



**W&W Radiological and Environmental  
Consultant Services, Inc.**

**1 Glen Park Avenue, Suite 604  
Toronto, Ontario, Canada M2K 2H7**

**EMF SURVEY AND ASSESSMENT  
MONSIGNOR JOHN CORRIGAN SCHOOL  
100 ROYAL CREST ROAD  
ETOBICOKE, ONTARIO**

Prepared for:  
Corrado Maltese  
Senior Manager  
Occupational Health and Safety  
Toronto Catholic District School Board  
80 Sheppard Avenue East  
Toronto, Ontario,

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## **1. INTRODUCTION**

W & W Radiological and Environmental Consulting Services Inc. was retained by the Toronto Catholic District School Board to evaluate the 60 Hz magnetic field environment inside and external to the Monsignor John Corrigan School at 100 Royalcrest Road in Etobicoke. The school is located beside a Hydro One right-of-way.

The school was visited on Thursday July 3, 2008 between the hours of 9:00 AM and 4:00 PM. Corrado Maltese, Safety Manager for the school board and Ross Ferlenda, Certified Worker Member, CUPE Local 1280 were in attendance. All measurements were made under normal building occupancy conditions with computers and lights on. Measurements were performed inside the school including hallways and classrooms, outside on the grounds behind the school and on the right-of-way west of the school. A picture of the site is shown in Figure 2.1. The findings of the survey are described in this report.

## **2. MEASUREMENTS OF MAGNETIC FIELDS OUTSIDE THE SCHOOL**

### **2.1 Survey Procedure**

Power frequency magnetic field measurements were made with a Model 1000 Drexil Field Star magnetic field recorder, Serial Number 31400342. The Field Star is a multiple-function recorder for logging 60 Hz magnetic fields. Three orthogonal sensing coils measure the magnitude of the magnetic field component along the x, y and z axes. The Field Star can be used as a survey instrument or, when used with the Field Star Mapping Wheel it can be used as a data logger to record magnetic field data as a function of distance. Complete maps of magnetic field strength can be made of any area or building, such as in a school or under transmission lines. All results are reported in units of milligauss (mG), for consistency with most North American literature. The readings may be converted to microtesla ( $\mu\text{T}$ ) by dividing by a factor of 10.

Following standard EMF procedures, magnetic field strengths are reported at a nominal height of 1 meter above ground or grade level unless otherwise indicated. The field measurements are valid for the time of the measurement. However, it is known that ambient field levels can vary with time as a function of the electrical load on the source wires. Where fluctuations in readings were noted in the present survey, the highest reading was recorded.

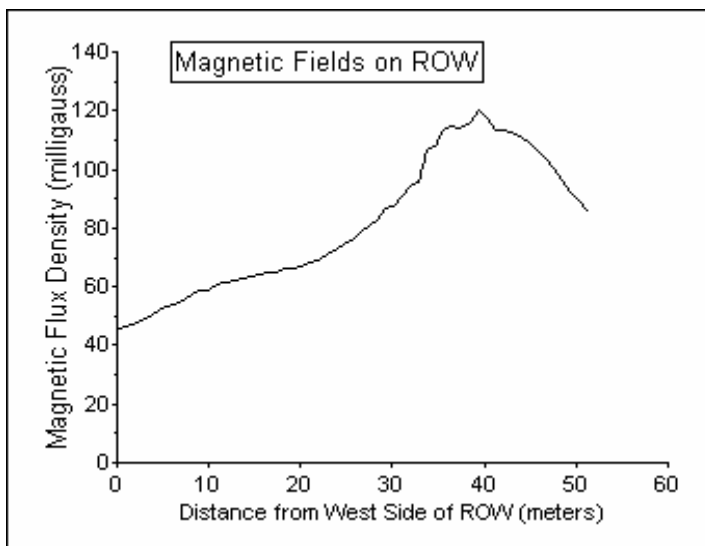
### **2.2 Test Locations and Results**

A survey was performed on the right-of-way (ROW) north of the sidewalk on Royalcrest Road (see Figure 2.1 dotted line #1). Measurements were made every meter along a line perpendicular to the transmission lines from the fence on the west side of the right-of-way toward the school and to the fence on the east side of the right-of-way. A profile of the magnetic field on the right-of-way is shown in Figure 2.2. The field strength peaked at 120.3 mG, falling to 86.1 mG at the fence beside the school.



**Figure 2.1 Site Picture of Monsignor John Corrigan School**

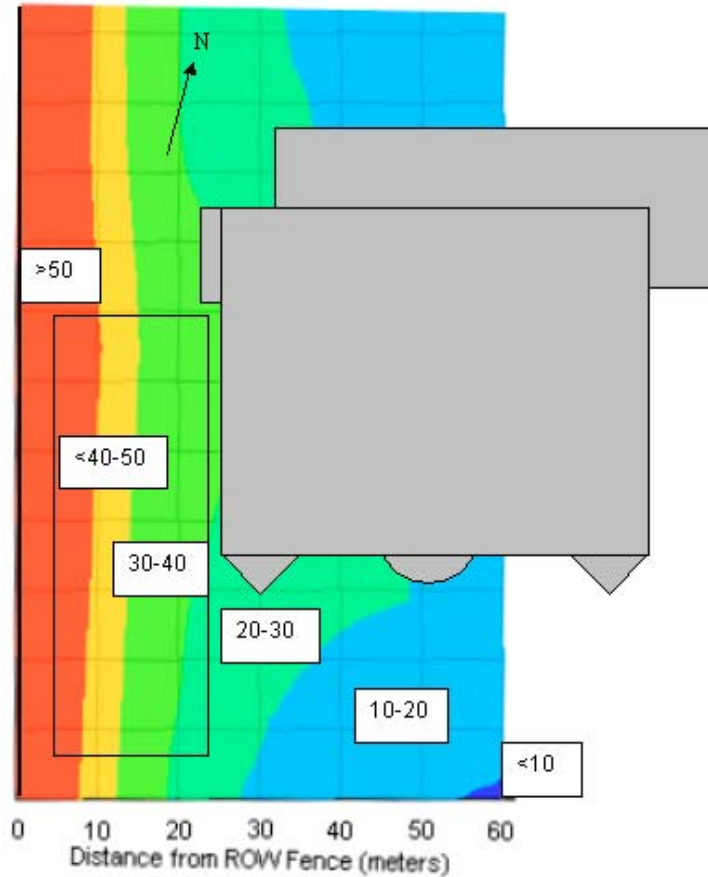
Measurements were also made on the school property from the fence by the right-of-way eastward. The measurement paths are shown by the dotted lines 2-4 in Figure 2.1. A survey was also performed along a similar path further north in the park (not shown).



**Figure 2.2. Magnetic Field Profile From the West  
Fence to the East Fence of the ROW**

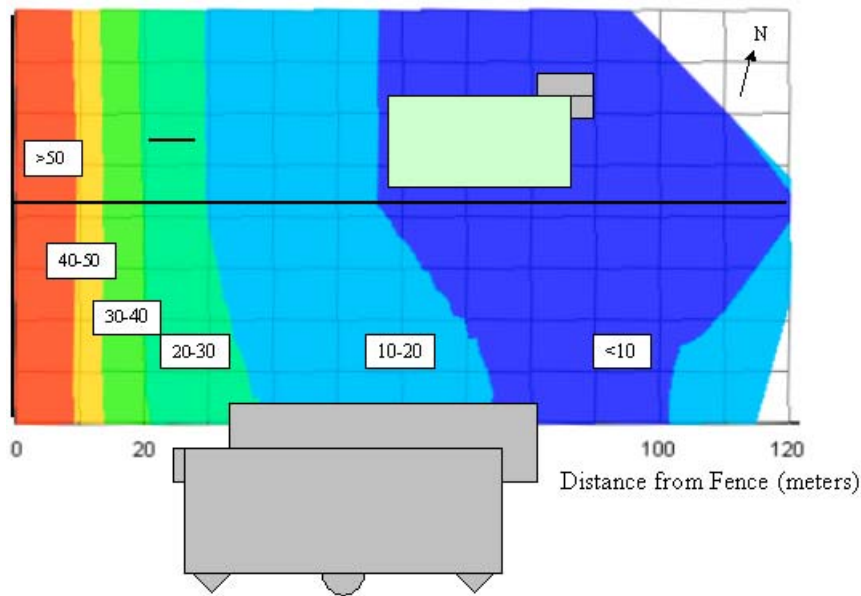
The results of the survey for the west side of the school are shown in Figure 2.3. Each square on the grid represents an area of 10m X 10 m. The rectangular area to the left of the school indicates the location of the parking lot. The left border of the figure is at the location of the fence at the edge of the right-of-way, and the bottom of the figure is at the sidewalk.

The coloured areas show ranges of magnetic field strength. The dark blue area (labeled as <5) shows where fields are less than 5 mG. The light blue area (labeled as 5-10) marks the area where fields are equal to or greater than 5 mG but less than 10 mG. Areas with the magnetic field strength equal to or greater than 50 mG are shown in red.



**Figure 2.3 Magnetic Field Levels (in units of milligauss) on West Side of School**

The map showing ranges of magnetic field strength behind the school is give in Figure 2.4. Each square on the grid represents an area of 10 m X 10 m. The colour coding of ranges is the same as for Figure 2.3. The black line across the coloured area indicates the location of the back fence of the school. North of the fence is a park area. In the park there is a tennis court (shown in green) and a soccer pitch. The short black line represents the goal posts at the south end of the pitch. The left border of the figure coincides with the fence along the right-of way. The vertical dimensions of the school have been reduced for convenience.



**Figure 2.4 Magnetic Field Levels (in units of milligauss) on North Side of School**

On the east side of the school there is a fenced play area (see Figure 2.1) that is divided into three sections with a fence between them. Measurements were taken in each of the sections using the Drexil Meter in order to obtain a map of the fields. The measurement results were very uniform, averaging about 10 mG, and so the results are presented in Table 2.1 rather than as a map. The sections number 1-3 from south to north.

**Table 2.1 Magnetic Field Measurements in Play Areas on East Side of School**

Section	Data Points	Minimum	Maximum	Average	Std. Deviation
1	110	9.44	13.08	10.78	1.46
2	77	7.92	11.36	10.36	0.85
3	124	7.72	12.08	9.82	1.16

### **2.3 Comments on Outside Measurements**

- A significant fraction of the exterior of the school is located in magnetic fields in the 20-30 mG range, with field strengths reaching 30-40 mG along the west wall of the building.
- The field strengths in a large fraction of the play areas of the school are equal to or greater than 10 mG, including along the east side of the building where the fields average about 10 mG.
- Magnetic fields measured in the back of the school along the right-of-way fence reached a maximum value of 85 mG.

### **3. MEASUREMENTS OF MAGNETIC FIELDS INSIDE THE SCHOOL**

#### **3.1 Survey Procedure**

Power frequency magnetic field measurements inside the school were made using the Model 1000 Drexil Field Star magnetic field recorder and a model 42B-1 AC milligaussmeter manufactured by Monitor Industries of Boulder, CO. The model 42B-1, Serial Number 1350 is a professional quality, true RMS (root-mean-square) reading, single-axis instrument that measures ambient power-system magnetic fields covering a frequency range from 40 Hz to 1000 Hz. Measurements are obtained by rotating the coil to obtain an maximum reading.

Following standard EMF procedures, magnetic field strengths are reported at a nominal height of 1 meter above ground or grade level unless otherwise indicated. The field measurements are valid for the time of the measurement. Where fluctuations in readings were noted in the present survey, the highest reading was recorded.

In each classroom 5 measurements were made (4 corners and middle of class). In larger rooms such as the library and gymnasium a minimum of 9 measurements were taken

#### **3.2 Test Locations and Results**

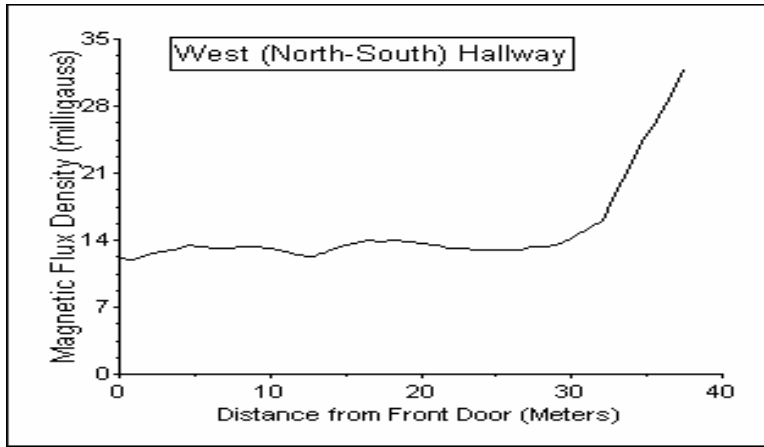
Measurements of the magnetic flux density (in milligauss) were made in each of the school classrooms and common areas occupied by students. The Table 3.1 below is a summary of the measurement results, including minimum, maximum and average flux densities. The average values for each room are also plotted on floor plans for the school. This information can be found in Appendix A of the report

Measurements of the magnetic field strength in hallways were made using a Model 1000 Drexil Field Star magnetic field recorder. Measurements were made in the West hallway (for location of hallways see figure in Appendix 1) starting at the front door and proceeding north to the wall of North hallway. A similar measurement was performed in the East hallway. Measurements in the North hallway started at the inner west doors and proceeded to the doors at the east end of the hallway. Measurements were made every 0.6 meters. The results are shown in Figures 3.1 to 3.3.

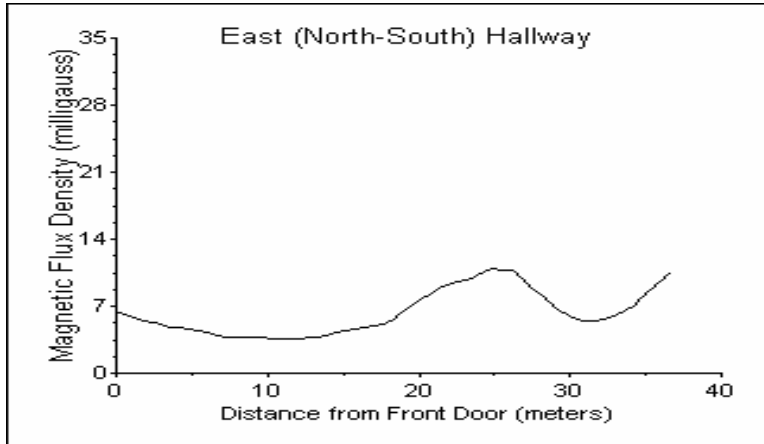
The peak at 25 meters in the profile for the East hallway was due to fields from the transformer room and associated electrical conductors. The two peaks in the curve for the North hallway are associated with the electrical conductors of the building.

**Table 3.1 Measurement of Magnetic Field Strength (in units of mG) in Monsignor John Corrigan Public School**

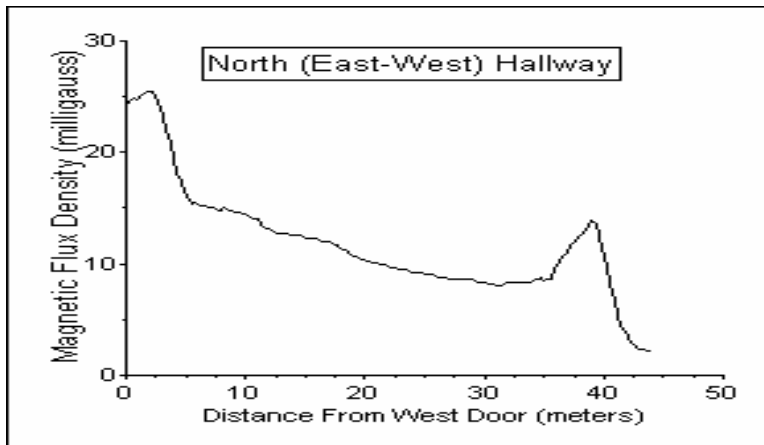
<b>Room ID</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average</b>
103	10.8	18.5	14.0
104A	20.1	30.7	24.5
104B	20.8	32.4	25.4
104C	17.2	30.8	24.9
104D	12.3	20.0	14.9
105A	15.2	26.7	21.8
106A	15.6	39.6	27.5
106B	11.5	36.5	23.0
107	17.2	38.7	27.1
109	6.68	18.8	12.8
110	13.6	5.07	10.2
111	4.40	9.52	8.14
112	4.05	9.44	7.30
113	2.24	7.05	6.03
114	3.12	6.08	5.22
115	2.07	6.75	5.23
117	2.09	8.71	5.88
118	6.00	30.8	14.3
119	4.28	13.6	8.51
120/121	3.21	9.85	5.96
125 Mech. Room	5.78	9.81	7.60
Library	6.32	19.2	12.1
Office	14.7	22.0	18.8
Principal's Office	21.2	26.0	23.7
Teacher's Workroom	16.8	28.4	19.8
Gymnasium	2.97	9.95	6.30
Electrical Room	8.36	84.7	18.8
Office by Teacher's Workroom	11.6	16.4	13.6



**Figure 3.1. Magnetic Field Profile Along West Hallway**

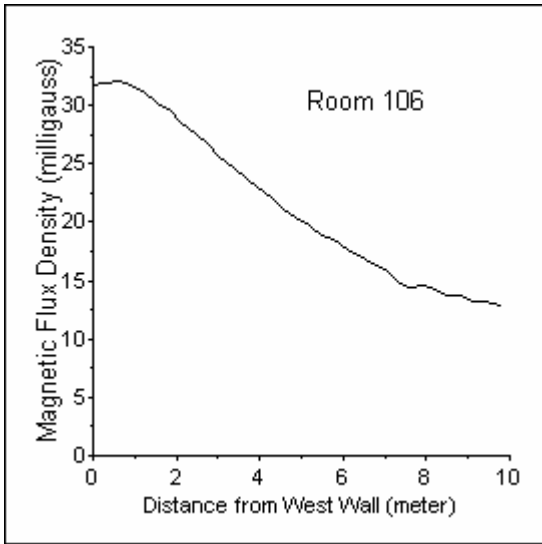


**Figure 3.2. Magnetic Field Profile Along East Hallway**

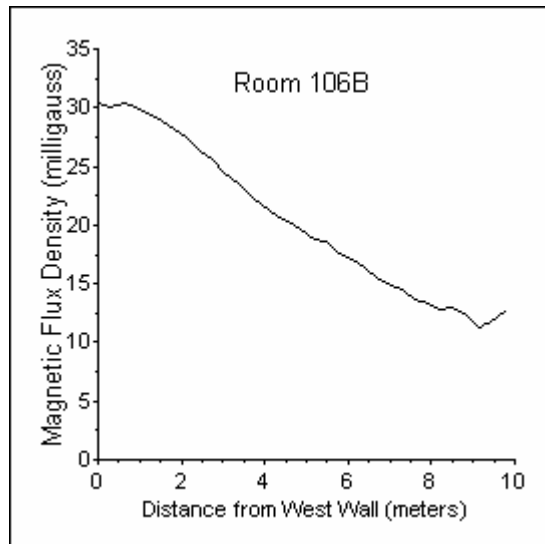


**Figure 3.3 Magnetic Field Profile Along West Hallway**

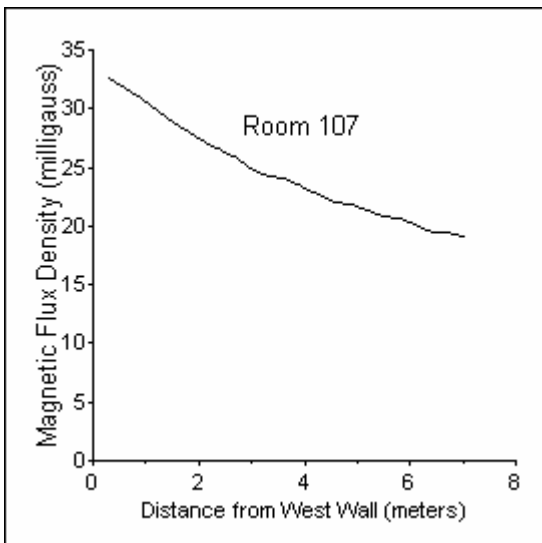
School rooms that recorded field strengths greater than 10 mG were revisited and additional measurements taken. For rooms 106, 106B and 107 measurements were taken every 0.30 meters from the west wall of the rooms to the east wall. Results are shown in Figures 3.4 to 3.6. Figure 3.7 shows the field gradient in Room 118 that resulted from magnetic fields emitted from the transformer room located south of Room 118. Measurements were made from the south wall to the north wall.



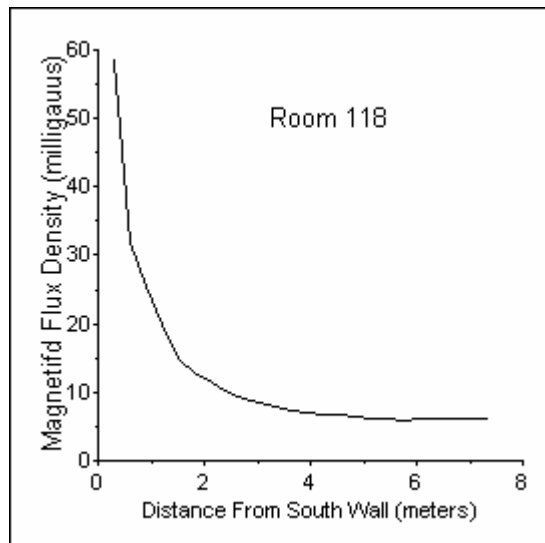
**Figure 3.4 Magnetic Flux Density (mG) In Room 206**



**Figure 3.5 Magnetic Flux Density (mG) In Room 206B**



**Figure 3.6 Magnetic Flux Density (mG) In Room 107**



**Figure 3.7 Magnetic Flux Density (mG) In Room 118**

Measurements for the other rooms where field strengths exceeded 10 mG are summarized in Table 3.2. The fields in these rooms showed less of a gradient and were weaker than those shown in the above figures. In the library the fields were highest near the south windows and along the west side of the south wall of the room.

**Table 3.2 Statistical Data for Rooms with Magnetic Fields Greater Than 10 mG**

Room	Data Points	Minimum	Maximum	Average	Std. Deviation
109	27	7.52	15.4	10.2	2.05
110	63	5.48	12.5	8.11	2.17
119	83	5.1	16.0	8.45	2.71
Library	119	7.12	21.3	12.3	3.51

### 3.3 Comments on Inside Measurements

- Rooms with the highest fields are located along the west side of the building, including staff areas, classrooms and daycare. The elevated fields in these rooms are associated with the transmission lines west of the building.
- Magnetic fields from the transformer room and associated conductors produce elevated fields in adjacent classrooms and hallway.

#### 4. COMPARISON OF FIELD LEVELS TO INTERNATIONAL ACCEPTED STANDARDS AND GUIDELINES

There are no recommended standards in Canada either at the federal or provincial level for 60 Hz electric and magnetic fields. The federal limits for electromagnetic radiation contained in Safety Code 6 do not address power frequency fields. However, in January 2005, the Federal-Provincial-Territorial Radiation Protection Committee (FPTRPC), organized under Health Canada's Radiation Protection Bureau, issued a Position Statement stating that adverse health effects from exposure to power frequency EMFs at levels normally encountered in homes, schools and offices have not been established. "...FPTRPC is of the opinion that moderate measures and the participation in the process of acquiring new knowledge are sufficient. These types of activity are consistent with the Canadian government framework on precaution."

A few international organizations have published recommended exposure limits for workers and members of the general public. Since these bodies have concluded that the available scientific data on the long-term effects, such as cancer, are insufficient to provide a basis for setting exposure restrictions, these guidelines are based on preventing short-term immediate effects. These include effects such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conduction objects, and elevated tissue temperature resulting from absorption of energy during exposure to EMF. These organizations introduced additional safety factors beyond those applied to workers in order to further reduce the recommended exposure limits for members of the public. The recommended exposure limits are provided in Table 5.1

**Table 5.1 Recommended Exposure Limits for 60 Hz Magnetic Fields**

Organization	Protected Group	Magnetic Flux Density (milligauss)
ICNIRP	Workers	4167
	General Public	833
IEEE/ICES	General Public	9040 (632000 for arms and legs)
ACGIH	Workers	10000

ICNIRP: International Commission on Non-Ionizing Radiation  
 IEEE/ICES: Institute of Electrical and Electronic Engineers/International Committee on Electromagnetic Safety  
 ACGIH: America Conference of Industrial Hygienists

The maximum field level measured inside the school was 84.7 mG in the Electrical Room. The maximum outside measurement on the school grounds of 85 mG occurred at the fence of the right-of-way. These levels are of the order of 10% of the most restrictive (ICNIPR recommended level of 833 mG)) levels recommended for members of the general public, which includes children.

