Continuing safety training: 2015 re-certification

This document applies only to those people who have already passed the BIC Safety Training and wish to retain BIC card key access privileges for 2015.

Introduction:

In mid-November, 2014 two hospital workers were seriously injured when an oxygen cylinder was brought into an MRI suite and became attached to the magnet, crushing the workers in the process. The bad situation was made worse when colleagues were unable to shut down the magnet by depressing the quench button. It transpired that the local service engineers had intentionally either bypassed or modified the quench circuitry so that a special procedure was required to deactivate the magnet, and for some as yet unknown reason none of the local personnel nor the first engineer to arrive were privy to the custom procedure. The two hospital workers were crushed by the oxygen cylinder for four hours until engineers familiar with the customized switch were finally able to discharge the magnet and the oxygen cylinder could be removed.

The re-certification process:

Please work through the syllabus in the following section – I anticipate it will take between one and two hours – and then answer the questions in the quiz section. There are eight questions. You may print out this document and write your answers by hand, or you can use a PDF editor to produce your answers on a keyboard. You can submit the quiz as a hard copy or electronically.

All BIC card key access will be discontinued automatically at the end of December unless I have already received your re-certification quiz before then. If you miss the deadline this month then just submit the quiz as soon as you can in January and your card key will be re-activated.

Syllabus:

1. Read the three newspaper reports of the event in Appendix 1.

2. Read the e-mail from our local Siemens service engineer regarding the performance of our 3 T quench button, in Appendix 2. Note the unequivocal tone of the email: OUR QUENCH BUTTON WILL WORK.

3. Re-read the latest 3 T Safety Training Syllabus & SOPs (standard operating procedures), available on the BIC website: http://bic.berkeley.edu/scanning. This is the document you read when you first took the Safety Training.

4. Watch these two videos:
https://www.youtube.com/watch?v=6BBx8BwLhqg

https://www.youtube.com/watch?v=9SOUJP5dFEg
Re-certification quiz

Your Name:       

Today's Date:  

Your Email:    

1. It is clear that under no circumstances should a magnetic oxygen cylinder have been taken into an MRI suite. Do you think the ward boy bears primary responsibility for the incident? If so, why? If not, who do you think was primarily at fault and why?

2. Large magnetic objects like oxygen cylinders present rather obvious safety hazards around an MRI magnet. But much smaller items can be very dangerous, too. What is the overriding factor when considering whether or not to activate the quench button?
3. In BIC, Zone III exists to provide a buffer between unscreened personnel (as well as any magnetic objects they might be carrying) in Zone II and the magnet in Zone IV. If you permit your subject to de-magnetize inside Zone III, are you in compliance with BIC's standard operating procedures?

4. We don't have any magnetic oxygen cylinders in Zone III. What magnetic items are permitted to reside in Zone III and how can you determine what they are?
5. There are two quench buttons for the Siemens 3 T scanner. Both have a clear plastic box around them, to prevent accidental use of the button, and a hinged lid that is taped down with a piece of purple tape.
   a. What happens if you remove the purple tape from either plastic box?
   b. What other procedures are required in order to activate the quench circuit?

6. Using the magnet quench button is a very serious action, but it could reduce the severity of an injury or even save someone's life. If a person was being pinned to the magnet by a large metal object such as a chair, how long after depressing the quench button do you think you could render assistance by taking the chair off the person? Why is an estimate of this time an important thing to know?
7. It is important to evacuate the magnet room as quickly as possible after a magnet quench has been initiated. Why? In spite of these risks, why should you be prudent in deciding how quickly to remove an injured person from the magnet?

8. Would the patient table still be operational if the magnet quench button is activated? Please explain your answer.

Thanks for continuing your MRI education, and more importantly thanks for being safe!!!!!
Appendix 1 – Newspaper articles reporting the oxygen cylinder incident

**Two stuck to MRI machine for 4 hrs**
By Lata Mishra, Mumbai Mirror | Nov 11, 2014, 12:00 AM IST

The ward boy fractures his arm, while his colleague sustains serious injuries, including a punctured urinary bladder and severe internal bleeding.

Two employees of the Tata Memorial Hospital’s treatment and research centre in Khargar in Navi Mumbai suffered grievous injuries on Saturday evening when one of them walked into the centre’s MRI room holding an oxygen cylinder, activating the machine’s monstrous magnetic field.

The two employees - one a technician and the other a ward boy - were pulled to the machine like a toy magnet pulls a pin and remained stuck to it for nearly four hours before an engineer from General Electric arrived and deactivated the magnetic field.

While the ward boy, Sunil Jadhav, 28, who brought the oxygen cylinder into the MRI room, fractured his elbow, the technician Swami Ramalai, 35, who was sandwiched between Jadhav and the cylinder on the one side and the MRI machine on the other, suffered serious injuries to the lower part of his body, including a punctured urinary bladder and severe internal bleeding.

Sunil and Swamy, who were rushed to Bombay Hospital, were on Monday being attended to by a panel of six doctors - neurologist Dr Vihbor Pardasani, neuro-surgeon Dr Suned Shah, orthopaedic surgeon Dr Pravin Munshi, nephrologist Dr Shrirang Bichhu, plastic surgeon Dr Vinay Jacob, and an intensivist. With blood flow to Swamy’s lower body interrupted for four hours, leading to overload of toxins in the system, his kidneys too have suffered damage. Doctors said the sensation in his legs has been compromised because of damaged nerves.
The mishap took place at around 7 pm at the Tata Memorial-run Advance Centre or Treatment Research and Education in Cancer (ACTREC) when a male patient was wheeled in for a routine MRI.

During the process of carrying out the scan, the attending doctor asked Jadhav to fetch an oxygen mask. Jadhav, who had never worked in the MRI room and had no idea that no metal is allowed anywhere near the machine, thought he was asked to bring in an oxygen cylinder.

As soon as he entered the room with the cylinder, the machine pulled him with such brute force that he flew towards the machine with the cylinder still in his left arm and carried Ramaiah with him. Before anybody in the room knew what was happening, Jadhav and Ramaiah were stuck to the machine. And they remained glued to it four hours.

While the machine can be switched off, deactivating its magnetic field is a complex process. Both Jadhav and Ramaiah lost consciousness after a couple of hours of fruitless attempts to wrench them out.

It was only after an engineer from General Electric, the machine’s manufacturer, arrived and deactivated the magnetic field that the two could be disengaged and taken to Bombay Hospital.

Talking to Mumbai, plastic surgeon Dr Vinay Jacob said Swamy’s condition was critical when he was brought to the hospital. "His lower abdomen and upper thigh had got crushed. The blood circulation to the lower part of his body was severely compromised and the muscles and nerves in the thigh region were crushed," he said.

MRI rooms in hospitals have notices outside asking employees and patients to leave all metal articles - including jewellery - outside. While such a note is posted outside the ACTREC MRI room too, Jadhav obviously did not pay attention.

One of the doctors, an eyewitness to the mishap, said hospital staff tried every trick to pull the two out. "ACTREC engineers to did everything they could to demagnetize the machine, but all in vain. It was only after a GE engineer detached the magnet from the machine that Jadhav and Ramaiah could be pulled out," he said.

Deputy director, ACTREC, Dr Sudeep Gupta, said: "This is really an unfortunate incident. Thankfully, we were able to successfully rescue both our staff members and provide them timely treatment. We have already launched an internal inquiry to ascertain what went wrong."
Hospital says GE took 4 hrs for a 30-sec job

By Lata Mishra, Mumbai Mirror | Nov 12, 2014, 12.48 AM IST

Officials say it should not have taken over 30 seconds to disable machine's magnetic field, but the switch malfunctioned.

The Tata Memorial Hospital on Tuesday blamed GE Healthcare for the horrific accident at the hospital's research and treatment centre in Navi Mumbai last week in which two of its employees suffered serious injuries when one of them entered the MRI room carrying a gas cylinder, triggering the machine's powerful magnetic field.

At a press conference on Wednesday, a day after this newspaper broke the story, senior officials of Tata Memorial-run Advance Centre or Treatment Research and Education in Cancer (ACTREC) in Kharghar said that because a switch to disable the machine's magnetic field malfunctioned, it took engineers four hours to disengage the two employees -- a ward boy and a technician -- stuck to the machine, when it should not have taken more than 30 seconds.

While the ward boy, Sunil Jadhav, 28, who brought the oxygen cylinder into the MRI room, fractured his elbow, the technician Swami Ramaiah, 35, who was sandwiched between Jadhav and the cylinder on the one side and the MRI machine on the other, suffered injuries to the lower part of his body, including a punctured urinary bladder and severe internal bleeding.

The ACTREC officials, however, refused to dwell on how the ward boy was allowed to enter the MRI room of Tata Memorial-run Advance Centre or Treatment Research and Education in Cancer (ACTREC) in Kharghar with a gas cylinder in the first place, saying an internal probe has been ordered to fix responsibility.

The press conference held at the Tata Memorial Hospital in Parel was addressed by Director, ACTREC, Dr S V Chiplunkar; chief administrative officer, Dr Venkat; deputy director Dr Sudip Gupta; and head of radiology Dr Nikhil Merchant.
Dr Gupta said the MRI machine was bought just four years back and its last periodic maintenance was carried out by GE engineers just six months back. "We were shocked. Despite several attempts to switch off the machine, we just could not disable it. Ideally, we should have removed both of our employees in 30 seconds, but they were stuck for four hours," he said.

Dr Gupta said that while ACTREC engineers had reached the spot within minutes of the mishap, they just could not switch off the machine. The manufacturer was informed immediately, but the GE engineer who arrived after an hour too could not turn the machine off. Nearly two-and-a-half hours after the incident, three more GE engineers arrived and replaced the existing electronic circuit with a new one and then switched off the machine.

In the meantime, the hospital and tried everything - from getting nearly twenty people to try and pull the cylinder out and free up two men stuck, to tying a rope to the cylinder and trying wrench it out. When all efforts failed and the condition of one of the two employees stuck deteriorated he was administered IV fluids even as he lay suspended from the machine.

Meanwhile, doctors are Bombay Hospital, where the ward boy and the technician are being treated, said both are out of danger now. Swamy was operated upon on Tuesday evening by orthopaedic surgeon Dr Parag Munshi and plastic surgeon Dr Vinay Jacob.

Urologist Dr Sadanand Thatte said bleeding in Ramaiah’s urinary bladder is also under control. He will, however, remain on dialysis for a few weeks more.
Manufacturer disabled MRI’s demagnetising switch: Report

By Lata Mishra, Mumbai Mirror | Nov 20, 2014, 12.40 AM IST

An inquiry into the November 8 mishap at a Tata Memorial research and treatment centre, where two employees remained stuck to an MRI machine for four hours after one of them walked into the room carrying an oxygen cylinder, has revealed that the machine’s manufacturer, GE Healthcare, had disabled a switch that could have instantly deactivated the machine’s magnetic field.

leading to the release of a large amount of helium gas.

Officials at the Tata Memorial-run Advance Centre or Treatment Research and Education in Cancer (ACTREC) in Navi Mumbai, where the mishap occurred, have maintained that the extent of injuries sustained by its two employees would have been much lower had the machine’s magnetic field been switched off in time. While the ward boy, who had walked into the room carrying the cylinder, suffered a fractured arm, the technician, who got sandwiched between the ward boy and the cylinder on the one side and the MRI machine on the other, damaged his kidneys severely because of disrupted blood flow to his lower body. He is still undergoing treatment at Bombay Hospital.

Chief Administrative Officer, Tata Memorial Hospital, Dr Venkata Varaprasada Rao, on Wednesday confirmed that the inquiry report speaks about the changes made to the MRI machine by the GE engineers without the ACTREC’s knowledge or approval. He said the report is ready and a copy has been sent to the Prime Minister’s Office, which had sought an explanation. Refusing to get into the details of the report, he said it would be made public soon.

The GE engineers told the committee that the machines are now so programmed that the switch to demagnetise them can only be operated by them. Immediately after the accident at ACTREC, the centre’s own engineers had failed to switch the machine off. In fact, the first batch of GE engineers who arrived at the scene too had failed to switch the machine off. The machine could eventually be demagnetised only after a struggle of four hours.

The hospital’s probe panel comprised of four persons and it recorded statements of every person witness to the incident. "The revelations made by GE engineers were shocking. In fact, the machine involved in the mishap underwent maintenance recently. But they did not reveal anything about the demagnetising switch," said an inquiry committee member.

After the incident, the committee member said, GE engineers went to Tata Hospital in Parel to activate the quenching switch in an MRI machine installed there. "They were denied permission because the fact that the switch had been deactivated is an important piece of evidence for us," the member said.
Mirror sought an explanation over email from Manoj Menon, Communications Leader, GE Healthcare (a copy was sent to Meetali Saxena of Genesis Burson-Marsteller, GE Healthcare’s public relations representative) on Thursday; including a clarification on the disabled demagnetizing switch in their MRI machines.

**What the company says**

"GE Healthcare responded immediately upon receiving the call from ACTREC. GE Healthcare followed the protocols in place to turn off the magnet as quickly as possible," the company said in a statement.

"There are multiple safety measures in place for an incident such as this. Wipro GE Healthcare provides extensive training on usage of MRI equipment to ensure safety of patients and hospital staff. Preventive maintenance is done on periodic basis for all our installations."

It also said that all its "MRI sites" had an emergency switch with battery backup and authorised personnel had been taught how to use it. "Wipro GE Healthcare is taking the matter seriously and extending all support to the hospital staff to complete their investigations into the incident," the company said, adding that its own investigation into the incident was underway.

Terri Brosnahan, CEO of GE Healthcare India and South Asia, is scheduled to visit Tata Memorial on Friday.
Appendix 2 – Report on the status of the BIC quench button

This email was received from our local Siemens engineer:

"Your rundown unit will work. It is tested thoroughly every year, parts are tested daily, and parts are tested on the fly (always).

A magnet load simulator tool is connected (in place of the magnet) every year, and the quench circuits are tested into these loads to verify function. Yes, we push the quench buttons every year.

In case of power failure, there is a battery backup for the rundown unit. The battery is load tested automatically every day at 2 AM to insure it is sustaining a proper charge and capacity (if it fails this test, the scanner will NOT SCAN!).

There is a small amount of current that is always applied through the quench and switch heaters in the magnet. Seems like a scary concept, but it is shown not to produce enough heat to activate the heaters. With this current applied, the voltage drop across the heaters is proportional to their resistance; if this value exceeds the allowed specification (too low or too high), you get an alarm. You heard this alarm not too long ago when the switch/quench heater connector was corroded/wet from condensation, and this resistance value was incorrect as a consequence. So you got first-hand experience of what happens if the heaters aren’t connected with the correct resistance. Further, this is also tested every year . . . we simulate high + low resistances with a tool for all three heaters in the magnet to check the monitoring circuits for proper function.

We even disconnect one of the ‘quench buttons’ to be sure the system gives an alarm reporting ‘too few buttons’. Yes, even the presence of the switch being electrically connected is monitored.

These tests are monitored with a date/time stamp (file C:\MedCom\log\MsupHistory.log). This data is transferred via remote connection to our server, and monitored by Erlangen (automated running script, I believe). When the Siemens Magnet experts (not Oxford!) visit for magnet service, they also download this data from the magnet monitoring system. If the logs show this test hasn’t been run within an approx 12 month interval, a service call is opened and an engineer is dispatched to check this immediately.

Again, your rundown unit will work. The heaters are monitored and known to be connected with the correct resistance, the switches are monitored as being physically connected, the rundown unit ‘quenches’ a simulated magnet, and the battery backup is tested, and the monitoring circuits are all tested. And we have a quality process in place to be sure these tests/functions are carried out."