Kementerian Kesihatan Malaysia

Act 304 & Radiological Emergency Preparedness

6 Mei 2017

Bazli Sapiin
Bahagian Kawalselia Radiasi Perubatan

The line story

- ✓ **Radiation and Emergency**
- ✓ **Radiation Accident**
- ✓ **Arahan No. 20 MKN - Dasar Dan Mekanisme Pengurusan Bencana Negara**
- ✓ **Regulatory requirements related to radiation accident**
- ✓ **Summary**

Accident & Emergency

Accident

an undesirable or unfortunate happening that occurs unintentionally and usually results in harm, injury, health hazard, death, damage or loss of property; or combination thereof

Cont… Accident & Emergency

Radiation Accident

- An unintended or unexpected event occurring with a radiation source or during a practice involving ionizing radiation (IR) including operating errors, equipment failures or other mishaps;
  - *where the consequences or potential consequences are not negligible from the point of view of protection or safety*
  - *which may result in possible deleterious effects on the exposed individuals.*
- Expose to IR or radioactive contamination
- Exposure may be real or suspected

Cont… Accident & Emergency

Emergency

A non-routine situation or event that requires prompt action**,** primarily to mitigate a hazard or adverse consequences for human life, health, property or the environment.

- Conventional emergencies such as fires, releases of hazardous chemicals, storms or earthquakes.
- Nuclear and radiological emergencies

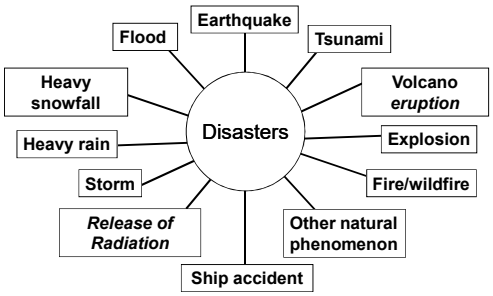
An emergency in which there is, or is perceived to be, a hazard due to:
(a) Nuclear activities - the energy resulting from a nuclear chain reaction or from the decay of the products of a chain reaction;
(b) Radiation exposure.

Cont… Accident & Emergency

- Radiation accidents include
  - *radiological* and
  - *nuclear accidents*
- It is more appropriate and practical to use the term "***Nuclear And Radiological Emergency Preparedness***" for the purposes of ***planning, preparedness*** and ***response***.

Radiation Accident

What is difference between Release of Radiation and Others?



In radiological emergency, management paradigm changes….

Radiation
can not be seen, heard, smelt or felt,
&
dose not cause immediate symptoms.

Contamination complicates.

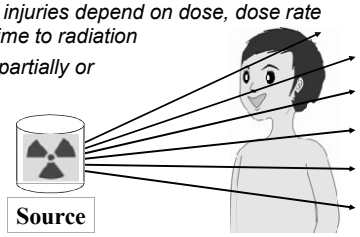
Radiation accident …

1. Rare
2. Difficult to realize
3. Symptoms/signs do not appear soon
   - *not specific for radiation exposure*
4. Increased fear/anxiety to radiation
5. Need special devices for radiation detection
6. Highly emotional subject
7. Wide spread public concern
8. Misunderstanding and rumors
   - *Potassium iodide (KI) is effective for blocking all radionuclides !*

Radiation Exposure ⇨
- *External ; or*
- *Internal Contamination*

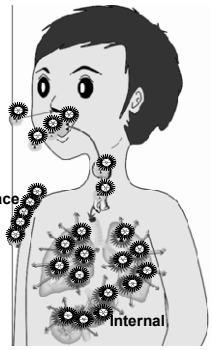
External Exposure

- ❑ Do not involve contamination to the victims
- ❑ *Severity of the injuries depend on dose, dose rate and exposed time to radiation*
  - *whole body, partially or localized*



Surface or Internal Contamination

- *High levels of external contamination with beta radionuclide could lead to severe radiation burns.*
- *High level of internal contamination could result in lethal dose and death of the person.*



Main Type of Radiation Accidents

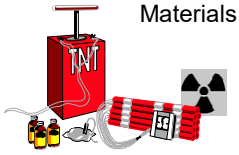
- **Accidents during work - workers**
  - *radiography*
  - *irradiators (sealed sources and accelerators)*
- **Accidents due to loss of control over radiation sources - public exposure**
  - *radiotherapy*
  - *"orphan sources"*
- **Accidents in medical applications - patients**
  - *misadministration of radiopharmaceuticals*
  - *miscalculation of the dose for radiotherapy*

However, loss of control over radiation sources has recently lead to more severe accidents

Where do radiation accidents happen?

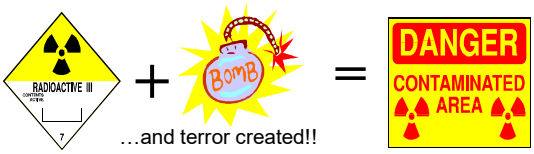
- **Nuclear installations (reactors)**
- **Isotope productions**
- **Materials testing (industrial radiography)**
- **Industrial irradiation (medical, food)**
- **X-ray and radiotherapy units (medicine, research)**
- **Unsealed radionuclides (medicine, research)**
- **Transportation**
- **Public domain**
- **Terrorist event (dirty bomb, low yield, nuclear weapon)**

Terrorists may use Radioactive Materials

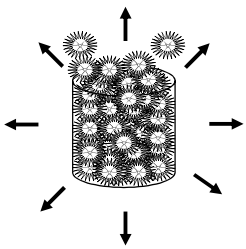


Dirty bomb - conventional explosives with radioactive source….

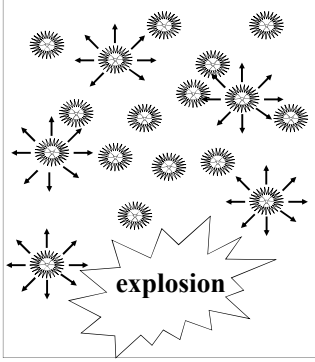
…..Contamination could be spread over a wide area…



…and terror created!!



High-dose rate before explosion



Low-dose rate after explosion

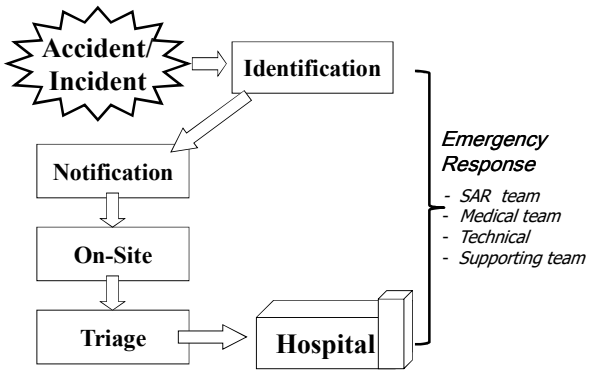
Potential Victims

A terrorist incident involving a radioactive or nuclear device could lead to large numbers of individuals who are:

- Contaminated and injured
- Contaminated but not injured
- Not contaminated but injured
- Not contaminated or injured but frightened

Combined radiation injury (CRI)

Disaster Management Mechanism

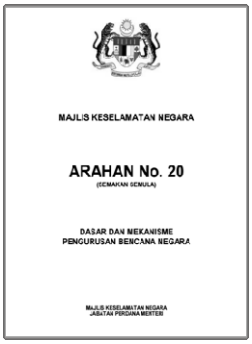


Emergency Response

The goals of emergency response involving radiation are:

(a) To regain control of the situation and to mitigate consequences;
(b) To save lives;
(c) To avoid or to minimize severe deterministic effects;
(d) To render first aid, to provide critical medical treatment and to manage the treatment of radiation injuries;
(e) To reduce the risk of stochastic effects;
(f) To keep the public informed and to maintain public trust;
(g) To mitigate, to the extent practicable, non-radiological consequences;
(h) To protect, to the extent practicable, property and the environment;
(i) To prepare, to the extent practicable, for the resumption of normal social and economic activity.

Arahan No. 20 MKN


MAJLIS KESELAMATAN NEGARA

ARAHAN No. 20
(CEMAKAN SEMULA)

DASAR DAN MEKANISME PENGURUSAN BENCANA NEGARA

MAJLIS KESELAMATAN NEGARA
JABATAN PERDANA MENTERI

- MKN – Arahan 20
  - Tangungjawab MKN
  - Mekanisme Pengurusan Bencana
    - *Pembentukan J/K di peringkat daerah/ negeri/kebangsaan*
  - Pencegahan dan Peredaan
  - Kesiapsiagaan
  - Mekanisme Tindak Balas Bencana
  - Pemulihan
  - Perisytiharaan Darurat Bencana

Majlis Keselamatan Negara (MKN)

- MKN adalah **Agensi Peneraju Utama Pengurusan Bencana Negara**.
- MKN bertanggungjawab
  - ✓ menyelaras pengurusan bencana negara; dan
  - ✓ membentuk serta memastikan segala dasar dan mekanisme pengurusan Bencana Negara dipatuhi dan dilaksanakan di setiap peringkat pengurusan Bencana

Tafsiran…1

"Bencana"

suatu kejadian yang menyebabkan gangguan kepada aktiviti masyarakat dan urusan negara, melibatkan kehilangan nyawa, kerosakan harta benda, kerugian ekonomi dan kemusnahan alam sekitar yang melangkaui kemampuan masyarakat untuk mengatasinya dan memerlukan tindakan penggemblengan sumber yang ekstensif;

"Kejadian Bukan Bencana"

kejadian atau kemalangan yang bersifat kecemasan yang melibatkan sejumlah kecil mangsa dan kesannya hanya kepada mangsa terlibat. Kejadian atau kemalangan yang bercorak ini tidak mempunyai kemungkinan untuk merebak dan dapat dikendalikan dalam tempoh masa yang singkat oleh agensi-agensi yang berkenaan dengan menggunakan sumber atau kemudahan yang minima di peringkat tempatan;

Tafsiran…2

"Kesiapsiagaan (*preparedness*)"

pengetahuan dan keupayaan yang dibangunkan oleh agensi, masyarakat dan individu supaya berkebolehan untuk menjangka, bertindak balas dan pulih daripada kesan-kesan Bencana secara efektif;

"Tindak Balas (*response*)"

tindakan penyediaan perkhidmatan kecemasan dan bantuan awam semasa atau sebaik sahaja berlakunya Bencana dengan tujuan menyelamatkan nyawa, menjamin keselamatan awam dan membantu dari segi keperluan asas mangsa Bencana.

Kejadian Bencana

6. Kejadian Bencana di bawah Arahan ini adalah:

(a) Bencana ombak b
(b) Bencana dan kebo loji dan d berkenaa
(c) Kemalan bahan-ba
(d) Keruntuh
(e) Kemalan tinggi;
(f) Pelanggaran atau kegelinciran keretapi dan lain-lain sistem pengangkutan rel yang melibatkan jumlah mangsa dan kemusnahan harta benda yang besar;
(g) Kebakaran yang melibatkan kawasan yang luas termasuklah kebakaran bangunan tinggi dan struktur khas yang mempunyai ramai orang;
(h) Kejadian empangan/takungan air pecah;
(i) Kemalangan kimia, biologi, radiologi dan nuklear melibatkan pepasangan atau yang berkaitan dengannya yang mana kemalangan ini berkemungkinan boleh merebak dan mengakibatkan kehilangan nyawa, kemusnahan harta benda atau pencemaran alam sekitar serta menjejaskan aktiviti setempat;
(j) Kejadian jerebu yang boleh menimbulkan keadaan kecemasan alam sekitar yang menggugat keselamatan, kesihatan dan ketenteraman awam, perjalanan pentadbiran Kerajaan dan aktiviti ekonomi Negara;
(k) Kejadian penularan wabak penyakit berjangkit yang tidak terkawal/pandemik; dan
(l) Lain-lain kejadian Bencana yang akan diisytiharkan dan ditetapkan oleh Kerajaan.

12 jenis bencana

Kemalangan Kimia, Radiologi dan Nuklear

10. Kejadian Bencana akibat kemalangan kimia, radiologi dan nuklear serta bahan-bahan berbahaya dikendalikan oleh Jabatan Bomba dan Penyelamat Malaysia (JBPM) sebagai Agensi Penyelamat dalam menangani Bencana ini. Lembaga Perlesenan Tenaga Atom (LPTA) bertanggungjawab sebagai Agensi Peneraju dalam memberikan khidmat kepakaran dan teknikal dalam pengurusan Bencana radiologi dan nuklear.

"**Agensi Penyelamat**" ertinya agensi Kerajaan yang dipertanggungjawabkan untuk melaksanakan operasi mencari dan menyelamat serta memberi perkhidmatan perubatan kecemasan dan bantuan logistik lain ketika sesuatu kejadian bencana;

"**Agensi Peneraju**" ertinya agensi yang dipertanggungjawabkan mengurus sesuatu kejadian Bencana mengikut bidang kepakaran masing-masing;

Penentuan Tahap Pengurusan Bencana

- Penilaian oleh Jawatankuasa Pengurusan Bencana di peringkat Daerah, Negeri atau Pusat.
- Penilaian tersebut hendaklah berdasarkan elemen-elemen :

i) kompleksiti dan magnitud;
ii) kemusnahan dan kerosakan;
iii) kemampuan sumber kewangan, tenaga manusia dan kelengkapan;
iv) kepakaran;
v) bantuan; dan
vi) tempoh masa Tindak Balas.

Jawatankuasa Pengurusan Bencana

- JK Pengurusan Bencana Pusat (JPBP)
  - Bencana Tahap 3
- JK Pengurusan Bencana Negeri (JPBN)
  - Bencana Tahap 2
- JK Pengurusan Bencana Daerah (JPBD)
  - Bencana Tahap 1

Tahap Pengurusan Bencana .. 1

Bencana Tahap 1

- Kejadian setempat yang terkawal (setempat)
- Tidak berpotensi untuk merebak & tidak begitu kompleks
- kehilangan nyawa dan harta benda yang kecil.
- Tidak menjejaskan aktiviti harian penduduk setempat secara meluas.
- Mampu ditanggani oleh **Jk Pengurusan Bencana Daerah (JPBD)**

Bencana Tahap 2

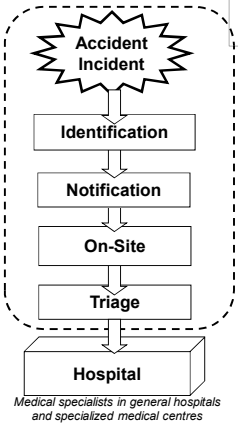
- Meliputi kawasan yang luas atau melebihi dua daerah dan berpotensi untuk merebak.
- Kehilangan nyawa, kemusnahan harta benda yang banyak, kemusnahan infrastruktur dan menjejaskan aktiviti harian masyarakat.
- Bersifat lebih kompleks dan menyulitkan usaha mencari dan menyelamat.
- Berupaya dikendalikan oleh **Jk Pengurusan Bencana Negeri (JPBN)** tanpa atau dengan bantuan dari luar yang terhad.

Tahap Pengurusan Bencana .. 2

Bencana Tahap 3

- Sangat besar dan bersifat lebih kompleks
- Meliputi kawasan yang lebih luas atau melebihi dua buah negeri.
- Sumber tempatan tidak mencukupi dan memerlukan bantuan dari lain-lain agensi
- Perlu dan berupaya dikendalikan oleh **Jk Pengurusan Bencana Pusat (JPBP)** tanpa atau dari bantuan luar negara.
- Ketentuan tahap bencana bergantung kepada penilaian pihak berkuasa di daerah/negeri/pusat untuk menentukan pengurusan atau mencadangkan pengambilalihan pengendalian bencana oleh pihak yang lebih tinggi.

Pengarah Keselamatan Dalam Negeri Dan Ketenteraman Awam, PDRM	- Komander
Timbalan Ketua Pengarah Operasi, JBPM	- Timbalan Komander Operasi Bencana



Carta alir Pengurusan Bencana

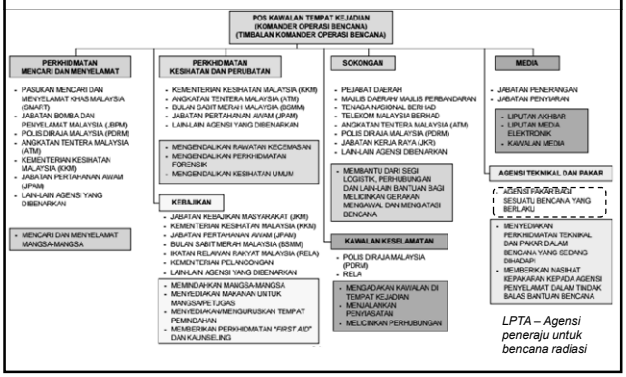
Nuclear and Radiological Emergency
[Tempat Kejadian]

- Pelbagai agensi
- Agensi Peneraju utama - MKN
- Agensi Penyelamat
- Agensi Teknikal & Pakar (LPTA –peneraju)
- Agensi Bantuan dan Pemulihan

Medical response to radiation emergency
[Hospital]

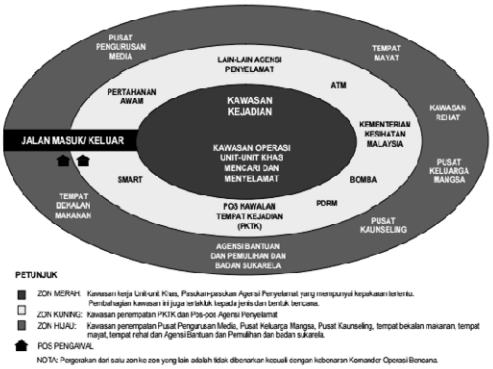
- KKM

Carta Peranan Agensi Terlibat Dalam Pengurusan Bencana Di Tempat Kejadian



Cont… Arahan No. 20 MKN

Pengurusan Bencana Di Tempat Kejadian Mengikut Zon



Cont… Arahan No. 20 MKN

Peranan & Tugas Agensi Penyelamat Dalam Pengendalian Di Tempat Kejadian

A. PASUKAN MENCARI DAN MENYELAMAT KHAS MALAYSIA (SMART)

- *Mencari dan menyelamat mangsa-mangsa dalam sesuatu kejadian Bencana yang memerlukan bantuan kepakaran, kemahiran, peralatan serta kelengkapan yang khusus.*

B. POLIS DIRAJA MALAYSIA (PDRM)
C. JABATAN BOMBA DAN PENYELAMAT MALAYSIA (JBPM)
D. ANGKATAN TENTERA MALAYSIA (ATM)
E. JABATAN PERTAHANAN AWAM
F. KEMENTERIAN KESIHATAN MALAYSIA

i. Perkhidmatan Kecemasan dan Menyelamat
ii. Perkhidmatan Pangkalan Perubatan
iii. Perkhidmatan Kesihatan Awam

- *Memberikan perkhidmatan kepakaran perawatan kecemasan kepada mangsa Bencana di dalam operasi menyelamat bersama-sama Agensi Penyelamat yang lain.*

G. AGENSI BANTUAN DAN PEMULIHAN/BADAN2 SUKARELA

PERANAN DAN TUGAS AGENSI BANTUAN DAN PEMULIHAN DAN BADAN-BADAN SUKARELA DALAM KERJA-KERJA BANTUAN DAN PEMULIHAN DI TEMPAT KEJADIAN

G. Lembaga Perlesenan Tenaga Atom (LPTA)

1. Mengawal dan mencegah pencemaran bahan radioaktif daripada merebak.
2. Membantu menyediakan segala peralatan dan kelengkapan yang berkaitan untuk operasi mencari dan menyelamat dalam Bencana nuklear dan radiologi.
3. Menjalankan siasatan dan menyediakan laporan berkaitan dengan Bencana nuklear dan radiologi yang berlaku.
4. Menilai Bencana nuklear dan radiologi, mengumpul maklumat untuk menasihati dan untuk disalurkan kepada Komander Operasi Bencana supaya tindakan pengungsian (*evacuation*) kawasan dilakukan.
5. Menasihati petugas-petugas dalam aspek-aspek keselamatan perlindungan sinaran radioaktif sebelum dan semasa operasi mencari dan menyelamat dilaksanakan.
6. Menilai sama ada khidmat Agensi Nuklear Malaysia/Agensi Tenaga Atom Antarabangsa (IAEA) diperlukan dan membantu mendapatkan khidmat tersebut bila diperlukan.

Mengapa Arahan 20 MKN sangat penting?

MAJLIS KESELAMATAN NEGARA

ARAHAN No. 20
(SEMAKAN SEMULA)

DASAR DAN MEKANISME PENGURUSAN BENCANA NEGARA

PERKARA 27: PEMULAAN KUAT KUASA DAN PEMAKAIAN ARAHAN INI

45. Sekiranya terdapat sebarang percanggahan di antara Arahan ini dengan mana-mana Peraturan atau Arahan Tetap Operasi yang dikeluarkan oleh mana-mana Agensi Kerajaan berhubungan dengan dasar dan mekanisme pengurusan Bencana, Arahan ini hendaklah mengatasi Peraturan atau Arahan Tetap Operasi tersebut.

DATO' SRI MOHD NAJIB BIN TUN HAJI ABDUL RAZAK
PERDANA MENTERI MALAYSIA
MERANGKAP PENGARAH GERAKAN NEGARA

Bertarikh: 30 Mac 2012

Regulatory Requirement related to Radiation Accident

Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010 – BSRP 2010

- *Safety requirements for radiation sources*
- *Prevention of accident*
- *Emergency Plan*
- *Security and protection of radiation source*
- *Notification of theft, loss or sabotage*

Cont… Reg. Requirement related to Radiation Accident

Requirements for radiation source

The licensee shall ensure that the radiation source and the system associated with the radiation source are designed, constructed, operated and maintained in a manner that would minimize the magnitude and likelihood of exposure of workers and members of the public. (*Reg.66*)

Prevention of accidents

The licensee shall make suitable arrangements to prevent as far as possible, any accident that could reasonably be foreseen for any radiation source which is in his possession or under his control, and to limit the consequences of any accident that occurs. (*Reg.67(1)*)

The licensee shall ensure that—

(a) adequate procedures are established for the control of the radiation source and of any potential accident that is reasonably foreseeable;

(b) the system, components and equipment which are important for safety are inspected and tested in a manner as specified by the appropriate authority for any degradation that could lead to abnormal conditions or inadequate performance;

(c) appropriate maintenance, inspection and testing are carried out without undue occupational exposure;

(d) appropriate automatic systems for safely shutting off or reducing radiation output from the radiation source when the operating conditions exceed the operating ranges are provided; and

(e) a system which can detect and respond immediately to abnormal operating conditions that can significantly affect the protection or safety and to allow for timely corrective action to be taken, is provided. (*Reg.67(2)*)

Emergency plans

Reg. 68

(1) The licensee shall establish an emergency plan for responding to and correcting every reasonably foreseeable emergency situation involving a radiation source.

(2) Every emergency plan established under subregulation (1) shall be subject to the approval of and the conditions imposed by the appropriate authority.

(3) An emergency plan shall include—

(a) the emergency organization;

(b) allocation of responsibilities for individuals identified in the emergency plan;

(c) identification of the various operating conditions and other conditions of the radiation source which could lead to the need for intervention;

(d) measures to be taken during an emergency;

(e) the establishment of intervention levels for different emergency situations;

(f) a list and description of equipment that is necessary during an emergency;

(g) a description of the public information arrangements in the event of an accident;

(h) protective actions to be taken subsequent to an emergency; and

(i) the criteria for terminating, the measures and protective actions mentioned in paragraph (d) and (h), respectively.

The licensee shall :

- *review and update the emergency plan as determined by the appropriate authority.*
- *provide training for personnel who are or will be involved in implementing the emergency plan.*
- *provide prior information to the members of the public who could be affected by an accident which may occur at his facility*.

The emergency plans shall be rehearsed at suitable intervals in conjunction with the relevant authorities.

(*Reg.68(4)-(7)*)

Security And Protection Of Radiation Source

The licensee shall take all measures to ensure the security and protection of all radiation sources in his possession or under his control to prevent theft, loss or sabotage.

- Radioactive Source Category 1 & 2

Notification of theft, loss or sabotage

Reg. 71.

(1) The licensee shall, upon discovering any theft, loss or sabotage of any radiation source in his possession or under his control—

(a) notify the appropriate authority of such theft, loss or sabotage within 24 hours after discovering the theft, loss or sabotage; and

(b) submit a complete report of the theft, loss or sabotage in writing to the appropriate authority within 30 days after the notification to the appropriate authority.

Cont… Reg. Requirement related to Radiation Accident

(2) The report to be submitted by the licensee under paragraph (1)(b) shall contain :-

(a) where appropriate, a description of the radiation source, including its kind, quantity and its chemical and physical forms;

(b) a description of the circumstances under which the theft, loss or sabotage occurred;

(c) a statement of the location or probable location of the radiation source;

(d) the possible radiation exposure to individuals, circumstances under which the exposures may occur, and the extent of potential hazard to members of the public;

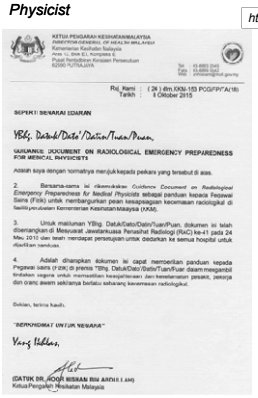
(e) the actions which have been taken, or will be taken, to recover the radiation source;

(f) the procedures or measures which have been or will be adopted to prevent a recurrence of the theft, loss or sabotage of the radiation source; and

(g) any other information as the licensee deems necessary.

Guidance Document on Radiological Emergency Preparedness for Medical Physicist

https://radia.moh.gov.my/project/new/radia/downloads.php



KETUA PENGARAH KESIHATAN MALAYSIA

Rujukan : (24) dlm.KKM-153 PCG/PP/TA(18)
Tarikh : 1 Oktober 2015

SEPERTI SENARAI EDARAN

Ybhg. Datuk/Dato'/Datin/Tuan/Puan,

GUIDANCE DOCUMENT ON RADIOLOGICAL EMERGENCY PREPAREDNESS FOR MEDICAL PHYSICISTS

Adalah saya dengan hormatnya merujuk kepada perkara yang tersebut di atas.

2. Bersama-sama ini dikemukakan *Guidance Document on Radiological Emergency Preparedness for Medical Physicists* sebagai panduan kepada Pegawai Sains (Fizik) untuk membangunkan pelan kesiapsiagaan kecemasan radiologikal di kemudahan-kemudahan Kementerian Kesihatan Malaysia (KKM).

3. Untuk maklumat Ybhg. Datuk/Dato/Datin/Tuan/Puan, dokumen ini telah dibentangkan di Mesyuarat Jawatankuasa Penasihat Radiologi (RAC) ke-41 pada 24 Mac 2015 dan telah mendapat persetujuan untuk diedarkan ke semua hospital untuk diambil tindakan.

4. Adalah diharapkan dokumen ini dapat memberikan panduan kepada Pegawai Sains (Fizik) di premis Ybhg. Datuk/Dato'/Datin/Tuan/Puan dalam menganbil tindakan segera untuk memastikan kesiapsiagaan dan kesetiaraan pesakit, pekerja dan orang awam sekiranya berlaku sebarang kecemasan radiologikal.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Yang Ikhlas,

(DATIN DR. NOOR HISHAM BIN ABDULLAH)
Ketua Pengarah Kesihatan Malaysia

KEMENTERIAN KESIHATAN MALAYSIA

Guidance Document on Radiological Emergency Preparedness for Medical Physicists

INTRODUCTION:

Ionizing radiation for medical purposes is based on the principle that it produces sufficient benefit to offset the radiation detriment it causes to the irradiated person. The main aim is to ensure that the magnitude of individual doses, the number of people exposed to radiation and the likelihood that potential exposures will actually occur should all be kept As Low As Reasonably Achievable (ALARA), economic and social factors being taken into account. The use of ionizing radiation for medical purpose is well regulated by the existing Atomic Energy Licensing Act 1984 (Act 304), subsidiary regulations, standards and guidance documents.

A radiological emergency is a critical situation in which there is, or is perceived to be, a hazard from unwarranted exposure to ionizing radiation. Radiological emergencies include incidents involving sealed and unsealed radioactive sources, and radiation generators. Radiation accidents may cause health effects if the radiation dose is above the threshold of deterministic effect This may cause injuries and eventual death. There is also a risk of stochastic effects from radiation exposure which may cause cancer and severe hereditary effects. In any emergency immediate steps must be taken to minimize the radiological risk to the patient, worker and public.

In a hospital environment the medical physicist is the Radiation Protection Officer (RPO) and he is part of the radiological emergency response team (ERT) that handles all such emergencies. The RPO is responsible for overall radiation safety and ensures that radiation exposure is kept to a minimal acceptable level.

BACKGROUND:

Summary

- ✓ Loss of control over radiation sources has recently lead to more severe accidents
- ✓ Involvement from all related agencies in the event of radiological emergency are very crucial
- ✓ Role and responsibilities of each agencies involved in emergency should be clearly defined for the effective coordination and implementation
- ✓ Disaster management mechanisms need to be in line with the Directives 20 of MKN
- ✓ Act 304 provides rules and regulations to prevent theft, loss or sabotage of radiation sources that could be lead to radiation accident