資料1

Intermediate Frequency Electromagnetic Field Exposure and Health Risk

Current Status and Issues of Epidemiology

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Outline

i. What is “Intermediate Frequency (IF) Electromagnetic Fields (EMF)”?

ii. “Video Display Terminal (VDT) and Spontaneous Abortion” was the first concern!

iii. Why IF-EMF?

iv. The current issues are “Induction Heating (IH)” and “Wireless-Power Transfer (WPT)”.

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There is no unified definition in the IF band.

WHO EMF Project , Fact sheet(2005)

300Hz~10MHz

WHO Environmental Health Criteria 238(2007, Last update:2016)

300Hz~100kHz

International Commission on Non-ionizing Radiation Protection (ICNIRP) Guideline 2010

1Hz~100kHz

Ministry of Internal Affairs and Communications (MIC) of Japan:

10kHz~10MHz

Frequency range belonging to either definition upper

1Hz～10MHz

Common frequency range of the definitions upper

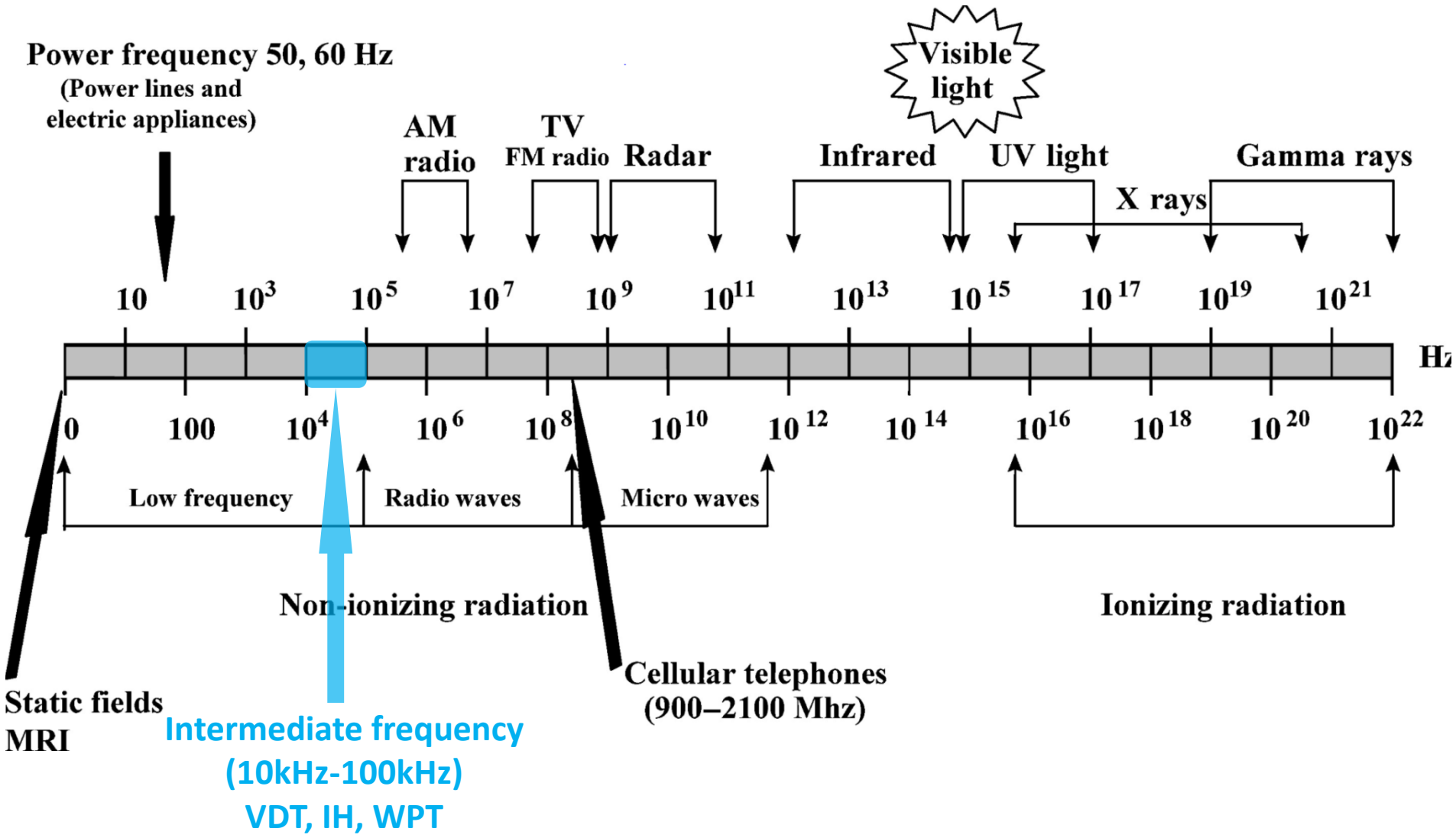
10kHz~100kHz

IH for cooking heater : 20kHz ~ 90kHz

WPT for electric vehicle: 85kHz

Monitor: a few to several hundreds of kHz

IF band in the electromagnetic spectrum



From Feychting M, Annu. Rev. Public Health 2005, modified by Sokejima (Blue characters).

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“Video Display Terminal (VDT)” was the first concern!

Alison McDonald of McGill University said in his lecture:

“Unusually high rates of miscarriage and birth defect were reported in North America in 1978-82 in a limited number of large office blocks where employees had used visual display terminals (VDTs) in early pregnancy”.

“Although there was no apparent reason to suspect that the very low frequency electro-magnetic fields around VDTs could affect the fetus, there was public concern”.

In this paragraph, “very low frequency” band included “intermediate frequency” of today.

"Video Display Terminal (VDT)" was the first concern!

Table I Main characteristics of studies considered in the review

Author, country, study period	*Type of study*	*Outcomes considered*	*Selection of*		*Definition of exposure*
			Cases	*Controls*	
Bryant and Love; Canada, 1984–1985[6]	Case-control	SA	SA (<20 weeks' gestation) admitted in a network of collaborating hospitals	Two control groups: (a) prenatal: women <25 weeks gestation identified from prenatal class list (interviewed at home or in the office) (b) post partum: women delivering healthy infants in the same hospitals as cases.	Self-reported (interview)
Brandt and Nielsen; Nielsen and Brandt; Denmark, 1983–1985[7 8]	Case-control	SA, CM	SA or CM in women members of the Danish Union of Commercial and Clerical Employees.	"Random" sample of normal deliveries reported in the same population as cases.	Self-reported (postal questionnaire; response rate 76% for cases and 75% for controls).
Ericson and Källen; Sweden, 1980–1981[9]	Case-control nested in a cohort	SA, CM, LBW (<1500g)	SA, CM, LBW reported in three cohorts of women at professional high, medium, and low probability of using VDT	Sample of women with favourable reproductive outcome in the same cohorts as cases	Self-reported (postal questionnaire, response rate 99%).
Goldhaber *et al*; USA, 1981–1982[10]	Case-control nested in a cohort	SA and CM	SA and CM reported in a cohort of women self-referring for pregnancy testing at three Kaiser Permanente Medical Care Programs	Random sample (20%) of normal deliveries in the cohort	Self-reported (postal questionnaire and for non-responders interview by phone) overall response rate 83% for SA, 88% for CM and controls)
Kurppa *et al*; Finland, 1976–1982[11]	Population based case-control	CM	Sample of cases reported to the National Register of Congenital Malformations	Women who delivered immediately before the cases in the same maternity health care district	Self-reported (interview during the mother's first post-natal visit)
McDonald *et al*; Canada, 1982–1984[12]	Case-control	SA, LBW (<2500g) CM	SA, LBW, CM in women with professional high probability of using VDT	Normal delivery in woman at professional high probability of using VDT	Self-reported (interview in hospital)
Schnorr *et al*; USA, 1983–1986[13]	Case-control	SA	Married women aged 18–33 employed as directory assistants or general telephone operators who reported SA	Women who reported normal pregnancy	Personal records and interview data
Windham *et al*; USA, 1986–1987[14]	Case-control	SA, LBW (<2500g)	Women who had a SA by 20 weeks' gestation, for which a pathology specimen was submitted to a network of hospitals.	Women who had a live birth matched with cases by last menstrual period and hospital. LBW were compared with normal controls.	Self-reported (telephone interview, response rates 73% and 81% respectively cases and controls).

SA=spontaneous abortions; CM=contenital malformations; LBW=low birth weight

From: Parazzini F, et. al. J Epidemiol Community Health (1993).
Video display terminal use during pregnancy and reproductive outcome--a meta-analysis.

“Video Display Terminal (VDT) use” was the first concern!

Spontaneous abortion (SA) and video display terminal (VDT) 1980～1987

Table II Main results from selected studies on spontaneous abortion (SA) and video display terminal (VDT) use

Authors	*SA (exposed/total)*	*Controls (exposed/total)*	*Odds ratio (95% CI)*	*Comments*
Bryant and Love[6]	140/334	151/314*	0·8 (0·6,1·1)	No change after adjustment for covariates
		127/333†	1·2 (0·9, 1·6)	
Ericson and Kallen[9]	208/327	572/926	1·1 (0·8, 1·4)	No change after taking into account major covariates
Goldhaber *et al*[10]	115/355	213/723	1·1 (0·9, 1·5)	No change after adjustment for covariates
McDonald *et al*[12]	361/1763	4711/24 614‡	1·1 (1·0, 1·2)	–
	415/4887	2164/22 517§	0·9 (0·8, 1·0)	
Nielsen and Brandt[7]	353/666	421/764	0·9 (0·7, 1·1)	No marked difference in OR in an analysis stratified for major potential covariates.
Schnorr *et al*[13]	54/134π	312/742	0·9 (0·6, 1·4)	No excess risk among women who used VDT in the first trimester of pregnancy.
Windham *et al*[14]	239/439	461/909	1·2 (0·9, 1·5)	No change after adjustment for covariates. OR=1·5 in the first trimester of pregnancy.
Total	1885/8905	9005/51 509	1·0 (0·9, 1·0)	

*Prenantal controls, included in the pooled analysis; †postnatal controls, not included in the pooled analysis; ‡current pregnancies; §previous pregnancies; πEstimated from percentages.

Negative result !

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Recommendations for research WHO EHC238 (2007, Last update:2016)

As an overarching need, further research on intermediate frequencies(IF), usually taken as frequencies between 300 Hz and 100 kHz, is required, given the present lack of data in this area.

General requirements for constituting a sufficient IF database for health risk assessment include exposure assessment, epidemiological and human laboratory studies, and animal and cellular (invitro) studies (ICNIRP, 2003; ICNIRP, 2004; Litvak, Foster & Repacholi,2002).

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SOURCES

- Industry: Dielectric heater sealers, induction and plasma heaters, broadcast and communications transmitters,
- General public: Domestic induction cookers, proximity readers, electronic article surveillance systems and other anti-theft devices, computer monitors and television sets,
- Hospitals: MRI systems, electromagnetic nerve stimulators, electro-surgical units, and other devices for medical treatment,
- Military: Power units, submarine communication transmitters and high frequency (HF) transmitters.

FROM: WHO(2005): Electromagnetic fields & public health: Intermediate Frequencies (IF)
http://www.who.int/peh-emf/publications/facts/intmedfrequencies/en/