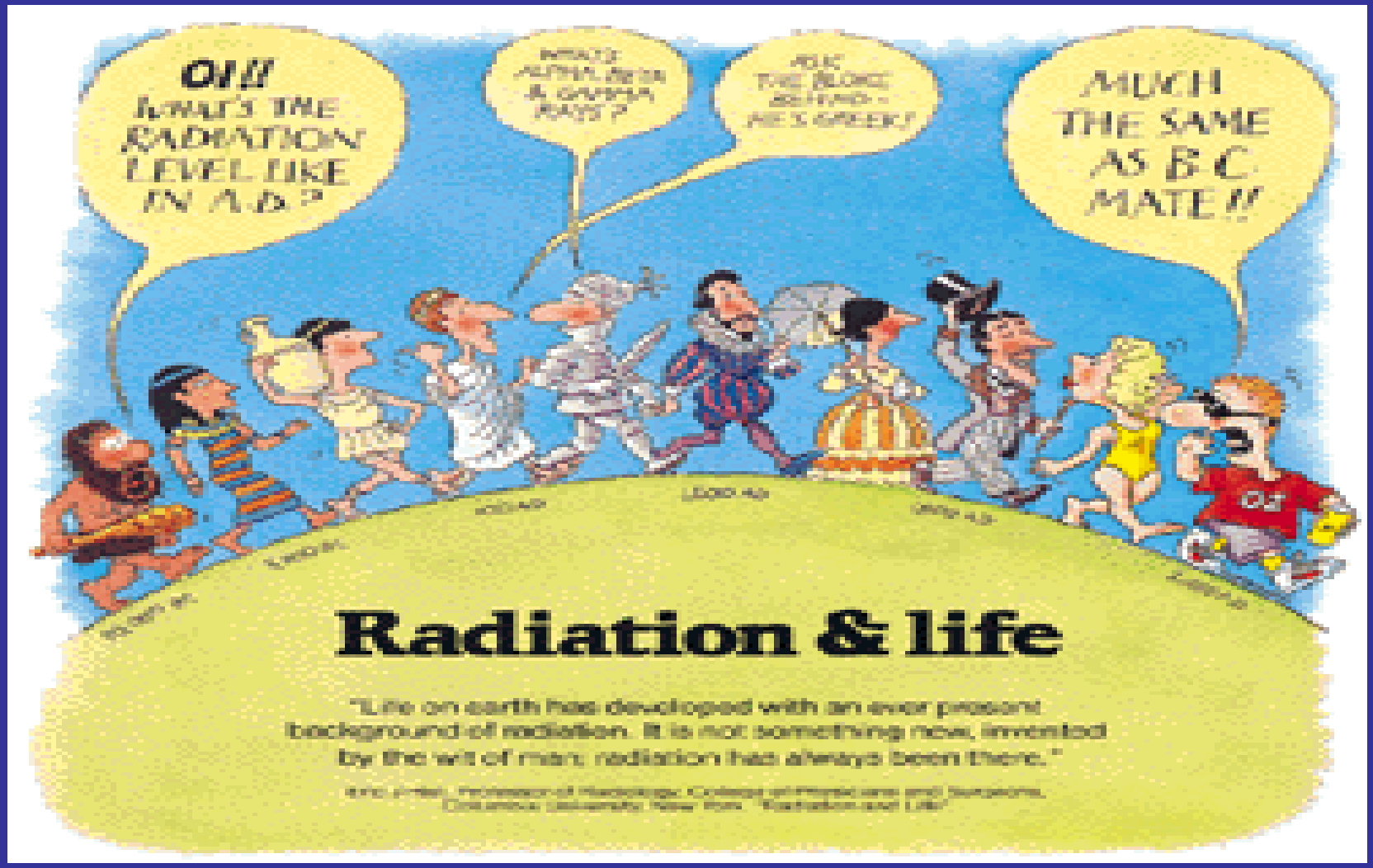
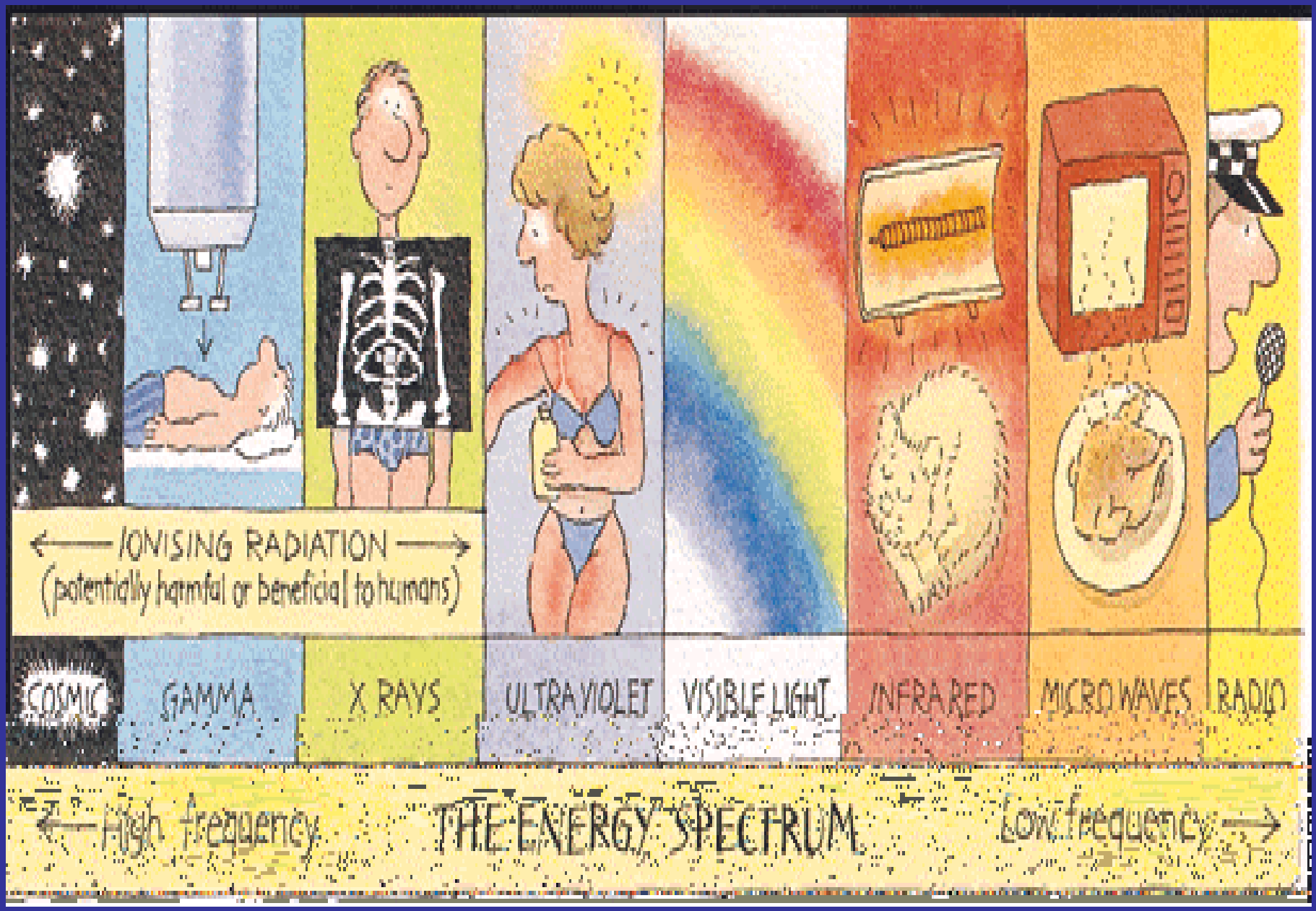
Prof Eric J Hall (Columbia Univ.)
Life on earth has developed with an ever present background of radiation. Radiation has always been there



Application



Radiation is used in medicine in three ways

1. Diagnostic radiology

uses x-ray machines to obtain images of the inside of the patient's body

2. Nuclear medicine

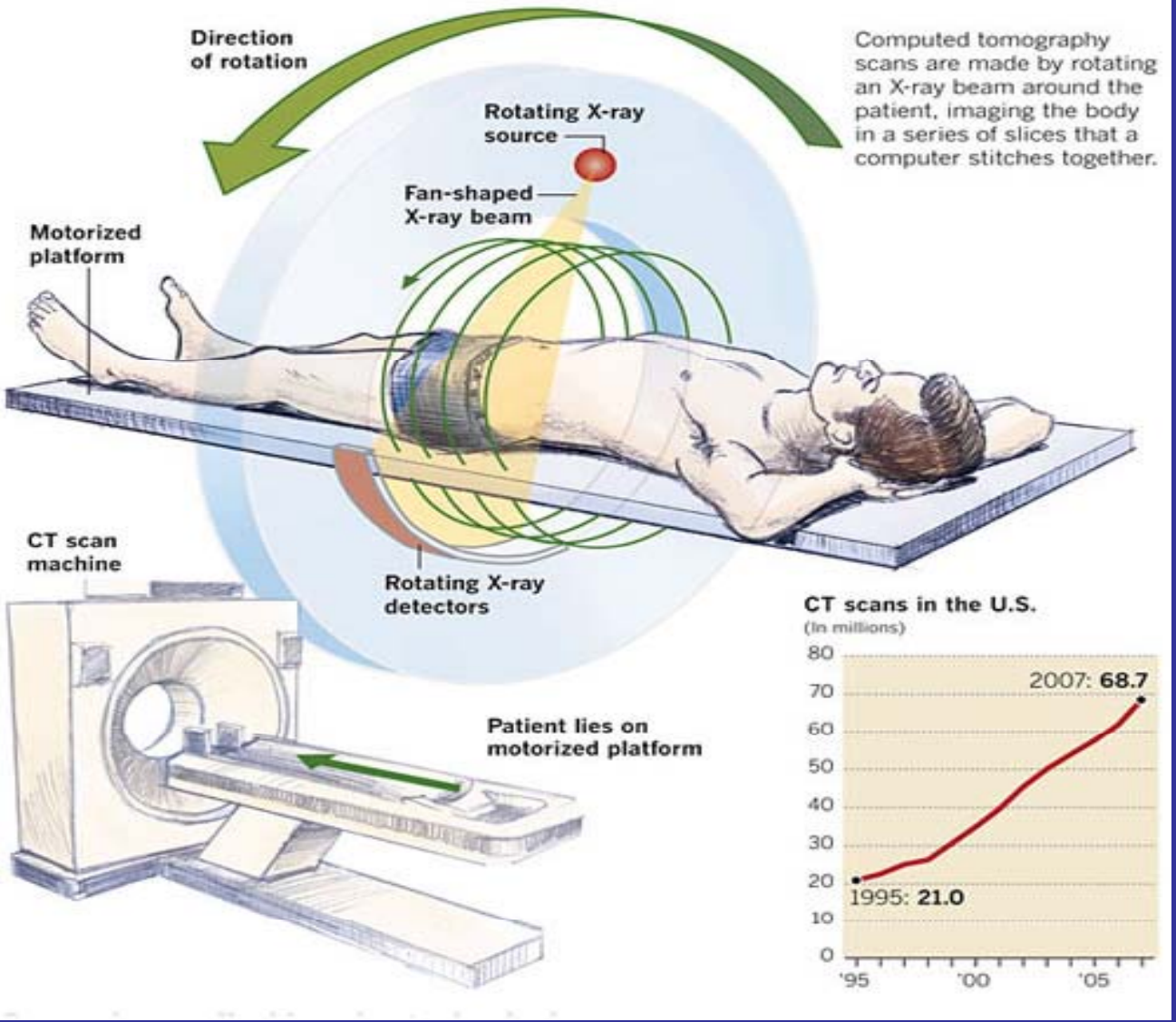
uses radioactive substances introduced into the patient for diagnosis or treatment

3. Radiotherapy

uses high-power x-ray machines or radioactive sources to treat cancer

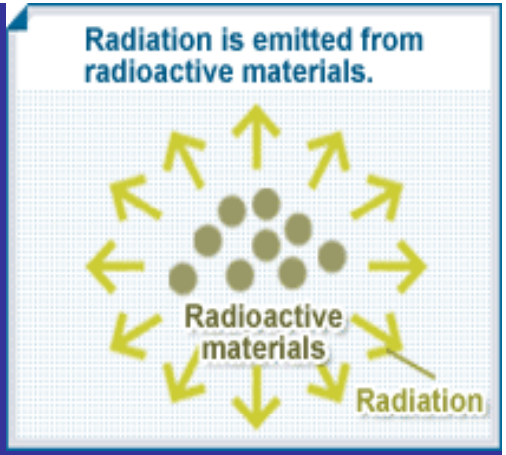
Anatomy of a CT scan

CT scanners give doctors a 3-D view of the body. The images are exquisitely detailed but require a dose of radiation that can be 100 times that of a standard X-ray.



Computed tomography scans are made by rotating an X-ray beam around the patient, imaging the body in a series of slices that a computer stitches together.

RADIASI



- Suatu cara perambatan energi dari suatu sumber ke lingkungannya

- Radiasi 2 jenis :
  1. Radiasi mengion (ionizing radiation
  2. Radiasi tidak mengion (non-ionizing radiation)

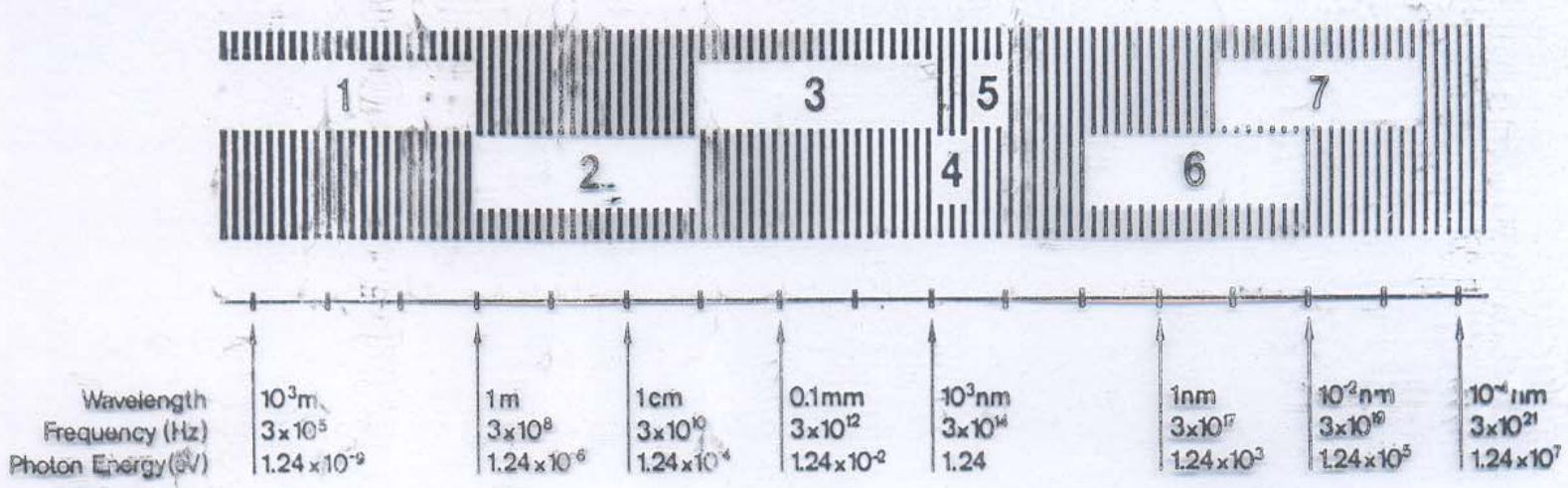
RADIASI MENGION

(ionizing radiation)

- **Energi besar (diatas 12 eV), diakibatkan o/ disintegrasi atom membentuk ion**

- **Radiasi mengion dibagi 2**
  1. **Elektromagnetik : X-Ray, gamma ray**
  2. **Partikel : elektron, netron, proton, alpha**

Spektrum Gelombang Elektromagnetik



1. Radio/TV frequency
2. Microwaves
3. Infra-red
4. Visible spectrum
5. Ultra-violet
6. X Ray
7. Gamma

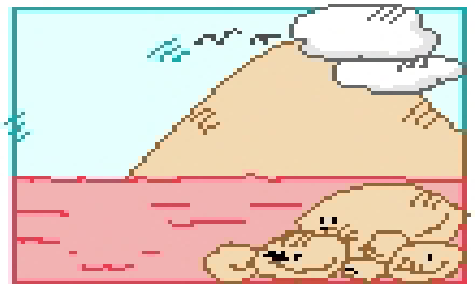
$1mm = 10^6 nm$
10 mm = 1 cm
100 cm = 1 m

Sumber Pemaparan Radiasi Mengion :

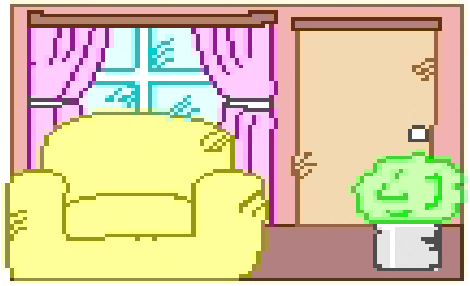
- Industri tabung sinar katoda
- Pembangkit tenaga nuklir
- Pertambangan
- Rumah sakit (kedokteran gigi, umum, radiologi, lab.)
- Lembaga penelitian
- Pertanian
- dsb.

- Background radiation is a small amount of radiation coming from the environment, such as the cosmic rays from outer space, the natural radioactive materials in rocks and soil and radioactive gases in air, e.g. radon

cosmic rays, 12%

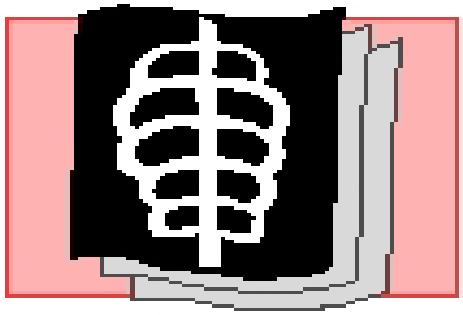


radioactive materials in rocks and soil, 15%

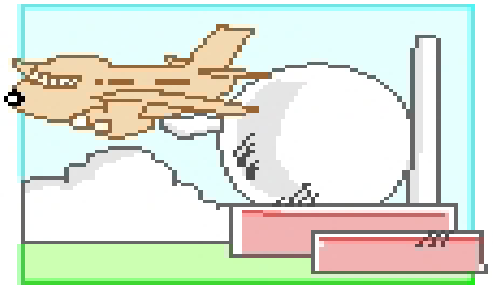


radioactive gases in air, 40%

living bodies, and food and drinks, 15%

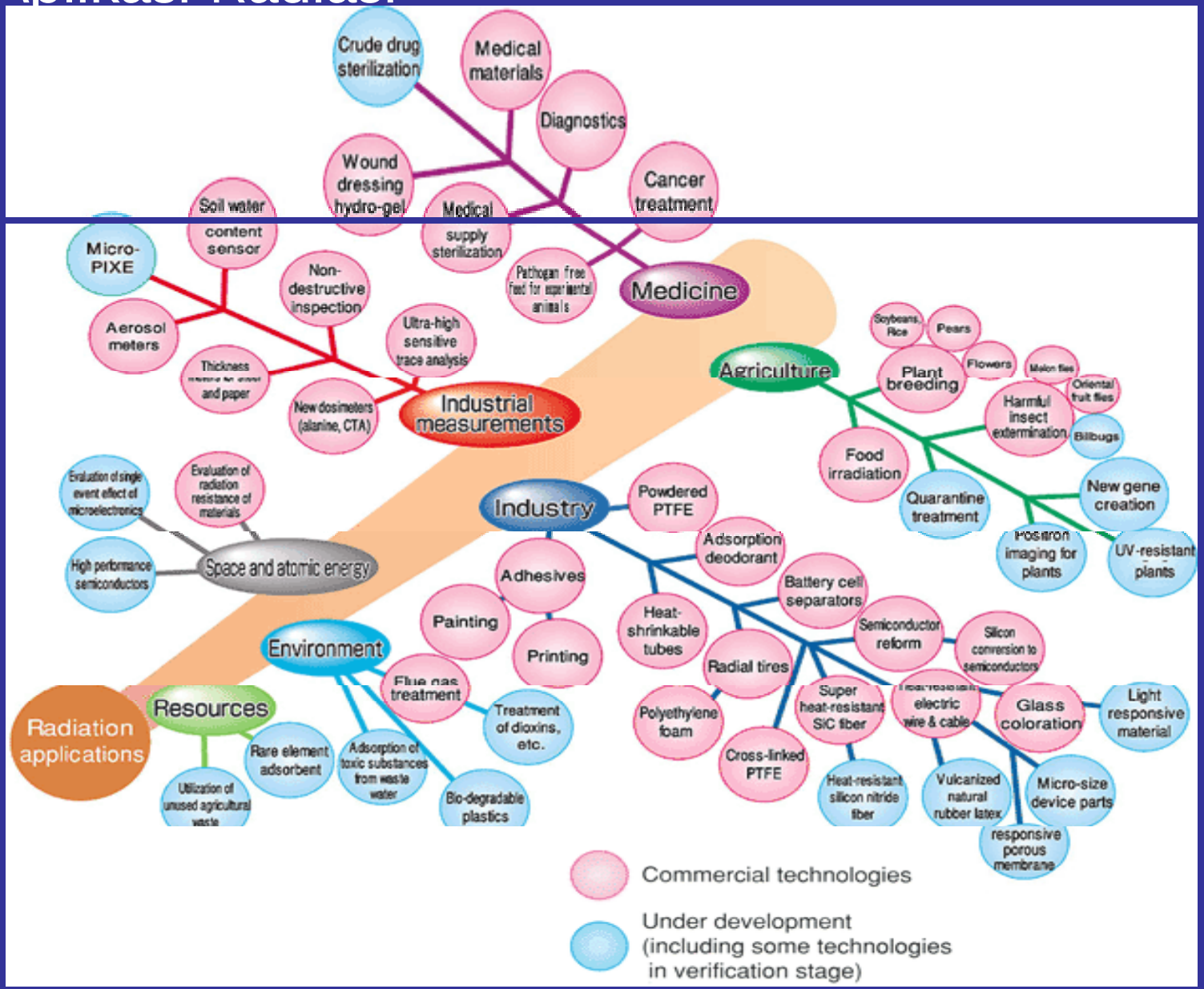


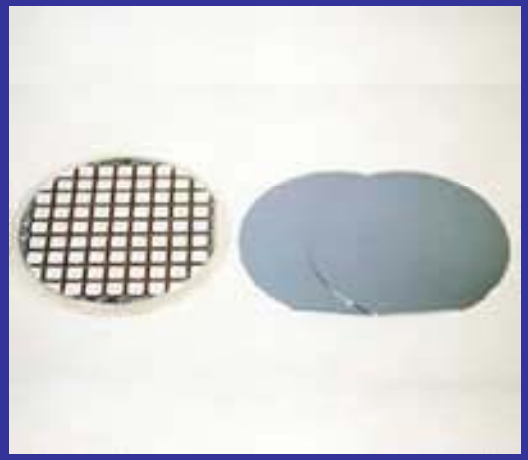
medical practice, 17%

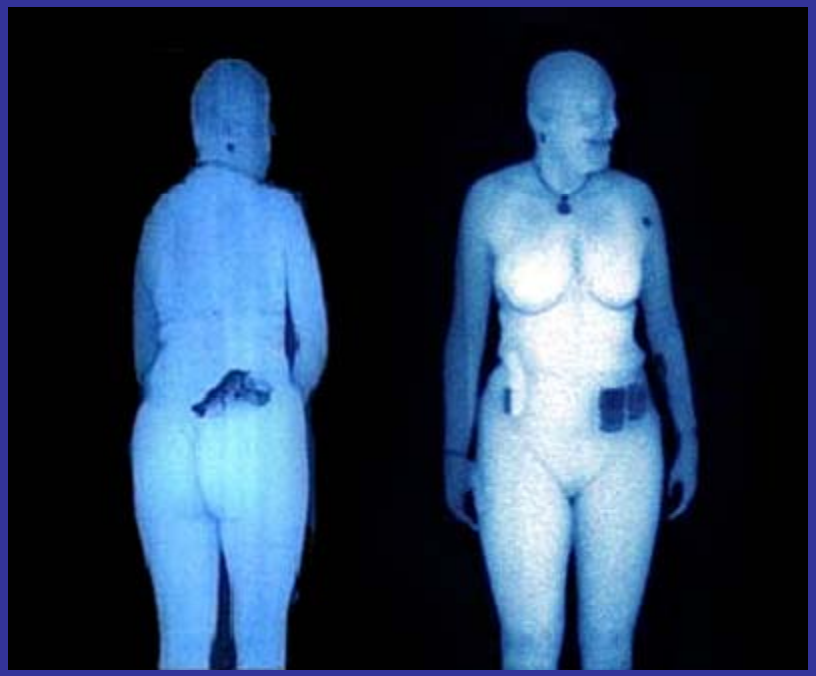


nuclear discharge and others, 1%

Aplikasi Radiasi

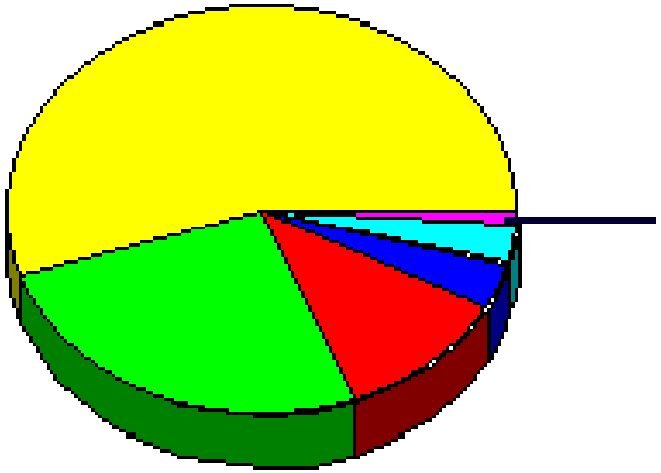


Radiation sterilization	**Polyethylene foam**	Glass craft
		
silicon to semiconductor	**New chrysanthemum**	Radial tire
		



Sources of Radiation Exposure

From: NCRP Report No. 93



Other
- Occupation 0.3%
- Fallout < 0.3%
- Nuclear Fuel Cycle 0.1%
- Misc. 0.1%

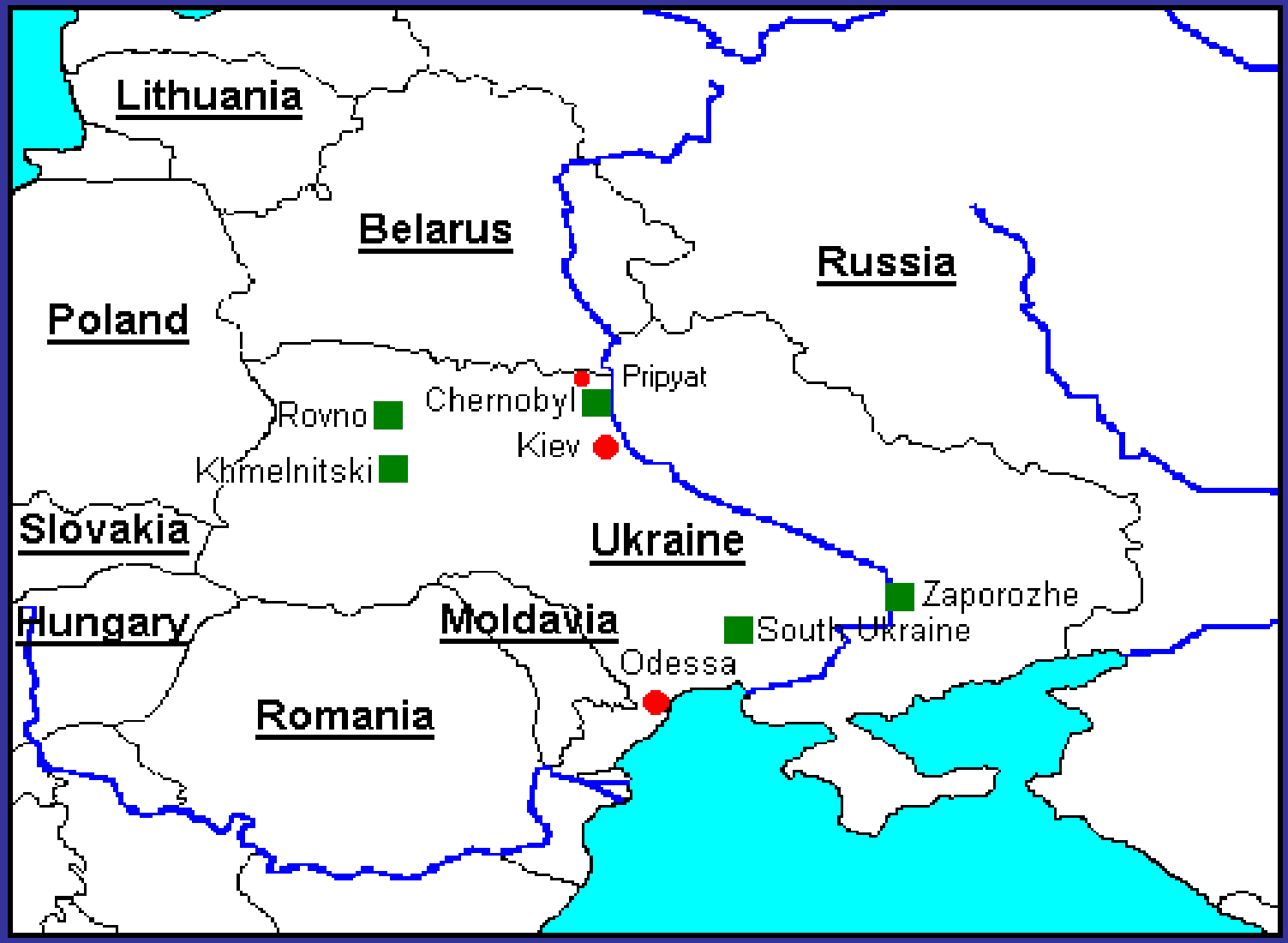
- Radon (55%)
- Natural Sources (excluding Radon) (26%)
- Medical X-rays (11%)
- Nuclear Medicine (4%)
- Consumer Products (3%)
- Other (<1%)

Estimated dose of radiation/year, US

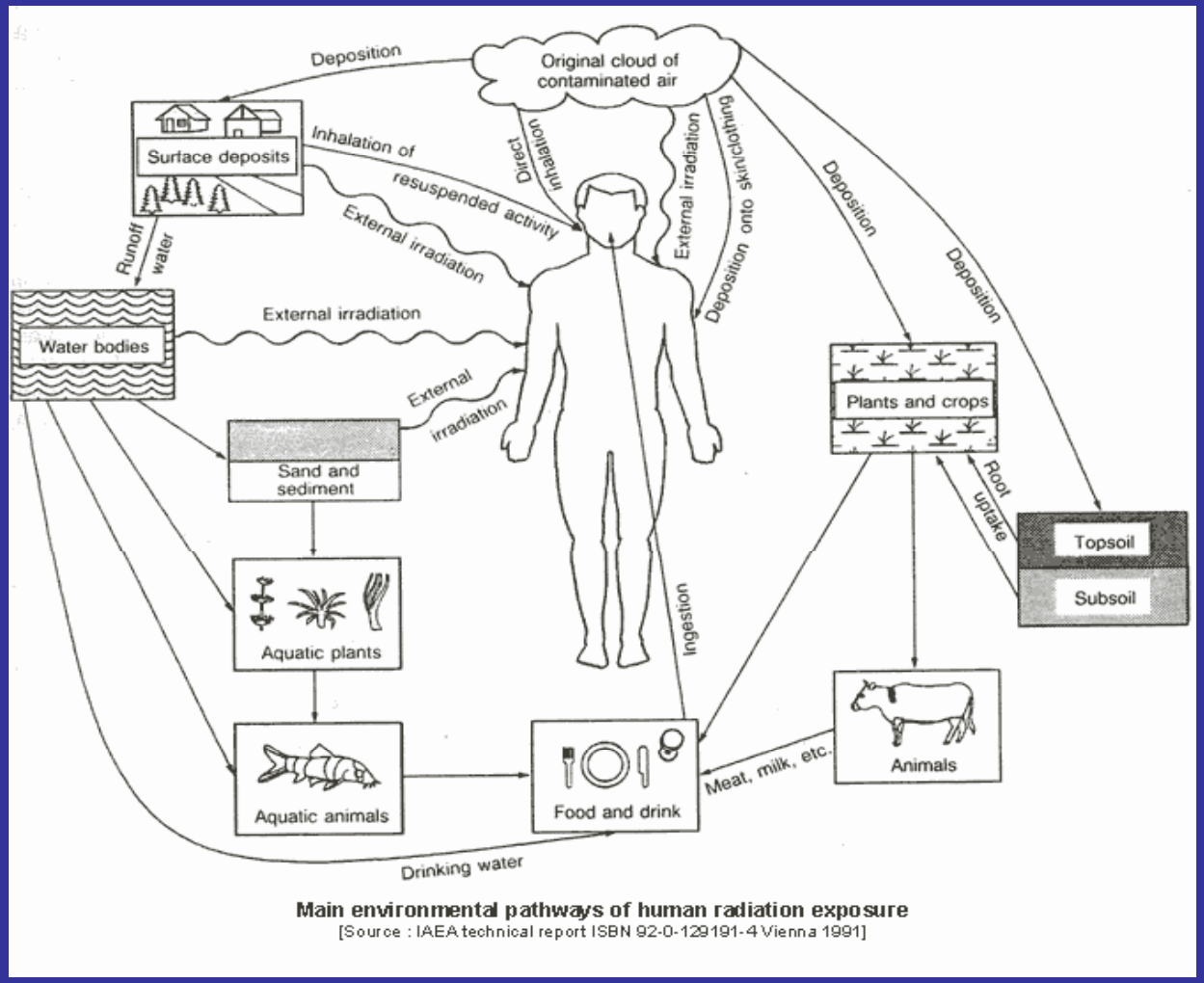
Source	Dose/year (mSv)
- Radon	24
- Cosmic/outer space	0,27
- Terrestrial/earth	0,28
- Internal(K40,C14)	0,39
Total Natural	0,94
- Medical X-ray	0,39
- Nuclear medicine	0,14
- Consumer product	0,10
- Occupational	0,009
- Nuclear fuel	<0,01
- Fallout: atomic weapon	<0,01
- Miscellaneous	<0,01
Total artificial	<0,66

Kasus Chernobyl, (Rusia, 27 April 1986) :

- Ledakan dan kebakaran terjadi pd reaktor; kebocoran bhn radioaktif ratusan mil
- 2 pekerja meninggal seketika; 29 meninggal (acute radiation); ribuan cedera berat


Lithuania
Belarus
Russia
Poland
Pripyat
Chernobyl
Rovno
Kiev
Khmelnitski
Slovakia
Ukraine
Zaporozhe
Hungary
Moldavia
South Ukraine
Odessa
Romania

Paths of radiation exposure



Main environmental pathways of human radiation exposure
[Source : IAEA technical report ISBN 92-0-129191-4 Vienna 1991]

Doses received from the Chernobyl accident

Population (years exposed)	number	Average total in 20yrs (mSv)[1]
Liquidators (19861987) (high exposed)	240 000	>100
Evacuees (1986)	116 000	>33
Residents SCZs (>555 kBq/m2)(19862005)	270 000	>50
Residents low contam. (37 kBq/m2) (19862005)	5 000 000	1020
Natural background	2.4 mSv/year	48
Approximate typical doses from medical x-ray exposures per procedure:		
whole body CT scan	12 mSv	
mammogram	0.13 mSv	
chest x-ray	0.08 mSv	
[1] These doses are additional to those from natural background radiation.		

Efek Radiasi Mengion :

Menyebabkan terjadinya kerusakan atom/ molekul yg dilaluinya

Efek radiasi mengion 2 jenis :

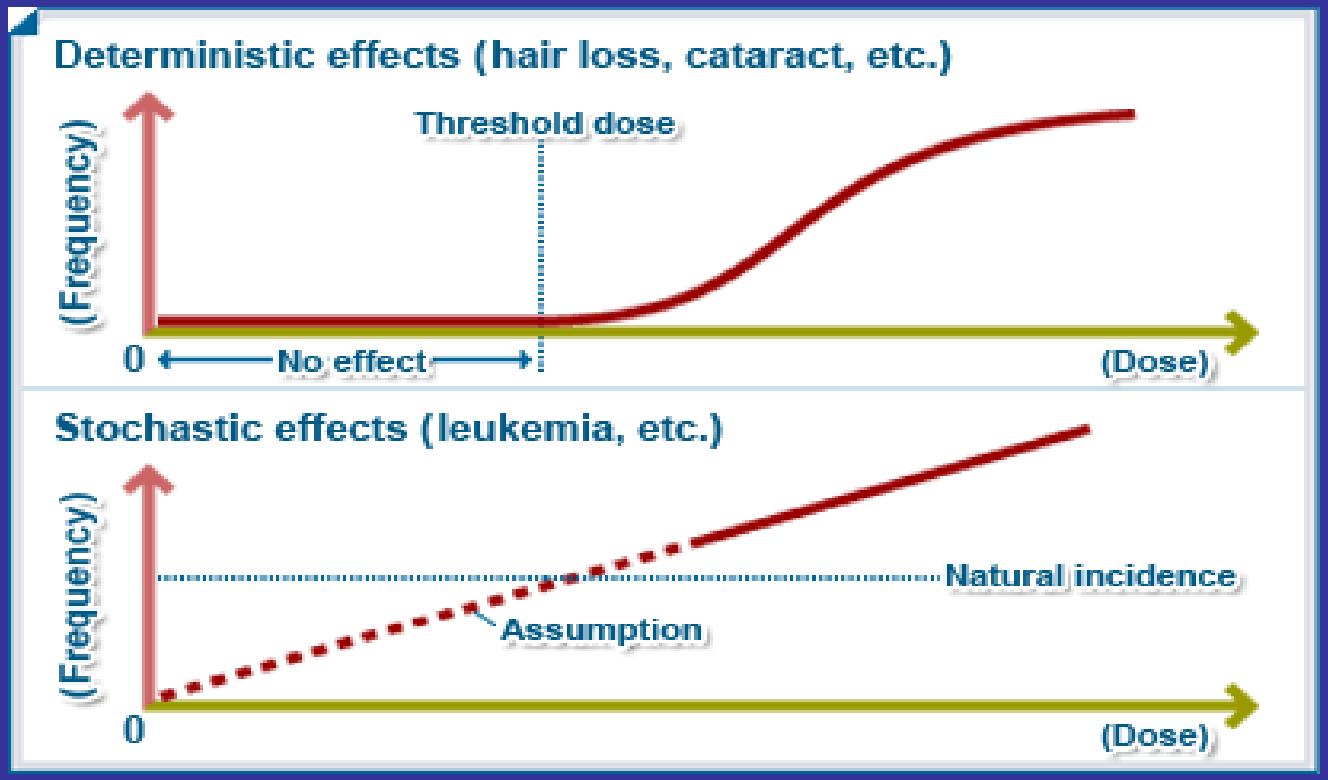
1. **Efek stokastik**,

- Tergantung pd frekuensi pemajanan, tingkat keparahan tidak tergantung pd dosis
- Contoh: mutagen (kerusakan gen/chromosom), teratogen (cacat bayi dalam kandungan), dan karsinogen (menyebabkan kanker).

2. **Efek Non-stokastik/Deterministik**

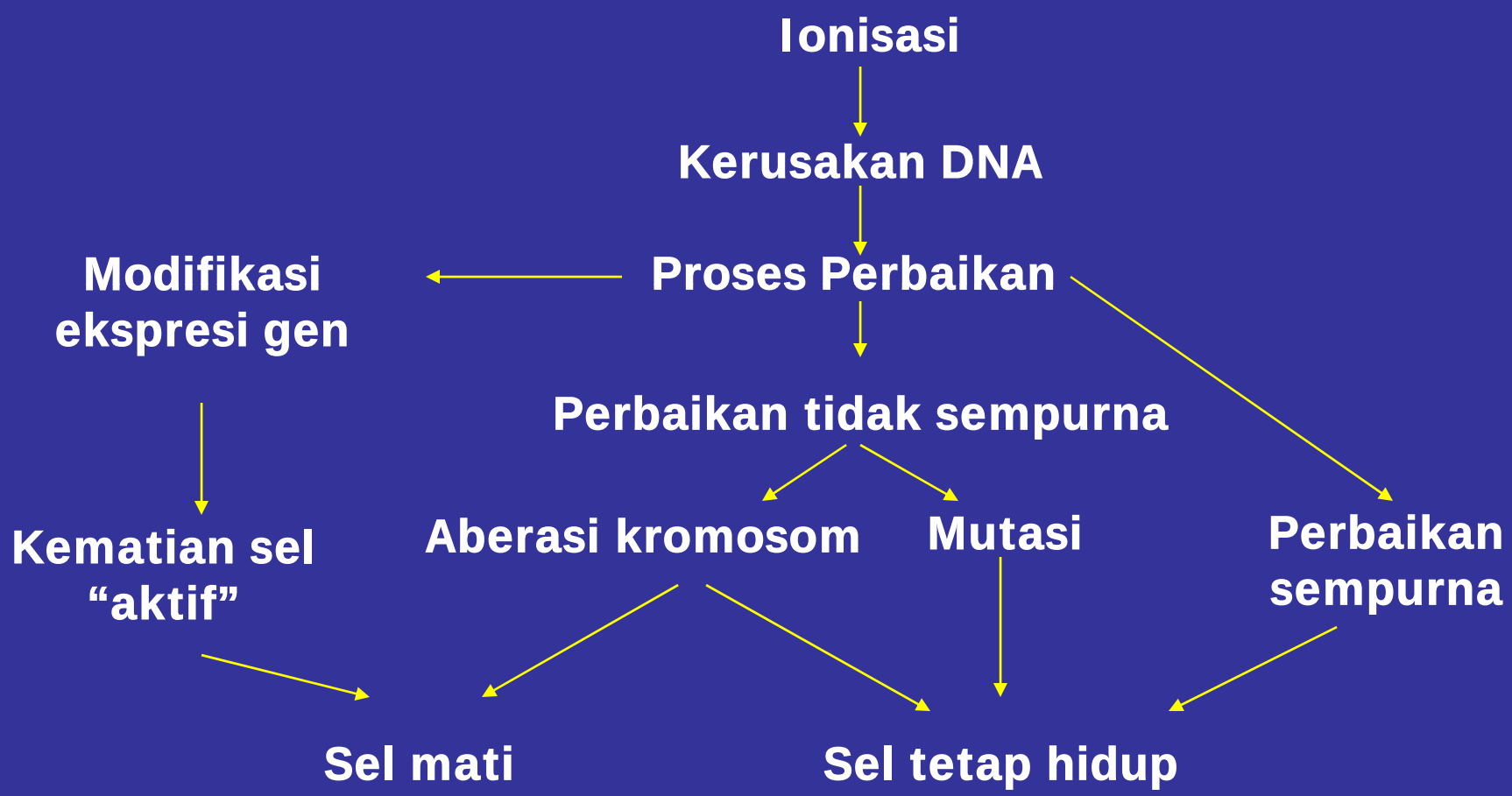
- Efek yg ditimbulkan tergantung pd frekuensi dan dosis
- Efek ini terjadi karena adanya kematian sel.
- Contoh : erythema pd kulit, katarak pd mata

Charts: Dose-Frequency Relationship



- Efek deterministik : timbul bila dosis yang diterima di atas dosis ambang (threshold dose) dan umumnya timbul beberapa saat setelah terpapar
- Efek stokastik **:** tanpa ada dosis ambang dan baru akan muncul setelah masa laten yang lama.

Efek Radiasi terhadap Sel



Klasifikasi Efek Radiasi (lanjutan)

Efek Radiasi Akut

(Radiation Sickness)

- Mual, muntah, sakit kepala,erythema (stlh 24 jam)
- Sakit perut, demam (2-3 hari)
- Diare, dehidrasi (minggu ke 2)
- Rambut rontok, lesu, demam, perarahan (minggu ke 3)
- Jika gejala diatas semakin parah dpt timbul perdarahan hebat yg menyebabkan kematian (4-6 minggu setlh radiasi)

Victim of Chernobyl

a. Five-year-old Alec Zhloba from a town in Belarus is suffering from leukemia. Some 70 percent of the fallout from the 1986 Chernobyl disaster fell on Belarus.

b. These children live in a village not far from the Chernobyl nuclear plant. Four years after the 1986 Chernobyl accident, these children are suffering intestinal problems from exposure to radiation

Radiation burns

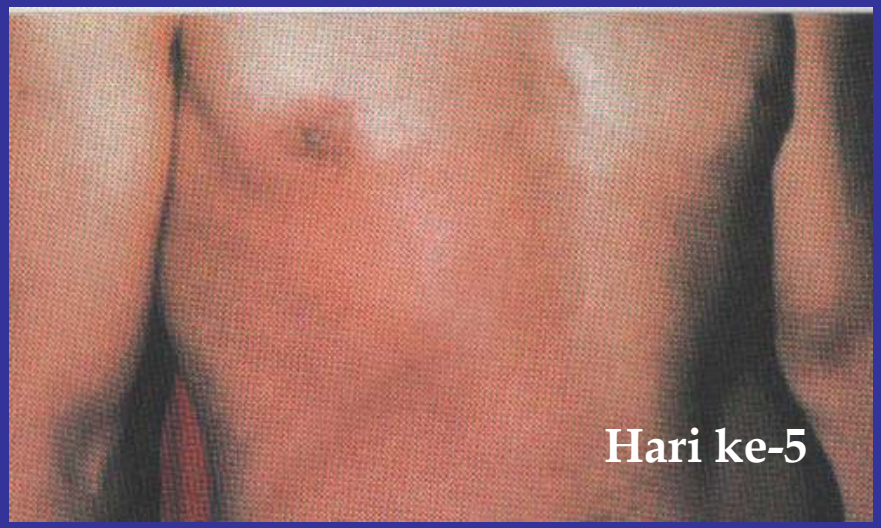
(28 days, 2400-4800 rad)

Occup. Medicine 3rd ed. Carl Zenz. Mosby-Year Book Inc., N.Y., 1994.

Ionizing Radiation / 403

Fig. 27-7. Radiation burns 28 days after a single acute skin dose of 2400 to 4600 rad of 60-kVp x-rays. Dose to the palm was less than 1000 rad. The employee suffered some loss of tissue and function of the left index finger. *Courtesy of Robert C Ricks, Oak Ridge Associated Universities, Oak Ridge, Tenn.*

Efek paparan radiasi oleh Ir-192 (185 GBq) selama 2 jam



Acute ulceration

3 days

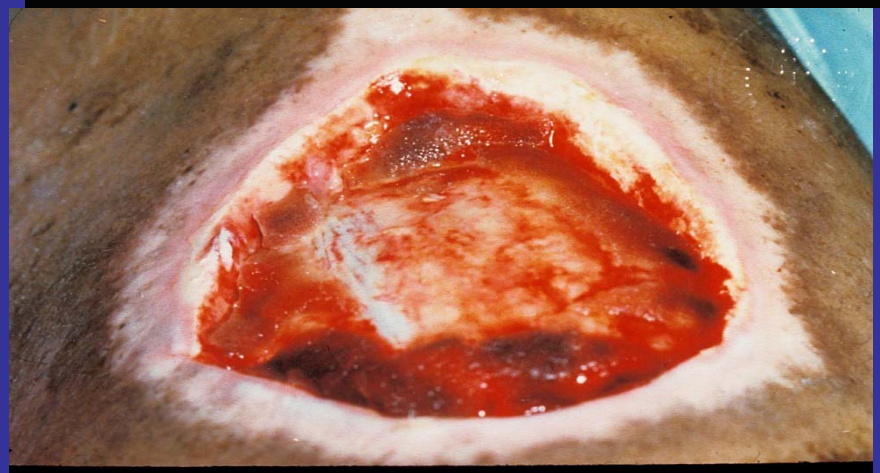
10 days

Figures 1 & 2. acute ulceration in a Peruvian patient who inadvertently placed a 26-Ci (0.962-TBq) irridiun-192 (192 Ir) source in his back pocket, 3 days and 10 days post exposure. The source remained in the patient's pocket for approximately 6.5 hours *(photos courtesy of Ricks RC and reprinted with permission)*

Radiation accident, Goiania, Brazil, Sept 13, 1987

75 Days P/Exp. Close Up

75 Days P/Exp. Healing



Thigh 75 Days P/Exp.

Radiation accident, Goiania, Brazil, Sept 13, 1987

- Sumber : Ce-137
- symtoms: gastrointestinal and flu-like symptoms, hair loss, malaise
- Korban : 112.800 orang dimonitor (sept-Des 1987); 249 orang terkontaminasi(628)

  4 meninggal 1st days, Total 60 org;
- Lingkungan : 2000 m^2 terkontaminasi; 7 rumah dihancurkan; 3500 m^3 limbah;275 truk

Goiania Radiation accident

a. radiotherapy unit in Goiania from which the cesium source was taken.
b. a tele-therapy unit
c. Goiania Olympic stadium where screening for cesium radiation exposure was performed
d. Contaminated rubble from a demolished house in Goiania, Brazil

a. Cesium-137 (60 died; 628 contaminated; over 6,000 exposed; spread 100 miles away) source: GP,sept07

b. A graves of four Goiania residents who died from exposure to radiation and were buried in lead coffins surrounded by concrete.

Standar Pemajanan

Ambang batas yg direkomendasikan o/ International Commission on Radiological Protection didasarkan pd dosis ekivalen yg diterima oleh seluruh tubuh dalam pemajanan/tahun, yaitu :

- **5 rem (= 50 mSv) u/ tenaga kerja**
- **0,5 rem (= 5 mSv) u/ masy. Umum**

(PP No.63/2000 ttg Keselamatan dan kesehatan thd Pemanfaatan Radiasi Pengion)

Nilai Batas Dosis - NBD

(ditetapkan dlm SK Ka.BAPETEN No.01/Ka.BAPETEN/V/1999 ttg Ketentuan Keselamatan Kerja dg Radiasi)

- NBD utk penyinaran seluruh tubuh 50 mSv (5000 mRem)/thn
- NBD utk wanita usia subur 13 mSv dlm jangka 13 minggu pd abdomen
- NBD utk wanita hamil 10 mSv pd janin, terhitung sejak dinyatakan mengandung hingga saat bayi lahir
- NBD utk penyinaran lokal rata2 pd setiap organ/jaringan 500 mSv/thn

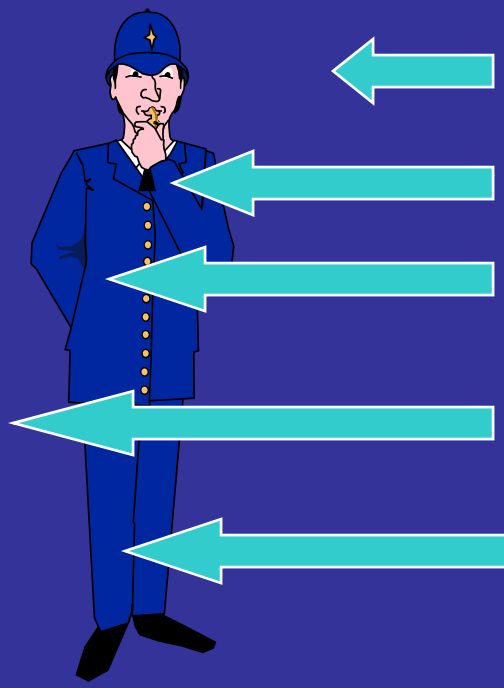
Persyaratan proteksi radiasi

- Justifikasi :Tdk menerapkan /menggunakan radiasi, kecuali jika ada positive net benefit
- Optimisasi :Prinsip ALARA (as low as reasonably achievable)
- Limitasi : Standar pemajanan/ Dosis sesuai rekomendasi

Pengendalian

- Isolasi peralatan dan daerah radiasi dg penyekatan
- Maksimalisasi jarak, menjauhkan TK dari sumber radiasi
- Membatasi waktu pemajanan
- Pemasangan pagar, label dan tanda peringatan bhy radiasi
- Penggunaan APD(pakaian, kaca mata, dsb.)
- Pelatihan dan pengawasan
- Emergency preparadness, kesiap-siagaan jika terjadi keadaan darurat

POTENSI BAHAYA EKSTERNA



Alpha ----> sangat kecil/tidak ada

Beta ----> kecil

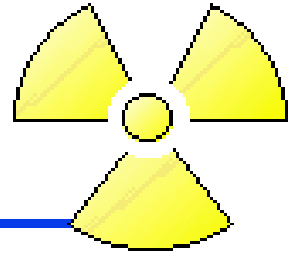
Sinar X ----> besar

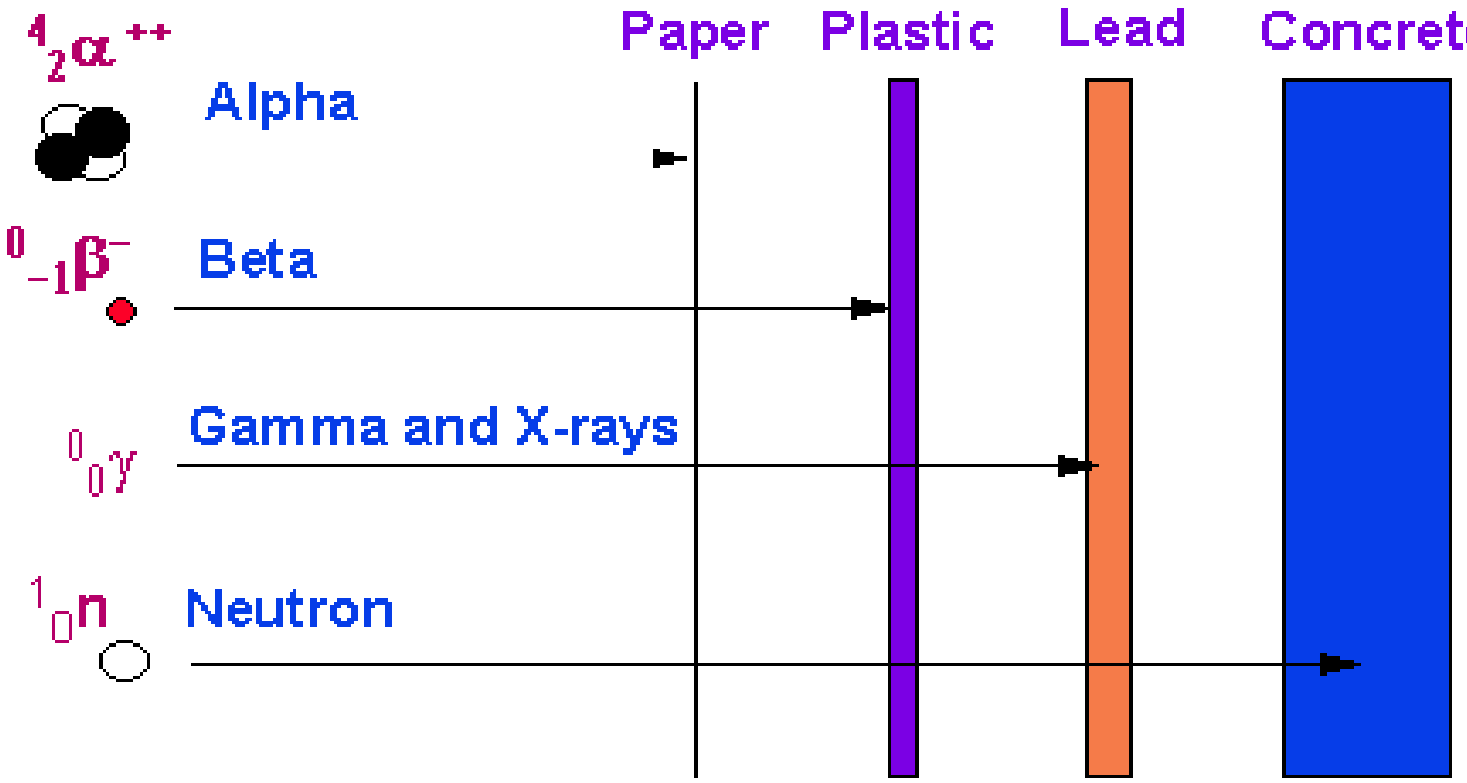
Sinar gamma ----> besar

Neutron ----> besar

Radiation	Shielding Material
Alpha	dpt dihambat dengan bhn tipis, mis. kertas atau lapisan luar kulit mati
Beta	penyekatan dg bhn spt aluminium dan plastik/Al dg ketebalan sp 1 cm
Gamma & X-ray	Semakin tebal dan tinggi berat jenis bhn, semakin besar intensitas radiasi yg diserap. Pb / tembok beton
Neutron	dihambat dg penyekatan bhn yg mengandung kadar hidrogen tinggi, shg bhn cair spt air, poliethilen, parafin dsb. banyak digunakan

Penetrating Distances





Tingkat keparahan/bahaya radiasi

	Bahaya external	Bahaya internal
Kurang	Alpha	Gamma
	Beta	Beta
Sangat	Gamma	Alpha

Risk factors

(Timbulnya kanker pd organ tubuh, menurut UN Scientific Committee on the Effects of Atomic Radiation- UNSCEAR)

Body organ	Risk factor
- Gonads	1×10^{-2} / Sv
- Breast	$2{,}5 \times 10^{-3}$ / Sv
- Bone	5×10^{-4} / Sv
- Lung	2×10^{-3} /Sv
- Thyroid	5×10^{-4} /Sv
- Red bone marrow	2×10^{-3} /Sv

Examples of various tissues and their relative radiosensitivities are listed below.

High Radiosensitivity

Lymphoid organs, bone marrow, blood, testes, ovaries, intestines

Fairly High Radiosensitivity

Skin and other organs with epithelial cell lining (cornea, oral cavity, esophagus, rectum, bladder, vagina, uterine cervix, ureters)

Moderate Radiosensitivity

Optic lens, stomach, growing cartilage, fine vasculature, growing bone

Fairly Low Radiosensitivity

Mature cartilage or bones, salivary glands, respiratory organs, kidneys, liver, pancreas, thyroid, adrenal and pituitary glands

Low Radiosensitivity

Muscle, brain, spinal cord

Ionizing radiation & tissue

Charged particles

↓

Electrical interactions

↓

Ionization occurs

↓

Chemical changes

↓

Biological effect

Effect of Radiation on Cells

- Inhibition of cell division
- Damage to chromosome (number of structure)
- Damage to genes (mutation)

Pemajanan radiasi dlm jaringan tubuh tergantung pd sifat fisik dan kimia dr bahan radioaktif.

Contoh :

- Radioaktif iodine, umumnya mempengaruhi/terkonsentrasi pd kelenjar thyroid;
- Strontium-90, mengendap pada tulang;
- Cesium, pd jaringan lunak

Setelah terakumulasi, konsentrasinya dpt menurun setelah beberapa waktu melalui peluruhan atau proses biologi (Iodine-131, waktu peluruhan 7 hr; plutonium-239, 24 000th; strontium-90, 28 tahun)

PERATURAN PERUNDANG-UNDANGAN

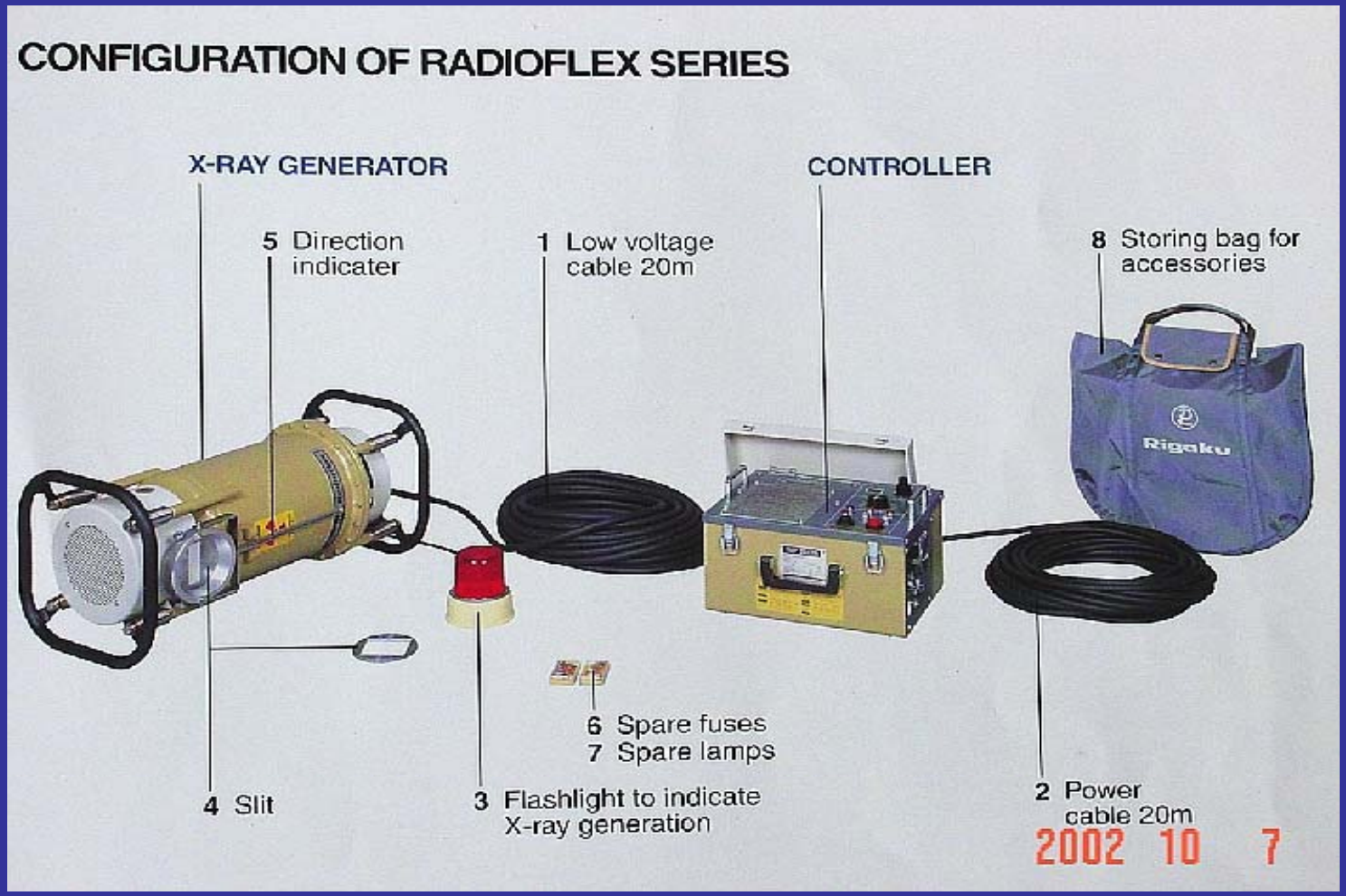
- UU No. 1/1970 ttg Keselamatan Kerja
- UU No. 10/1997 ttg Ketenaganukliran
- PP No.63/2000 ttg Keselamatan dan Kesehatan thd Pemanfaatan Radiasi Pengion

BERBAGAI JENIS SURVEY METER

BERBAGAI JENIS PERSONAL DOSIMETER

BERBAGAI JENIS DETEKTOR RADIASI

RADIOGRAFI DENGAN FILM

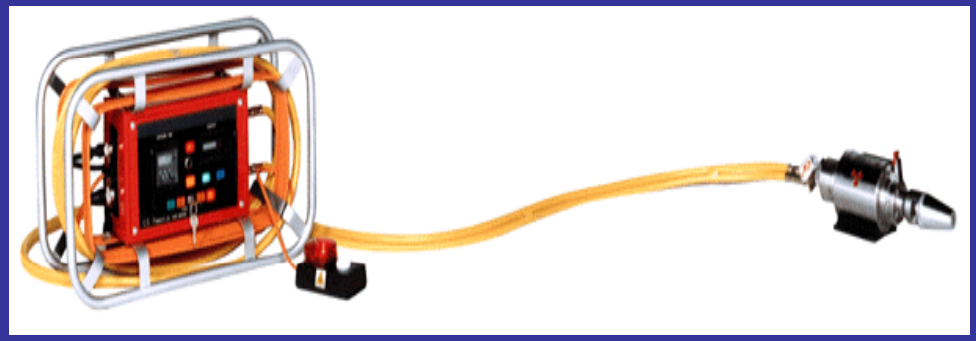


Peralatan Pesawat Sinar-X

RADIOGRAFI DENGAN FILM

KameraGamma

Type Amersham 660 manual



Type Automatic

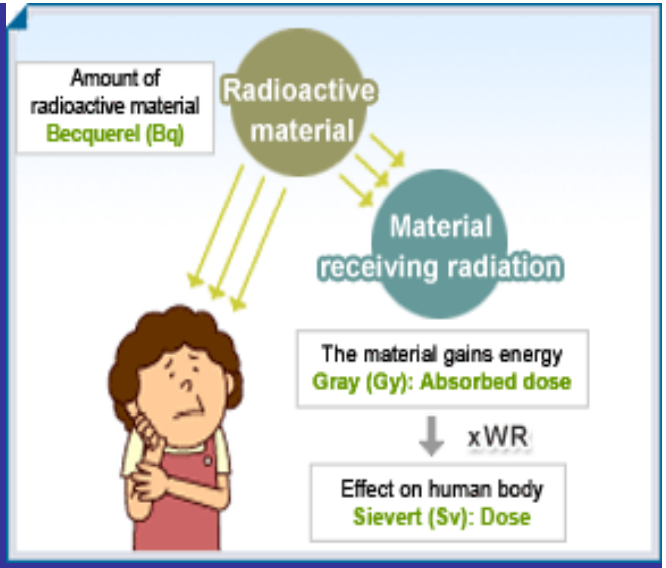
Crawler

Kamera Co-60

Table 1. Types of detectors used for various types of radiation

Type of detector	Type of radiation
Proportional or scintillation counter, surface barrier diode	Alpha
Geiger-Mueller tube or proportional counter	Beta
Ionisation chamber, scintillation counter	X and gamma
Proportional counter, ionisation chamber	Fast neutrons
Proportional counter	Thermal neutrons

Old & new radiation unit



quantity	Old unit	New unit	Relationship
Activity	Curie(Ci)	Becquerel (Bq)	1Ci=3.7x1010Bq
Absorbed dose	Rad (rad)	Gray (Gy)	1 rad=0.01 Gy
Dose equivalent	Rem(rem)	Sievert (Sv)	1 rem =0.01 Sv

Konversi :

Dosis ekivalen = dosis absorbsi x quality factor

Sievert = Gray x QF

Rem = rad x QF

1 Gray = 100 rad = 1 J/kg

1 Sv = 100 rem

1 rad = 1.15 roentgen = 0,01 Gray

1 roentgen = 0,87 rad

Dosis radiasi : jml energi yg diserap oleh jaringan tiap satuan massa pd tempat pengukuran(satuan rad)

Jenis radiasi	Quality factor (QF)
X-ray, gamma, beta	1
Neutron, proton	10
alpha	20

Hierarchy of Dose quantities

- Absorbed dose

(energy imparted by radiation to unit mass of tissue)

- Dose equivalent

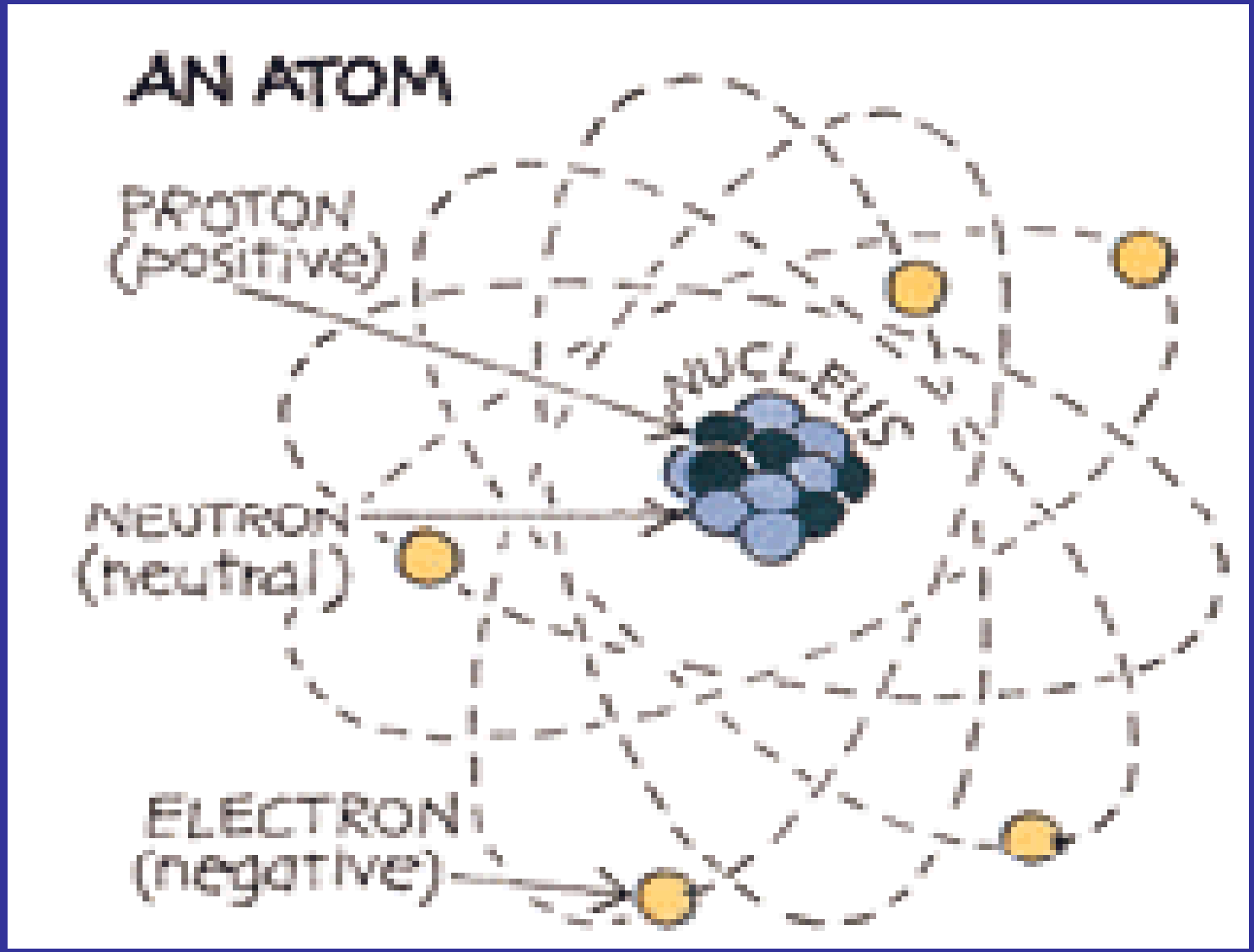
(absorb dose weighted for harmfulness of different radiations)

- Effective dose equivalent

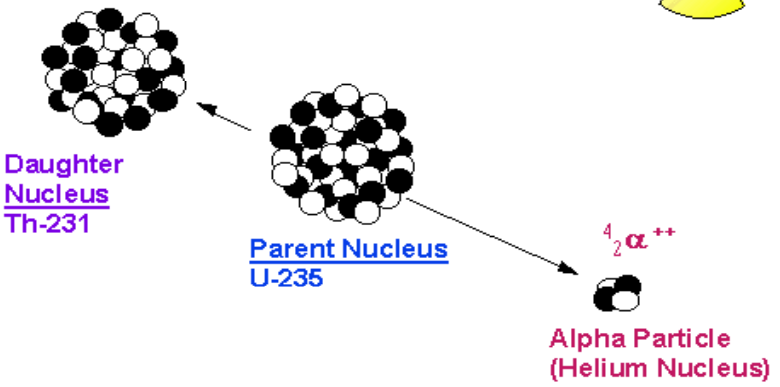
(dose equivalent weighted for susceptibility to harm of different tissues/risk weighting factors)

- Collective effective dose equivalent

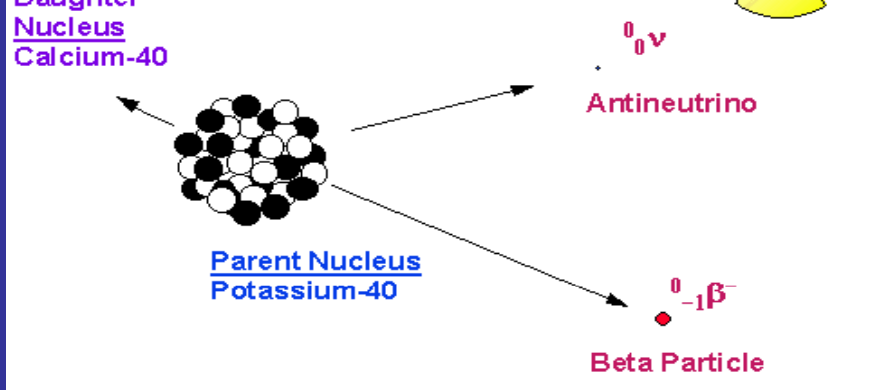
(effective dose equivalent to a group from a source of radiation)


AN ATOM
PROTON
(positive)
NUCLEUS
NEUTRON
(neutral)
ELECTRON
(negative)

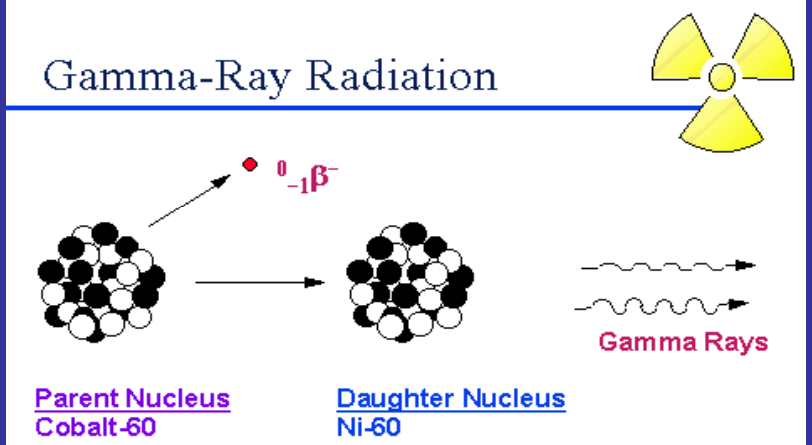
Alpha Particle Radiation



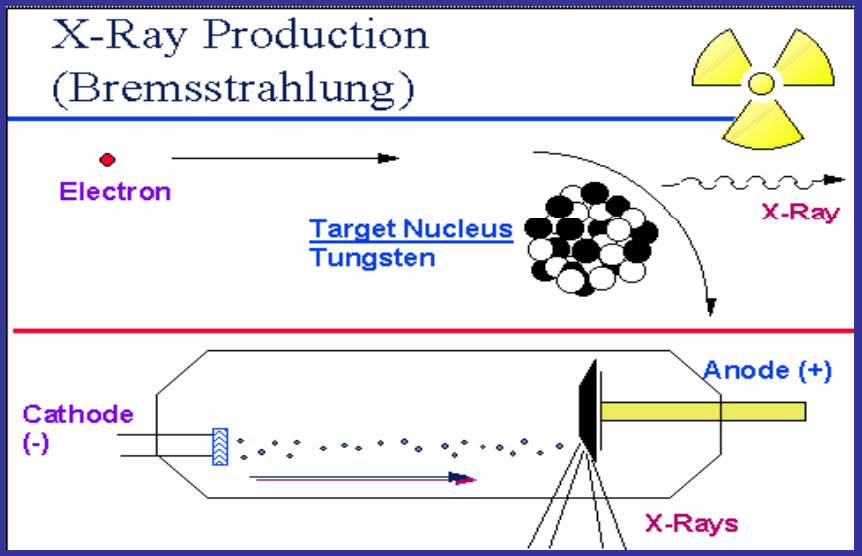
Beta Particle Radiation



Gamma-Ray Radiation



X-Ray Production (Bremsstrahlung)



RADIASI TIDAK MENGION

(Non ionizing radiation)

- Energi rel. rendah (<12 eV, tdk mengion)
- Spektrum radiasi elektromagnetik tdk mengion
  - Frekuensi : 3.10^5-3.10^{15} Hz
  - Panjang gelombang : 10^3 m-10^2 nm
- Yg termasuk radiasi tdk mengion
  - Frekuensi radio/TV
  - Gelombang mikro
  - Infra merah
  - Sinar tampak
  - Ultra violet

1. Gelombang mikro (Microwave)

- **<u>Spektrum</u> :**
  - f : 3.10^8 Hz – 3.10^{11} Hz (0,3 - 300 GHz)
  - Relatif tdk berbahaya pd pemajanan luar tp sgt berbahaya jika tertelan/terhirup : 1m – 1 mm
- **<u>Sumber</u> :**
  - **alamiah : matahari, bumi, bulan**
  - **buatan : satelit komunikasi, radar, hp, unit diatermi, dapur peleburan logam / plastik**
- **<u>Gel mikro</u> : 3**
  - **Frek. Ultra (ultra high frequency-UHF):0,3-3 GHz**
  - **Frek Super (super high frequency – SHF): 3-30 GHz**
  - **Frek Tertinggi (extra high frequency – EHF):30-300 GHz**

Efek Microwave thd Kesehatan

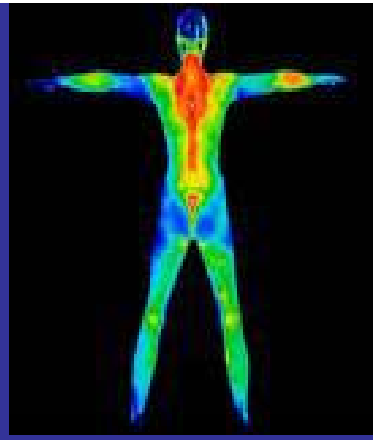
- Pengaruh termal dan non termal (medan EM, molekuler dan modulasi)
- Pemajanan melalui proses absorbsi, dipantulkan, dan dpt berpenetrasi ke dlm tubuh tergantung pd panjang gelombang. Jaringan dg kandungan air > akan memudahkan absrbsi gel mikro ke dlm tubuh.
- Radiasi menyebabkan gangguan sistem syaraf, gangguan reproduksi dan dugaan leukemia

Kasus :Koki pizza menderita kerusakan liver serius akibat radiasi microwave oven (tanpa tutup pelindung)

Standar pemaparan gel. mikro

Kepmenaker No. 51/men/1999 ttg NAB faktor fisik di TK u/ radiasi gel mikro dg frek. 3-300 GHz adl 10 mW/cm^2 berlaku u/ pemajanan seluruh tubuh dari satu sumber pemajanan a/ lebih untuk waktu maksimum 6 menit

2. Infra Red



- Spektrum :
  - f : 3.10^{11} – 3.10^{14} Hz
  - λ : 1 mm – 1000 nm
- Sumber : dapur peleburan, pengelasan, lampu pemanas/pengering
- Efek kesehatan : Katarak pd mata, kulit terbakar (dugaan : gannguan reproduksi, sistem syaraf, jantung)
- Standar :10 mW/cm2 u/ radiasi infra red dg λ > 770 nm

3. Radiasi Sinar Tampak (visible spectrum)

- f : $3.10^{14} – 3{,}5.10^{14}$
  λ : 1000 nm – 500 nm
- **Sumber : lampu, sinar / pengelasan, dapur peleburan,**
- **Efek u / lingkungan kerja : pencahayaan kurang dan kesilauan (glare) : kelelahan, ketdk nyamanan yg dpt menyebabkan kecelakaan kerja**
- **Standar : Intensitas radiasi sinar tampak 10 mW / cm^2 u / 10.000 dtk (3 jam)**

4. Ultra Violet

- **λ : 400 nm -180 nm**

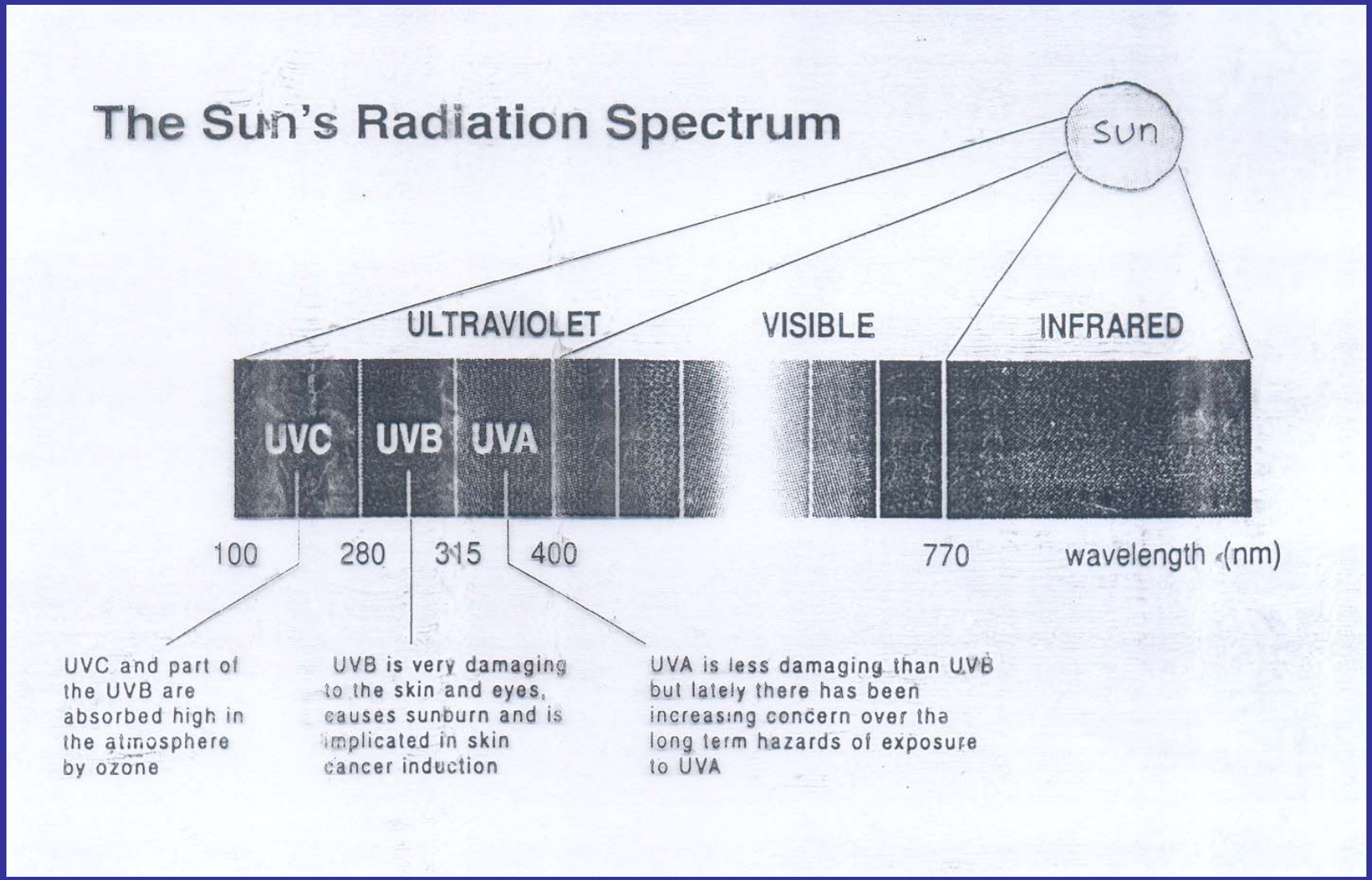
  f : 3,5. 10^{14} – 3.10^{15} Hz
- **Sumber : sinar matahari, lampu merkuri/halogen, las listrik, pemotong logam**
- **Ultra violet dibagi 3, dari segi efek yg ditimbulkan :**

  - UV-A : 400-300 nm, pigmentasi kulit

  - UV-B : 320-280 nm, erythema pd kulit

  - UV-C : 200-180 nm, katarak pd mata

Spektrum Radiasi Matahari



Health effect

Pada kulit dan mata dimana energi radiasi diserap.

Acute :

- Pd mata Photokeratitis (inflamation of cornea) dan conjunctivis
- Radiation burn (sunburn)

Chronic :

- Cataract(clouding of the lens)
- Premature ageing, keratosis (dry,spot on the skin)
- Skin cancer

Who is at risk?

- Outdoor workers (gardener, road worker, building & construction workers, surveyors, forestry workers, agriculture workers, mining workers, harbour workers, traffic officer
- Fair skin

Pengendalian

- Elimination
- Substitution with safer alternative
- Engineering control (reduction to minimum level)
- Administrative control (job rotation, 10-2pm; etc)
- PPE (clothing, sunglasses, creams SPF15+)

UV radiometer

- Australia has the highest incidence of skin cancer in the world.
- 2 dr 3 Australian yg mencapai usia 75th diperkirakan menderita kanker kulit

Skin cancer

1. Basal cell carcinoma (BCC)

- Sering dijumpai, bentuk yg rel. tdk berbahaya
- Benjolan di permukaan kulit (muka, leher)

2. Squamous cell carcinoma (SCC)

- Jarang ditemukan (20% kasus kanker kulit), lebih berbahaya
- Kulit merah, melepuh/luka, dpt menjalar

3. Melanoma

- Paling jarang ditemukan (5% kasus), paling berbahaya, sangat fatal
- Berawal dari tumor hasil sel yg berpigmentasi di epidermis

Exposure assessment

- Job tasks
- Hours of the day
- Availability of natural shade
- Feasibility of artificial shade (canopies, etc)
- Rescheduling tasks where nat./art. shade is inadequate
- Reorganizing work (indoor/outdoor)
- Availability of control option

5. Gelombang Radio/TV

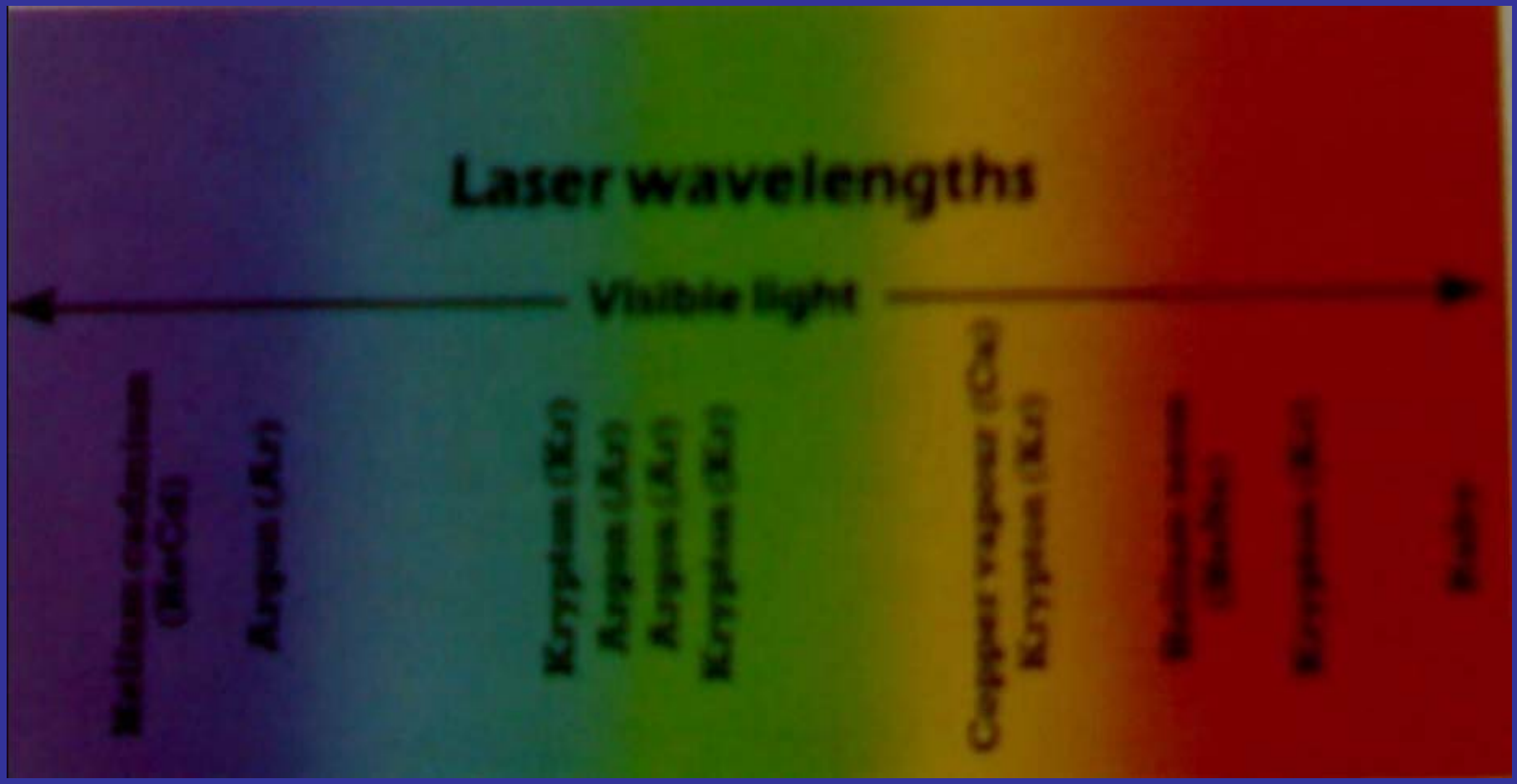
- f : 3.10^5-3.10^8 Hz
  λ : 1000 m – 1 m
- **Sumber : TV, radio, sistem komunikasi, radar**
- **Efek :**

  Umumnya non thermal (medan listrik dan magnet) : gangguan sistem syaraf, jantung, reproduksi, kanker pd anak2 (Dugaan; percobaan binatang)

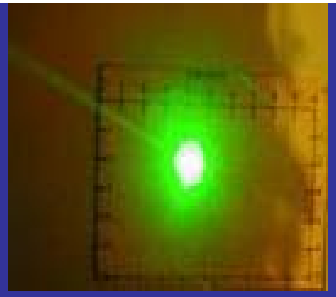
LASER

- Akronim: **Light Amplification by Stimulated Emission of Radiation**
- **Merambat pada satu arah panjang gel. Sinar paralel, Koheren, tekonsentrasi**
- **Bahaya: terutama pada mata, dan kulit**
- **Jenis :Kristal ruby; Laser gas(CO_2, CO, HeNe, argon, Nitrogen, krypton); semikonduktor**

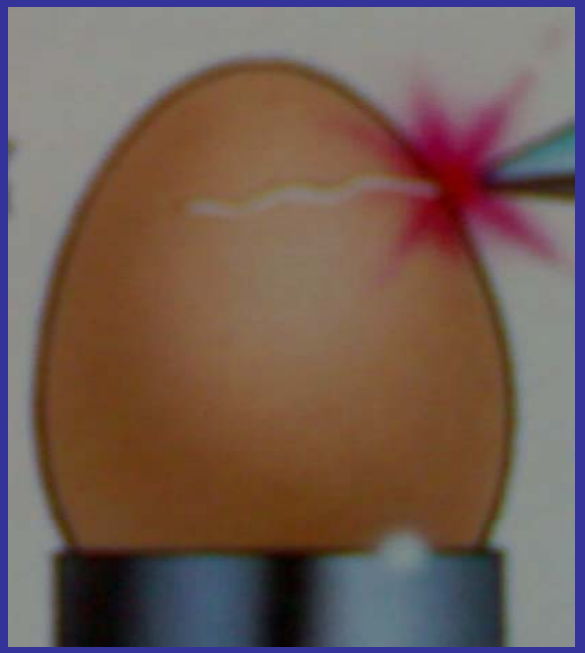
Spektrum Laser



Aplikasi

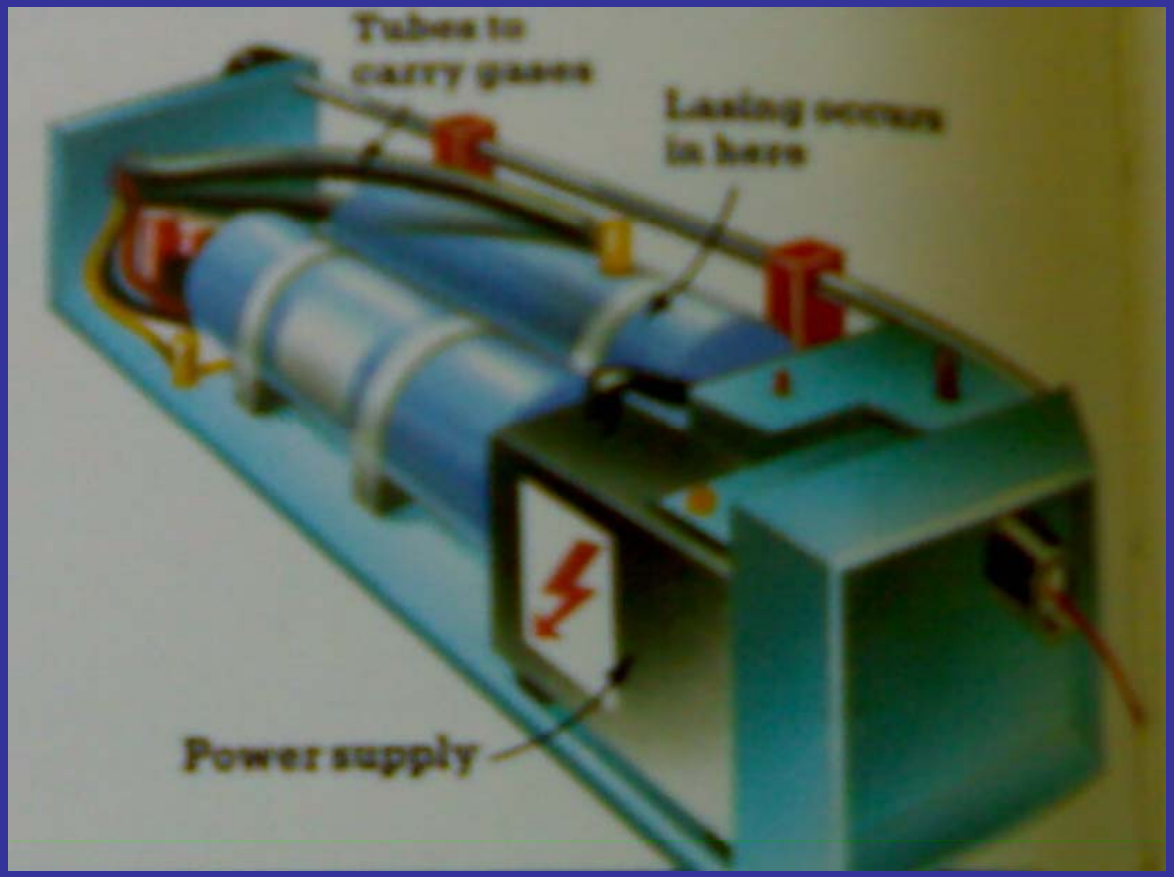


- Operasi medis (bloodless surgery), perawatan kulit & gigi,
- Pengelasan, pemotongan, pengeboran
- Komunikasi (via fiber glass)
- Entertainment (laser light, laser disc, hologram, dsb)
- Senjata laser



5 Klasifikasi LASER (Standard internasional)

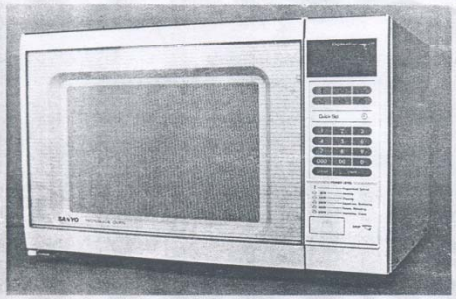
- Klas 1 : intensitas radiasi rendah, tanpa resiko
- Klas 2 : intensitas rendah, memancarkan radiasi tampak (400-700 nm)
- Klas 3A : intensitas lebih tinggi, memancarkan radiasi tampak
- Klas 3B: intensitas tinggi, visible a/ invisible, immediate eye damage
- Klas 4: intensitas tinggi, berbahaya


Tubes to
carry gases
Lasing occurs
in here
Power supply

One colour and direction

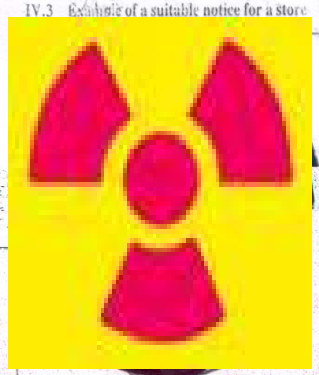
A red light bulb produces light of one colour but it is really a mixture of all the different wavelengths that make various reds, and probably some orange, yellow and other colours too. Laser beams are made up of light waves of identical wavelength, so they are truly just one colour or "monochromatic".

The light waves in a beam of ordinary light spread out in all directions, so the beam quickly fades as it travels. In a laser beam the light waves all travel in the same direction, forming a straight, nearly parallel "rod" of concentrated light which keeps its intensity, even over long distances.



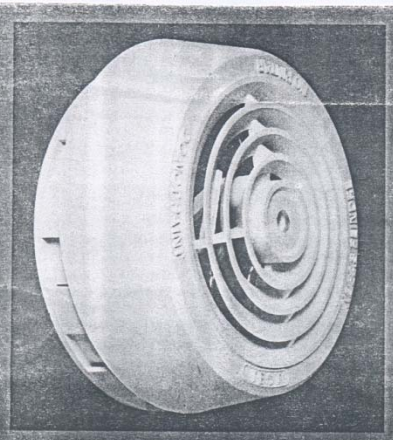
RADIATION EMISSIONS FROM MICROWAVE OVENS

IV.3 Example of a suitable notice for a store



CAUTION

STORE FOR RADIOACTIVE SUBSTANCES



Domestic Smoke Detectors using Radioactive material

RADON IN HOMES

Non ionising radiation


WHAT!?
THERE'S A NEW STUDY SAYING RADIATION CAUSES BRAIN TUMORS, INFERTILITY, HEADACHES, NAUSEA, AND CANCER? BURY IT! BUSINESS IS BOOMING!!!
Sellular, Inc.

Electric & Magnetic Field (EMF)

(Efek pada binatang/ percobaan laboratorium)

- Nervous system;
- change in balance between white & red blood cell
- Heart; Change in electrical hearth activity
- Genetic effect; Infertility, Chromosomal change
- Immune system

Studi pd manusia :

- Fewer children were born to workers exposed to high voltage lines; 8% anak cacat dibanding 3% dari kontrol group (Swedia)
- More death due to leukemia (confounding factor : benzene)- USA
- 30 pekerja instansi listrik di Paris: kesehatan baik, bukan perokok&peminum alkohol, 7 - 20 tahun masa kerja, alat dosimeter setiap 30 detik mengunjukkan nilai paparan elektromagnetik yang terjadi.

  Hasil :penelitian ini dapat dinyatakan bernilai amat meyakinkan yang membuktikan untuk pertama kalinya, bahwa paparan spektrum elektromagnetik (teg. Tinggi) yang berjalan terus-menerus dan kumulatif tidak menimbulkan efek yang mengganggu (American Journal of Physiology, June 2005)

- DR Sudarti (Univ Jember;Kompas 24 Jan 2006)
  - SUTET mempengaruhi faktor psikis warga; rasa tdkaman/depresi (suara berisik spt letusan yg muncul malam hari krn arus listrik dg beban puncak)
  - Tidak berpengaruh langsung pada kesehatan
  - Mempengaruhi kualitas suara dan gambar TV

Voltage Levels

- Low voltage lines : < 1000 V
- Medium voltage : 1000 V – 60 000 V
- High voltage : 60 000 – 150 000 V
- Extra High voltage : > 150 000 V

Dirty bombs contain radioactive material blown up using conventional explosives, which disperse the often highly poisonous radioactive substances