STANDARDS AND LEGISLATION ON EMF

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NUKLEAR MALAYSIA

Outline of Presentation

- Introduction
- Where do we get EMF from?
- Why standards?
- Current situation in Malaysia
- Situation in other countries
- Malaysian Standards on EMF
  - Background
  - Why ICNIRP?
  - Important aspects of the Standards
- Way forward
- Conclusions

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Introduction

- EMF has been with us ever since we start using electricity.
- EMF has been suspected to be hazardous to human beings.
- EMF has been an issue among local public for quite a while.


BERITA HARIAN/TOMAAT, 28 JUN 1996

Nasional

Jarak pemancar, ...mah mesti 150m

Study on effects of mobile phones

WORLD

EMF: Penduduk mahukan jaminan

SS25 residents doubt govt assurance on EMF hazards


Utusan 28 | Kota

Bantah pencawang TNB 20 meter dari kediaman

KAMI BANTAH ...TALIAN 275KV... PENDUDUK TAMAN TEMPLER

KANSER · LEUKEMIA · KEGUGURAN · TUMOR

Kami telah berpindah ke sini sejak 2004 lagi dan sebelum projek ini diluluskan oleh MTES pada Oktober tahun yang sama

Penghuni Pangsapuri Setapak Indah Jaya dibela


Monday, March 27, 2000

DANGER ZONE ... Samad holding up the police reports as he stands near his house. The tower which he claims is posing a danger to his family is in the background.

Tower too close for comfort for Ipoh family

By MAZNI MUSTAFA

IPOH: A family in Kampung Cepor, Chemor, is living in fear as their house is only nine metres from Tenaga Nasional Berhad's high voltage transmission tower.

Abdullah Samad Tawahidullah, 64, said it was especially so whenever it rained heavily with thunder and lightning.

He alleged that the 132kV transmission tower had also damaged most of their electrical appliances.

"Very often electricity from the earth charges up to the surface of the concrete floor of my house on rainy days.

"There were times when the current was so strong that it caused minor explosions on the floor," he said, adding that the floor of his house was now full of holes.

He said that two years ago on a rainy night his wife and two-year-old son almost died when they were suddenly "sent flying" after electricity shot through the floor.

He said he had lodged six police reports since 1995.

"Several electrical appliances such as the television, washing machine, rice cooker, stand fan and a video player were damaged even before I could finish paying the instalments," said Samad, a lorry driver who has seven children.

He said initially there was only a small transmission tower of 66kV, but about five years ago the tower was replaced with a huge one, supporting high-voltage cables.

He said he had lodged numerous complaints with Tenaga but there no action had been taken so far.

"I can no longer tolerate this and have sought legal advice on how to deal with the situation," he said.

Samad said he would seek compensation from Tenaga for putting his family's lives at risk and for the losses he had to suffer.

"I will also ask for compensation if Tenaga wants to relocate my house to a safer area some 600m from the tower," he said.

Until then, Samad said he would switch off electricity to prevent short-circuiting whenever it rained, and at times moved his family to a relative's house whenever the rain got worse.

Tenaga consumer services general manager Shabrizan Ahmad said he would refer the matter to the Electricity and Gas Supply Department to ascertain whether the complaint had basis.

He said this was because in normal circumstances Tenaga would get the approval from the department and the Land and Mines Department on the location of every transmission tower.

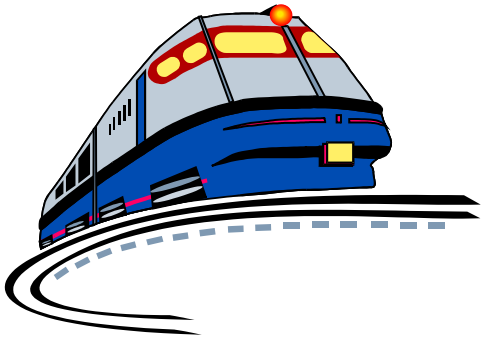
He said that in the case of Samad, he did not know why the distance of the house was less than the 198m buffer zone required for a 132kV tower.

"As far as we know Tenaga followed the right procedures as it is the organisation's policy to not put lives of the people at risk," he said.

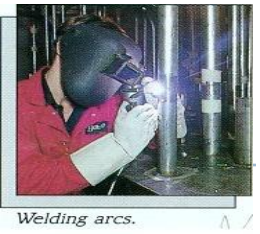
He said he would also send some officers there to check on the complaint and find ways to solve it.

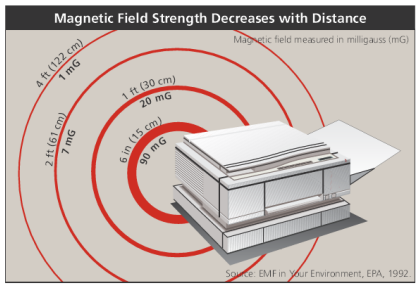
Why do we get EMF from?

- From countless number of electrical devices, equipment and machines used in industry



- From countless number and types of consumer products used in offices, at places of work and at home

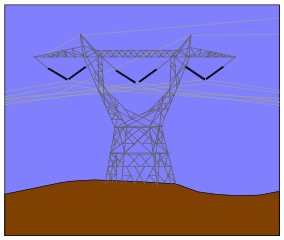
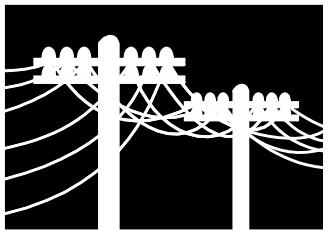




You cannot see a magnetic field, but this illustration represents how the strength of the magnetic field can diminish just 1–2 feet (30–61 centimeters) from the source. This magnetic field is a 60-Hz power-frequency field.

Why do we get EMF from? (2)

- From electricity supply system – generation, transmission, distributions:
  - Generation of electricity by 4 major hydro plants (1,911 MW) and 28 major gas, coal, oil power plants (21,445 MW)
  - Electricity is transmitted through 600,000 km grid of underground and overhead cables


  - Supported by 50,000 transmission and distribution sub-stations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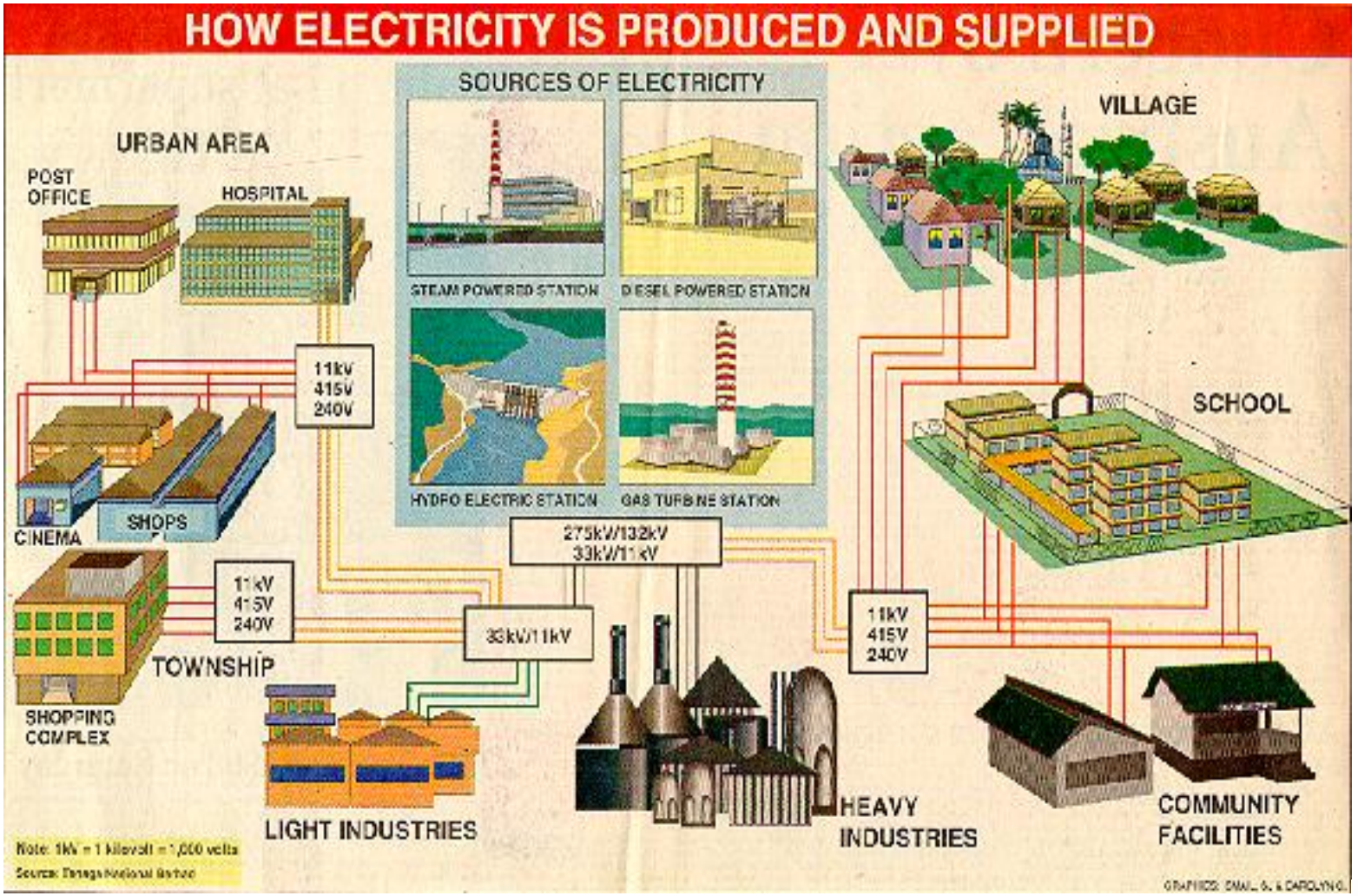
Electricity supply system in Malaysia



Why standards?

- There is a need to have a proper guide and standards:
  - There are a lot of things around us that can generate EMF (electrical consumer items, electrical equipment, wiring in the buildings, power lines, sub-stations etc).
  - To limit overexposure to EMF present in our environment.
  - To control and minimize any potential hazard caused by EMF.
  - To facilitate implementation and compliance of the regulations.
  - To guide users and safety officer in the establishment and implementation of EMF safety program in workplaces and in all public areas.
  - To harmonize in term of standard measurements and to quantify safe and unsafe condition.
  - For the relevant authorities to be transparent.

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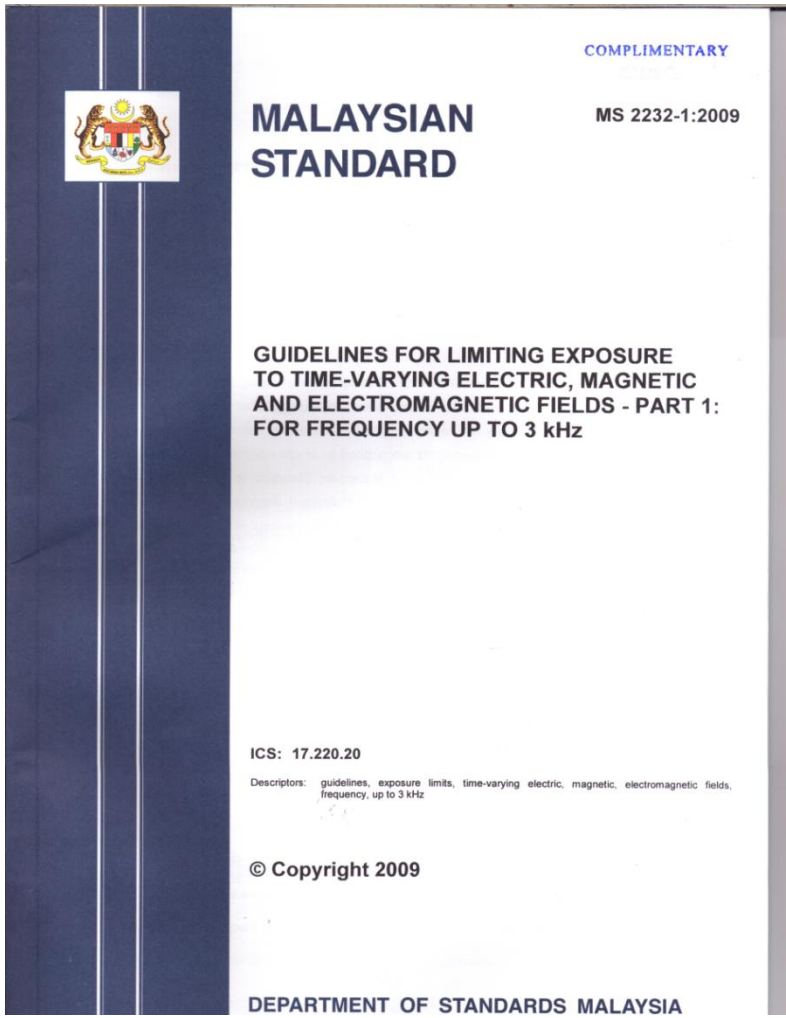
Current situation in Malaysia

- At the moment there is no national legislation controlling exposure to EMF.
- There is a national standards on EMF exposure which was released by SIRIM in February 2010.



Situation in other countries

- Countries set their own standards for exposure to EMF.
- Majority of these national standards adopt the recommendations of the guidelines issued by a non-governmental international scientific organization, ICNIRP.

  ICNIRP - International Commission on Non-Ionizing Radiation Protection

- ICNIRP guidelines stipulate permissible exposure limits in term of electric fields and magnetic fields.

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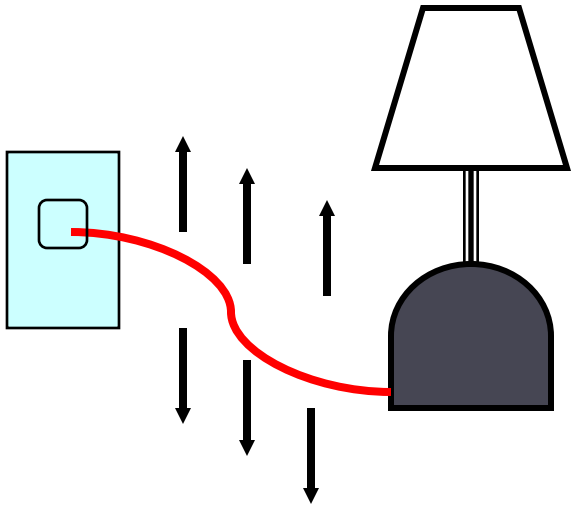
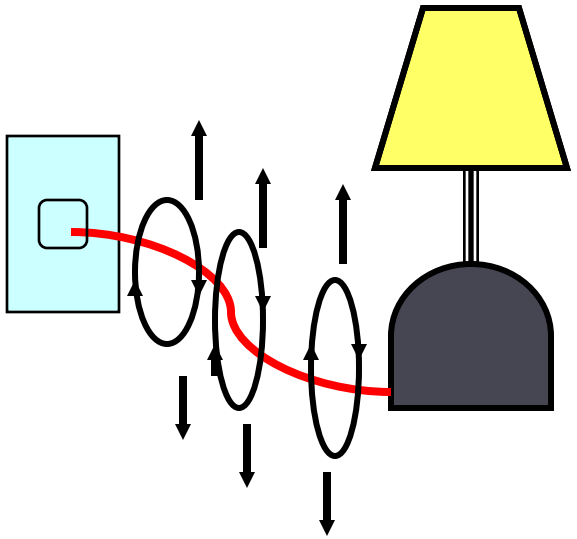
EMF- Electric & Magnetic fields

ELECTRIC FIELDS



Lamp plugged in but turned OFF

ELECTRIC & MAGNETIC FIELDS



Lamp plugged in and turned ON

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Situation in other countries (2)

Country	Magnetic Field (uT)	Electric Field (kV/m)	Basis
Germany – Ordinance 26 1997	100	5	ICNIRP. No regional variation
Austria – 2 Standards	100	5	ICNIRP, More stringent at some local authorities
Belgium – Royal Decree 2001	50	2.5	Half of ICNIRP. No regional variation
Denmark - Standards	100	5	ICNIRP
Finland – Act and Regulations (new one covers <100kHz)	100	5	ICNIRP
France – Regulations and Order/Decree	100	5	Eu Council Recommendations (ICNIRP)

Situation in other countries (3)

Country	Magnetic Field (uT)	Electric Field (kV/m)	Basis
Greece– Act	80	4	80% of ICNIRP. No regional variation.
Ireland – Regulations and Guidelines	100	5	ICNIRP. No regional variation
Italy– Act 2001	100	5	ICNIRP. There is a regional variation
The Netherland – Act and Decree	100	5	ICNIRP. No regional variation.
Spain– Royal Decree 2001	100	5	ICNIRP
Sweden– Act, Regulations and Guidelines	100	5	ICNIRP. No regional variation

Situation in other countries (4)

Country	Magnetic Field (uT)	Electric Field (kV/m)	Basis
UK– Act	100	5	ICNIRP
Australia – Guidelines	100	5	ICNIRP
New Zealand– Guidelines	100	5	ICNIRP
Canada - Guidelines	100	5	ICNIRP
Poland – Law and Orders	100	5 1 (residential areas, schools, hospitals, churches, kindergartens	ICNIRP. No regional variation
Switzerland - Ordinance	100	5	ICNIRP supplemented by precautionary measures (emission limits)

Standards and Guidelines in the US

- There are no federal standards limiting exposure to EMF
- 6 States have set standards for transmission lines electric fields and 2 with magnetic fields

State Transmission Line Standards and Guidelines

	Electric Field		Magnetic Field	
State	On R.O.W.*	Edge R.O.W.	On R.O.W.	Edge R.O.W.
Florida	8 kV/m[a] 10 kV/m[b]	2 kV/m	—	150 mG[a] (max. load) 200 mG[b] (max. load) 250 mG[c] (max. load)
Minnesota	8 kV/m	—	—	—
Montana	7 kV/m[d]	1 kV/m[e]		
New Jersey	—	3 kV/m		
New York	11.8 kV/m 11.0 kV/m[f] 7.0 kV/m[d]	1.6 kV/m	—	200 mG (max. load)
Oregon	9 kV/m	—	—	—

*R.O.W. = right-of-way (or in the Florida standard, certain additional areas adjoining the right-of-way). kV/m = kilovolt per meter. One kilovolt = 1,000 volts. [a]For lines of 69-230 kV. [b]For 500 kV lines. [c]For 500 kV lines on certain existing R.O.W. [d]Maximum for highway crossings. [e]May be waived by the landowner. [f]Maximum for private road crossings.

Malaysian Standards on EMF

- Background
  - Drafted by a technical committee formed by SIRIM, comprising representatives from Ministry of Health, Nuklear Malaysia, University Malaya, Malaysian Communication and Multimedia Communication (SKMM), UNITEN, TNB.
  - Drafted based on recommendations made by a non-governmental international scientific organization, ICNIRP.
  - The draft was finalized by the Committee in 2009 and was released by the Department of Standards Malaysia as the Malaysian Standards (MS 2232-1:2009) in October 2010
  - Comes in 2 parts:
    - Part 1 – power lines
    - Part 2 - Radiofrequency and microwave radiation (mobile phones, radio, TV etc)

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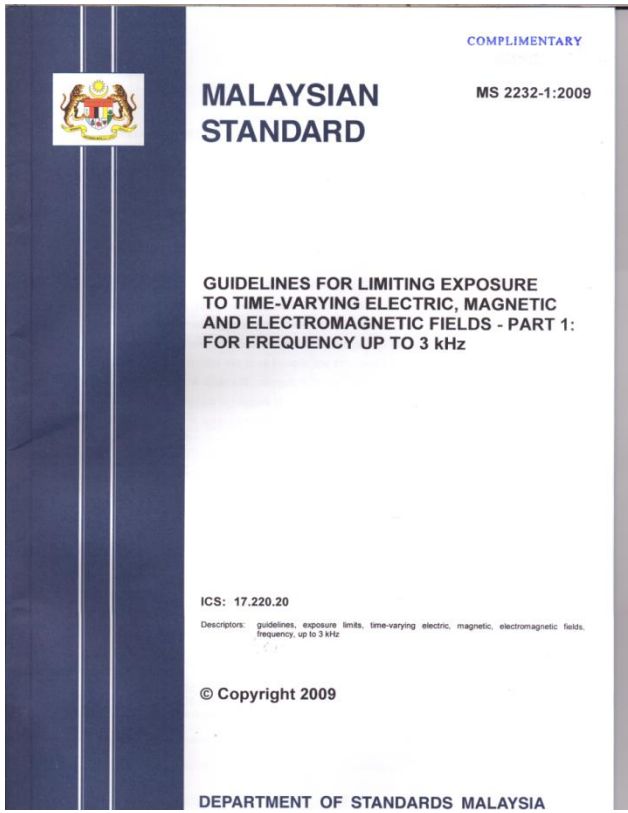
Malaysian Standards on EMF (2)

- Why ICNIRP?
  - ICNIRP is a voluntary, non-profit, scientific organization with sole interest to protect health and safety of people from hazards of non-ionizing radiation including EMF.
  - Widely represented by well known scientists and experts (>15,000) from all over the world (> 40 countries) in the fields of non-ionizing radiation safety .
  - Decisions are made based on well established and tested acceptance criteria and detailed deliberation of findings made by all research groups in the world including Asian countries.
  - ICNIRP's recommendations are adopted in order to harmonize use of EMF safety standards throughout the world.
  - ICNIRP's recommendations have been adopted by many countries in the world (e.g. UK, Germany, Sweden, France, Canada, Australia, New Zealand, etc)
  - Recognized by international organizations such as WHO, ILO, European CENELEC.

Malaysian Standards on EMF (3)

- The title: Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields – Part 1
- Some important aspects of the Standards:
  - Scope - not applicable to:
    - patients undergoing medical treatment or diagnosis using EMF
    - Protection against ignition of sparks
    - Protection of interference in performance of electronic equipment
    - EMC



Malaysian Standards on EMF (4)

- Objectives:
  - To specify limits of exposure to EMF to prevent adverse health effects.
  - To recommend standard equipment and procedures that can assist in determination of compliance of the Standards.
  - To recommend general procedures for ensuring exposure of workers and the general public are below the limits specified in the Standards.
  - To recommend working conditions that will lead to high standard of safety for all workers.
- Target Group:
  - Workers.
  - Members of the public (5 times lower).
- Exposure limits:
  - Given in basic components of EMF:
    - Electric fields
    - Magnetic fields

Exposure limits for workers and public (50 Hz)

Occupational	Electric Field (kV/m)	Magnetic Field (uT)
Whole working day	10	500
General Public		
Up to 24 hrs/d	5	100

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Malaysian Standards on EMF (5)

- The authority may establish suitable operational limits lower than the exposure limits.
- Compliance with the limits shall be verified by direct measurements or evaluation.
- Measurements or evaluation to prove compliance shall be made by a qualified and experienced person or an authorized body.
- Measurements or evaluation shall be carried out according to protocol and procedures described in the Standards for areas accessible by workers and members of the public.
- Measurements results shall be kept in a proper record.
- Measurements or evaluation results shall remain valid for a period to be determined by the authority .Any modification will render the results invalid.

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Malaysian Standards on EMF (6)

- Protection of the General Public:
  - Determination of the boundaries of areas where public exposure limits may exceed.
  - Restriction of public access to areas where public exposure limits may exceed.
  - Provision of appropriate signs and notices
  - Notification to the authorities in the event of exposure exceeding the limits.
  - Minimizing, as appropriate, exposure to EMF with reasonable cost.
- Precautionary principles
  - Prudent avoidance
  - Optimize protection
  - Buffer zone around substations
  - Transformers should be placed in isolated buildings

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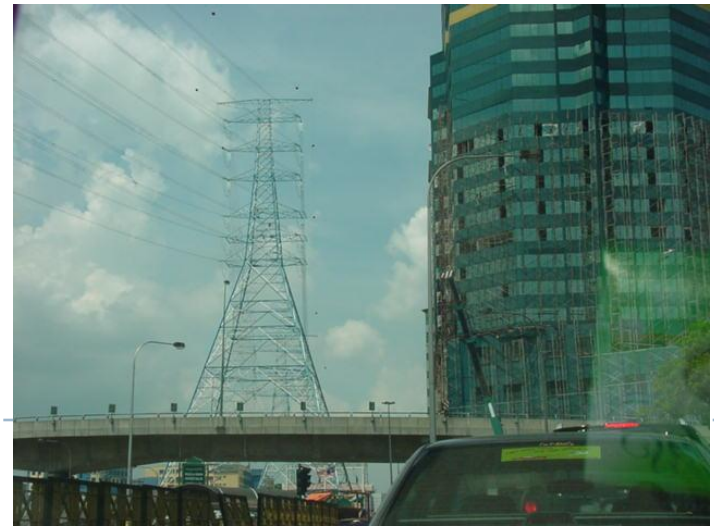
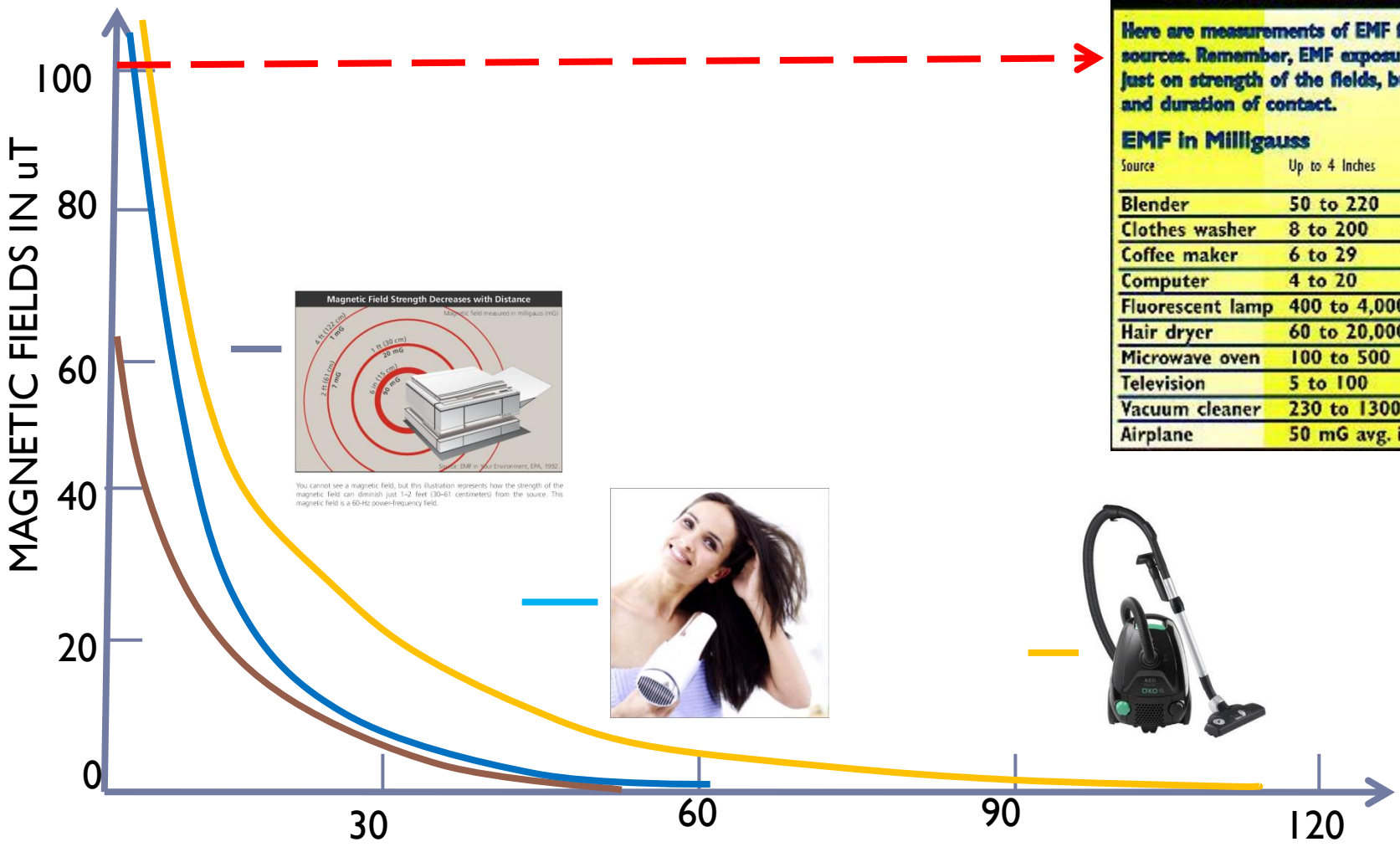
275kV - jalan reko (kajang)



What does 100 uT really mean to us?



DANGER ZONES

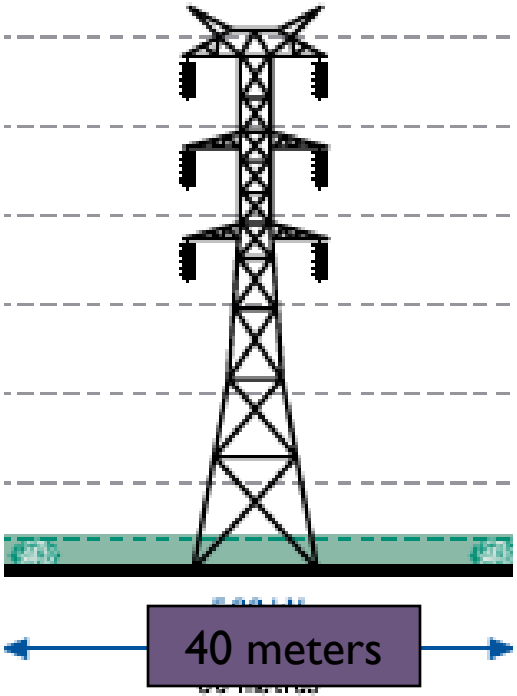
Here are measurements of EMF from common sources. Remember, EMF exposure depends not just on strength of the fields, but on proximity and duration of contact.

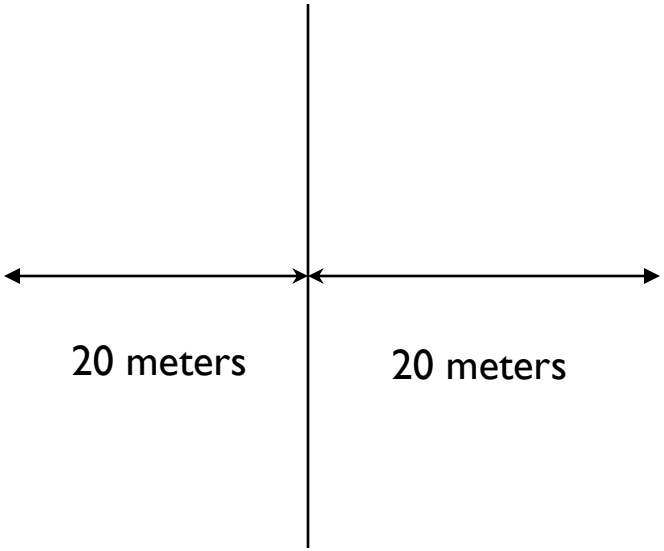
EMF in Milligauss

Source	Up to 4 Inches	At 3 Feet
Blender	50 to 220	0.3 to 3
Clothes washer	8 to 200	0.1 to 4
Coffee maker	6 to 29	0.1
Computer	4 to 20	2 to 5
Fluorescent lamp	400 to 4,000	0.1 to 5
Hair dryer	60 to 20,000	0.1 to 6
Microwave oven	100 to 500	1.0 to 25
Television	5 to 100	0.1 to 6
Vacuum cleaner	230 to 1300	3 to 40
Airplane	50 mG avg. in a 747	

ROW/ clearance of transmission line in Malaysia

Transmission line





Center point of the tower

Right of way for the Overhead lines

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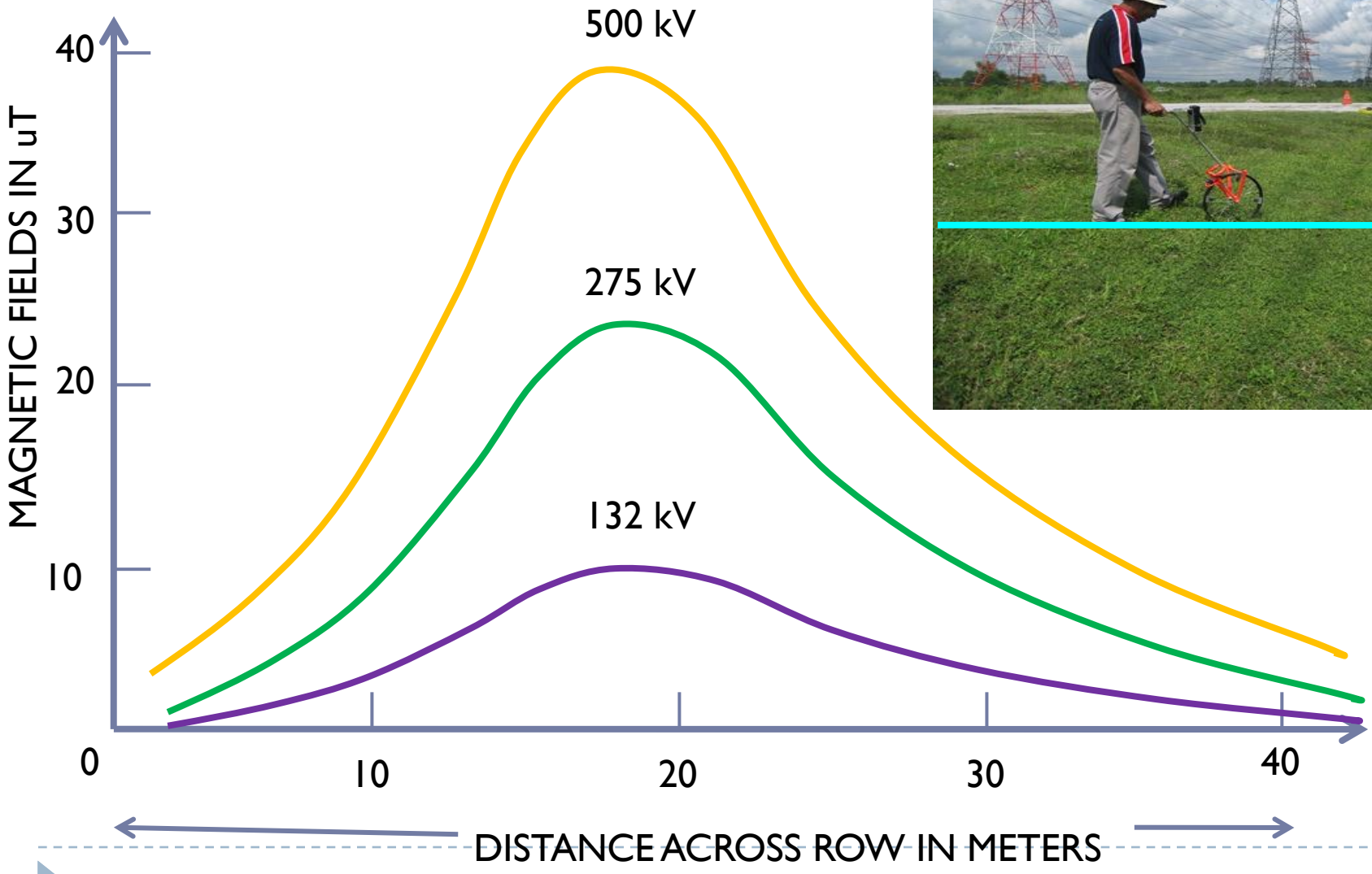
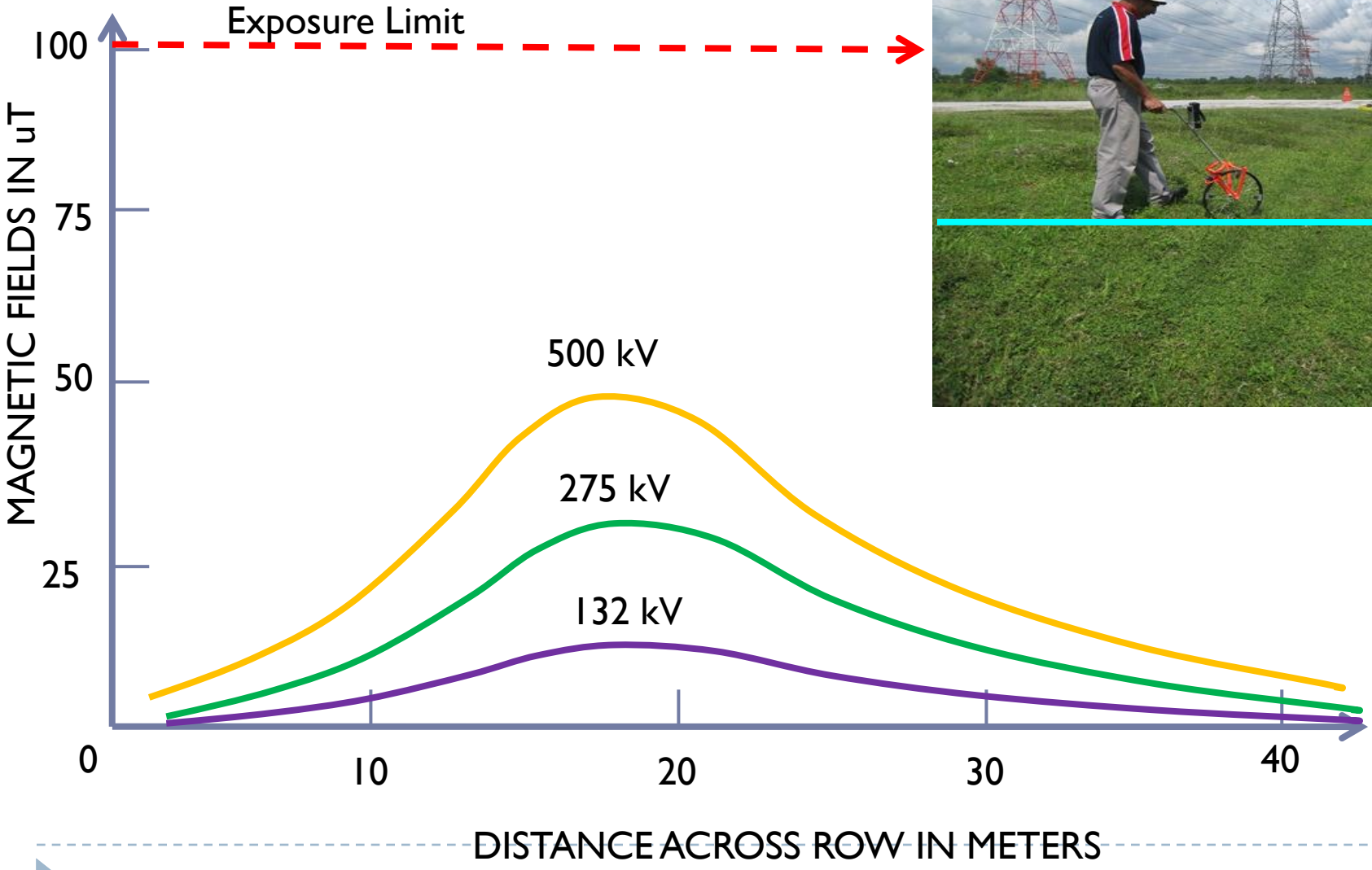
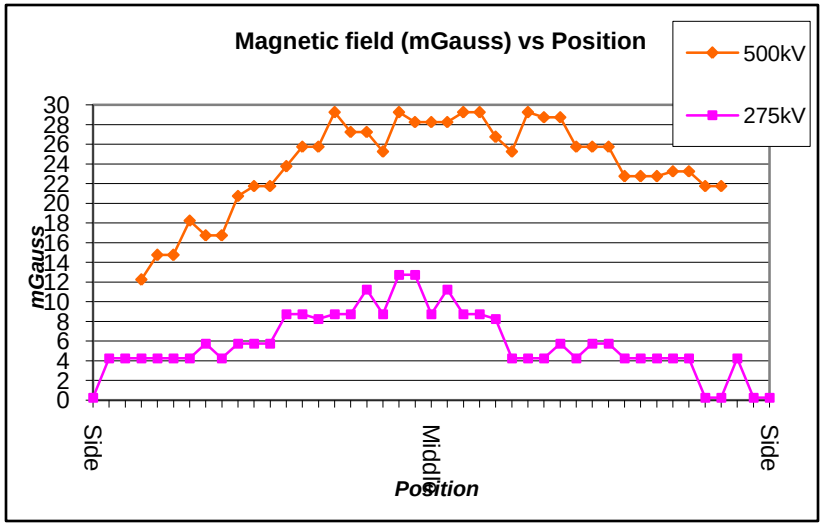
Magnetic fields under the cables



Magnetic fields under the cables



Measured Magnetic Fields under the Transmission lines of 275kV and 500kV.



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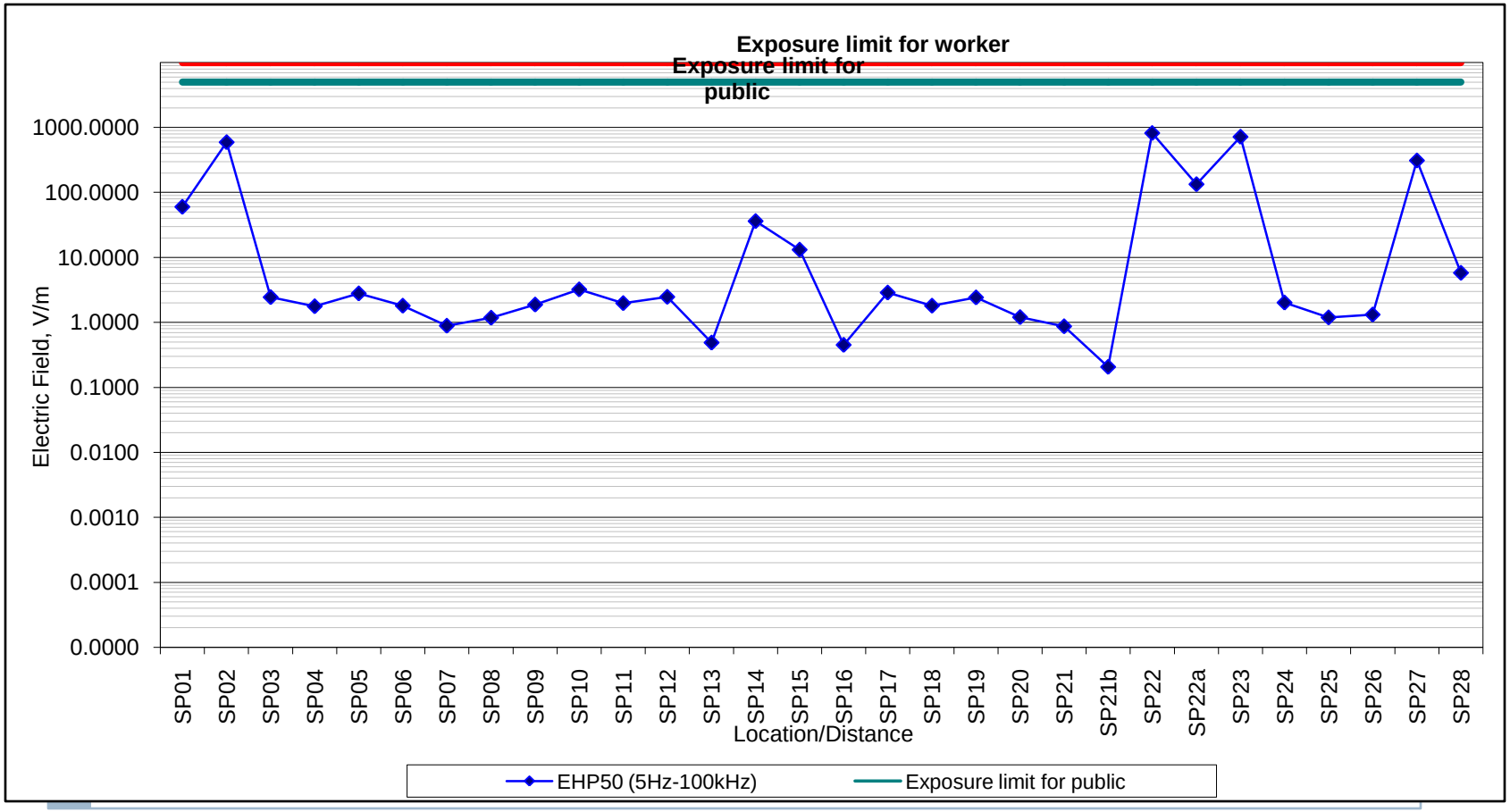

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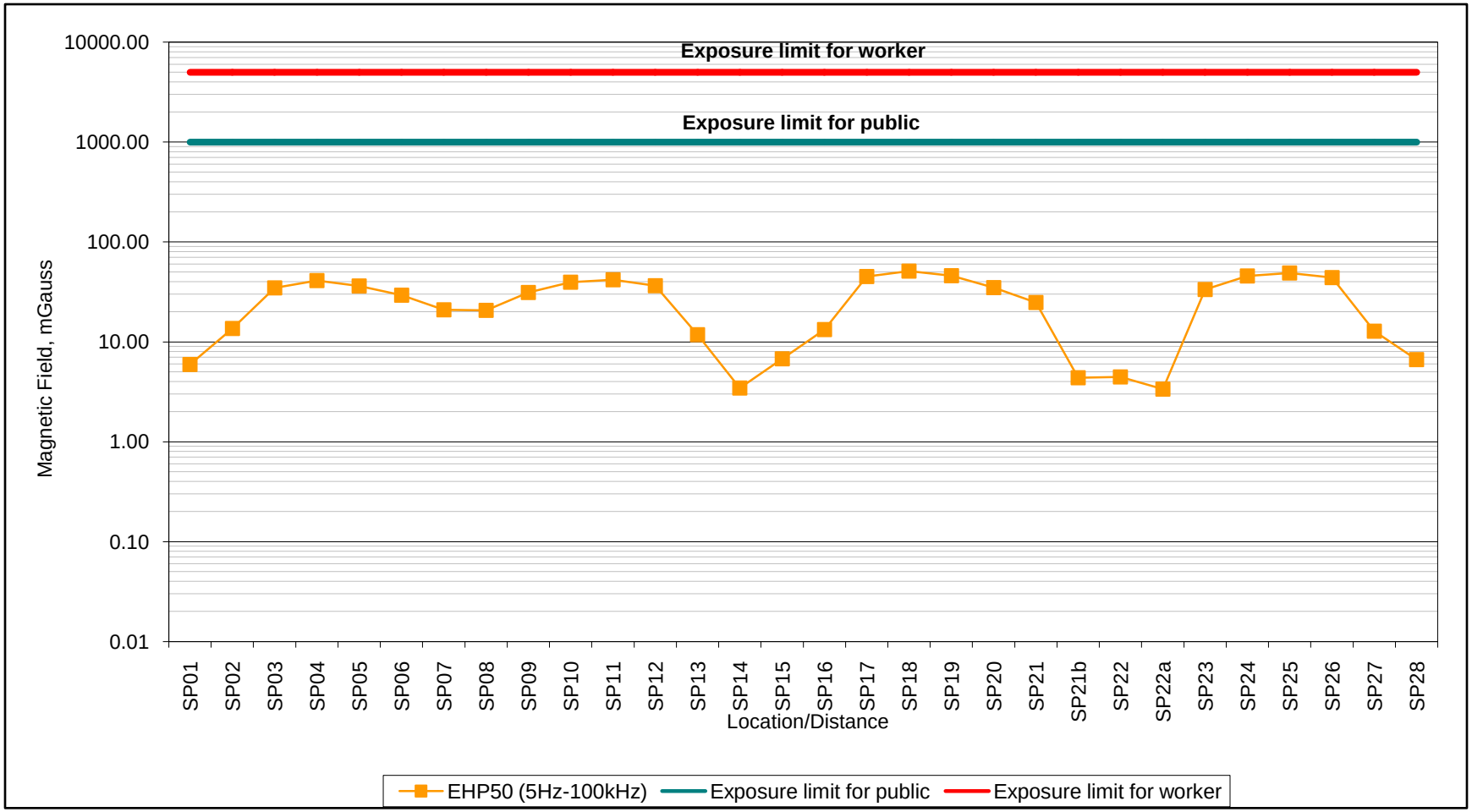

Typical E and H fields under/at close distances to some ELF sources

ELF Source	H field (μT)	E field (V/m)
Generating Stations	20 - 40	5000 - 16000
Sub-stations	0.1 – 6.6	< 1
HV overhead cables (110, 380,765 kV)	10 - 30	1000 - 12000
Heavy Industry	1000 – 10,000	10 - 810
Office & household	0.01 - 1	2 - 500

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EMF in common environment

EMF Exposures in Common Environments
Magnetic fields measured in milligauss (mG)

Environment	Median* exposure	Top 5th percentile
OFFICE BUILDING		
Support staff	0.6	3.7
Professional	0.5	2.6
Maintenance	0.6	3.8
Visitor	0.6	2.1
SCHOOL		
Teacher	0.6	3.3
Student	0.5	2.9
Custodian	1.0	4.9
Administrative staff	1.3	6.9
HOSPITAL		
Patient	0.6	3.6
Medical staff	0.8	5.6
Visitor	0.6	2.4
Maintenance	0.6	5.9
MACHINE SHOP		
Machinist	0.4	6.0
Welder	1.1	24.6
Engineer	1.0	5.1
Assembler	0.5	6.4
Office staff	0.7	4.7
GROCERY STORE		
Cashier	2.7	11.9
Butcher	2.4	12.8
Office staff	2.1	7.1
Customer	1.1	7.7

*The median of four measurements. For this table, the median is the average of the two middle measurements.
Source: National Institute for Occupational Safety and Health.

Way forward

- Introduction of legislation on EMF safety.
- Road show for introduction of the EMF Standards to Malaysian public and authorities.
- Establishment of EMF database.
- Establishment of guidelines on EMF measurements to meet the standards.
- Establishment of standard testing and calibration facility for EMF measurements.
- R&D on EMF safety.

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The way forward (2)

- Legislation to control EMF usage/sources:
  - Currently no regulations controlling NIR usage (including EMF) in Malaysia.
  - Lack of awareness on potential health hazard caused by exposure to strong EMF .
  - Late issuance of recommendations and guidelines on exposure limits and safe handling of EMF sources.
  - Limited access to EMF info before the internet era.
- Road show for introduction of the EMF Standards to Malaysian public and authorities:
  - Awareness about the presence of the Standards.
  - To include and use the standards in existing implementation procedures.

The way forward (3)

- Establishment of EMF database:
  - To cover both sources and exposure.
  - Important for reference and input for assessment.
  - Data are available but incomplete and scattered.
- Establishment of standard guidelines for EMF measurements:
  - Important for QA of EMF measurements – accurate, reliable and trustable reading.
  - Important to support implementation of EMF safety program.
  - Should be established by SIRIM.

NST, 11-4-2002 (Pg 6)

'Radiation within permissible levels'

KUALA LUMPUR, Wed. — Telecommunications service providers have given the assurance that radiation levels at their towers are within permissible levels. Celcom (M) Sdn Bhd, DiGi Telecommunications Sdn Bhd, Maxis Communications Bhd and TIMECel Sdn Bhd said they would comply with standards set by the Government on radiation levels.

In a joint statement, they said the new guidelines announced by the Government yesterday outlined more clearly the permissible height of roof-top structures and the distance between free-standing towers and the nearest building.

"This brings the country closer in line with other countries around the world which require telcos to comply with the permissible radiation level," the statement said.

The way forward (4)

- Establishment of Malaysian standard facility for testing and calibration of EMF measuring equipment:
  - Important for QA of EMF measurements – accurate, reliable and trustable reading.
  - Important to support implementation of EMF safety program.
  - Should be looked after by relevant authorities.
- R&D on EMF safety:
  - Researches on NIR safety (including EMF) are mostly done in developed countries.
  - Need to have local data as environment, sources, characteristics of exposure and local population are different from other countries.
  - To convince the public on safety of EMF sources.
  - Require adequate budget allocation.


BERITA HARIAN/TOMAAT, 28 JUN 1996

Nasional

Jarak pemancar, umah mesti 150m

Study on effects of mobile phones

WORLD

EMF: Penduduk mahukan jaminan

SS25 residents doubt govt assurance on EMF hazards

Conclusion

- Standards are very important to properly manage and control EMF hazards to workers and the public.
- SIRIM has issued Malaysian Standards for limiting EMF exposure based on international standards ICNIRP and it is a common practice in majority of the countries in the world.
- These Malaysian Standards require additional support from all parties concerned to make them effective.
- Most of the EMF present in public accessible areas are below the limits set by the Malaysian Standards.

Thank you