

ELECTROMAGNETIC FIELDS:

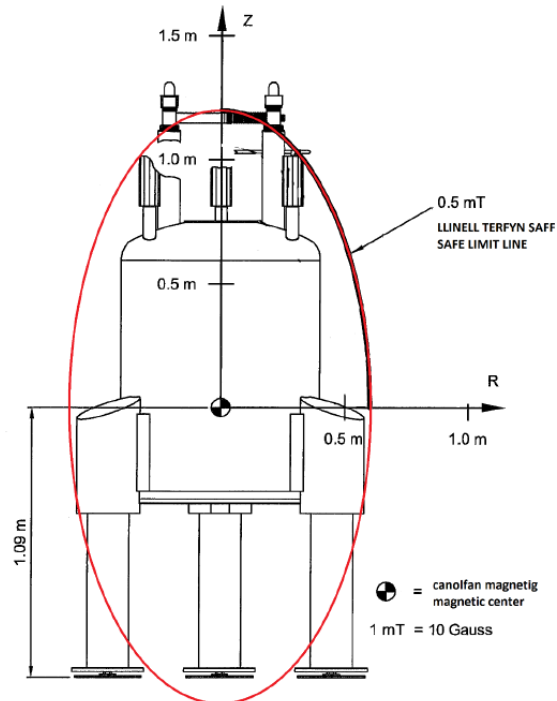
CASE STUDY: RISK ASSESSMENT EXAMPLE: NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROMETER (2018 example)

RHYBUDD **CAUTION**

MAES MAGNETIG CRYF **STRONG MAGNETIC FIELD**

CYNGHORIR UNIGOLION SYDD Â RHEOLYDDION CALON
NEU FEWNBLANIADAU METEL I AROS O FEWN Y'R MAN
DIOGEL (GWELER LLUN ISOD)

PERSONS WITH PACEMAKERS OR METALLIC IMPLANTS ARE
ADVISED TO STAY WITHIN THE SAFE LIMIT AREA
(SEE IMAGE BELOW)



NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROSCOPY is an analytical chemistry technique used for determining the content and purity of a sample, as well as its molecular structure.

The principle behind NMR is that many nuclei have spin and all nuclei are electrically charged. If an external (static) magnetic field is applied, an energy transfer is possible between the base energy to a higher energy level (generally a single energy gap). The energy transfer takes place at a wavelength that corresponds to radio frequencies and when the 'spin' returns to its base level, energy is emitted at the same frequency. The signal that matches this transfer is measured in many ways and processed in order to yield an NMR spectrum for the nucleus concerned.

By their very nature NMRs will create a magnetic field and produce radio waves, which could be a risk to human health and should therefore be assessed for risk.

Bangor University has a small number of NMRs, all of which have integral "shielding" to reduce EMF emissions. This typical risk assessment is based on published [European Union's guidance](#) and the Bruker UltraShield Plus500 & Bruker Ultra Shield Plus400 NMRs, used by the School of Natural Sciences, Bangor University.



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Risk Assessment (RA) Title:	Bruker UltraShield Plus500 & Bruker Ultra Shield Plus400 NMRs		
Summary of Activity RA Covers:	<p>The hazard and risks associated with Electromagnetic Fields (EMF) from the location and use of NMRs within the School of Natural Sciences, Bangor University. It considers both <i>'Persons at Particular Risk'</i> and other users</p> <p><u>Note:</u> The Assessment does not consider the risks associated with chemicals and materials being analysed, nor loading or maintenance activities</p>		
Location(s) RA Covers:	NMRs used in the Analytical Space, Floor 6, Alun Roberts Building	Person(s) RA Covers:	<p>All persons operating NMRs</p> <p>All persons within the Analytical Space, including maintenance staff and visitors</p>
College / Service:	College of Environmental Sciences and Engineering	School / Section:	School of Natural Sciences
RA Assessor(s):	Health and Safety Services	Contact Details:	01248 38 3847
Date RA Created and / or Reviewed ¹ :	July 2018	Next RA Review Date:	<p>General review by School:</p> <ul style="list-style-type: none"> • every 2 years and; • upon changes to room design, or introduction of new NMRs or other potentially hazardous equipment
RA Version Number:	NMR 01/2018		

¹ Remember to complete Footer details

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Risk Assessment (RA) Title:	Bruker UltraShield Plus500 & Bruker Ultra Shield Plus400 NMRs		
Date:	July 2018	RA Version Number:	NMR 01/2018

Ref	Hazard - EMF Exposure From:	Persons at Particular Risk	ADDITIONAL SPECIFIC CONTROLS: Persons at Particular Risk
1.	Indirect Effects: Static magnetic field could interfere with Passive and Active Medical Implanted Devices (AMIDs)	<p>Consider:</p> <ul style="list-style-type: none"> As potential for interference with Passive and Active Medical Implanted Devices (AMIDs) consider: <ul style="list-style-type: none"> ❖ Persons working in close proximity to machine eg loading samples and working with probes at base 	<p>As General Controls below PLUS</p> <ol style="list-style-type: none"> RESTRICT persons fitted with medical implanted devices from: <ul style="list-style-type: none"> Loading samples Working at base Person to seek advice regarding precautions from their Medical Consultant and advise their Line Manager / Supervisor if precautions recommended Line Manager / Supervisor to prepare individual Risk Assessment if precautions recommended by Medical Consultant can be put into place Line Manager / Supervisor to assess new NMR equipment, or if adjustments to the existing NMR machines are made, with the person concerned Person concerned to seek further advice from their Medical Consultant if necessary Line Manager / Supervisor to review Risk Assessment and associated procedures as required eg Signs, Safe Operating Procedures

Ref	Hazard - EMF Exposure From:	Risk to Any Person	Persons at Particular Risk	General Controls
2.	<p>Bruker UltraShield Plus 500 & Bruker Ultra Shield Plus 400:</p> <p>Direct Effects: Static magnetic field</p> <p>Indirect Effects: Interference with active and passive implanted medical devices</p>	<p>Staff, Students, Service Engineers, Domestic & Maintenance Staff</p> <p>Visitors to the facility</p>	<p>YES</p> <p>Persons working in close contact ie loading samples in the Plus 500 and working with probes at the base of both machines</p> <p>There is potential for interference with Passive and Active</p>	<p><u>General access into Analytical Space</u></p> <p>Due to the shielding of both units there is no significant risk from EMF effects to any persons who enters the facility and remains away from the two NMR units by more than 0.5m of base. This includes <i>Persons at Particular Risk</i>.</p> <p><u>NMR Operators</u></p> <ol style="list-style-type: none"> See Persons at Particular Risk Both NMRs have a fixed (static) magnetic field with shielded magnets integral to the machines and which cannot be accessed by operators

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	<p>Indirect Effects: Interference with medical electronic equipment</p> <p>Indirect Effects: Static magnetic field creating projectile risk from loose ferromagnetic objects</p>		<p>Medical Implanted Devices (AMIDs)</p>	<p>c. Because of shielding, static magnetic field negligible outside the footprint of the NMRs (this is usually demarked by the 0.5 milli Tesla line)</p> <p>d. Magnetic field strongest at the top of the NMRs and at their base where probes are located. Only trained Technicians & Engineers access these areas</p> <p>e. Diagrams of magnetic fields available (see below)</p> <p>f. General Controls:</p> <ul style="list-style-type: none"> ❖ Only trained Technical staff carry out basic maintenance of machine eg cleaning probes, filling liquid nitrogen and helium ❖ Only authorised persons who have been instructed by Technical staff are permitted to load samples ❖ Staff and students may only operate the NMRs following training from Technicians ❖ NMRs fixed to floor in a dedicated laboratory ❖ Warning Notice regarding interference with AMIDs displayed on door ❖ Only non-magnetic tools used on the Units ❖ Information, instruction and training on risks provided to those working in the lab and which is also included in the School Staff and Student Handbook ❖ Staff and students instructed to inform a Technician if they have AMIDs etc that could be affected by the NMR. Individual Risk Assessment then undertaken on a case by case basis ❖ Technicians keep relevant records eg maintenance <p><u>NMR Maintenance</u></p> <ul style="list-style-type: none"> ❖ User maintenance is undertaken by authorised Technical staff, none of whom are <i>Persons at Particular Risk</i> and therefore there is no significant risk from the magnetic fields ❖ Technicians arrange formal maintenance with a competent engineer as required, who will produce their own safe system of work / risk assessment for their activities
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Note: Due to shielding and ceiling heights there is no significant risk from EMF for those on the floors above or below the units.

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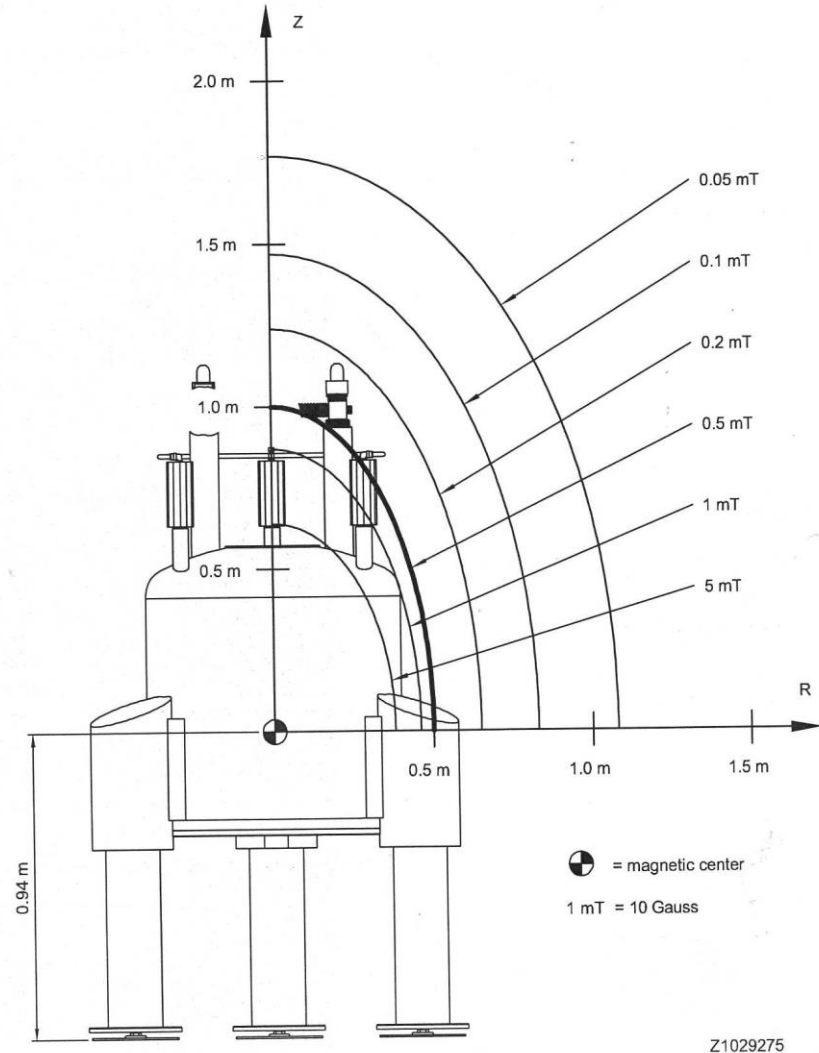
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NMR Magnet System

UltraShield™ 400 MHz / 54 mm

3.15 Stray Field Plot

UltraShield™ 400/70H PLUS



NMR Magnet System

UltraShield™ 500 MHz / 54 mm

3.16 Stray Field Plot

UltraShield™ 50/70D PLUS

