

RFI protection checklist for visitors to the Murchison Radio-astronomy Observatory (MRO)



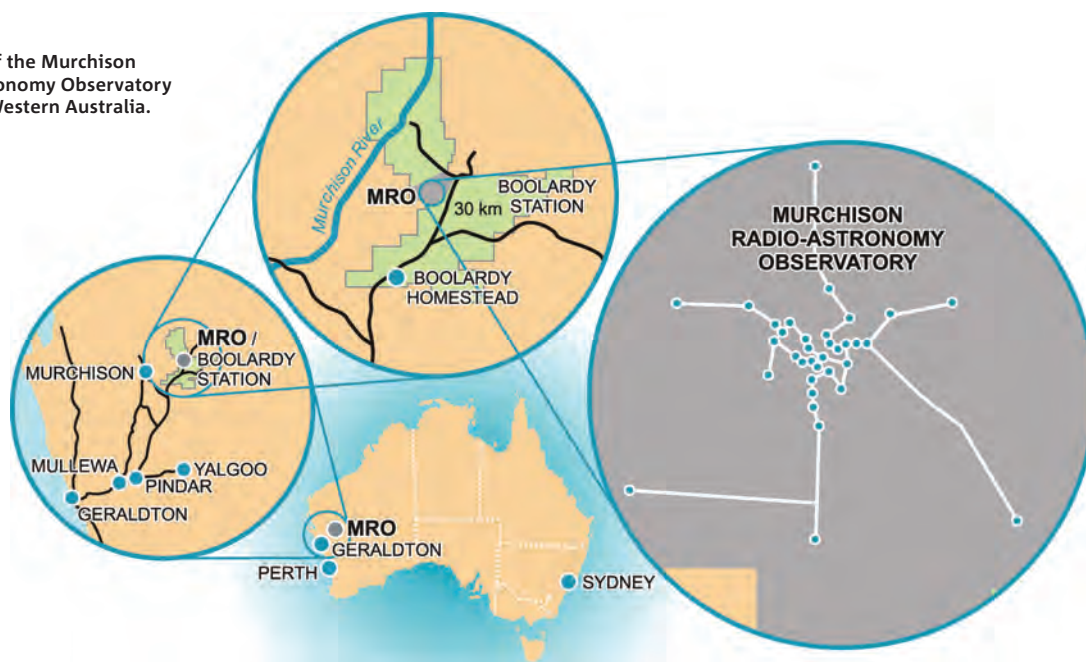
Don't

- ✗ Use your mobile phone on Boolardy Station or the MRO (there will be no signal anyway)
- ✗ Use your laptop on the MRO (except in the shielded control building)
- ✗ Use Bluetooth or WiFi on Boolardy Station or the MRO
- ✗ Stay on or near the MRO at night (i.e. no camping)
- ✗ Use cameras unless approved by the CSIRO Site Manager
- ✗ Lock cars with the wireless remote

Do

- ✓ Turn off your WiFi and Bluetooth capability on all devices, including phones, laptops and iPads while on Boolardy Station and the MRO
- ✓ Turn off mobile phones while on Boolardy Station or the MRO
- ✓ Minimise the use of vehicles on Boolardy Station and the MRO
- ✓ Minimise the use of UHF/VHF radios on Boolardy Station and the MRO
- ✓ Lock cars using the manual locking mechanisms.

Location of the Murchison Radio-astronomy Observatory (MRO) in Western Australia.



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FOR FURTHER INFORMATION

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RFI regulations for visitors to the Murchison Radio-astronomy Observatory (MRO)

“Help us listen to whispers from space”.

CSIRO’s Murchison Radio-astronomy Observatory (MRO) is an excellent radio quiet place and unique observatory; it is the most protected radio astronomy site in the world.

The MRO is the site of the Australian Square Kilometre Array Pathfinder (ASKAP), the Murchison Widefield Array (MWA), and the future core site of the Australian component of the international Square Kilometre Array (SKA) telescope project.

The MRO is situated inside the Australian Mid West Radio Quiet Zone (RQZ), an area 260km in radius that is protected by Federal Government legislation and regulations to control activities that can cause radio-frequency interference to the telescopes.

To preserve the radio quiet nature of the MRO, we require you to:

- ♦ Minimise the use of vehicles on Boolardy Station and the MRO
- ♦ Minimise the use of UHF/VHF radios on Boolardy Station and the MRO
- ♦ Turn off devices such as laptops, iPads, and mobile phones
- ♦ Not stay on or near the MRO at night (i.e. no camping)

What is RFI?

Radio astronomers examine astronomical objects such as stars, galaxies and other objects by using radio telescopes to collect cosmic radio waves. Radio telescopes are designed to detect extremely faint radio signals from space, making them highly sensitive to radio-frequency interference (RFI) caused by other radio transmissions, such as signals from mobile phones, two-way radios and broadcasting towers, or by electrical equipment such as vehicles, appliances or electrical machinery.

RFI can also be emitted from many of the devices that you might otherwise expect

to use on a radio-astronomy site, such as a wireless computer mouse, microwaves, mobile phones, car engines, Bluetooth devices, keyless car entry, or electronic tablets. RFI is a major and increasingly serious issue for many radio astronomy observatories.

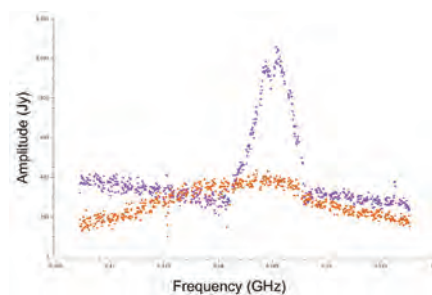
The MRO was specifically chosen to be located in an area with low population density (thus removed from TV, AM/FM radio and mobile phone towers), however many of these personal items are commonly brought with people visiting the site.

Why is RFI a problem?

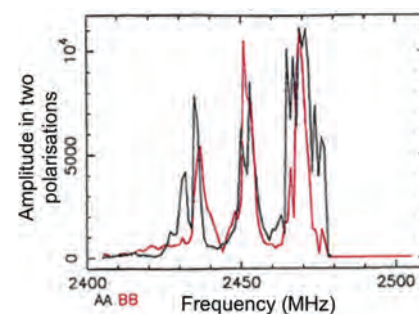
Everyday devices can emit RFI at levels that are high enough to cause damage to the highly sensitive observations of the radio telescopes at the MRO. This RFI then interferes with the detection of weak radio signals from the sky.

A typical radio telescope, such as the CSIRO Parkes 64m radio telescope (aka “The Dish”), is 15 orders of magnitude (i.e. 1,000,000,000,000,000 times) more sensitive to radio signals than a typical mobile phone.

For a radio telescope, the effect of bringing a WiFi device close is analogous to a person standing next to a jackhammer while trying to listen to music. The WiFi device creates so much ‘radio noise’ that the telescope can’t ‘hear’ the weak radio signals arriving from outer space.



A TV transmitting station, even a long distance away, can also cause high levels of RFI. This figure shows a huge spike in the amplitude of a radio signal received by the Murchison Widefield Array (MWA) telescope at the MRO – representative of the detection of a TV station at 185 MHz. The spike is almost three times higher than the ‘normal’ level (shown in orange). Even an RFI-emitting object several hundred kilometers away can affect the radio observations at the MRO – imagine how ‘radio loud’ it would be if it was on site!



The effect of a microwave oven being used during standard observations on the site of CSIRO’s Australia Telescope Compact Array (ATCA) in Narrabri. The microwave emits broadly across the part of the radio band, with the worst peaks at around 10,000 times higher than the ‘normal’ level. If you have a microwave oven with you, in a caravan for example, please do not even have the power to it turned on while you are on Boolardy Station.

How can you help protect the MRO from RFI?

In light of the RFI potential of many devices, we ask you to please think about whether equipment you have will generate RFI and if possible, to please turn off all RFI-emitting devices while on the MRO and Boolardy Station.

The only exceptions to these rules are the SPOT devices used in tracking vehicles driving to Boolardy from Geraldton and UHF radios being used on site for safety purposes.

However, please turn off the SPOT devices upon reaching Boolardy Homestead from Geraldton, and keep the use of vehicles and UHF radios to an absolute minimum.

We also ask you to turn off any UHF radios if they are not in use (at night, or if the vehicle is not being used), and to lock cars with the manual locking mechanism rather than using the keyless entry systems.

Staff at the MRO will soon be switching to use of 27 MHz radios. However, even when not deliberately transmitting these devices still produce incidental RFI so we request that you still keep use to a minimum.

Please also note that the use of radio equipment in any genuine emergency is permitted anywhere on site.

WiFi and Bluetooth enabled devices

If you need to use your laptop, please make sure that the WiFi and Bluetooth capability are turned off as many modern laptops have both these options. The use of mobile phones, tablets or iPads on site, **even in flight mode**, requires approval from the CSIRO MRO Site Manager.

The electronics inside these devices produce radio noise even with the WiFi turned off, and again, both Bluetooth and WiFi options must be turned off at all times (even in Flight Mode) while on Boolardy Station.

The use of cameras is also restricted to times when no observations are scheduled.

Please check with the CSIRO MRO Site Manager before using your camera.

For more information

Following these guidelines will help to preserve the radio quiet environment at the MRO for the world-leading telescopes that are being built or operating there. Your cooperation is vital to protecting the site and the research that goes on at the MRO.

If you have further questions, or become aware of other RFI issues, please contact CSIRO SKA Site and Infrastructure Executive Officer Dr Kate Chow (see details below).



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Welcome to the Murchison Radio-astronomy Observatory (MRO)

CSIRO's Murchison Radio-astronomy Observatory (MRO) is an excellent radio quiet place and unique observatory. It sits within the CSIRO-held 346,000 hectare Boolardy Station pastoral lease in the Mid West of Western Australia, about 350km NE of Geraldton.

The MRO is already home to the Australian SKA Pathfinder (ASKAP) and the Murchison Widefield Array (MWA) radio telescopes, and Australia's components of SKA1 will be centred on and around the MRO.

The MRO is ideal for radio astronomy as it exhibits excellent sky coverage, superb radio quietness, ionospheric stability and benign tropospheric conditions.

The extremely low levels of radio-frequency interference will allow highly sensitive instruments such as ASKAP and the MWA, as well as the future SKA telescope, to conduct ground-breaking astronomy research.

Radio-Quiet Zone

The Australian and Western Australian Governments have established a radio quiet zone to protect this world-class radio astronomy site.

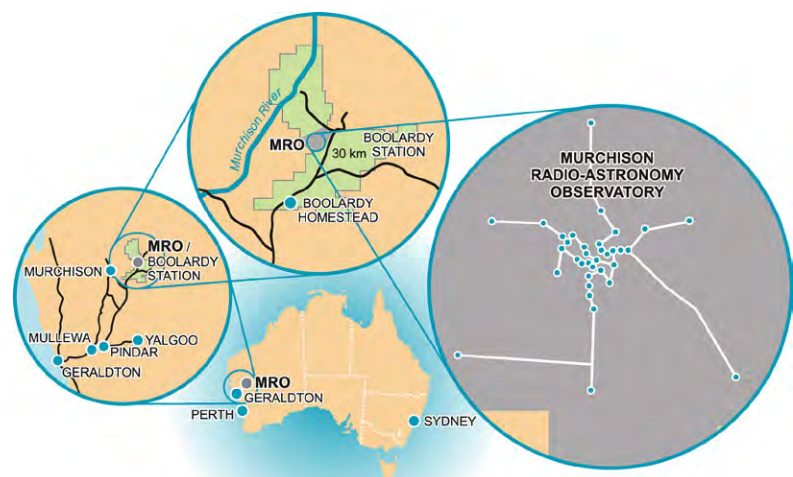
The Australian radio quiet zone WA is an area 260km in radius centred on the MRO, in which signal levels from radiocommunications equipment (such as television transmitters, mobile telephones and CB radios) and electrical devices are controlled to limit interference to radio telescopes.

Within the inner 70km radius area of the radio quiet zone, radio astronomy is the primary radiocommunications activity, with other activities considered secondary.

This is reflected in legislative, regulatory and policy instruments put in place by the Australian Communications

and Media Authority (ACMA) and the Western Australian Department of Mines and Petroleum (DMP).

Coordination zones extend the RQZ outwards to 260km radius at the lowest SKA frequencies.



The location of CSIRO's Murchison Radio-astronomy Observatory (MRO), zooming in to show the layout of the ASKAP antennas.

RFI protection checklist

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Cultural Heritage

The land on which the MRO and telescope equipment are situated is part of the ancestral lands of the Australian Aboriginal people.

Many partners have come together to develop an Indigenous Land Use Agreement (ILUA) for the MRO to permit the current set of activities at the site.

The MRO Indigenous Land Use Agreement allows certain radio astronomy equipment, including ASKAP and the MWA telescopes, to be constructed and operated on the MRO.

Heritage is not simply about sites and objects, but all that is passed down from one generation to the next, including language, stories and children's tales, places of significance, history, belief and memories. It's what connects the past with the present, and what continues to have relevance in to the future.

The Wajarri people of the Murchison region of the WA have been in the Murchison for approximately 40,000-60,000 years.

The Wajarri Yamatji value the sun, moon and stars for information and seasonal survival and also for the keeping of culture and stories.

The amazing thing about the Murchison is undeniably its ancient landscape. Rivers, creek beds and water holes are outstanding features for the Wajarri people as well as the plants and animals in a hot, dry land.

Although the traditional way of life may be long gone, many Wajarri people still enjoy spending time hunting, collecting and eating traditional foods, and visiting important sites in the area.

Several communities have developed on Wajarri Country, allowing people to live permanently on their traditional homelands, including the remote communities of the Pia Wajarri, the Yalga Jinna and the Burrungarra.

The Wajarri language is still spoken by a select few in the Wajarri community, with a large number of people who still understand the language.

At a local community event held in 2011, the first six ASKAP antennas were bestowed traditional names such as the Wajarri words for stars, moon, Milky Way, and local flora and fauna.

At the official ASKAP & MRO Opening Ceremony in 2012, the remaining 30 antennas, as well as roads and other significant structures at the MRO, were also given names from the Wajarri language.

This is a great reminder of the importance of the Wajarri people to the region.

CSIRO acknowledges the Wajarri Yamatji as the traditional custodians of the MRO site, and gratefully acknowledges the important role the Wajarri Yamatji have played in enabling Australia to secure the rights to co-host the SKA.

Health and Safety

While at the MRO, your personal health and safety, as well as those around you, is important to us.

Please remember the following:

- Stay within designated areas at all times.
- Wear flat, enclosed footwear - no open toe shoes or heels if possible.
- Reapply sunscreen as needed, wear a hat, and if possible, wear loose-fitting, long-sleeved clothing.
- Drink plenty of water and stay hydrated.
- The first sign of dehydration is a headache; please alert a CSIRO staff member if you need help.
- If you take medication, don't forget to bring sufficient quantities for the whole day.
- If you feel unwell, please notify a CSIRO staff member who will arrange assistance for you.
- If you hurt yourself - no matter how minor - please alert a CSIRO staff member.
- In the event of an emergency, please take direction from CSIRO staff.
- Please do not attempt to interact with native wildlife as animals can become aggressive when they feel that they are threatened.
- Please do not pull up or cut flowers or plants, or collect stones or soil.
- The MRO is a rubbish-free site, so please be mindful of disposing of any rubbish in the bins provided.
- If you smoke, please do so only at these designated points and use the ashtrays provided.

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Working on the MRO

Respecting objects, places, plants and animals on Wajarri Yamatji lands.

Purpose

This document supplements face to face indigenous cultural heritage inductions conducted by CSIRO staff, our Aboriginal Liaison Officer or nominated Wajarri Yamatji (WY) people. It is not a replacement for a heritage induction. Heritage inductions are mandatory for all CSIRO staff, contractors and affiliates working on the Murchison Radio-astronomy Observatory (MRO) and any visitors to the site.

Background

CSIRO's activity on the MRO is covered by an Indigenous Land Use Agreement (ILUA) and by leases between CSIRO and the WA Government. Before work commenced on the MRO, the site was surveyed by WY elders, professional anthropologists and environmental and conservation staff. The MRO contains places of significance to the traditional owners and cultural artefacts of social and historical value, and it is home to several rare plant and animal species.

CSIRO, as the manager of the MRO, has a responsibility to ensure that obligations defined in the ILUA and various environmental and land clearing approvals are adhered to. Knowledge of these obligations is essential for all staff working at the MRO. The following dos and don'ts are offered as a guide.



The Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope.
Credit: Antony Schinckel, CSIRO.



Western spiny-tailed skink (*Egernia stokesii badia*), a protected species found at the MRO.
Credit: T. Rasmussen, www.ecologica.com.au

Do Stay in designated these work areas:

- 25 metre radius around each ASKAP antenna
- 100 metre corridor from the middle of roads or tracks
- control building compound
- geothermal cooling field
- MRO airstrip and surrounds
- The core of the Murchison Widefield Array (MWA), the outermost tiles, plus a plus a two metre wide corridor to each of the outer tiles.
- The EDGES site.

Do not Take short-cuts between the tracks, go

bushwalking, or climb any rock outcrops. There are known

and unknown sites of significance to the WY people and known and unknown populations of protected species dotted all over the MRO and these must be avoided.



Stone cutting tools are common and do not need to be reported.



Other old objects, even if they look like litter, should be left alone.



A grinding stone is a significant object and should be reported.
Credit: Yamatji Land and Sea Council.

Do Report anything you think might be human remains. Stop work, secure the area and inform the MRO Site Manager immediately. The MRO has been occupied by humans for thousands of years. The wind and rain may expose human remains even within designated work areas.

Do not Cover, move, or ignore bones. It is a criminal offence to interfere with human remains and it is deeply disrespectful to the WY people.

Do Report anything you think might be important. Significant artefacts have been located and identified, but if you think you've spotted something, tell the MRO Site Manager.

Do not Disturb any artefact. There are concentrated 'scatters' of rocks that have been shaped by WY ancestors into hand tools, but more can be uncovered by wind and rain and are sometimes distributed over a wide area. You don't have to report these rock tools, just leave them alone. There are also piles of rocks which hold special meaning to the WY people. It is an offence under the *Aboriginal Heritage Act* to knowingly disturb Aboriginal sites.

Do Take your rubbish with you and dispose of it at the control building or accommodation facility.

Do not Remove anything that is not yours. Not a rock, a rusty tin, a broken toy, or a flower. What you think is rubbish might be an object of significance to the WY people and it is an offence under the wildlife and biodiversity Acts to pick wildflowers.

Do Consider cultural heritage, environmental and land use issues, as well as engineering matters such as underground cables, before you commence any work on the MRO. Even in designated work areas or on previously disturbed land, you may be breaking the law by ignoring these issues.



A rare plant of the MRO, *Ptilotus beardii*.
Credit: R. Davis / Department of Parks and Wildlife.

Do Ask for permission before taking photographs or video. CSIRO recommends individuals do not record WY cultural stories. Even if the WY person with whom you are speaking says it is OK, broader WY permissions may be required.

Do Enjoy the experience. Travelling to and working at the MRO can be rewarding, but it also demands particular thought and planning to ensure respect for cultural heritage and environmental issues. The MRO is special and deserves special treatment from all of us who have the privilege of working there.

More information

If you have any questions about anything you find at the MRO, or about where you can go or what you can do, please contact the MRO Site Manager, Shaun Amy: shaun.amy@csiro.au.