4. Research Center for Radiation Emergency Medicine

Outline of Research:
Dr. Fujimoto graduated in Science from Kyoto University and obtained a Doctoral Degree in Engineering at the University of Tokyo. He has spent most of his career in studies on natural environmental radiation, especially for terrestrial gamma radiation and indoor radon. After the criticality accident at JCO in Tokai his major involvement shifted to dose estimation for radiation emergencies. He was at the Harvard School of Public Health as a visiting scientist from 1981 to 1982 and in the International Atomic Energy Agency as an environment protection specialist from 1990 to 1994. He also served as a lecturer at the University of Tokyo from 1989 to 1996. He is now Supervisory Director, Research Center for Radiation Emergency Medicine (since 2003), an International Editorial Adviser of the Journal of Radiological Protection and an Advisory Editorial Board Member of Nuclear Technology & Radiation Protection. Contact Point: kenzofuj@nirs.go.jp

Objectives:
The statutory function of the Research Center for Radiation Emergency Medicine is the establishment of a solid system for dealing with a radiation emergency; the Research Center is assigned as the final stage radiation emergency medicine hospital within the nuclear disaster prevention plan of the Japanese government. In addition to our responsibility for the whole nation as it was before, the primary concern area has now been reduced to be the eastern part of Japan after the assignment of Hiroshima University as the other tertiary radiation emergency medicine hospital to cover the western part of Japan in March 2004.

Our required aims are as follows.
1. To accept radiation exposed victims who require specialized diagnosis and treatment
2. To dispatch a radiation emergency medical team to local emergency medical headquarters
3. To facilitate exchange of information, research activities, and human resources, by constructing networks in cooperation with other organizations who could deal with a radiation emergency
4. To maintain and reinforce an efficient radiation emergency medicine system under normal conditions
5. To promote technical development and research on radiation emergency medicine

Other objectives are research on radiation emergency medicine that is carried out as a research project involving scientists not only in this Research Center but also the Research Center for Radiation Safety. Details are given in other pages; only subjects are given here.
1. Pathologic physiology of high-dose exposure
2. Chelating agents for removing radionuclides
3. Development of systems for precise measurement and evaluation in emergencies
4. Mitigation of radiation injuries
5. Emergency response to environmental contamination

Overview
After the nuclear accident at Three Mile Island in 1979, the Central Disaster Prevention Council (CDPC) in the Prime Minister's office reinforced the emergency preparedness for nuclear power station emergency and issued a report "Urgent Disaster Countermeasures to be taken for Nuclear Facilities by Governmental Agencies" in July, 1979. In June 1980, the Nuclear Safety Commission (NSC) came up with a guideline entitled "Off-site Emergency Planning and Preparedness for Nuclear Power Plants." This guideline nominated NIRS as a tertiary radiation emergency hospital that serves as the final stage hospital for receiving heavily exposed or contaminated victims due to nuclear or radiological accidents. From January 2004 the Research Center has served as a liaison institution of WHO/REMPAN. The Research Center carries out the following activities to maintain and enhance or strengthen the emergency preparedness system required as the tertiary radiation emergency hospital.

1) Network System
The primary goal is strengthening its institutional system to prepare for radiation emergencies by establishing three nation-wide network committees, for medicine, chromosome analysis as bio-dosimetry, and physical dosimetry.

1-1. NIRS Radiation Emergency Medicine Network
**Council**

This is a group of experts and medical organizations from which NIRS asks for help at the time of a nuclear disaster or a radiological accident. The cooperation involves dispatch of an expert in the specific field in an emergency, arrangement of acceptance of patients at medical facilities affiliated with the expert's organization, and provision of advice. Such collaboration is expected to reinforce the functions of NIRS. NIRS will call the Radiation Emergency Medicine Network Council to solicit cooperation when it is requested by authorities (or when NIRS thinks the necessity arises) to respond to radiation emergencies. We held a meeting in February 2005. An institutional cooperation agreement was signed between Kyorin University and NIRS in March 2005.

**1-2. Chromosome Network Council**

This council forms a network among specialists having dose evaluation capability based on chromosome analysis. Through this network, NIRS can be prepared for radiation emergencies, and also help maintain and enhance the technical standards of specialists involved by providing support and advice. We held meetings in June 2004 and February 2005.

**1-3. Physical Dosimetry Network Council**

This council is a network of experts in physical dose evaluation techniques. The network is expected to respond to emergencies through collaboration among experts in prompt and precise dose measurement systems. It is also responsible for accumulating dose evaluation technology, while fostering followers. We held meetings in July 2004 and March 2005.

**1-4. Local Medicine Network Council**

In Japan, medical systems are currently being constructed in accordance with disaster prevention plans of local governments that have nuclear facilities in their territories. Within the framework of each local nuclear disaster prevention plan, a specific collaboration system with NIRS is required to be set up, specifying the steps to be performed in the prompt transfer of patients from a site to a hospital, including radiation management and prevention at the hospital, and sending patients to other facilities when necessary. We organized meetings with prefectural government officers and medical doctors in primary and secondary radiation emergency hospitals in seven prefectures in fiscal year 2004.

**2) Training**

The primary goal is conducting educational training in radiation emergency medicine for medical professionals and disaster prevention personnel such as doctors and nurses involved in nuclear disaster medical care, emergency crews, and nuclear establishment employees. KIRAMS/NIRS Seminar on "Radiation Emergency Medical Preparedness" was conducted at NIRS for 24 medical professionals from Korea on 11-13 January 2005. The following training courses were regularly held in fiscal year 2004.

(A) Radiation emergency medicine course

The course was held three times with 20 participants in each course. More than 260 participants were trained so far. Many of them are working actively in primary or secondary medical emergency hospitals.

(B) Emergency rescue training course

The course was held three times with 30 participants in each course.

(C) Training course for the "whole body counter" measurement

**3) Emergency Exercises**

The primary goal is participating in nuclear disaster prevention training, seminars on medical response and other activities conducted by local governments to disseminate the information to the area. We participated in the nuclear disaster prevention training conducted by Ibaraki prefecture on 30 September 2004 and simulated emergency arrangements for a patient transferred to NIRS by helicopter. On 2 November 2004, the emergency monitoring exercise was conducted in the radiation emergency medicine facility with the participation of our medical staff and monitoring team (Fig.10).

**4) Follow-up Studies**

In addition to the activities required for the tertiary radiation emergency hospital, the Research Center for Radiation Emergency Medicine also conducts research work in a wide range of areas: medical care, radiation measurement and investigation, health physics, cytogenetics, and psychology. In addition, we study dose evaluation which facilitates decision-making in treatment methods, identification of radionuclides, treatment for high-dose exposure or reduction of high-dose exposure hazards, and rapid evaluation of population exposure. NIRS carries on follow-up clinics for the victims of thermonuclear explosion test on Bikini Atoll, patients with thorotrastosis and the remaining JCO accident victim who has survived.

**4-1. Follow-up examination of the victims of Bikini nuclear test**

During the nuclear test on Bikini Atoll on 1 March, 1954, 23 crew members (18 to 39 years old at the time) of the Dai-go Fukuryu-maru out of
Yaizu City, Shizuoka Prefecture, were exposed to radiation. This follow-up survey aims to examine the physical states of these patients over a long period of time to study late radiation injuries. The follow-up examinations that have been conducted for 50 years provide precious data. The mode of exposure was composite, and the estimated dose was 1.7 to 6.0 Gy. A physical checkup of still living survivors was conducted at Yaizu City General Hospital this year.

4-2. Follow-up examination of patients with thorotrastosis

Thorotrast is a radioactive contrast medium for angiography. The main constituent is thorium dioxide. A German company started sales in 1930. In Japan, the product was used from 1932 to 1945 for 10,000 to 20,000 patients, the majority of whom were killed in World War II. Thorotrast is deposited in the liver and spleen and causes internal radiation exposure over a long period of time. This follow-up examination estimates the amount of thorium deposited in surviving patients, investigates their clinical symptoms, analyzes the relationship between the deposited amount and malignant carcinogenesis, and elucidates the effects of long-term internal radiation exposure on human bodies.

5) Database

A database including the cases of radiation exposure on Bikini Atoll and cases of thorotrastosis is being constructed. Since radiation accidents are rare, the maximum amount of information must be collected from each accident and accumulated to help medical workers decide strategies to treat patients, and improve and establish therapeutic methods. Today, there are various databases on radiation accidents and their victims, but most are not accessible from other countries. Under the supervision of the World Health Organization (WHO), an international program called REMPAN (Radiation Emergency Medical Preparedness And Response) exchanges information on radiation accidents, including those in the database owned by the US REAC/TS (Radiation Emergency Assistance Center/Training Site). REMAPAN has a collaborating center at Ulm University in Germany and manages a SEARCH database of patient information. It aims to construct an international database by registering cases that are attributable to the Chernobyl accident and other radiation accidents. The NIRS registered the Dai-go Fukuryu-maru accident in the SEARCH database. In addition, our center is constructing a database by collecting the medical data of the victims of radiation accidents and exchanging information with countries that have developed radiation accident medicine. In 2004, we obtained 80 data sets for acute exposure patients; 40 from Institute of Biophysics in Russia and 40 from Beijing Institute of Radiation Medicine in China.

6) International Cooperation (Fig.11)

(A) Korea Institute of Radiological and Medical Sciences (KIRAMS) and NIRS signed a Memorandum of Understanding in the fields of radiation emergency medicine and dose estimation in November 2004, and conducted the KIRAMS/NIRS Seminar on "Radiation Emergency Medical Preparedness" at NIRS under this memorandum in January 2005.

(B) Seven professionals from National Defense Medical Center and Atomic Energy Committee (Taiwan) visited us on 4 November 2004 and discussed on radiation emergency medicine with NIRS staff.

(C) Fourteen officers and specialists of emergency from Andes countries (Bolivia, Colombia, Ecuador and Venezuela) in South America visited NIRS on 3 February 2005. We presented our activities in lectures including case studies for radiation accidents and gave a technical tour in the radiation emergency medicine facility.

(D) Dr. M. Benderitter of Institut de Radioprotection et de Surete Nucleaire (IRSN) visited NIRS from France for a week in February 2005. He lectured on medical management of localized radiation exposure at the meeting of the Radiation Emergency Medicine Network Council.
Conducted by Ibaraki Prefecture
(30 September 2004)

Emergency monitoring training
(2 November 2004)

Fig.10. Radiation Emergency Exercise

KIRAMS/NIRS Seminar
(11-13 January 2005)

Visitors from Andes Countries
(3 February 2005)

Visitor from IRSN
(16-22 March 2005)

Fig.11. International Cooperation