

# IRRIGATORS AND POWER LINES

GUIDANCE ON SAFE OPERATION  
OF LARGE IRRIGATORS NEAR  
HIGH VOLTAGE POWER LINES

*Keeping the energy flowing*



TRANSPower





# ABOUT TRANSPOWER NEW ZEALAND LIMITED

Transpower owns and operates the National Grid – the network of high voltage transmission lines and substations that powers the electricity needs of New Zealanders at work, home and play.

This brochure provides guidance to operating large irrigators near existing overhead high voltage power lines, and suggests ways to avoid electrical hazards. This information is provided to ensure the safe operation of both the irrigators and the transmission lines.

The main risk associated with the operation of irrigators near power lines is the risk of electric shock. The effects of a shock may range from being negligible, to being very serious or even fatal. Therefore it is very important for you to know how to operate plant near power lines.

## Mandatory clearance requirements

**The use of irrigators needs to comply with the New Zealand Electrical Code of Practice 34 (NZECP34). NZECP34 defines that the absolute minimum distance between any overhead electric line and any part of any mobile plant, (including irrigators) should be at least four metres.**

Unfortunately, transmission line wires (or conductors) are not always in the same place. As they cool, they rise up, and when they get warmer they sag down lower. Air temperature, network load and wind all influence the conductor temperature. In addition, strong winds will swing the conductors out from their normal position. The greater the distance between towers (the span), the greater this side swing can be.

The table below gives safe horizontal distances from transmission line conductors allowing for side swing.

<b>Transmission line span length</b> (Distance between towers) (m)	<b>Horizontal distance either side of the conductor</b> (from position with no wind) <b>where the minimum distance beneath conductors applies</b> (m)
Up to 125	11
121-250	14
251-375	22
Over 375	Seek Transpower's advice

The height of the irrigator need not be considered if no part of it (or its solid jet of water) will ever get closer to the live wires than shown in column 2 of the above table.

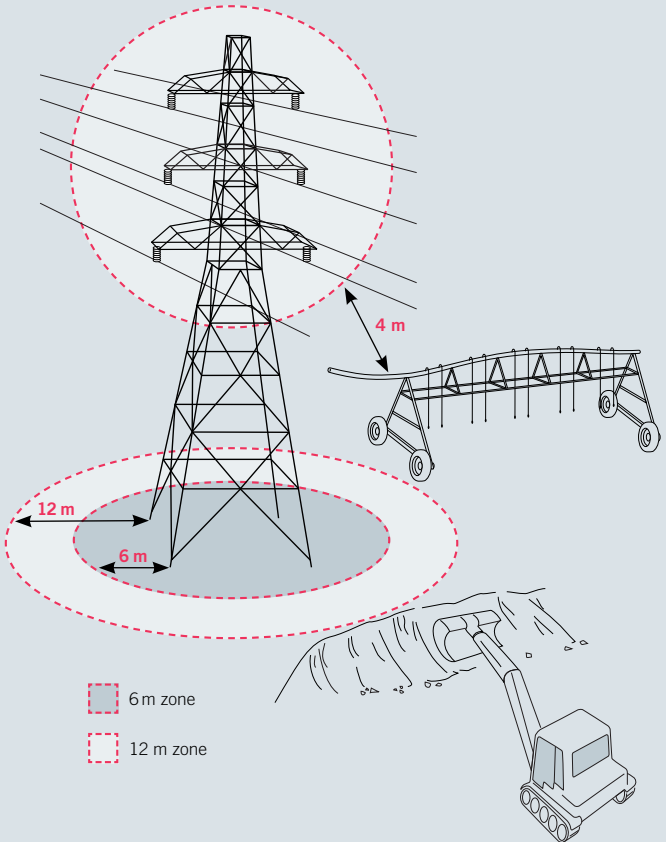
**If you wish to operate your irrigator or section of an irrigator, closer to the lines than shown in column 2 of the table, you will have to take care to ensure you maintain the mandatory 4 m clearance at all times. In this case, please contact Transpower for assistance. We can help by advising where the conductors will sag to at peak operating conditions.**

## Excavation

NZEC34 requires that the distance between any excavation greater than 300 mm deep (e.g. pivot irrigator foundation and pump house) and a transmission tower, must be further than 6 m from the visible tower foundation - unless prior written consent from the tower owner is obtained.

If the excavation is greater than a depth of 3 m, the separation must be greater than 12 m. In the interests of safety, Transpower has other specific requirements for buildings near transmission lines. Please contact Transpower for more information.

Irrigators must be kept at least 4m from overhead wires at all times.



## What typical hazards result from the use of different types of irrigators near power lines?

This information will provide some guidance on the hazards of operating any irrigator near power lines. Whilst irrigator models can vary, the electrical hazard risks are similar. However, the risk and effect of possible electrical shocks can vary depending on the irrigator's proximity to a transmission line, its size and earthing mechanism. Some irrigator types are described below.

### **Pivot irrigator**

The pivot irrigator below consists of a pivot structure that is earthed, and a boom that rotates about the pivot. The boom is supported by mobile structures that are insulated from earth via rubber tyres. In dry conditions, it is considered that this irrigator has one earth point, but in wet conditions there is not normally a problem. In order to protect the tower steelwork from being struck by the boom, it is prudent not to locate the pivot point of the irrigator closer than 20m from the transmission tower legs, and to take care in setting the irrigator angle of travel. Pilot wires should not be buried closer than 20m from a tower to prevent damage to the pilot system in the event of a fault occurring on the tower.



*Example of a pivot irrigator*

### **Travelling irrigator with rotating boom**

The travelling irrigator has a central support structure on rubber tyres. A boom rotates on top of this structure. This irrigator moves by a tow wire and winch. When connected the tow wire earths the structure where it touches the ground.



*Example of a travelling irrigator*

## **Linear or lateral move irrigator**

The lateral move irrigator consists of a large boom supported by mobile structures insulated from earth via rubber tyres. It moves laterally across the paddock by diesel or electric motor. The particular irrigator shown below will be earthed by the towing connection. Depending on an irrigator's towing connection, the lateral move irrigator may have no effective earth in dry conditions.



*Example of a lateral move irrigator*

## **Side roll/wheel line irrigator**

The side roll irrigator is of metal construction and is therefore naturally earthed at every wheel. As seen below, the side roll irrigator moves laterally across the paddock. It is powered by a small diesel or petrol engine. This irrigator is considered to have multiple, regular earths.



*Example of a side roll irrigator*

## **Pipe irrigation systems**

Pipe irrigation systems are laid on or under the ground, and have sprinkler heads installed along the irrigation piping. These systems are considered to be earthed.

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## What are the electrical hazards?

The main hazards to be aware of relate to receiving electric shocks. The risk and severity of electric shocks vary depending on the proximity of the plant to towers, earthing of the plant, and weather conditions. Shocks are more likely when an irrigator is being moved and manually handled, or being assembled or disassembled, particularly in dry conditions.

**Minor shocks** may be experienced either due to a *magnetic induction* between the transmission line and the irrigator, or what's called *capacitive coupling* between the transmission line and the irrigator.

*Magnetic induction* shocks are due to current flowing through a conductor, or transmission line, which creates a magnetic field around it. Where this magnetic field path passes through another conductive structure, such as an irrigator, a voltage may be induced on the structure, causing a shock.

*Capacitive coupling* shocks are caused by the electric field between the lines and the irrigator, and can only arise if the irrigator is not well earthed. Once a connection to earth is made, such as a person touching the irrigator, the current will discharge and the person may receive a mild electric shock or tingling. The voltage will be higher when the irrigator is parallel and close to, or under, the transmission line. The voltage will also increase as the length of the irrigator increases, and as the current flowing in the overhead line increases.

Both these types of shocks can be likened to minor electric shocks received when exiting a car.

**Serious electric shocks** may occur when direct contact is made with any power line. This is extremely dangerous and can be fatal.

## What are the electrical hazards? *continued*

**Transferred Earth Potential Rise** is another possible electrical hazard. An irrigator located near a tower may become temporarily livened, should an earth fault occur at the tower. This will transfer high voltage to the irrigator and may result in hazardous touch voltages on the irrigator and possible damage to irrigator controls. The probability of this happening is very low because it is dependent on the concurrence of local tower faults and a person being in contact with the irrigator. However, irrigation introduces bird life to the area, especially herons and large gulls. These birds may perch above insulators and defecate and cause a flashover. Thus the earth fault rate and the overall risk increases. It is therefore important to be aware of birds resting on, or near irrigators. Transpower may fit bird guards to its towers and you are advised to call us to discuss.

**Flashovers** may also occur. A flashover is a major electrical discharge, usually in the form of an electric arc which leaps or arcs from the conductor across the insulator string to the tower (or from the conductor to another object, resulting in a short circuit. Flashovers may be caused by a lightning strike, contamination of the insulator, or when a person/object is too close to, or comes into contact with, the lines. Whilst flashovers are rare, **THEY ARE EXTREMELY DANGEROUS** - which is why it is vital to always maintain safe separation distances from the lines.

**REMEMBER:** These transmission lines are carrying electricity at very high voltages. Electricity at these voltages can arc through the air even without direct contact. Getting too close to transmission lines, or holding something close to a line, is **EXTREMELY DANGEROUS**.

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## What are the risks to the power lines?

Flashovers can cause damage to the line's conductors and/or loss of electricity supply to customers.

Contact with a transmission structure could cause damage to the structure and/or the irrigator.

## How can irrigators be operated safely around power lines?

All of the risks identified in this brochure can be managed through taking care in installing and operating irrigation systems. Some things to consider when installing and operating irrigation systems:

### **When installing:**

- long irrigation systems, where practical, should be operated at right angles to the transmission line.
- where possible, avoid locating the pivot point of a pivot irrigator within 20 m of a tower and maintain at least the minimum clearance of 4 m from the irrigator to the conductors (the wires).
- where layout alternatives are available, maximum separation from transmission lines is recommended.
- during relocating, assembly or disassembly, care needs to be taken so that pipes or long metal parts are carried in a horizontal position, especially around power lines.
- adjust the nozzles so the jets of water do not hit the conductors or the tower steelwork - direct spraying could cause a flashover and can corrode the tower structure.

For further advice, or if in doubt, please contact Transpower when planning to install irrigation.

### **When operating:**

- ensure your equipment is effectively earthed at all times.
- prevent any chance of inadvertent contact with the conductors when handling long lengths of pipe - make adjustments well away from the line.
- keep to a minimum the time a person is in contact with the irrigator.
- during maintenance or storage, keep the irrigator at right angles to the transmission line and earth each end to minimise induced voltage.
- if long term maintenance is to be carried out, it is recommended that the irrigator be removed away from the area with transmission lines.
- earthing an irrigator by using a bare trailing earth wire bolted to the irrigator so that the end is in contact with the ground. This will minimise any induced voltage on the irrigator and nuisance shocks when touched. The earth wire can consist of a 500 mm length of bare copper conductor. A temporary earth can be connected to the irrigator by using a standard set of car battery jumper leads or similar and connecting the irrigator to earthed metal like metal - e.g. to a rod driven into the ground. The temporary earth should be connected prior to handling the irrigator, and should be installed during operation and maintenance.

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## Transpower's responsibilities

Transpower's responsibilities include:

- encouraging greater awareness of electrical hazards associated with irrigation and existing transmission lines;
- responding to enquiries relating to irrigation and transmission; and
- where appropriate, installing bird preventions on towers near irrigation.

## Other information

- Transpower's publication 'Working on your Land' contains other useful information relating to rural activities and high voltage transmission lines.
- Additional information is available at [www.transpower.co.nz](http://www.transpower.co.nz)

## Contact us

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(0800 Landowner)

## IN EMERGENCIES

If you notice any significant damage such as a broken wire, a flashover (bright flash and a loud bang), or a fire under a transmission line, urgently contact Transpower on the 24-hour emergency phone 0800 843 474 (0800 The Grid)

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