

# **GUIDELINES FOR MITIGATION OF POWER FREQUENCY MAGNETIC FIELDS – C&I SUBSTATIONS**

## **Why mitigate?**

- Comply with Australian and QLD standards
- Precaution (ARPANSA)
- Public concern
- Eliminate VDU interference

## Prudent Avoidance

*Gibbs Report, 1991:*

*“It .. becomes a question of policy what action should be taken to avert a possible risk to public health when it cannot be said either that it is probable that the risk exists or in what circumstances a risk, if one exists, arises. A suggestion has been made in the United States that a policy of prudent avoidance should be adopted.”*

## Precaution

*ARPANSA 2009:*

*“Compliance with this Standard requires performance of an assessment as to whether precautionary minimisation of exposure is justified. The assessment should be documented and retained.”*

## Standards

- ARPANSA 3000 mG for immediate, measurable effects on neural systems
- QLD government buildings 50 mG
- VDU screens (CRT type) shimmer >10 mG
- Epidemiology studies suggest an “association” with childhood leukemia at >4 mG
- Target value for office accommodation suggested in C&I Manual 10 mG as a precautionary measure

**NB: This is not a scientific standard**

## **Design - distribution substations**

- Increasing the distance from the source of the magnetic field
- Reducing the conductor or busbar spacing
- Selecting an appropriate phase configuration
- Balancing load between phases to reduce the neutral current

## Design - distribution substations

In the case of high rise buildings:

- locating substations away from normally occupied areas such as offices, lunchrooms
- planning the substation layout so that the lv side is further away from adjacent dwellings, offices, computer rooms, etc than the HV side
- locating transformers, low voltage busbars, disconnecter switches as far away as possible from adjacent offices, etc.

## **Design - distribution substations**

- if the floor above the substation is used as residential office space, avoiding where possible, direct ceiling mounting of heavy current cables, open type busbars or disconnector switches. The converse applies if the floor below the substation is used as office or residential space
- locating all cable trays as far as possible from the substation ceiling and walls that separate it from adjacent dwellings, offices, etc.

## Design - distribution substations

- designing busbars to minimise separation between phases and between phases and the neutral bus
- if practicable, orienting transformers and other sources that have uneven field patterns so that their highest field strength side is turned away from the field sensitive area
- where possible, using three phase cables in preference to three single phase cables
- using a trefoil arrangement of single core cables. If the neutral conductor is a separate s/core cable, placing it, where practicable, in the centre of the trefoil



## Phasing arrangement for LV cables



## **Design - distribution substations**

- avoiding phase by phase grouping of single core cables in parallel circuits
- distributing all large single phase loads and all constant current load such as lighting and office equipment equally between three phases of the low voltage supply.

## **Magnetic field mitigation C&I subs Summary**

- 10 mG target suggested
- Watch phasing and cable top entry in particular
- Responsibility of builder to ensure reasonable magnetic field environment for workers who occupy office areas
- We provide guidance on his assets and make sure ours minimise fields