

The background of the slide is a solid blue color. It is decorated with a geometric pattern of various-sized triangles and squares in different shades of blue, some overlapping. The pattern is more dense in the top-left and bottom-right corners, with some scattered shapes in the center.

# 의료기관 방사선 안전관리 어떻게 할 것 인가?

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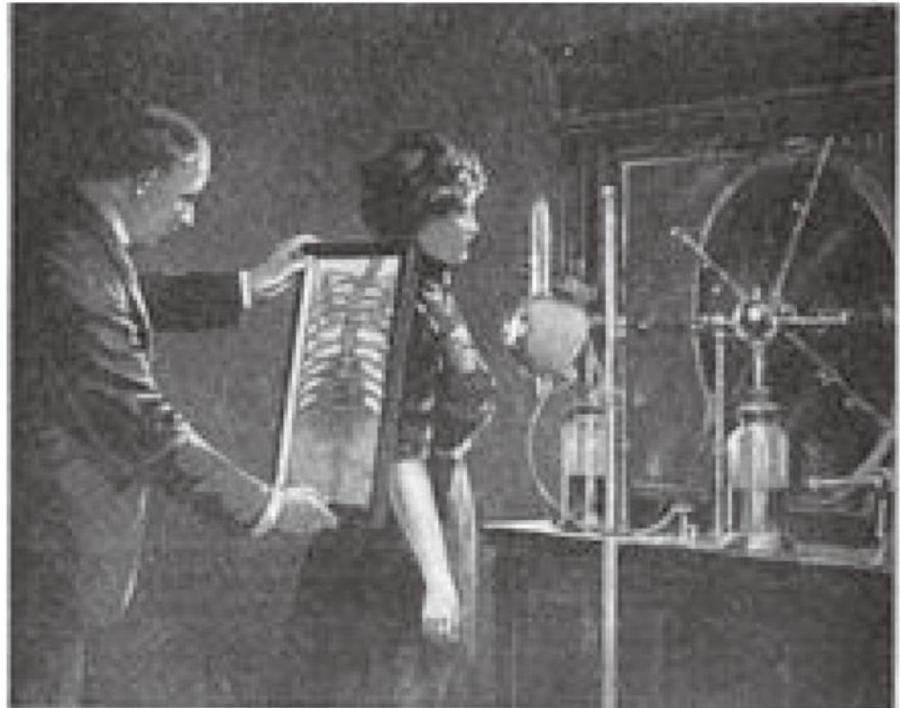
- 방사선안전관리이란?
- 외국기관에서 방사선 안전관리
- Radiation safety culture 외국 사례
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# 방사선안전관리

- 진단용 방사선 발생장치의 안전관리에 관한 규칙
  - 제 2조 4항
  - “안전관리”란 진단용 방사선 발생장치, 방사선 방어시설 및 암실, 현상기, 방사선 필름 카세트, 산란엑스선 제거용 그리드, 엑스선사진 관찰대 등 진단 영상정보에 관한 설비의 관리와 방사선 관계 종사자에 대한 피폭관리를 말한다.
- The protection of people from harmful effects of exposure to ionizing radiation, and the means for achieving this – by Wikipedia

# 방사선 안전관리

- 초창기



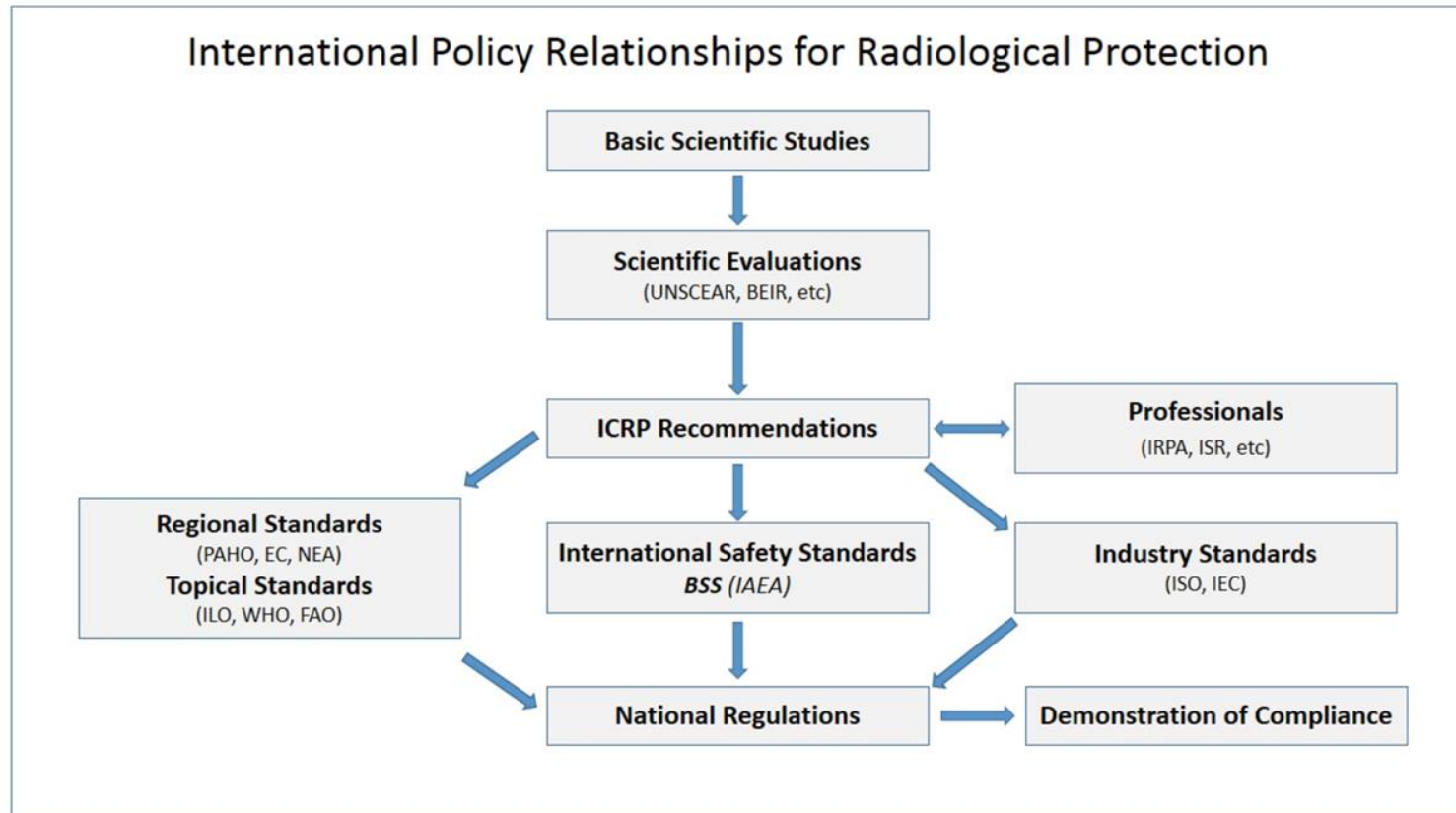
# 방사선 안전관리

- 초창기

- Wolfram Fuchs in 1896
- 방사성피부화상, 탈모 등이 1896년에 보고됨
- 1925년 1회 International Congress of Radiology가 개최되고 국제적인 방사선 방호 표준에 대한 논의가 시작
- 1928년 2회 ICR에서 International Commission on Radiological Protection(ICRP)의 전신인 International X-ray and Radium Protection Committee(IXRPC) 구성됨



# 방사선 안전관리



# Radation Safety Culture

- UK

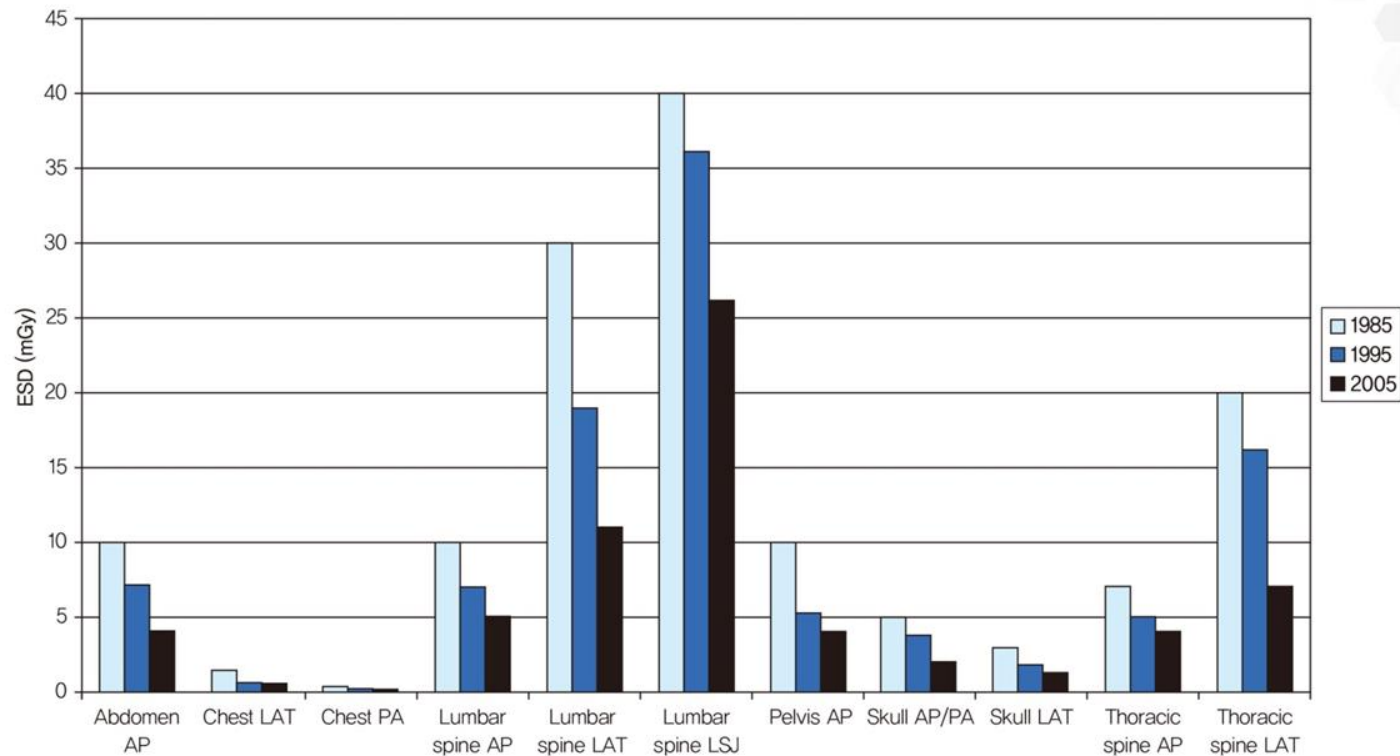


Figure 3. Third quartiles for entrance surface dose (ESD) for radiographs. AP, anteroposterior; LAT, lateral; LSJ, lumbosacral joint; PA, posteroanterior.

# 국제기구 Safety Culture

- Strong safety culture by IAEA
  - The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance
  - Independent Safety Culture Assessment를 구성하여 이를 시행하기 위해 노력함

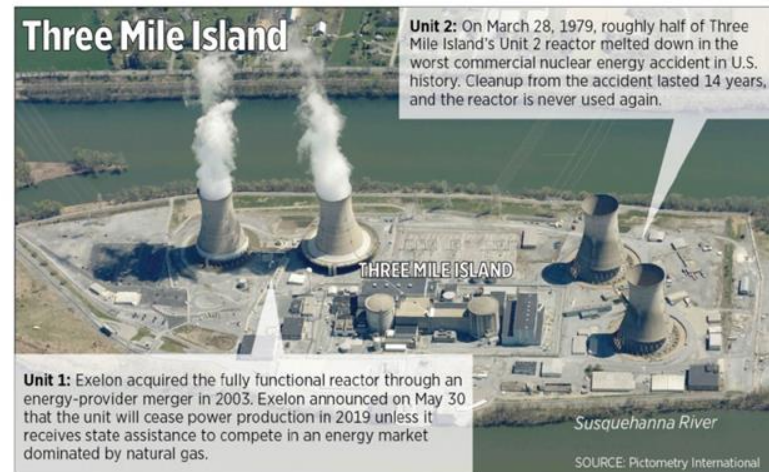


# 국제기구 Safety Culture

- Technical Meeting on Safety Culture in Medical Uses of Radiation
  - Purpose: to develop training material for strengthening radiation safety culture in medicine
  - Hosted by IAEA
  - IAEA, AAPM, ESR, ESTRO 등 국제기구
  - Austria, China, USA, Kenya 등 각 나라

# 국제기구 Safety Culture- IAEA

- Three Mile Island
  - 1979.3.28
  - Around 14 years to clean up
  - Cost of clean up around \$1 Billion
  - Plant not reopened until 1985
  - 5등급 원자력 사고



# 국제기구 Safety Culture- IAEA

- 체르노빌 원전 사고
  - 1986.4.26
  - Flawed reactor design
  - Operators inadequately trained
  - Poor operational decision making.
  - \$235 billion over 30 years
  - 7등급 원자력 사고



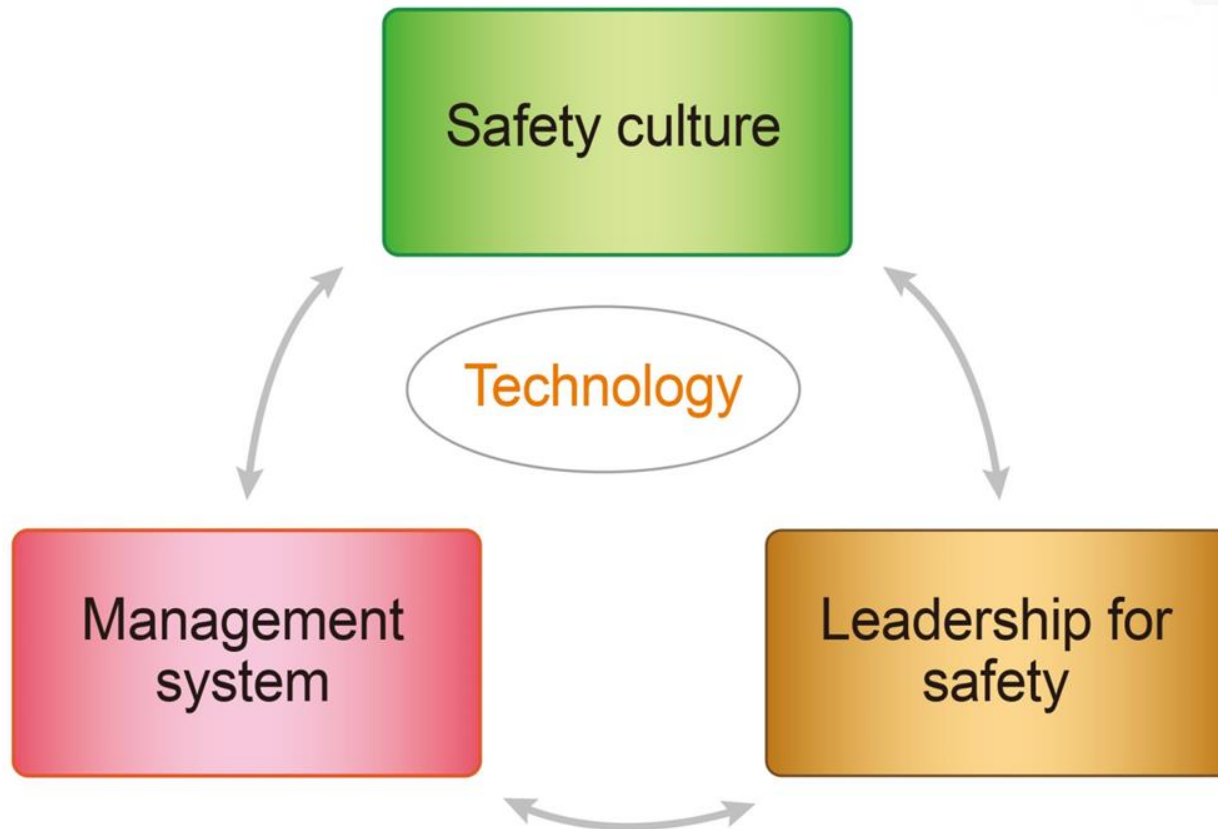
# 국제기구 Safety Culture- IAEA

- 후쿠시마 원전
  - 2011.3.11
  - 도호쿠 대지진
  - 쓰나미
  - 7등급 원자력 사고

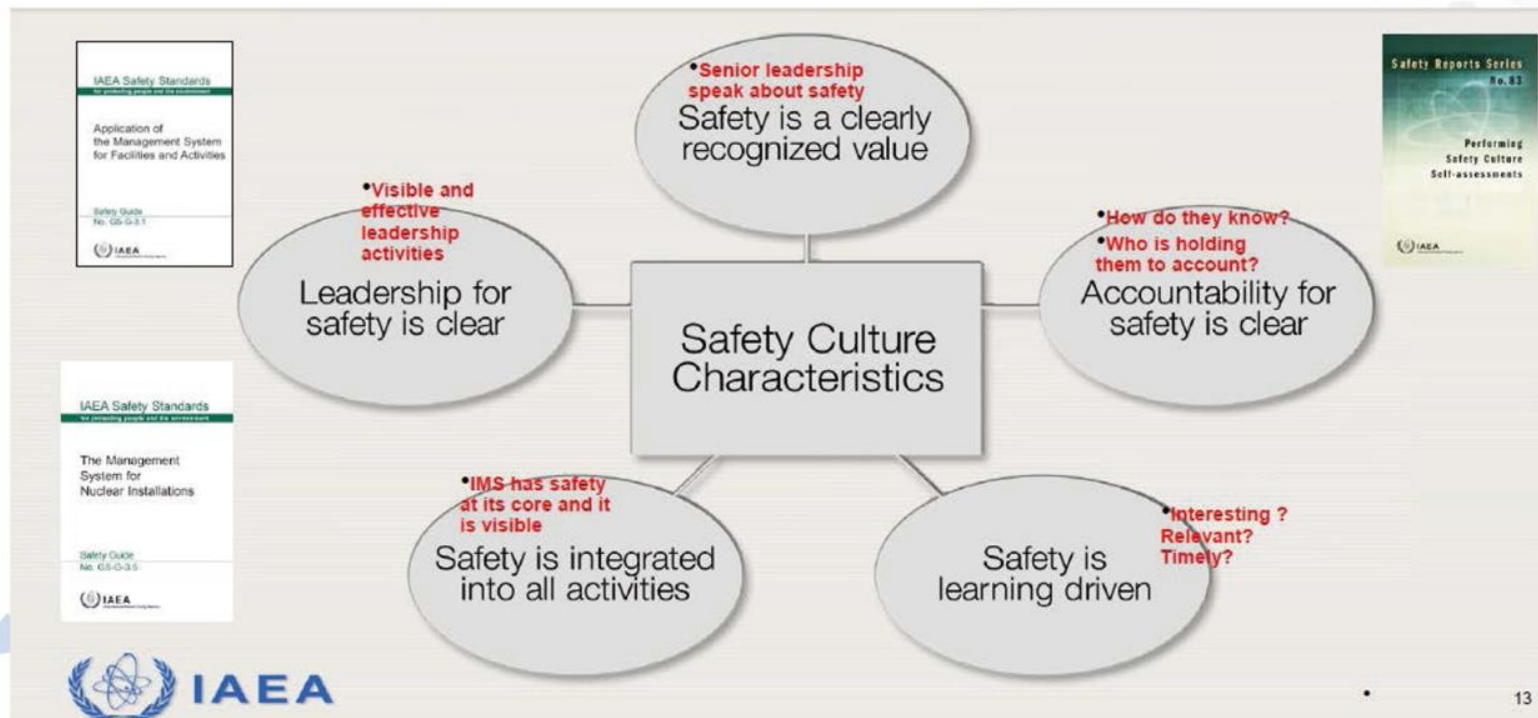




# 국제기구 Safety Culture- IAEA



# 국제기구 Safety Culture- IAEA





# 국제기구 Safety Culture- AAPM

- Publications

- 2013: Practice Parameter for Diagnostic Reference Levels and Achievable Doses in Diagnostic Radiology – Joint Document developed in conjunction with ACR
- 2013: Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures – Joint Document with the ACR
- 2015: Practice Parameter for Reference Levels and Achievable Administered Activity for Nuclear Medicine and Molecular Imaging – Joint Document with the ACR

# 국제기구 Safety Culture- AAPM

- Meeting
  - 2013: CT Dose Summit: Strategies for CT Scan Parameter Optimization
  - 2013: Safety Culture in a Clinical Environment –AAPM Workshop at the CRCPD Annual Meeting

# 국제기구 Safety Culture- AAPM

- ACR
  - AAPM and ACR develop joint technical guidelines for performance of diagnostic imaging and nuclear medicine procedures. AAPM members participate on ACR committees to analyze the dose data in the national Dose Imaging Registry for CT and Fluoroscopy Procedures.
- Clinical residencies are now required for all applicants to the ABR Certification Exams.

# 국제기구 Safety Culture- ESR

- Eurosafe Imaging
- Mission: to support and strengthen medical radiation protection across Europe following a holistic, inclusive approach



... and many others

# 국제기구 Safety Culture- ESR

- Best practice in radiation protection



21 criteria

Re-evaluation  
after 3 years



Evidence to be  
provided for certain  
criteria

Criteria structured  
according to topics:

- Optimisation,
- Justification,
- Quality & safety,
- Education,
- Research,
- Regulatory compliance

CONCEPT



# 국제기구 Safety Culture- ESR

- Best practice in radiation protection

Topics	No of criteria per topic	★	★★	★★★	★★★★	★★★★★
1. Optimisation	7	5	5	5	5	6
2. Justification	5	3	2	2	3	3
3. Quality & Safety	6		2	4	5	5
4. Education	1		1	1	1	2
5. Research	1					
6. Regulatory compliance	1					
Total	21	8	10	12	14	16

85 facilities with ★★★★★★

14 facilities with ★★★★★

1 facilities with ★★★



# 국제기구 Safety Culture- ESR



2014

- EuroSafe Imaging launched
- First Call for Action issued
- First poster exhibition
- Data collection surveys started

2015

- Ask EuroSafe Imaging Tips & Tricks launched



2016

- EuroSafe Imaging Stars launched
- WGs on Appropriate Image Quality, Europ. CT Dose Repository, Clinical DRLs



2017

- First EuroSafe Imaging Lounge at ECR
- Paediatric Imaging WG



2018

- Second EuroSafe Imaging Lounge at ECR
- Call for Action 2018 issued
- Biggest poster exhibition ever at ECR
- ESR iGuide dissemination and promotion WG

2019

**Five-year anniversary**

SUCCESS  
STORY

# 나라별 Safety Culture- USA

- Conference of Radiation Control Program Directors
  - 1968년 설립
  - Published several documents addressing safety in medical imaging
  - H-38 – Committee on Radiation Medical Events
    - \* Charge: Oversee the development and maintenance of a national database of radiation medical events
    - \* Started with radiation therapy
    - \* Slowly adding medical events from some states

# 나라별 Safety Culture- USA

- Safety Shortcut
  - Employees become too comfortable around radiation & become relaxed in their environment
  - Taking shortcuts & pushing safety to the side
  - in Texas – Radioactive Materials
    - \* Source Security
  - in Texas – X-Ray
    - \* Machine testing not performed at correct interval
- Learning Program의 중요성 강조

# 나라별 Safety Culture- USA

- US Nuclear Regulatory Commission

## NRC Safety Culture History



**1989**

- Operators inattentive and unprofessional while on duty at nuclear power plant
- Commission Policy Statement: Conduct of Nuclear Power Plant Operations

**1996**

- Workers retaliated against for whistleblowing
- Commission Policy Statement: Freedom to Raise Safety Concerns Without Fear of Retaliation

**2002**

- Davis-Besse reactor head degradation event
- NRC revised Reactor Oversight Process (ROP) to more fully address safety culture

**2008**

- Commission direction to develop policy statement on safety culture that applies to all licensees

**2011**

- Final Safety Culture Policy Statement (SCPS) published in the Federal Register



# 나라별 Safety Culture- USA

- NRC

## Safety Culture Traits



Leadership Safety Values and Actions	Problem Identification and Resolution	Personal Accountability
Leaders demonstrate a commitment to safety in their decisions and behaviors	Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance	All individuals take personal responsibility for safety
Work Processes	Continuous Learning	Environment for Raising Concerns
The process of planning and controlling work activities is implemented so that safety is maintained	Opportunities to learn about ways to ensure safety are sought out and implemented	A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment or discrimination
Effective Safety Communications	Respectful Work Environment	Questioning Attitude
Communications maintain a focus on safety	Trust and respect permeate the organization	Individuals avoid complacency and continually challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action

# 나라별 Safety Culture- Austria

- Austria is member of the European Union
  - Under the Euratom Treaty the European Commission is responsible for the protection of patients and other individuals in medical facilities.
    - \* Basic Safety Standards Directives
    - \* Directives are translated into Austrian law
- Radiation Protection Act
  - Ministry of Sustainability and Tourism
- Radiation Protection Ordinance
  - Ministry of Sustainability (General Radiation Protection)
  - Ministry of Health (Radiation Protection in Medicine)



# 나라별 Safety Culture- Austria

- Radiation Protection Act
  - Safety, Accident Analysis & Risk Assessment
  - § 17 Inspections
    - \* Every year: Reactors, Radiotherapy, Nuclear medicine
    - \* Every 3rd year: all other
    - \* Every 4th year: dental radiology, veterinary medicine

# 나라별 Safety Culture- Austria

- Activities > Culture
  - Appropriateness Criteria (Radiology, Nuclear Medicine)
    - \* Stepwise inclusion of EBM
    - \* 4th Edition 2011
  - National >>>> International Procedure Guidelines
  - Education of other medical specialists using ionizing radiation
  - Guideline Pregnancy and Radiology

# 나라별 Safety Culture- Kenya

- Multidisciplinary formal structures specific to Radiation Safety such as AFROSAFE have recently taken root



## AFROSAFE Strategies

1. Strengthen **radiation protection** of patients, health workers and public.
2. Promote safe and **appropriate use** of ionizing radiation in medicine.
3. Foster improvement of the **benefit-risk dialogue** with patients and the public.
4. Enhance the safety and **quality of radiological procedures** in medicine.
5. Promote **safety in radiological equipment** and facilities.
6. Promote **research** in radiation protection and safety.

# 나라별 Safety Culture- Japan

## Atomic Energy Basic Law (1955)

Use atomic energy only for peaceful aim through democratic administration, autonomous accomplishment and results disclosure in the public

### Article 12

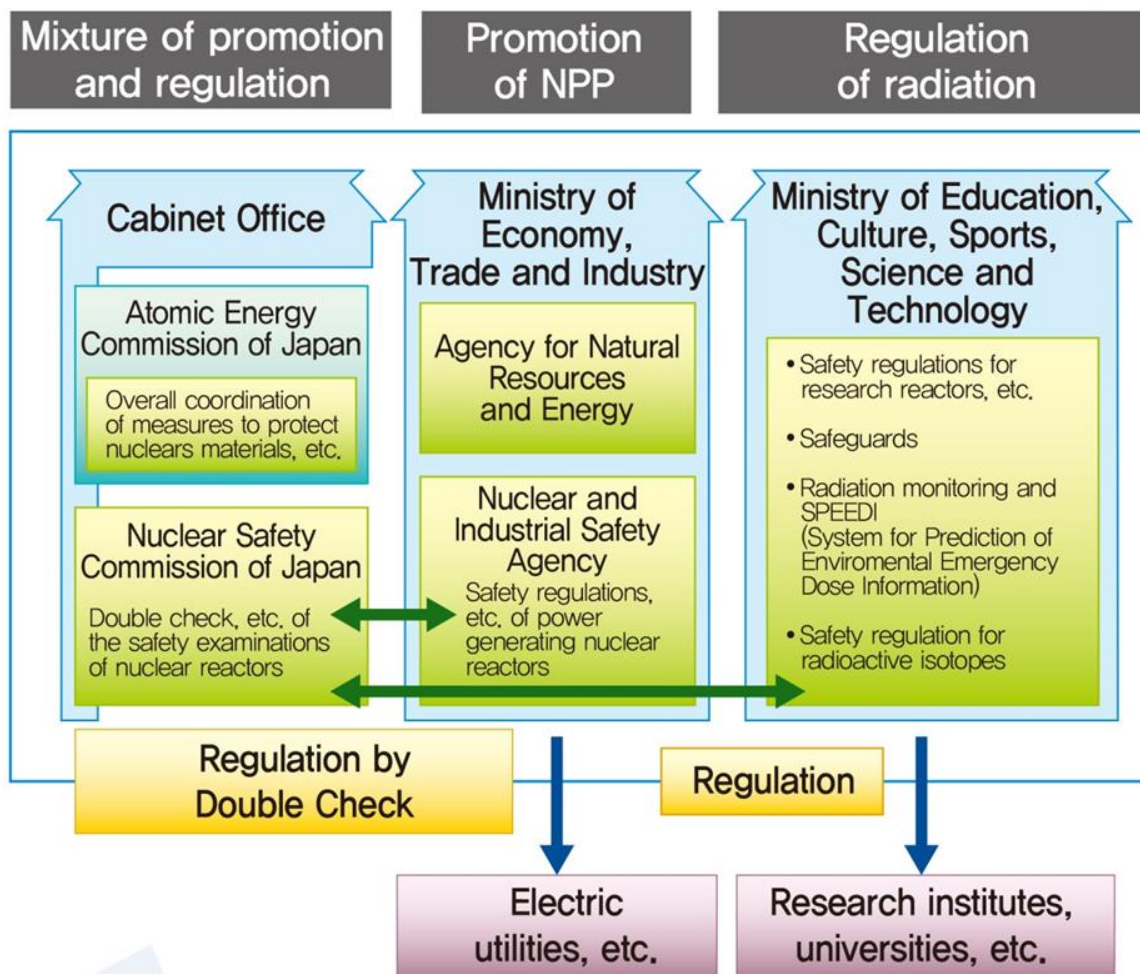
- Regulation concerning Nuclear Fuel Materials
- Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (1957)
  - Enforces the necessary regulations on manufacture, processing, storage, reprocessing and disposal activities of nuclear source materials, fuel materials and nuclear reactors.

### Article 20

- Protective Measures of Radiation Hazards
- Act on Prevention of Radiation hazards due to Radioisotopes, etc. (1957)
  - Regulates the use, sale, lease, disposal and other handling of radioisotopes, the use of radiation generating equipment, and the disposal and other handling of the articles contaminated by radioisotopes to prevent radiation hazards.



# 나라별 Safety Culture- Japan



# 병원인증평가와 방사선안전관리

- 3주기 급성기병원 인증기준

- \* 2 진료전달 체계와 평가

- \* 2.3 검사체계

- \* 2.3.7 방사선 안전관리 절차

- 방사선 안전관리 절차를 확립하고, 이를 준수한다.

- 조사목적

- \* 방사선을 취급함으로써 발생할 수 있는 위험을 예방하기 위하여 오염이나 사고 발생 시에 즉각 대응할 수 있는 절차를 마련하여 직원의 안전을 도모한다.



# 병원인증평가와 방사선안전관리

- 조사항목

1. 방사선 안전관리 절차가 있다.
2. 방사선 안전관리 책임자를 선정한다.
3. 직원에게 방사선 안전관리에 대한 교육을 시행한다.
4. 직원은 방사선 관련 안전보고체계를 알고 있다.
5. 방사선 안전관리 절차를 준수한다.
6. 방사성 물질을 안전하게 관리한다.

# 병원인증평가와 방사선안전관리

- 안전관리 절차에 포함되는 내용-1
  - 방사선 안전관리 책임자 자격 및 역할
  - 직원에 대한 안전관리 교육
  - 안전관리 보고 체계
  - 검사장비의 예방점검
  - 방사능 노출관리: 방사능 측정 배지 착용, 피폭 직원관리 등
  - 환자안전을 위한 절차: 임신, 인공제세동기 및 심박동기 사용, 섭취금기 식이, 의약품 복용(항응고제, 항혈전제, 메포민 등), 이전 검사 시 조영제 사용 여부 등

# 병원인증평가와 방사선안전관리

- 안전관리 절차에 포함되는 내용-2
  - 보호구(납가운, 목보호대, 장갑, 안보호대 등) 착용 및 관리: 환자, 보호자, 직원 등에게 검사 종류에 따른 개인 보호구 착용
  - 방사성 물질 및 환경관리: 위험물 표식, 주기적 오염 측정, 동위원소 저장실관리 등
- 방사선 안전관리 책임자
  - 직원 자격 및 면허
  - 교육 등

## 결론

- 방사선에 의한 위해가 알려진 후 안전관리에 대한 관심이 높아지고 기준이 만들어졌다.
- 각 나라의 상황에 맞는 방사선 안전관리 규정이 있으며 radiation safety culture가 있다.
- 의료기관인증평가에도 방사선 안전관리에 대한 내용이 있으며 숙지가 필요하다.