（1） Japan Atomic Energy Commission (JAEC)

The Atomic Energy Basic Law

The full-scale conduct of research, development, and utilization of atomic energy in Japan began when the **Atomic Energy Basic Law** was enacted on December 19th, **1955**. The Atomic Energy Basic Law stipulates that the **research, development, and utilization of atomic energy should be limited to peaceful purposes only**.

Based on this law, the **Japan Atomic Energy Commission** was established on January 1st, **1956**, with the purpose of systematically carrying out national policy measures under a democratic administration of atomic energy operations.

The Role of the Japan Atomic Energy Commission

The Commission plans, deliberates and makes decisions, **from a neutral and broad perspective**, on matters related to utilization of nuclear energy for peaceful purposes (except for enforcement of nuclear safety assurance). When the Commission deems it necessary as a part of its assigned mandate, it can recommend and seek reports from the head of relevant administrative organizations through the Prime Minister.

Commissioners

Dr. Yoshiaki Oka, Chairman　Mr. Nobuyasu Abe　Dr. Tomoko M. Nakanshi

Commission's Tasks

1. **Nuclear research, development and utilization policies**
2. Coordination of the activities of the Government agencies engaged in such activities
3. Collection of information and conducting of surveys concerning such activities
4. Other important matters relating to nuclear research, development and utilization.

Deliverables

- Plutonium Management in Japan
- Basic Policy of Atomic Energy Utilization
- White Paper on Nuclear Energy

（２）Basic Policy of Atomic Energy Utilization

1. Changes of the surrounding nuclear situation

4 items

2. Continuous issues in organizations related to nuclear power

3. Basic objectives in use of nuclear energy

4. Direction of prioritized areas and issues

8 items

（２）Basic Policy of Atomic Energy Utilization

1. Changes of the surrounding nuclear situation

Fukushima nuclear accident

- Listening carefully to the public voices, especially for the suffering people from the accident, and **rebuilding trust** toward nuclear technology.

Nuclear utilization

- Electricity System Reform to liberalize electricity retail business under the competitive environment.
  ⇒ Predictability of the nuclear business is decreasing has been pointed out .
- Increasing expectations for application of radiation, in industry, medical, agriculture, etc.

Global warming

- Reduction of global warming gas emission by **26% in FY2030** compared to FY2013

⇒It is difficult to achieve following the present strategy and requires the solution by the innovation.

Energy affecting people’s life and industry

- Rise of electricity cost due to increased thermal power generation and the Feed-in Tariff Scheme for Renewable Energy

⇒Rise of electricity cost may not be relevant to all the factors, but it has significant effects on the people’s life and economic activities.

（2） Basic Policy of Atomic Energy

2. Continuous issues in organizations related to nuclear power

Japanese features influencing on nuclear utilization

- **pressure to harmonize the majority opinions and to standstill the situation**

  ⇒ It is needed to share the opinions based on the evidences

3. Basic objectives in use of nuclear energy

It is important to **promote the utilization of nuclear power based on peaceful use**, prioritizing the **insurance of safety**, gaining the **trust of the public**, and considering the **significant value of nuclear technology** that benefits the environment, people's livelihoods and the economy.

- Seriously learn reflections and lessons from TEPCO Fukushima nuclear power plant accident
- Aim to use of nuclear energy in view of the global warming and the impact on the people's lives and the economy
- Promote domestic and international efforts in view of international trends
- Promote to secure peaceful use of nuclear energy and international cooperation
- Aim to recover public trust which is a major premise for the use of nuclear energy
- Advance firmly decommissioning measures and radioactive waste disposal
- Improvement of quality of life using radiation and radioisotopes
- Advance strengthens of infrastructure for the use of nuclear energy

（２）Basic Policy of Atomic Energy

4. Direction of prioritized areas and issues

➢Safety measures not based on “ zero-risk”

- Steady reconstruction and revitalization of **Fukushima** and reviewing the lessons of the accident
- Investigate the causes and events to **prevent the most critical severe accident** to secure the safety and to reduce the impact
- Establishment of **safety culture** overcoming weaknesses of Japanese mind
- Promoting risk management to enhance the voluntary safety and transfer to **preventive safety assurance**

➢Use of nuclear energy in view of global warming and the impact on people's lives and the economy

- Proper measures should be considered to **take advantage of the nuclear power characteristics** to solve the problem, though the operation cost is inexpensive in terms of the entire project period.
  ⇒ The predictability of the project may be judged low generation.
- Necessity of nuclear power generation considering not only for reducing greenhouse gas emissions but also for people‘s livelihoods, economy and stable supply of energy.
  ⇒ **Adequate measures should be planned based on the long term role.**
- **Fast reactors** should be developed by setting conditions and targets as a commercialization business, seeking for a proper way and direction based on the nuclear cycle policy.

➢Tackle domestic & interntl. challenges consistent with interntl. trends

- collection and disseminating the international expertise and experience to **develop an international mindset**
  ⇒ Introduction of the system complying international standards
- **Promote the coordination and cooperation, domestically and internationally**

（２）Basic Policy of Atomic Energy

4. Direction of prioritized areas and issues

➢Peaceful use of nuclear energy and nuclear non-proliferation and security

- **Contribute to nuclear non-proliferation and security**
- Fulfill international **accountability for plutonium use**, manage plutonium use and balance and promote MOX fuel use.

➢Rebuild public trust on nuclear energy, a basic premise of nuclear usage

- Facilitate the **consumers to understand** the nuclear energy based on science and facts and form an opinion.
- Build a **scientific knowledge-based Information network system**, available to anyone to consult whenever needed.
- Promote **two-way interaction** based on scientific knowledge and facts (evidence).
  ⇒ An intermediary between public and nuclear community is the key for success.

➢Decommissioning the reactors and disposal of the radioactive waste

- **Decommissioning of research reactors and disposal of radioactive waste should be in an integral manner**
- Steadily advance of the radioactive waste disposal is our obligation to the future
- Build a **mechanism** where the government centrally overlooks status of storage, processing and disposal of radioactive waste and advance an integrated policy.

➢Advance the utilization of radiation and radioactive isotope

- **Develop infrastructure** for utilization of radiation and radioisotopes, including quantum beam
- **Discover new technology** seeds and upgrade technologies along with the research of radiation effect

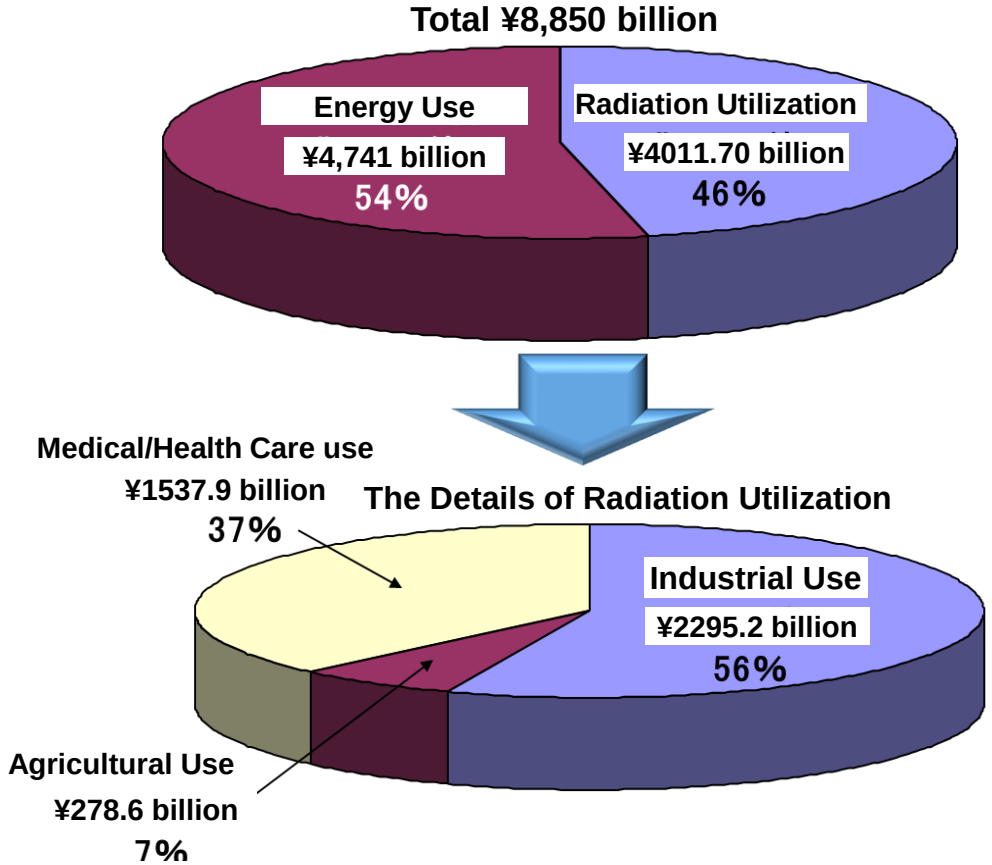
➢Enhance the infrastructure of nuclear energy utilization

- **Explore nuclear science and technologies** ⇒ advance basic research and innovation
- **Enhance foundational knowledge, technology and human resources**
- Nuclear institutions and operators need to cooperate building mutual rich knowledge, based on respective identity and roles.

Economic Scale & Radiation Usage

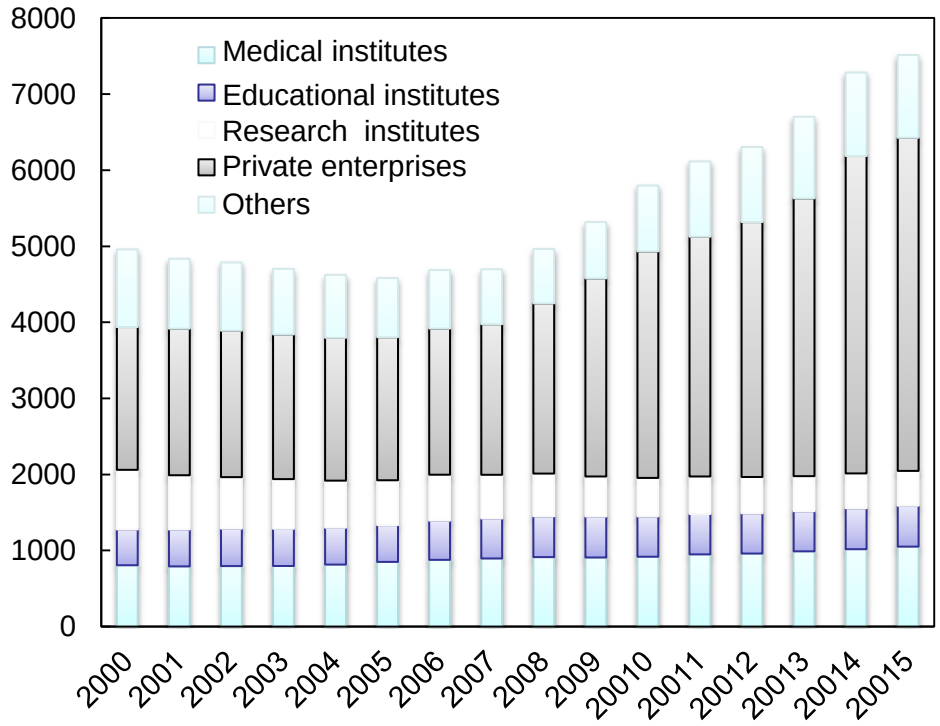
- Radiation is utilized on **almost the same economic scale** as nuclear energy use.
- **The number of businesses that use radioactive isotope (RI) and radiation generators has been increasing** in recent years to 7,515 as of May, 2015. The factor of this increase is due to the increase of business operator's (mainly private sectors) that notified the certification device with display accompanying the introduction of the design certification system in 2005. On the other hand, the number of research institutes is on a declining trend in recent years.

Economic Scale of Radiation Utilization in 2005



Resource: made by the Cabinet Office based on The CAO commissioned project; The Report "Research on Economic Scale of Radiation Use" by JAEA in 2007

Transition of the number of permits of utilization and the number of notifications of businesses for radioactive isotope (RI) and radiation generators



Resource: made by the Cabinet Office based on The Public Interest Association Japan Radioisotope Association "Radiation Use Statistics "

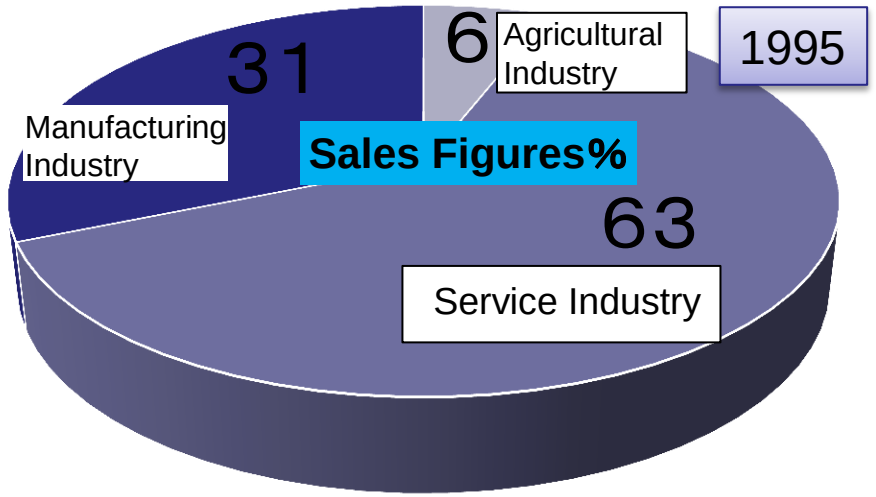
Economic Scale of Radiation Use in the U.S.

- **Radiation use (the diversion of radioisotope-used technology to Industries) brought about economic effects of over 300 billion dollars and created four million jobs as of 1995.**
- **The field of radiation use broadly affects industries. And its economic effects and its influences on employment exceed those of the field of nuclear energy use.**

Sales figures and employment from technologies used by nuclear energy and radioisotope in the U.S. industry.

All Industries	Sales Figures（$ 1million）		
	Nuclear Industry	Radioisotope	Horizontal Total
Vertical Total	$90,151	$330,739	$420,890

Individual Industry



※The service industry involves the electrical and sanitary service.

Source：Management Information Services, Inc., 1996

Radioisotope (RI) and Radiation

Radiation
(Gy, Sv)

Radioisotope (RI)

Light
(Candela, cd)

Flashlight

Application of Radiation and RI

Irreplaceable by any other means

① Radiation

1. Analysis： High sensitivity, Absolute measurement
   Multi-element analysis
2. Imaging： Non-destructive, Real-time(Oil, Water, etc.）
   Numerical treatment of the image
3. RI production： Semiconductor production

② Radioisotope（RI）

1. Tracer (pursue the movement）
2. Imaging： Non-destructive, under light condition
   Numerical treatment of the image

① Radiation

1. Element Analysis : trace element analysis

neutron activation analysis (NAA, PGA, etc.)

proton (particle) induced X-ray emission analysis(PIXE)

ex. Element in environment ⇒ environmental problem

search for mining veins, growth site of the plants etc.

2. Imaging : Permeability :

3. RI production :

Selenium (Se)

Historical description of hyper-accumulator of Se

It is a fact that when they take that road they can not venture among the mountains with any beast of burden (馬、ロバ、ラバなどの荷物運搬用動物) excepting those accustomed to the country, on account of a poisonous plant growing there, which if eaten by them has the effect of causing the hoofs of the animals to drop off (食べるとひずめが抜け落ちる毒草がある). Those of the country, however, being aware of its dangerous quality, take care to avoid it.

The Travels of Marco Polo

Accumulation of Se grown in soil containing Se (2 – 4ppm)

	ppm
Astragalus pecthnatus (narrow-leaved milk vetch)	4,000
Stanleya pinnata (prince's plume)	330
Haplopappus fremontii (goldenweed)	320
Gutierrezia sarothrae (snakewood)	70
Zea mays (corn)	10
Euphorbia sp. (spurge)	10
Xanthium sp. (cocklebur)	6
Salsola pestifer (Russian thistle)	5
Munroa squarrosa (False buffalo grass)	4
Helianthus annuus (sunflower)	2
Boutelona gracilis (blue grama)	2
Malvastrum coccineum (scarlet mallow)	1

A mice dies from eating wheat grain grown in soil containing 1mg of Se in 1kg of soil

1920's in USA

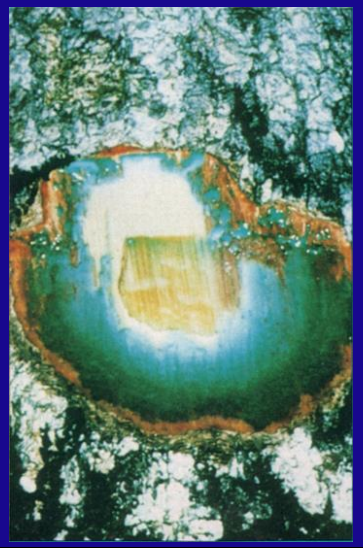
Millions of sheep were dead

Seep committee was founded

Numbers of known plant hyper-accumulators for eight heavy metals and the families in which they are most often found

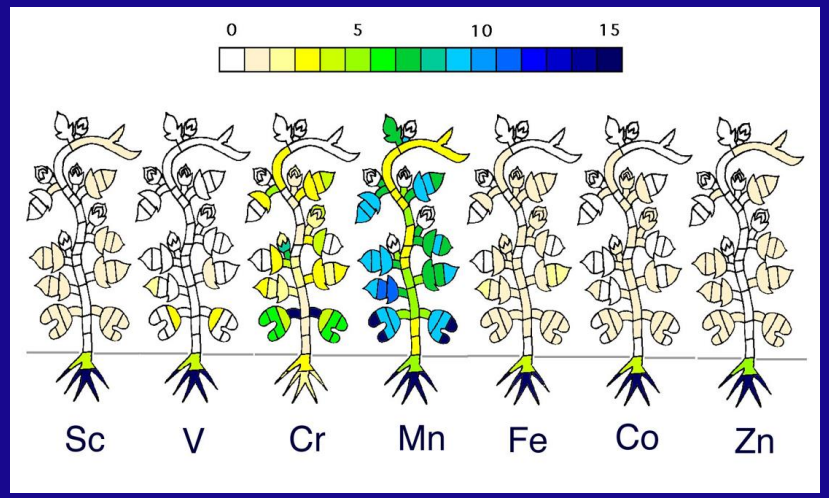
Element	No.	Families
Cadmium	1	Brassicaceae
Cobalt	26	Lamiaceae, Scrophulariaceae
Copper	24	Cyperaceae, Lamiacaeae, Poaceae, Scrophulariaceae
Manganese	11	Apocynaceae, Cunoniaceae, Proteaceae
Nickel	290	Brassicaceae, Cunoniaceae, Euphorbiaceae, Flacourtiaceae, Violaceae
Selenium	19	Fabaceae
Thallium*	1	Brassicaceae
Zinc	16	Brassicaceae, Violaceae

*Leblanc *et al.* (1997).



The New Caledonian *Sebertia acuminagta* that exudes a sap containing 11% nickel.

From “Plants that Hyperaccumulate Heavy Metals” by R.R.Brooks



Japanese morning-glory(T.M.Nakanishi et al.）

Mine survey by plants

Hg and Kobo-daishi (弘法大師)

There often found Hg mine close to the temples related to Koabo-daishi (弘法大師)

Hg was an important metals for stamp (red ink) .
Hg was monopolized by a special family called New (丹生).

Off spring of New(丹生) family (professor) said that
New（丹生) family financially supported Kobo-daishi

So, he must be interested in Hg mine.
It is said that he died because of Hg poisoning.

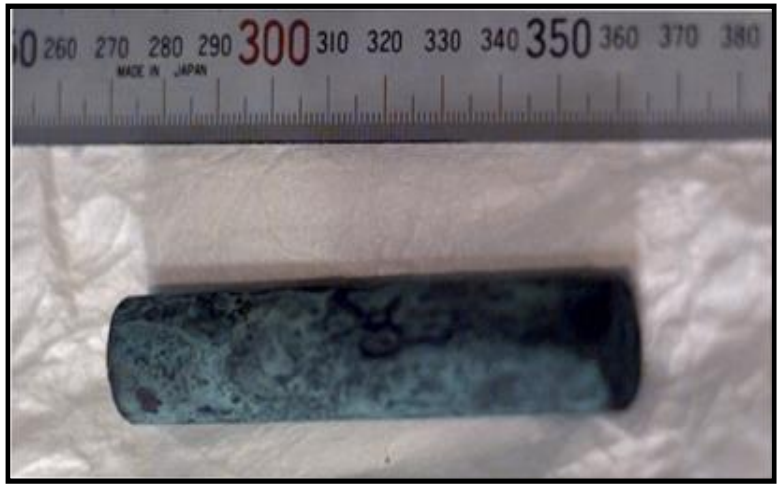
Did he rely on plants to find out Hg mine?

① Radiation

1. Element Analysis : trace element analysis

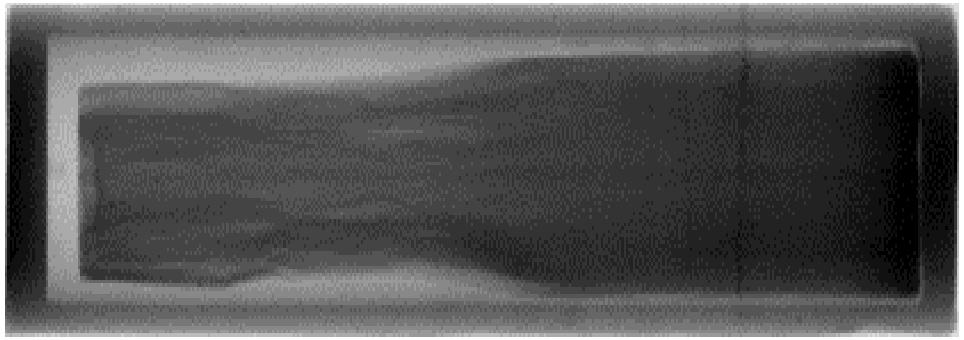
2. Imaging : Permeability of radiation

X-ray, γ-ray, neutrons, etc.



Cu container

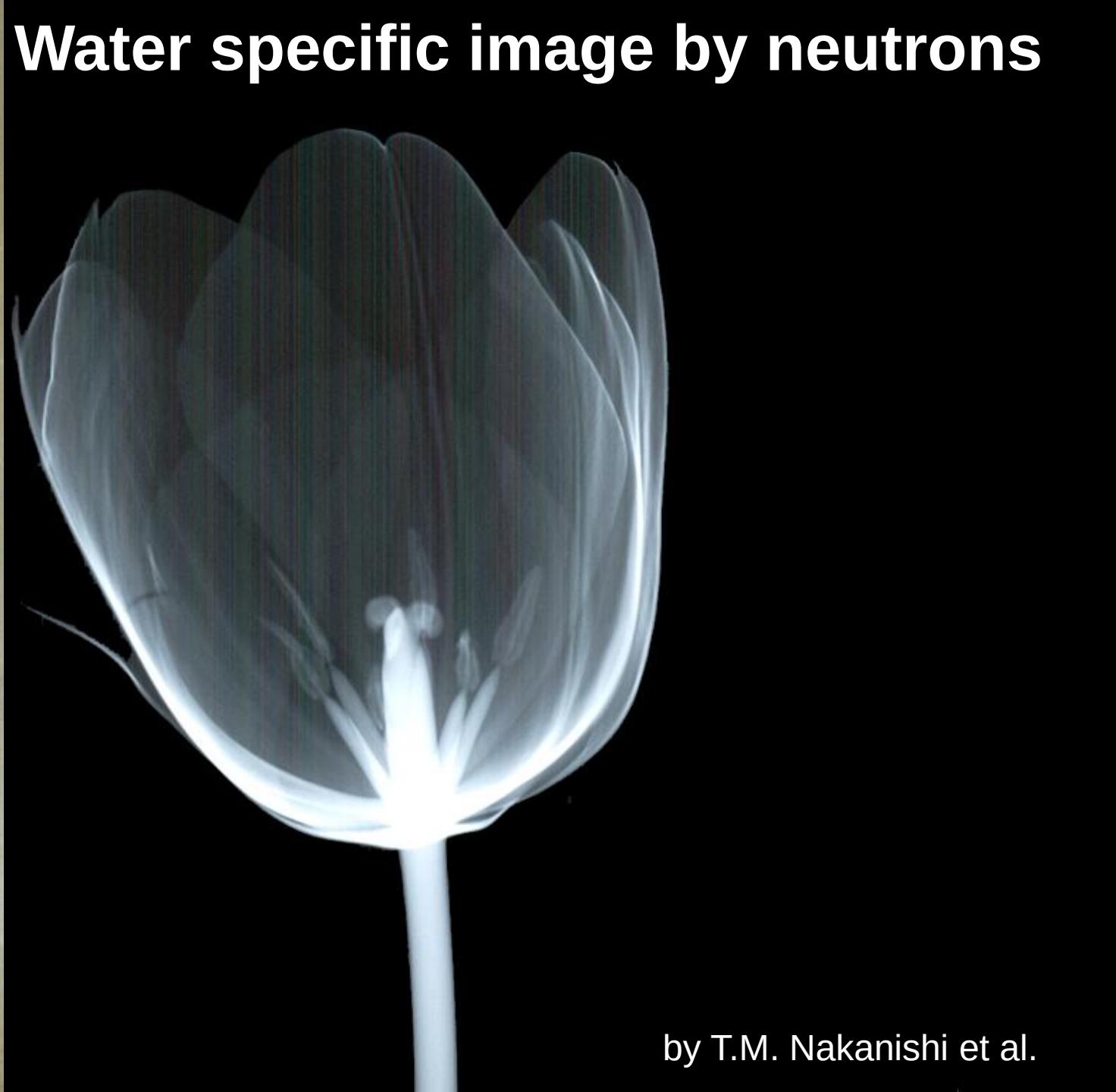
X-ray image



neutron image

3. RI production :

Water specific image by neutrons



by T.M. Nakanishi et al.

Application of Radiation and RI

Irreplaceable by any other means

① Radiation

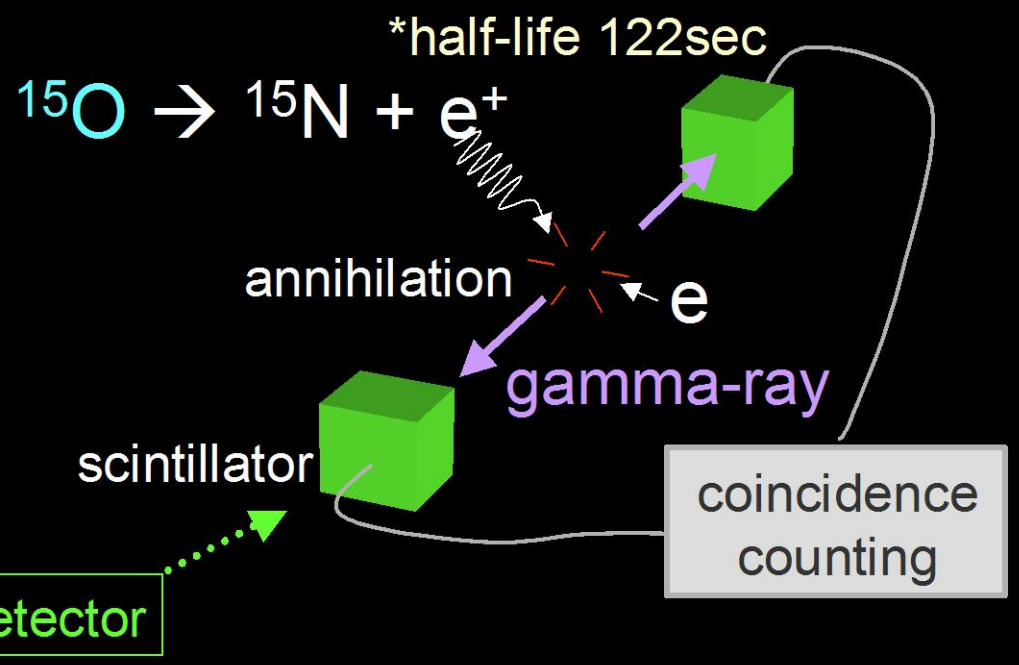
1. Analysis： High sensitivity, Absolute measurement
   Multi-element analysis
2. Imaging： Non-destructive, Real-time(Oil, Water, etc.）
   Numerical treatment of the image
3. RI production： Semiconductor production

② Radioisotope（RI）

1. Tracer (pursue the movement）
2. Imaging： Non-destructive, under light condition
   Numerical treatment of the image

Determination of Water Amount Moving in a Plant

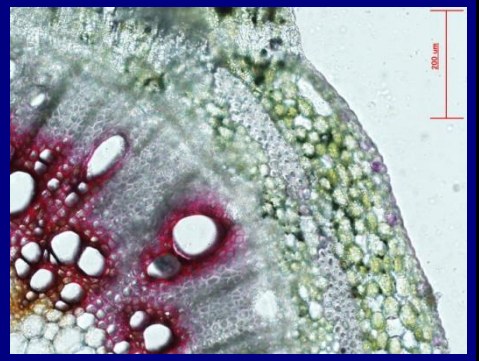
1. Trace water
2. Calculate water amount

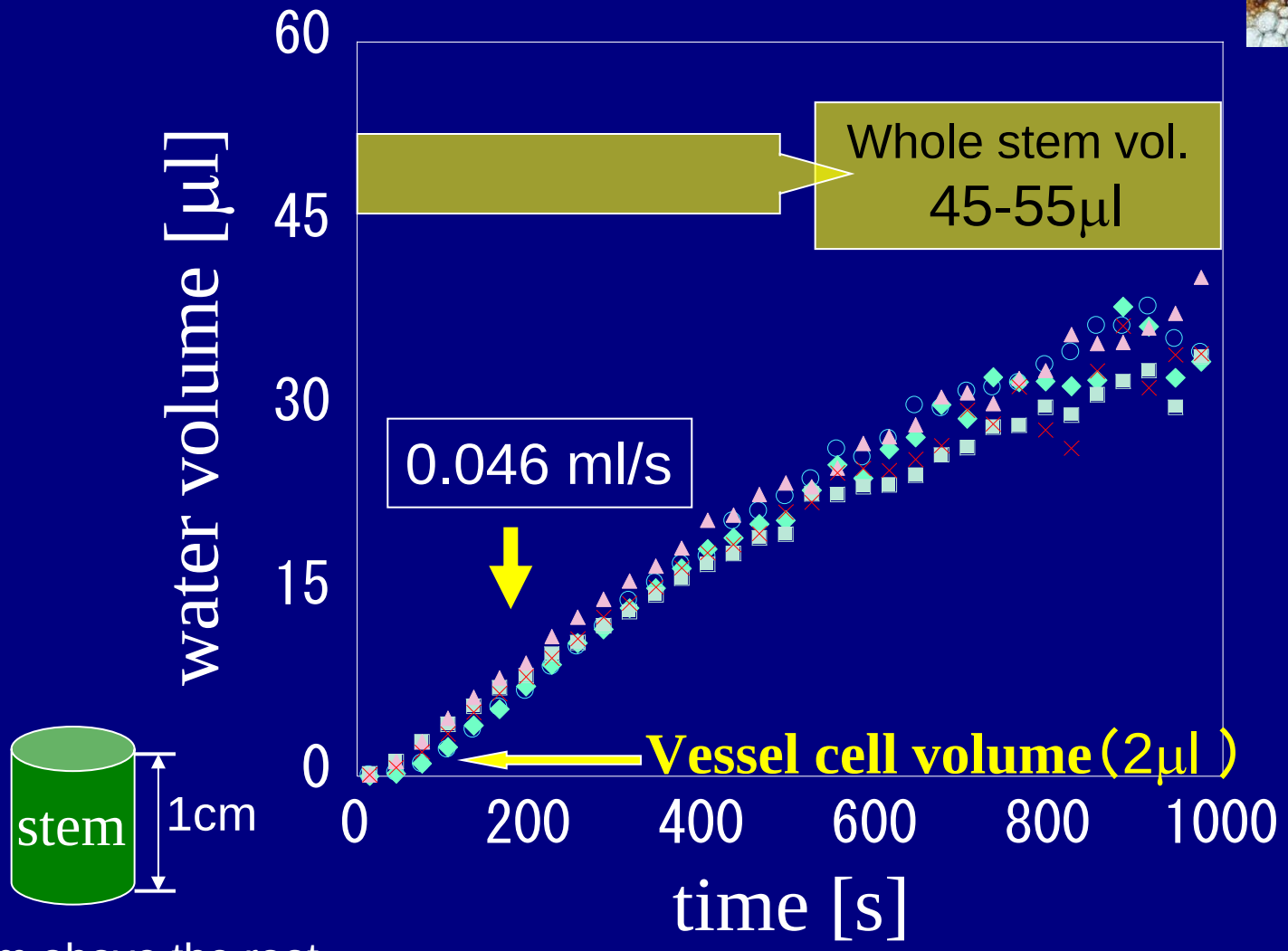


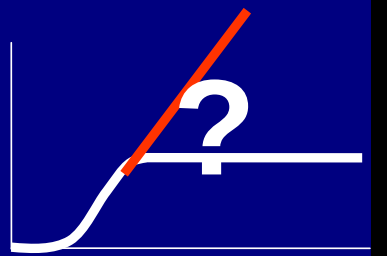
Target: [15O]water in 1cm stem

by T.M. Nakanishi et al.

Water uptake in a soybean plant







by T.M. Nakanishi et al.

Application of Radiation and RI

Irreplaceable technology by any other means

① Radiation

1. Analysis： High sensitivity, Absolute measurement
   Multi-element analysis
2. Imaging： Non-destructive, Real-time(Oil, Water, etc.）
   Numerical treatment of the image
3. RI production： Semiconductor production

② Radioisotope（RI）

1. Tracer (pursue the movement）
2. Imaging： Non-destructive, under light condition
   Numerical treatment of the image

There is a wide application of radiation and RI usage.

1. Industry
   semiconductor
   non-destructive investigation (bridge, buildings, etc.)
   functional resin by polymerization.etc.
2. Medical field
   inspection, medicine, sterilization, etc.
3. Agriculture
   mutation breeding, food irradiation, etc.

- What is the base for these technology? engineering, physics, chemistry, etc.
- What is the base for forensic study? ⇒to find out roots of RI

Radiochemistry is an essential field to support forensic study.

⇒It studies chemical separation, chemical analysis, measurement, etc.

（4） Future Expectations for Nuclear Security Assurance and Nuclear Forensics

The Basic Idea for Nuclear Power Utilization：

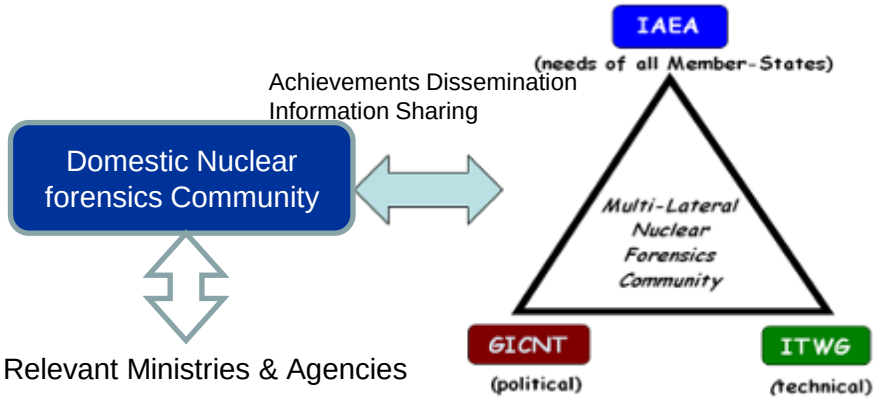
・The Role of Nuclear Forensics

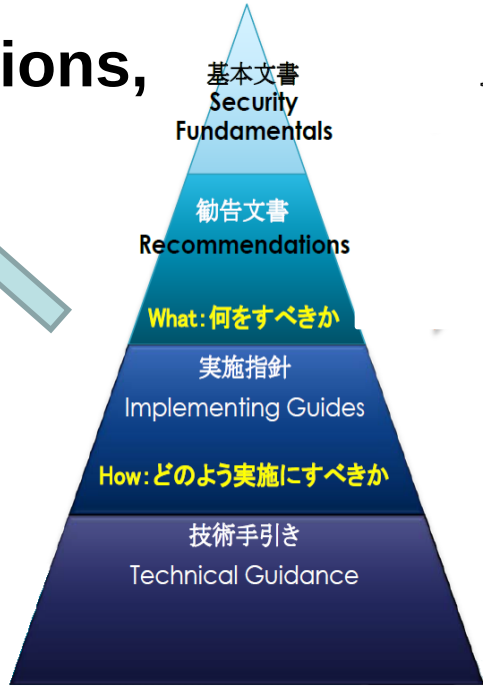
IAEA NUCLEAR SECURITY SERIES No. 2-G「NUCLEAR FORENSICS IN SUPPORT OF INVESTIGATIONS」

Governments are responsible for establishing the infrastructure for the nuclear security. When nuclear or radioactive substances are detected out of the controlled management, adequate measures, including nuclear forensics supporting investigations, should be prepared by governments.

・Japan's efforts The 1st Nuclear Security Summit Communiqué

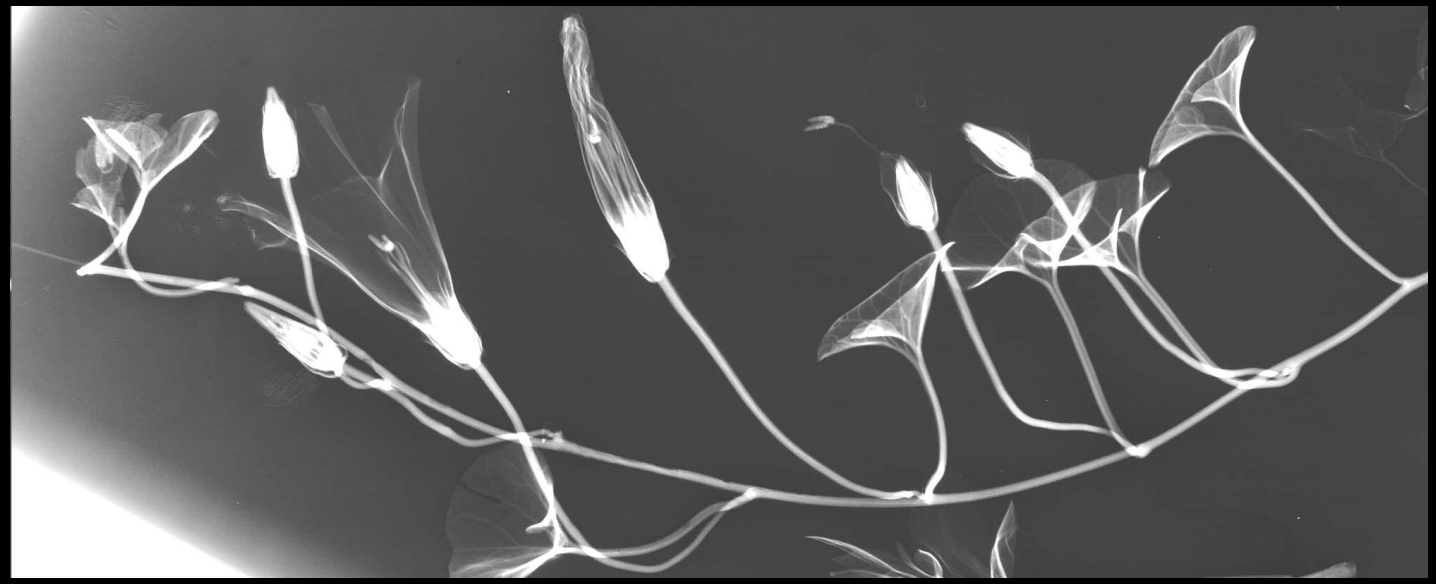
Japan aims to establish exact and strict detection and forensic technics in three years, and share these with international society and further contribute to the world.





IAEA Nuclear Security Series Document Architecture

Domestic and foreign research institutes, colleges and others are expected to promote together research and development.



Thank you