

## **60 HZ. ELECTRO-MAGNETIC FIELDS FACT OR FICTION?**

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- **WHAT IS AN ELECTRO-MAGNETIC FIELD?**
  - **CAN MAGNETIC FIELDS CAUSE PROBLEMS?**
  - **WHAT ARE THE SOLUTIONS?**

### **THEORY**

An electro-magnetic field consists of electric and magnetic field components. We will limit the discussion in this paper to the magnetic field component.

In 1819, Hans Christian Oersted discovered that an electric current flowing through a wire, set-ups a magnetic field. This magnetic field forms a closed circular loop or flux tubes around the wire. These tubes of magnetic flux are continuous, ie. They have no sources or sinks. To describe this continuous nature of magnetic flux tubes, it is said that the flux density  $B$  is solenoidal. Since it is continuous, as many magnetic flux tubes must enter a volume as leaves it. Hence when this surface integral is carried out over a closed surface, the result must be zero. It also can be seen:

- A. Magnetic flux tubes or lines cannot be destroyed.
  
- B. Magnetic flux lines do not "bounce off" surfaces such as the way x-ray emissions do against lead materials.
  
- C. More specifically, magnetic flux tubes go through or penetrate:
  - 1. Lead, aluminum and steel sheets.
  
  - 2. Poured concrete floors - concrete block walls.
  
  - 3. Wood / gyproc walls.
  
  - 4. PVC and rigid conduit materials.
  
  - 5. Bus duct materials.
  
  - 6. Clay and other similar materials found in the ground.

The magnetic fields can be amplified by metallic structures located within this magnetic field, ie. Structural I-beam, water piping, steel filing cabinets and desks, etc.

## **MAGNETIC FIELDS CAUSE**

Existing electrical design installation practices in and around industrial, commercial and institutional buildings have generally in the past, have not had to consider the affects of these radiated magnetic fields.

Through our detailed electrical engineering investigations for our clients, we have found magnetic fields have caused or contributed to:

- A. Numerous electrical shutdowns of a major multi-million dollar data processing centre.
- B. Electrical shutdowns of a national manufacturing operation.
- C. Caused high speed dives of a major passenger elevator system, resulting in an 8 million dollar lawsuit being launched.
- D. Caused large computer disk drives to "crash" and data corruption of off site magnetic media storage systems.
- E. Caused colour corruption and deterioration of very expensive computer graphics digital recording systems.
- F. These magnetic fields have also caused thousands of standard computer screen texts to waver.

The proliferation of these standard computer systems into just about every environment has inadvertently created an instant ambient magnetic field detector for the employee. Concerns are then raised by the employees to their unions, to management, to the electrical utility public relations departments, when they discover these screen text waverings are due to magnetic fields. The next logical question raised is "What about my health?" "Am I going to get cancer?" "I am pregnant, should I be constantly subjecting my baby to these "harmful rays"? "What level is safe?"

The jury is **"still out"** on this very controversial health subject and we will limit this discussion strictly to the non-health areas.

## **MAGNETIC FIELD SOURCES**

Problems have developed for this new era of sensitive computer microprocessor based equipment from:

1. Electrical utility high current feeders, above and below grades.
2. Electrical utility transformer vaults, located within the premises.
3. Electrical utility under floor slab loop feed and radial systems, etc.
4. Internal secondary building wiring, etc.

## **MAGNETIC FIELD SOLUTIONS**

1. De-sensitize and better shield the components within these microprocessor based systems from these stray ambient magnetic fields.
2. For existing installations, design and engineer special magnetic shield systems to prevent the cable and switchgear magnetic fields interfering with these computerized systems.
3. For new installations, develop standardized magnetic field design guidelines to minimize the radiating affect of these magnetic fields - "prudent avoidance".

In many cases, we have found a minor relative low cost change at the earlier design stage can result in up to 100 times reduction in the surrounding ambient magnetic fields.

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