the rate of major projectile accidents during the year 2000 at one accident for every six years of MRI operation. The authors, based on significant increases of accidents at their facilities, speculated at the time that this accident rate was increasing, meaning that the average time between these major accidents was actually less than six years.

For a major projectile accident, the costs minimally include vendor service time to remove the object, and the lost revenue from an inoperable scanner during this repair process. Even if your magnet is covered under a vendor service agreement, repairs or service required because of projectile accidents are not typically covered, and will be charged to your facility.

ABSOLUTE MINIMUM COSTS

Service call to ramp-down the magnet, extract object, ramp-up the magnet and re-shim the system.	$20,000*
Lost technical revenue during magnet down time ($1,000 per hour x 12 hours per day x 3 days).	$36,000**
Total:	$56,000

* Assumes normal daytime service rates. Multiply times four (x4) for weekend, nighttime, or emergency call rates.

** If the facility provides professional radiologist services as well, multiply times two (x2)

ANTICIPATED MEDIAN COSTS

Service call to ramp-down the magnet, extract object, ramp-up the magnet and re-shim the system.	$50,000*
Lost technical revenue during magnet down time ($1,000 per hour x 12 hours per day x 4 days).	$48,000**
Damage to coil / table / gantry.	$35,000
Administrative losses for accident reporting and investigation.	$20,000
Total:	$153,000

* Assumes ramp-down only. If magnet must be quenched, multiply times two (x2).

** If the facility provides professional radiologist services as well, multiply times two (x2)

POTENTIAL HIGH-END COSTS

Service call to restore the magnet following quench.	$100,000*
Lost technical revenue during magnet down time ($1,000 per hour x 12 hours per day x 10 days).	$120,000**
Damage to coil / table / gantry.	$200,000
Administrative losses for accident reporting and investigation.	$40,000
Medical care from patient staff injury.	$20,000***
Legal fees and settlement costs.	$150,000***
Total:	$630,000

* Assumes no moisture introduced in cryostat and no damage to magnet system from quench. If magnet must be dried, multiply times two (x2). If magnet is damaged from quench, multiply times four-eight (x 4-8).

** If the facility provides professional radiologist services as well, multiply times two (x2)

*** Assumes minor acute injury, such as broken bone.
More extensive injuries would require significant increases in these numbers.

Based on the anticipated median costs for a major projectile accident ($153,000) and an occurrence rate of once every six years, **the annualized cost-per-year of not interdicting large ferromagnetic threats for each MRI scanner is $25,500**. And this is based on accident rate data 8 years old, i.e., before the advent of 3 T/high gradient scanners.

If we look at the rise in sedation cases, interventional applications, and MRI use for emergent cases, each of these introduce more personnel and equipment into the MR suite and increases the probability of projectile accidents. If these increasing risk factors reduce the mean time between major projectile accidents to five years (some speculate that it's now less than five years), that puts the annualized cost per year of not interdicting large ferromagnetic threats at $30,600 for each and every MRI.

The above economic analysis does not address interrupted throughput from failed patient screening, the resultant interruptions in throughput, accumulated degradations to image quality from the build-up of small ferromagnetic objects inside the bore, or injuries resulting from small ferromagnetic projectiles. These more frequent, 'inconsequential' incidents, when combined, frequently exceed the costs of the larger, catastrophic incidents.

CONCLUSION

Beyond the 'Best Practice' recommendations of the American College of Radiology's *ACR Guidance Document for Safe MR Practices: 2007* for the use of ferromagnetic detection (FMD) systems for the safety of patients and staff, the rates and costs of major projectile accidents provide a solid economic justification for the use of FMD to screen every person and every object entering the MR suite.

Mednovus provides a broad range of ferromagnetic detection products and services. Our products offer our customers unsurpassed value in assisting in reducing accidents and protecting your patients, your staff and your revenue.