Radiation Protection in Hong Kong – The Early Days

Valedictory sharing

Hong Kong Radiation Protection Society

30 October 2015

CHENG Kit Man, MH

Preamble

1. Information in this presentation is primarily based on personal recollection, private communications and publicly available information.
2. While the best effort is taken to ensure the accuracy of the information, errors may still exist and your pardon is requested.
3. References to the original sources of information are stated wherever possible and known.
4. Every effort will be taken to avoid any conflict of interest, perceived or otherwise, to my roles and responsibilities, previous or present. Hence, answer to question that might even remotely be construed as being in conflict would be respectfully declined.

Overview

1. Uses and abuses of ionizing radiations in the early days
2. Radiation incidents affecting Hong Kong
3. Radiation emergency response plans for the protection of Hong Kong's public
4. Development of radiation protection infrastructures
5. Hong Kong's participation in international radiation protection arena

1. Uses – reference timeline

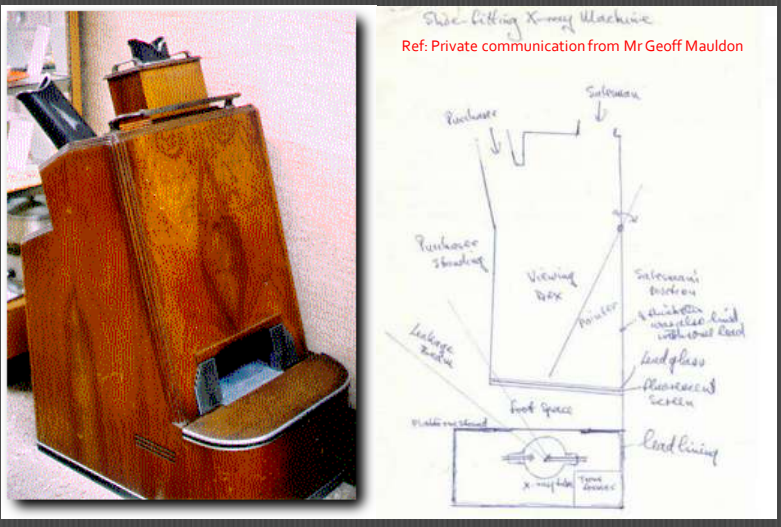
Year	Reference event
1895	Discovery of x-ray by Wilhelm Conrad Röntgen
1896	Discovery of radioactivity by Antoine Henri Becquerel
1910	First x-ray diagnosis system set up in Hong Kong
1913	Invention of thermionic diode high vacuum x-ray tube by William David Coolidge
1928	Establishment of the International X-ray and Radium Protection Committee with first report in the name of ICXRP
1939	First x-ray therapy system in Hong Kong
1945	Use of atomic weapons in Hiroshima and Nagasaki
1957	Enactment of the Radiation Ordinance in Hong Kong
1959	International Commission on Radiological Protection (ICRP) publication 1 provided first set of recommendations
1960	Establishment of the Radiation Protection Convention, 1960 (ILO No. 115)
1965	Enactment of subsidiary regulations under the Radiation Ordinance in Hong Kong

1 Uses and abuses of ionizing radiations in the early days

1. Pre-regulation uses, not justified
2. Pre-regulation uses, justified
3. Post-regulation uses, justified
4. Post-regulation uses, not justified

Work processes to be shown in this section have mostly become obsolete.

1.1.1 Shoe-fitting x-ray 1958



1.1.2 X-ray used by bone-setters (跌打師傅)

- Widespread use of x-ray by bone-setters before the requirement of licence in 1965.
- Bone-setters of the time usually did not possess the required qualifications for licensing.
- With the collaboration of bone-setter leaders, all unlicensed x-ray machines were sealed by RB Inspectors when the regulations came into force.

1.2.1 1st x-ray diagnosis system in HK - 1910

Röntgen Ray Apparatus with 16 inch spark coil at the Alice Ho Miu Ling Nethersole Hospital, Bonham Road

c.f.

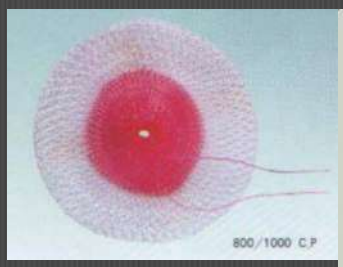
- 1895 - Discovery of x-ray by Wilhelm Conrad Röntgen.
- 1913 – Introduction of thermionic diode high vacuum type x-ray tube by William David Coolidge.

1.2.2 1st x-ray therapy system in HK - 1939

- GE Maximar 400 kVp therapy x-ray machine at QMH
- Installed by hospital engineer Hon Bing YUEN and GE representative Raymond HUANG with expertise support on operation by The University of Hong Kong
- Workshop staff prevented the machine from being dismantled and sent to Japan during the Japanese occupation of HK

Ref: Private communication from Mr Geoff Mauldon

1.2.3 Gas mantle production



1.2.3.1 Production process

1. Weaving of rayon threads & knitting of skeins
2. Dipping skeins in thorium nitrate solution, then drying
3. Rinsing with ammonium solution, then drying
4. Ironing the skeins
5. Cutting into pieces of suitable lengths
6. Stamping of trade marks
7. Knitting up loose ends, providing tie up strings
8. Packing individually, then bundling in dozens and cartoning

1.2.3.2 Radiation Production problems

- Legacy manual manufacturing processes
- External / Internal contaminations
- Direct exposure to α, β, and γ radiation
- Inadequate hazard awareness
- Inadequate safety culture
- Inadequate working environments
- Inadequate safety management
- Inadequate training
- Inadequate protective clothing

1.2.3.3 Raw materials

Thorium nitrate 50 kg drum

1.2.3.4 Wet processing

1.2.3.5 Sorting and drying

1.2.3.6 Improvements

1.2.3.7 Cutting & ironing

1.2.3.8 Trademark stamping

1.2.3.9 Packaging

1.2.4 Timepiece luminizing

- Luminous phosphor activated by beta radiation
- Radionuclides: ^{3}H (compound or gas form), ^{147}Pm and ^{226}Ra
- Radium girl litigation case of 1928
- Now disused by most, if not all, premium watch producers
- Hong Kong was the largest producer of luminous timepieces in 1980's

1.2.4.1 Timepiece luminizing

1.2.4.2 Timepiece luminizing


用量有限畢竟能致癌
日本鐘表公司
廢除夜光塗料
（新華社東京四月二十二日電）日本精工鐘表公司決定在今後五年內完全廢除含有放射性物質的夜光塗料。
目前鐘表上使用的夜光塗料是氚、鉕一四七、鐳二二六等放射性物質，雖管這些物質因用量有限，對人體不會有危害，但它終究是一種致癌物質，而且夜光塗料發光性能會逐漸減弱，因此，精工公司決定今後以發光性能良好的電子發光元件代替夜光塗料。

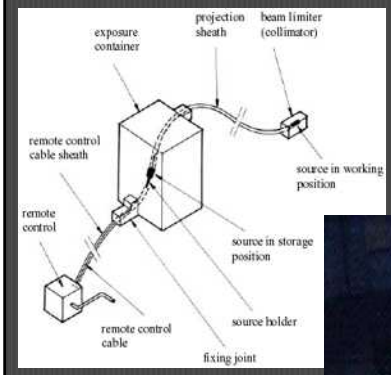
Ming Pao 23/4/1991
Seiko announced discontinuation of radioluminous watch production in 5 years

1.2.5 Lightning conductor

1.3.1 Non-destructive testing

X-ray energy	Up To 8 MV	140-300 kVp	60-140 kVp
Nuclide Typical Maximum	cobalt-60 100 GBq 100 TBq	iridium-192 10 GBq - 1 TBq 7 TBq	thulium-170 1TBq
Test material	Optimum sample thickness		
Steel Light alloy other	50 - 100 mm 150 - 45 mm 40 - 120 g cm^{-2}	10 - 60 mm 40 - 190 mm 10 - 50 g cm^{-2}	2.5 - 12.5 mm 7.5 - 37 mm 2 - 10 g cm^{-2}

1.3.1.1 Gamma radiography



1.3.1.2 Gamma radiography Incidents

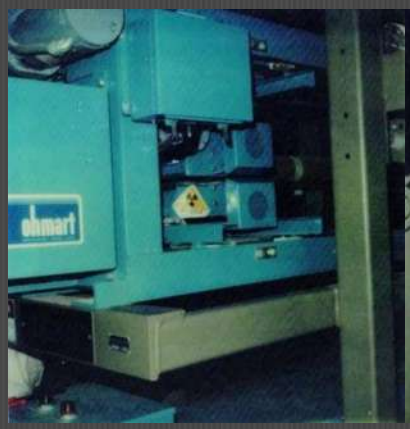
1. 1986/04/15: HAECO
   Dose < 30 mSv (estimate)
2. 1986/08/08: Eastern Technical Services
   Dose 52 mSv
   Fined $2,000
3. 1989/01/20: Intico Asia Testing Service
   Dose > 50 mSv
   Fined $2,000

1.3.2 Moisture/density control

Requires occupational neutron dose monitoring

^{241}Am/Be: 2 GBq
^{137}Cs: 300 MBq

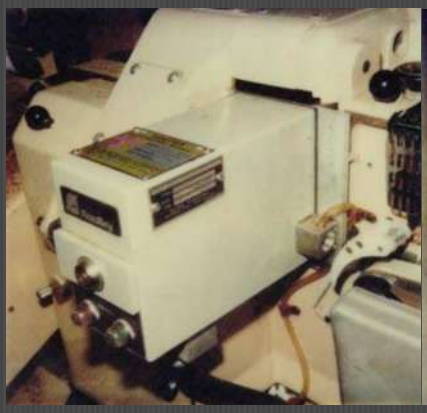
1.3.3.1 Process control / QA



Polyform thickness control
^{85}Kr: 40 GBq

Polyform thickness control
^{90}Sr: 4 GBq

1.3.3.2 Process control / QA



Cigarette density gauge
^{241}Am: 400 MBq

Liquid level gauge
^{60}Co: 20 MBq

1.3.3.3 Process control / QA

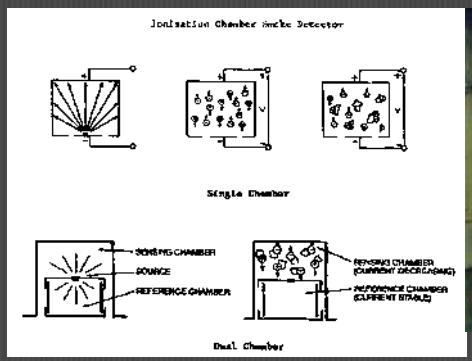
Sewage level control
^{137}Cs: 20 MBq x 2

Incinerator waste level control
^{137}Cs: 1 GBq

1.3.3.4 Process control / QA

^{85}Kr tracer flo system for IC production

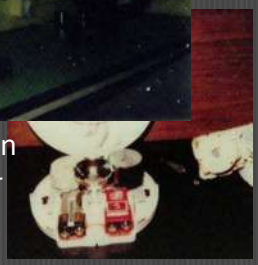
1.3.4 Ionizing Smoke detector



Ionizing smoke detector
^{241}Am: 30 kBq

Impression jig

Ionization chamber



1.3.5 Static elimination

Static eliminator brush ^{210}Po: 4 MBq

1.3.6 Plating thickness QA

X-ray fluorescence thickness gauge

^{204}Tl betascope thickness gauge 1MBq

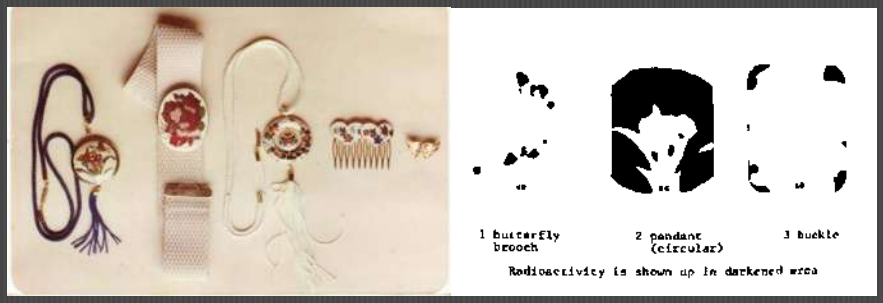
1.3.7 Special check sources

^{109}Cd CRT television screen check source of 5 µSv/h at 5 cm

1.4 Unjustified uses – consumer products

1. Thorium impregnated ornaments & accessories
2. Radium impregnated water pots and bath tiles
3. Anti-nicotine cigarette pack inserts

1.4.1.1 Thorium impregnated ornaments



1.4.1.2 Choice advice

1.4.2 Radium impregnated health aids

83 items of "life pot" & "life bath" seized on 21 September 1984

South China Morning Post

Vol. XL No. 299 HONGKONG, SUNDAY, OCTOBER 28, 1984 Price $2.00

Health aids are radioactive

By ANN QUOIN

Two Japanese products that claim to promote health and vigour contain dangerous radioactive substances, according to tests conducted by the Government which is expected to recommend that they be taken off the market.

The products, Life Bath and Life Pot, emanate radon, a substance that gives off radioactive radium gas.

Exposure to radium over a sufficient period can lead to lung or bone cancer or even death.

Test results, conducted by the Medical and Health De-

partment's radiation health unit, have revealed sufficient levels of radioactivity to pose a health threat to consumers and the Government is understood to be anxious to have both products withdrawn from the market.

The results have been handed over to the police.

Under the Radiation Ordinance, it is illegal to possess or deal in radioactive substances without a licence.

The distributor, Cream Co Ltd, has never applied for one, says Mr Kwan Seid-man who is in charge of the safe and responsible for vetting applications for licences.

Yet the test results have indicated that radiation levels in both products warrant a licence, according to Mr Kwan.

Cream, which has a full range of health aids such as radium-filled blankets, mirrors, girdles and insole pads, has yet to make a decision on whether it will withdraw these products in Hongkong.

It is understood that the distributor is aware of the Government's concern over the products, but it could not be reached for comment.

According to a representative of Cream, the manager in charge of the unit was not available for comment.

The SCM Post was also told the firm has temporarily suspended sales of the two health products.

The action came to the attention of the authorities two months ago when a display of assorted items in a promotional display at a major Japanese department store.

Members of the audience soon took notice about 250 of the products as a prospective before testing. An unknown number, probably between 30 and 50, have been sold and are considered unsuitable.

Mr Kwan advises anyone who has purchased either of the two products to stop using them immediately, throwing the stuff away will not eliminate the danger.

Radium has a half life of

Urine tests which showed it will take that long for the hazard to be reduced to half its present potency.

Life Bath, sold in the form of a tile is placed in the bath water, turning it into a kind of "health" tub. The heat that emanates from it is claimed to cure everything from aches to fatigue and ageing problems.

However, tests have shown that the glow from the bath containers over the tile is placed back in the bathwater, exposure where it continues to emit radiation.

Life Pot, at half the cost of Life Bath, is considered twice as dangerous by Mr Kwan because water is poured through

Life Bath and Life Pot products look like

CHENG Kit Man, MH (2015)© Credit: SCMP 28 October 1984 39

1.4.3 Anti-nicotine cigarette pack insert

Clean card for a dirty habit

WORRIED about the harmful effects of cigarette smoking? Then stick a card in your packet of 20 and your troubles will be over.

At least, that's the claim of the Japanese company launching an amazing new device in Hongkong next month.

The wonder invention is a chemical-coated card, resembling an MTR ticket. Slipped between the cigarette packet and its cellophane cover, it neutralises tar and nicotine levels, say the manufacturers.

The card, coated in quartz, feldspar, white and black mica and other natural materials, starts work 30 seconds after it is inserted, it is claimed. And, hey presto! Out goes the nicotine and tar content.

Its effectiveness, or otherwise, varies according to how long it is in the packet. However, laboratory tests in Japan are said to have shown that nicotine and tar can be reduced by up to 88.2 per cent for mild cigarettes and 77 per cent for high tar and nicotine content cigarettes.

And — the icing on the cake, as far as smokers are concerned — the ciggies will taste just the same. Each card lasts about a year, incidentally.

If all that sounds too good to be true, Taizo Hirota, managing director of Stick One (Hongkong) Ltd, the Hongkong representative for the cards, also proudly reveals that their reverse shows pictures of five outdoor scenes.

Firms buying in bulk can, of course, put in orders for special printing.

"We've ordered more than 10,000 dozen and will put them up for sale next month," Mr Hirota told PS.

Wonder what Health and Medical Service director Dr K.L. Thong and, for that matter, the anti-smoking lobby will make of this one?

NAC anti-nicotine card

Mr Taizo Hirota: an ace in the pack?

CHENG Kit Man, MH (2015)© Credit: SCMP 22 March 1987 40

1.5 Summary on early RP considerations

1. Justification
2. Optimization
   1. Structural shielding
   2. Equipment – standardization, automation, QA, etc.
   3. Training
3. Dose limitation
   1. Dose and risk assessment
   2. Occupational dose monitoring
   3. Health surveillance

2. Radiation incidents

1. Local radiation incidents
   1. Improper disposal of radioactive wastes
   2. Transport accidents
   3. Malicious uses
2. Radiation incidents with cross-border consequences affecting Hong Kong
   1. Chernobyl NPP accident, 1986
   2. Plutonium shipment from France to Japan, 1992
   3. ^{210}Po poisoning case, 2006
   4. Fukushima Daiichi NPP accident, 2011

2.1.1 Improper disposal

Level Gauge at Kornhill MTR Station, 1984

2.1.2.1 Transport accidents

1985/01/05 Transport package damaged at Kai Tak Airport

Could the Secretary for Health and Welfare give a brief report on the incident which happened at the Kai Tak Airport on 5 January this year?

HIS HONOUR THE PRESIDENT:—I think the question is somewhat removed from the original question; but if the Secretary wishes he may answer.

SECRETARY FOR HEALTH AND WELFARE:—Sir, I had anticipated that this might be the point of discussion. The incident which happened at Kai Tak Airport on

582 HONG KONG LEGISLATIVE COUNCIL—**23 January 1985**

5 January was in fact a false alarm and there was no leakage of radioactive material. The procedures for dealing with an incident of this kind operated quite satisfactorily. An officer from the Medical and Health Department's Radiation Health Unit was called to the scene and the area was declared safe. I gather that there were short delays in the shipping of some goods from the Airport; but the whole incident was over in less than two hours.

2.1.2.2 Transport accidents

1989/06/18 Transport package damaged at Kai Tak Airport

Airport staff in radiation scare

MAN HO

AVA0718 CX

A safety-suited fireman (right) supervises while cargo workers suspected of being contaminated shower in the open.

By Mark Brickwell and Yusuf Karamelin

Credit: HK Standard 19 June 1989

2.1.3 Malicious uses

1988/12/23 Discovery of ^{32}P contamination in two typist chairs in HKU

HKU probes radio isotope 'sabotage'

By VIOLA LEE

POLICE and senior academics at Hongkong University are investigating a mysterious case in which dangerous radioactive substances were apparently deliberately injected into the backs of two chairs in a laboratory.

The university Dr Wang Gungwu has ordered an extensive internal investigation and a working group has been set up among staff to find out how the leak had occurred.

The group, chaired by Professor Nelson Chan Nam-shan, the head of the university's Industrial Engi-

The spokesman said it was the first such incident in the 21 years that radioactive substances have been used at the university.

He said a comprehensive review exercise had indicated that regulations on the handling of radioactive substances were adequate and a further tightening of con-

Credit: SCMP 30 March 1989

2.2.1 Chernobyl accident, 1986

Impact to Hong Kong – Radioactivity in food imported from Europe

- No established responsibilities
- No established procedures
- No established measurement methods
- No established equipment
- No established reference level for food control

2.2.1.1 Response actions in HK

- Authority – MSB
- Sample preparation – GL
- Radioactivity measurement – RHU (May 1986 to October 1989)
- Measurement – gross beta & gamma spectrometry with ROI for ^{131}I, ^{134}Cs and ^{137}Cs
- Reference levels
  - 600 Bq/kg (adult food)
  - 100 Bq/kg (infant food)

2.2.1.2 Measurement

Gamma spectrometry with 2" NaI well detector and Canberra 35 Plus MCA

Gross beta counting

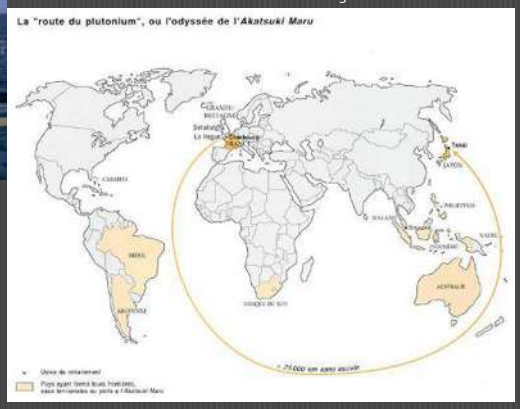
2.2.2.1 Plutonium shipment France to Japan 1992

- Vessel: Akatsuki Maru
- Port of origin: Cherbourg, France
- Port of destination: Japan
- Cargo: plutonium oxide 1.5 ton reprocessed from spent nuclear fuels
- Security: 6,500-ton armed escort ship and satellite tracking
- Singapore, South Africa, Chile, Argentina, Nauru, Hawaii, Puerto Rico and Panama Canal refused ship's entry
- Questions raised at LegCo on 11/11/1992
- Entry banned in Hong Kong

2.2.2.2 Plutonium shipment France to Japan 1992

Credit: Greenpeace

Credit: dissident-media.org



2.2.3.1 ^{210}Po Poisoning, 2006

Alexander Valterovich Litvinenko

Credit: wikipedia

Before

After

Credit: parikiaki

2.2.3.2 Impact to Hong Kong

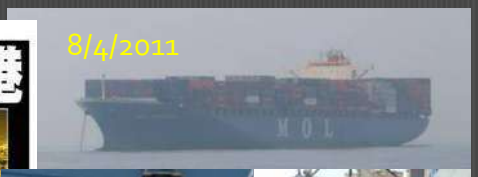
- Hong Kong residents affected at scene:
  - Trade delegation of 14 members who resided at the affected hotel
  - Diners who consumed food and drinks at the affected restaurant and wine bar
- First notification received from HPA of UK on 25/11/2006
- Public health advice and enquiry hotline set up by DH immediately on the same day to advise on health matters
- RHU actions –
  - Health advice to enquirers – 57
  - Detailed risk assessment – 14
  - Detailed follow up – 6
  - Medical follow up – 4
  - Urine sample for radioactivity measurement – 2
  - Confirmed ^{210}Po internal contamination – 1
  - Counselling – 1
- GL assisted on chemical processing of urine samples

2.2.4.1 Fukushima Daiichi NPP Accident, 2011

- Far field event, impact to HK similar to Chernobyl NPP Accident
- Early phase concerns – visitors and returnees from Japan
- Intermediate and late phase concerns – food and cargoes from Japan
- Response actions carried out by taking reference to the Daya Bay Contingency Plan
- Special event – vessel contaminated during voyage at sea outside Fukushima

2.2.4.2 Keeping the public informed

2.2.4.3 Monitoring of vessel from Japan



3. Radiation emergency response plans for the protection of Hong Kong's public

3.1 Guangdong Nuclear Power Station (GNPS) at Daya Bay

1983 CLP approved to invest in GNPS

1986 INES Level 7 accident at Chernobyl NPP in Ukraine

1.04 million people in HK signed up to object to the GNPS project

HK Government commissioned UKAEA to advise on emergency planning and preparedness to deal with an unlikely accident at GNPS

1987 It was discovered that 316 out of 576 steel reinforcement bars in the foundation of GNPS Unit 1 were missing

3.2 Objections to GNPS project

3.3 Daya Bay Contingency Plan UKAEA Harwell Reports

1. Evaluation of Equipment Specifications for implementation of Radiation Monitoring Programme, 1985
2. Appraisal of Background Radiation Monitoring Programme, 1985
3. A Public Education Strategy, 1985
4. Accident Assessment Phase I, 1986
5. Risk Assessment, 1987
6. Contingency Planning, 1989

3.4 DBCP – Radiological Protection Advisory Group

To advise DoH on health matters relating to the radiological consequences that might eventuate from radioactive releases from nuclear facilities. In particular the Group is required to advise on:

(a) the development and subsequent review of 'Dose Models' designed for use in assessing the consequences for the public of any accidental radiation release to the environment;

(b) the dose limits that should apply to the Hong Kong population and in particular to individuals in certain critical groups;

(c) the criteria that should be used to interpret emergency environmental monitoring data;

and, without prejudice to any decision that may be taken by the DoH, during the intermediate and recovery phases, of any nuclear accident situation affecting Hong Kong to advise on: ---

(a) the interpretation of environmental radiation monitoring data and their impact on the public;

(b) the countermeasures that should be adopted having regard to the widely applied principle that the risks should be reduced to a level which is as low as reasonably practicable.

3.5 Radiological Protection Advisory Group 1989

Professor POON Chung-kwong, J.P. (Chairman)
Professor LEUNG Tin-pui, J.P.
Professor Kenneth YOUNG
Professor Walter HO Kwok-keung
Dr. LEUNG Kon-chong
Dr. TSO WONG Man-yin
Dr. Damon CHOY
Dr. MA Kwok-man
Mr. CHAN Chok-leung (Senior Physicist, Medical & Health Department)
Dr. WONG Ming-chung (Senior Scientific Officer, Royal Observatory)
Mr. CHENG Kit-man (Senior Physicist, Medical & Health Department)
Dr. POON Chiu-bong (Physicist, Medical & Health Department)

3.6 RPAG reports

1. Report No. 1 – Intervention Levels and Derived Intervention Levels, 1990
2. Report No. 3 – Intervention Level and Derived Intervention Levels for Decontamination for Members of the Public, 1993
3. Report 2011 – Review of the Dose Criteria for Protective Actions in the Event of a Radiological / Nuclear Emergency Affecting Hong Kong, 2011

Credit: Ming Pao 21/11/1990

3.7 DH reports and Exercises

DH reports:

1. Aide-memoire on Stable Iodine Prophylaxis, 1992 (Administration of Thyroid Blocking Agent, DBCP 2012)
2. Shielding Effectiveness of Buildings in Hong Kong, 1993

Exercises:

1. 1990 – Exercise PENNANT
2. 1993 – Exercise BASILAR
3. 1996 – Exercise FIREBLIGHT
4. 2001 – Exercise FLAGSTAFF
5. 2012 – Exercise CHECKERBOARD
6. Numerous small-scale exercises to test specific modules of DBCP

Credit: Ming Pao 21/11/1990

4. Radiation protection infrastructure

1. Regulations and authorities
2. Occupational radiation monitoring
3. Occupational health surveillance
4. Radioactive waste management
5. Standardization
6. Quality assurance
7. Training
8. Professional body

4.1 RP empowering regulations

1. Radiation Ordinance (Cap 303)
   1. Radiation (Control of Radioactive Substances) Regulations
   2. Radiation (Control of Irradiating Apparatus) Regulations
   3. Authorities: RB, DoH, C for L
2. Import & Export Ordinance (Cap 60)
   1. Import (Radiation) (Prohibition) Regulations
   2. Import & Export (Strategic Commodities) Regulations
   3. Authorities: D-G of T&I, C for C&E
3. Occupational Safety & Health Ordinance (Cap 509)
   1. Notifiable occupational diseases
   2. Authorities: C for L

4.2 Occupational radiation monitoring

	Film Dosimeter NRPB	TLD ($CaSO_4$:Dy) Teledyne	TLD (LiF:MgTi) Harshaw/Bicron/Thermo
Period	1959 – 1985	1985 – 1994	1994 onwards
Service Cycle	Biweekly	Monthly	Monthly

$CaSO_4$:Dy On Teflon

LiF:MgTi Chips

4.2.1 Dosimeter calibration

Whole body water phantom

Finger phantom

Calibration against 1L standard ionization chamber

Standard x-ray field

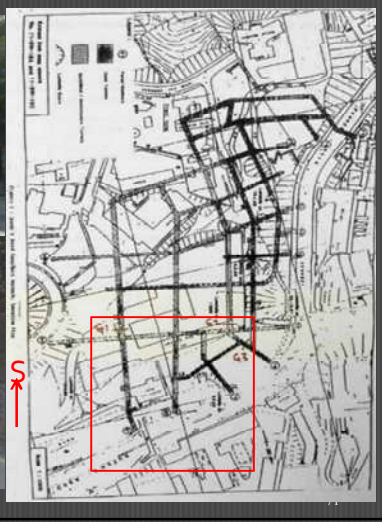
4.3 Occupational Health Surveillance

1. Pre-employment, Annual & Post-accident Assessment
   - Physical Examination
   - Haematology Assessment
   - Chromosome Aberration Assessment
   - Internal Contamination Assessment
2. Nuclear and Radiological Emergency Plans
   - Biological and Genetic Dosimetry

4.4 Radioactive waste management in Hong Kong

1. Fundamental principle – minimization at source.
2. Sealed source – return to original manufacturer. If proven impracticable, seek approval for transfer to LLRWSF.
3. Solid/Liquid contaminated waste – store for decay according to conditions of licence. If
   1. Activity > permitted discharge level – seek approval for solidification and transfer to LLRWSF
   2. Activity < permitted discharge level – dispose as exempt waste
4. Gaseous waste – collect for recycling or discharge through properly monitored purpose-designed exhaust system according to conditions of licence.

4.4.1 Radioactive waste store 1965 – 2005



4.4.2 Radioactive waste store snapshot 1987

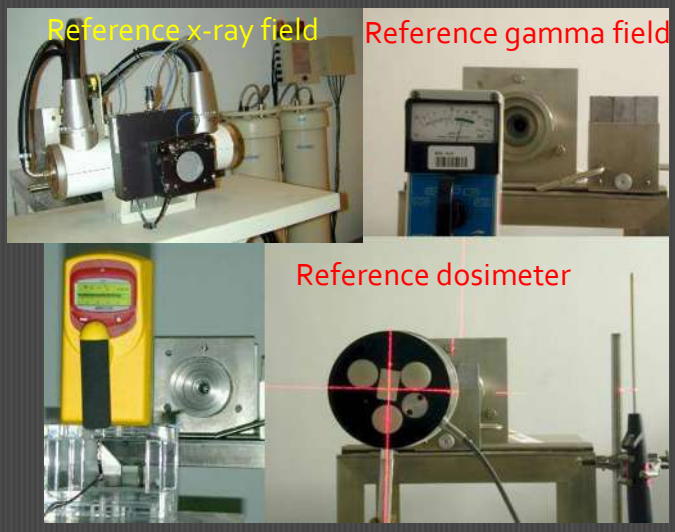
4.4.3 Developing Options

- 1970's: investigated feasibility for sea dumping
- 1989 – 1991: EPD consultant recommended the development of a purpose-built storage facility
- 1994 – 1997: investigated suitability of > 100 sites
- 1999 – 2001: investigated suitability of transfer to Mainland
- 2002 – 2004: compared sites and consulted the affected parties
- 2004 – 2005: construction of purpose-built facility at Siu A Chau

4.4.4 Repackaging legacy waste

4.4.5 LLRWSF at Siu A Chau

4.5 Standardization



4.6 Quality assurance

Approved laboratories to provide service on:

1. Calibration of radiation protection monitoring instrument
2. Workplace contamination monitoring
3. Integrity test of sealed radioactive source

Curious early cases:

1. Wipe test of ^{85}Kr capsule
2. Wipe test of ^{226}Ra brachytherapy needles
3. Wipe test of ^{241}Am foil

4.7 Radiation protection training

Participants satisfactorily completed the approved local courses are considered to have met the minimum requirements and competence of qualifying as radiation workers and/or supervising persons.

Requirements on approved training programmes:

1. Content coverage
2. Qualification and experience of course instructors
3. Course duration
4. Practical work
5. Examination and passing criterion

4.8 Professional body

Early practitioners joined UK professional bodies, including:

1. Institute of Physics
2. Hospital Physicists Association (now Institute of Physics and Engineering in Medicine)
3. Society of Radiological Protection

Need for the formation of a local professional body on radiation protection became imminent in mid-1990's in anticipation of the commissioning of the Guangdong NPP at Daya Bay

4.8.1 Preparation Committee HKRPS (1994 – 1996)

Chairperson:	Dr TSO WONG Man-yin
Secretary:	Mr CHENG Kit-man
Members:	Dr CHEUNG Kin-yin
	Dr LEUNG Kon-chong
	Dr MA Kwok-man (from 5th meeting)
	Dr WONG Ming-chung

4.8.2 HKRPS Honorary Officials

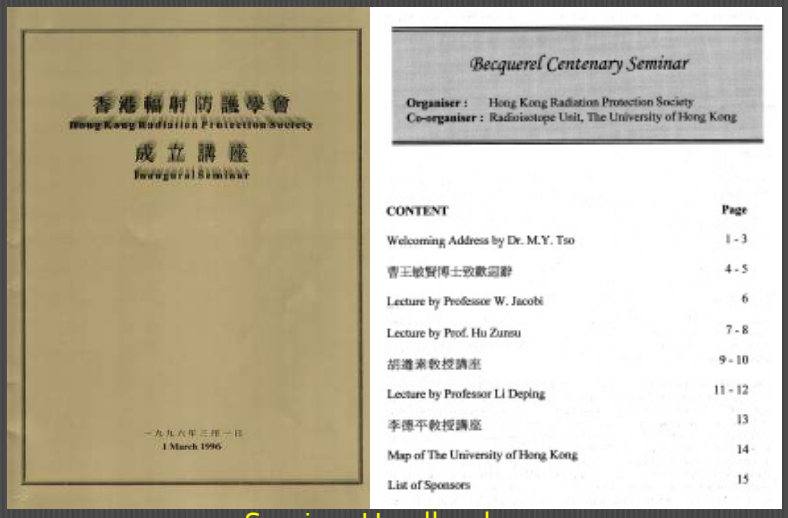
Hon Advisors:	Prof. H.K. Chang	張信剛教授
	Prof. Edward K.Y. Chen	陳坤耀教授
	Prof. Y.C. Cheng	鄭耀宗教授
	Prof. Arthur K.C. Li	李國章教授
	Prof. C.K. Poon	潘宗光教授
Hon Fellows:	Dr. Margaret Chan	陳馮富珍醫生
	Mr. Robert C.K. Lau	劉志鈞先生
	Prof. Deping Li	李德平教授
	Dr. Hector T.G. Ma	馬天兢醫生
Hon Legal Advisor:	Mr. Carson Wen	溫嘉旋律師
Auditor:	Mr. Charles Chan	陳維端會計師

4.8.3 Inauguration of HKRPS

The Preparatory Committee of the
Hong Kong Radiation Protection Society (HKRPS)
requests the honour of your presence at the
Inaugural Seminar of the HKRPS
to be spoken by
Professor LI Deping, Member of the China Academy of Sciences and
Member of the International Commission on Radiological Protection (ICRP);
Professor Wolfgang JACOBI, Advisor of GSF- Forschungszentrum
für Umwelt und Gesundheit GmbH, Germany and
Member International Commission on Radiological Protection (ICRP); and
Dr. HU Zuxun, Director of the China Institute of Radiation Protection and
Executive Vice-President of the China Radiation Protection Society
on Friday, 1 March 1996 at 6:30 - 8:00 p.m. at the
Kiang Wah Complex, The University of Hong Kong

Invitation to Inaugural Seminar of HKRPS, 1 March 1996

4.8.4 Inauguration seminar


香港輻射防護學會
Hong Kong Radiation Protection Society
成立講座
Inaugural Seminar
一九九六年三月一日
1 March 1996

Becquerel Centenary Seminar

Organiser : Hong Kong Radiation Protection Society
Co-organiser : Radioisotope Unit, The University of Hong Kong

CONTENT Page

Seminar Handbook

4.8.5 Inauguration snapshots

Welcoming Dr Margaret Chan, Director of Health

Welcoming Mr Li Xinhua, DD of Xinhua News Agency

Speaking on behalf of speakers in absentia

4.8.6 HKRPS events 1996-97

Programme	Speaker
Radiation Exposure and Cancer Risk from Natural Radiation	Prof Jacobi, Member, ICRP
A Short Introduction of China Radiation Protection Society	Prof Hu Zunsu, Director, CIRP
The Penetrating Component in Natural Background and Possible Difficulties in Monitoring Artificial Contamination	Prof Li Deping, Member, ICRP
Radon	Dr Toohey, Director of Internal Dosimetry Programme, ORAU
Radiation Accidents	Dr Ricks, Director, ORAU
ICRP Internal Dosimetry	Prof Kaul, Chairman, ICRP Committee 2
Visit to GNPS at Daya Bay	

4.8.7 HKRPS events 1997-98

Programme	Speaker
Health Effect of Non-Ionizing Radiation	Dr Repacholi, Chairman, ICNIRP
Global Energy Perspective	Dr Nakicenovic, EDF
Application of Monte Carlo Method in Radiation Analysis	Dr Jabo Tang, ORNL
Radioactive Waste Management in Sweden	Mr Barrdahl, SSI
Visit to Qinshan NPP	Joint function with HKIE
Notification and provision of service to public in response to USFDA report of radioactive contamination of RP devices	Joint function with HKMA and FMS

5. Hong Kong's participation in international radiation protection arena

5.1.1 International Atomic Energy Agency (IAEA)

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [Joint Convention] INFCIRC/546, 24 December 1997
  - China – accession, entry into force 12/12/2006
  - 1st Country Report (Hong Kong as Part II) presented at the 3rd Review Meeting of the Joint Convention (11 -20 May 2009)

English Version

THE PEOPLE'S REPUBLIC OF CHINA

National Report for
Joint Convention on the
Safety of Spent Fuel Management and on the
Safety of Radioactive Waste Management

September, 2008
Beijing, China

Part 2

A Overview

1.1 Hong Kong Special Administrative Region (hereinafter Hong Kong SAR) does not produce spent fuel. There are also no facilities related to spent fuel management.

National Report Distributed to Member States at the 3rd Review Meeting of the Joint Convention

5.1.2 International Atomic Energy Agency (IAEA)

Other IAEA conventions binding on HKSAR and of relevance to radiation protection:

- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [Assistance Convention] INFCIRC/336, 18 November 1986
- Convention on Early Notification of a Nuclear Accident [Early Notification Convention] INFCIRC/335, 18 November 1986

5.2.1 International Labour Organization (ILO)

- Radiation Protection Convention, 1960 (No. 115)
  - Convention governing the protection of workers against ionising radiations
  - Apply to Hong Kong since 01/12/1965
  - Continue to apply to HKSAR without modification through Notification of China – 01/07/1997
  - Implemented through the Radiation Ordinance (Cap 303)
  - Triennial report to ILO on the application of the RP Convention in Hong Kong
  - ILO may raise Observations and Direct Requests

Report 2002

Report on the application in the
Hong Kong Special Administrative Region of the
People's Republic of China of the
Radiation Protection Convention, 1960 (No. 115)

The above Convention has been applied to Hong Kong without modification since 1 December 1965.

2. On 1 July 1997, the People's Republic of China (PRC) resumed the exercise of sovereignty over Hong Kong. As from that date, Hong Kong has become a Special Administrative Region of the PRC. By a letter dated 6 June 1997, the Government of the PRC communicated a notification to the ILO to the effect that this Convention would continue to apply to the Hong Kong Special Administrative Region (HKSAR) of the PRC without modification with effect from 1 July 1997.

CEACR Individual Observation Published 2004

Hong Kong Special Administrative Region

The Committee notes the Government's comprehensive reports and the information supplied in response to its previous comments. It notes with satisfaction the provisions of Regulation 10 of the Radiation (Control of Radioactive Substances) Regulations, 1965, as amended referring to Regulations 2 and 14 of the Radiation (Control of Irradiating Apparatus) Regulations, as amended and the Legal Notice L.N. 154 of 1995 providing for dose limits of workers' exposure which are in conformity with the 1990 International Commission on Radiological Protections (ICRP) Recommendations and thus apply Article 3, paragraph 1, and Article 6, paragraph 2, of the Convention. It further notes with satisfaction Regulation 14(b) of the Radiation (Control of Radioactive Substances) Regulations giving effect to Article 8 of the Convention.

5.2.2 International Labour Organization (ILO)

Other ILO Conventions binding on HKSAR of relevance to radiation protection:

- Labour Inspection Convention, 1947 (No. 81)
- Minimum Age Convention, 1973 (No. 138)
- Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (No. 148)

5.3 United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

Extensive measurements have been conducted in Hong Kong to collect local data for inclusion in the UNSCEAR reports. These include:

1. Dose rate from cosmic radiation
2. Dose rate from terrestrial gamma in open field
3. Dose rate from terrestrial gamma in built-up area
4. Dose rate from gamma indoor
5. Annual effective dose indoor and outdoor
6. Annual dose from medical procedures
7. Annual dose from occupational exposure, and
8. Concentration of naturally occurring radioactive nuclides in soil

5.3.1 Dose rate from cosmic radiation – HKO (1991)

1. Sites: centre of High Island Reservoir and Plover Cove Reservoir
2. Measurement: 1 hour by portable HPIC (RSS-112) mounted with its centre 1 m above the deck of a fibreglass boat
3. Correction: gamma dose rate due to air and water, ^{40}K in human bodies and the internal background of HPIC
4. Assumption: average transmission factor of 0.7 for cosmic radiation indoor
5. Results: 0.039 μGy/h (outdoor) and 0.027 μGy/h (indoor)

Ref: KC Tsui et al, HKO Technical Report 4, 1991

5.3.2 Dose rate from terrestrial gamma in open field – HKO (1999)

1. Sites: open field grid 5 km x 5 km (42 sites) according to population & land use
2. Measurement: at street level with portable HPIC (RSS-112) 37 sites, fixed HPIC (RSS-1013) 5 sites
3. Correction: cosmic radiation, seasonal variations
4. Results: 0.087 μGy/h [0.051, 0.123]
5. Comparable to neighbouring cities in Guangdong

Ref: MC Wong et al, HKO Technical Report 17, 1999

5.3.3 Dose rate from terrestrial gamma in built-up area – HKO (1999)

1. Sites: built-up area grid 2.5 km x 2.5 km (61 sites) according to population & land use
2. Measurement: portable HPIC (RSS-112)
3. Correction: cosmic radiation, seasonal variations
4. Results: 0.179 μGy/h [0.135, 0.229]
5. Comparable to neighbouring cities in Guangdong

Ref: MC Wong et al, HKO Technical Report 17, 1999

5.3.4 Dose rate from gamma indoor – HKO and DH (1998)

1. Sites: built-up area grid 2.5 km x 2.5 km (54 sites) according to population & land use
2. Measurement: bundle of 2 TLD (Harshaw Type 8807) each comprising 2 calcium fluoride (CaF2:Dy) and 2 lithium fluoride (LiF: Mg, Ti) elements at 0.5 m from ceiling near the middle of the room for 2 months
3. Correction: dose accumulated during transit and waiting period, and from cosmic radiation indoor
4. Results: 0.199 μGy/h [0.141, 0.267]

Ref: MC Wong et al, HKO Technical Report 17, 1999

5.3.5 Annual effective dose indoor and outdoor

Assumptions:

- Terrestrial gamma 0.7 Sv/Gy
- Cosmic radiation 1 Sv/Gy
- Occupancy factor outdoor 0.2

Annual effective dose:

1. Outdoor
   - Terrestrial gamma 0.11 mSv
   - Cosmic ray 0.07 mSv
2. Indoor
   - Terrestrial gamma 0.98 mSv
   - Cosmic ray 0.19 mSv

Comparable to neighbouring cities in Guangdong

5.3.6 Annual dose from medical procedures – DH (2003-04)

1. Medical procedures covered
   - Diagnostic x-ray examinations including interventional, computed tomography and mammography procedures
   - Nuclear medicine imaging procedures
   - Therapy procedures including teletherapy, brachytherapy and administration of unsealed radioactive substances
2. Institutions covered
   - Major public hospitals, government clinics and health care institutes
3. Population
   - 6,882,600 at mid-Year 2004
4. Annual dose from medical diagnostic procedures
   - Collective dose 4879 man Sv
   - Per caput effective dose 0.71 mSv

5.3.7 Annual dose from occupational exposure – DH

1. Whole body monitoring since 1959
2. Extremity monitoring since 2004
3. Annual reports published since 1997
4. Summary 1997 – 2013
   - Persons under whole body monitoring [6 160, 10 952]
   - Annual collective whole body dose [0.57, 1.25] man-Sv
   - Annual averaged whole body dose [0.07, 0.16] mSv
   - Persons under extremity monitoring [82, 201]
   - Annual average extremity dose [3.68, 19] mSv

Ref: RMS Annual Reports, 1997 - 2013

5.3.8 Natural radioactivity in soil – HKO and HKU (1999)

1. Sampling: 20 soil samples from representative geological open field in 5 km x 5 km grid
2. Preparation: dried, ground, sifted to $\phi < 10$ µm, filled 1.6 L in 2L Marinelli beakers, weighed and sealed for 4 weeks for ^{226}Ra and ^{222}Rn equilibrium
3. Measurement: gamma spectrometry
4. Results in Bq/kg

^{40}K	653 [99, 1 336]	^{226}Ra	72 [24, 132]
^{232}Th	117 [20, 241]	^{238}U	103 [31, 162]

5. Comparable to neighbouring cities in Guangdong

Ref: MC Wong et al, HKO Technical Report 17, 1999

Thank you!