ICUS NEWSLETTER

International Center for Urban Safety Engineering

Institute of Industrial Science
The University of Tokyo

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HEALTH RISK MANAGEMENT IN THE FIELD OF BUILDING HYGIENE

By

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Recent years have seen the frequent appearance of health hazards related to the architectural environment. Events such as the outbreak of the Severe Acute Respiratory Syndrome (SARS) mainly in China in 2003, the mass outbreak of legionnaires' disease at a spa in Miyazaki Prefecture in 2002, and the terrorist attack with sarin gas in the Tokyo subway system in 1995 are still fresh in the minds of the public. These events nevertheless have not been thoroughly examined with respect to factors such as the routes involved in the mechanism of mass infection, characteristics of diffusion in building interiors, and human exposure; many issues about them still remain uncertain.

Taking into account these circumstances, our research group was organized under the support of the Ministry of Health, Labour and Welfare with the ultimately aim to define measures to be taken in the event of emergency situations, such as the outbreak of unforeseen health hazards in buildings with high concentration of people. The first task of this research group is to collect reports from related researches conducted to date and summarize their findings. This is to be followed by experimental studies and numerical fluid analyses to predict, for instance, the characteristics of the dispersion of contaminants inside buildings and exposure to them among residents, in order to establish countermeasures applying available technology. These studies and analyses would be premised on the outbreak (release) of pathogenic microorganisms or hazardous chemical substances in the building environment, particularly air-conditioning facilities, water supply and drainage facilities, and building interiors. The final step is to compile the results of these activities for preparation of an effective manual to be used in the event of actual health hazards.

Terrorism: Sarin gas spraying in the underground in Tokyo (March, 1995)

MEASURES AGAINST BIOCHEMICAL TERRORISM IN BUILDING ENVIRONMENT

Four areas should be focused at the present situation: 1) background factors, 2) current status of health hazard management in Japan, 3) trends in research in other countries, and 4) measures against biochemical terrorism in a building environment.

According to Dr. Yanagi, Chief of the National Institute of Public Health's Department of Architecture, Hygiene and Housing, over the period 1900 - 2003, there were a total of 1,154 acts of terrorism of a certain scale using chemical, biological, radiological, or nuclear (CBRN) material throughout the world. Of this total, about 90 percent of the acts involved biochemical substances. Mr. Yanagi pointed out that the 9/11 terrorist attack in the United States served to heighten wariness about biochemical terrorism around the world.This was followed by a description of the current status of health hazard management in Japan. In response to the 9/11 attacks and the incidents of anthrax poisoning by mail shortly thereafter, the Japanese government made an urgent study of preparedness and had setups for health hazard management constructed by the government as a whole, the prefectural administrative authorities, and health centers. In addition, it took steps for smooth provision of information to citizens on a timely basis.

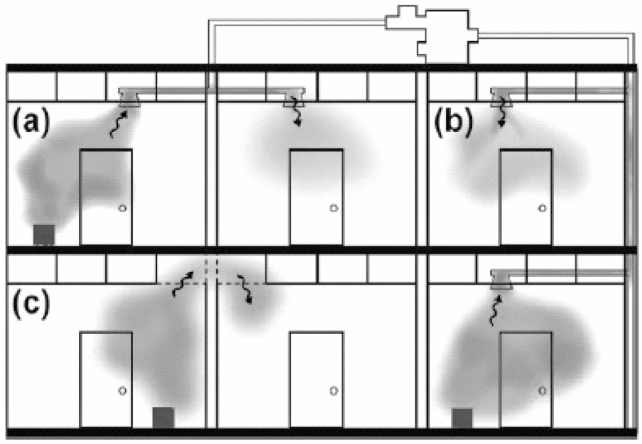
Disaster: Smoke dispersion at fire

An FBI agent opens letter addressed to US Senator Patrick Leahy. (Courtesy of the Monterey Institute of International Studies, Center for Nonproliferation Studies)

DISPERSION OF HAZARDOUS SUBSTANCES WITH AN ADVERSE INFLUENCE ON HEALTH WITHIN BUILDINGS

Let us consider ways of dealing with the diffusion, whether deliberate or accidental, of acute toxins within buildings as viewed from the aspect of architectural environmental engineering. It could first be noted that prevention of the dispersion of such toxins within buildings (i.e. the release of hazardous substances by acts of terrorism) is of primary importance. Measures to curtail any damage to the absolute minimum are, naturally, of a second-best nature. The discussion presented hereinafter concerns the latter. In this context, the first prerequisite is to detect the diffusion of the hazardous substance within the building. This demands development of systems to sense the substance. Canaries were once carried into mine shafts to test the quality of the air. Hinted from this practice, Professor Kato at the Institute of Industrial Science, the University of Tokyo, is now currently developing a bioassay sensor that detects the presence of toxins in the air by blowing it into a tank of killifish ("medaka"), whose behavior changes if the concentration of toxins is significantly high. The next step is to accurately forecast the difussion of the hazardous substance within the building and effectively prevent it. The urgent task to this end is development of a simulation system enabling analysis of the complex circulation of air in the building interior. Dispersion within buildings can be estimated by three-dimensional simulation of non-regular air flow and of the dispersion, but this takes a very long time. In response, Professor Kato is now developing a system which makes it possible to analyze the detailed distribution of contaminant concentrations in interior spaces and their changes over time, without heavy calculation loads. The system consists of investigation of the flow through a three-dimensional air flow simulation, followed by analysis of only contaminant diffusion using a simple method. It derives from the fact that formulas for flow and diffusion related to the dispersion of contaminants are linear. This makes it possible to calculate the non-regular concentration response through a convolution computation using a response coefficient for a limited time width pulse. The work has already moved out of the stage of theoretical studies into that of developing a concentration-response simulation system for use in the event of the introduction of contaminants into interior spaces due to terrorism or other.

SAFETY OF DRINKING WATER IN BUILDINGS



Ventilation ducts provide pathways for contamination to flow among rooms (Courtesy of the Lawrence Berkeley National Laboratory)

Positioning of water supply equipment

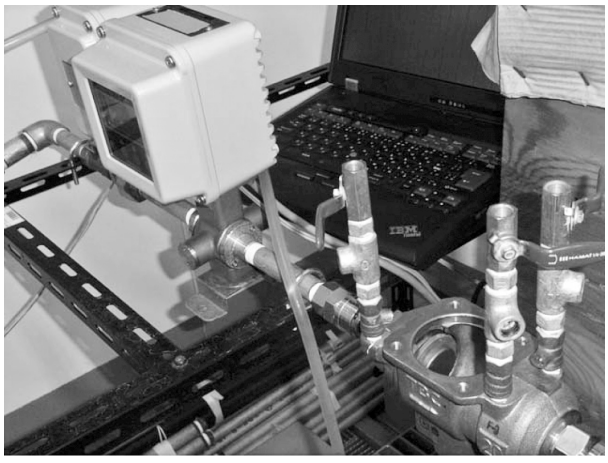
Water supply equipment consists of the pipes leading from the distribution pipes for supply of water to customers and the fittings attached directly to them. At present, the management of hygiene varies with the supply arrangement. In buildings such as condominiums, for example, the water may be either put into a receiving tank before being supplied to customers or supplied by direct connection to each unit. This difference in supply arrangements conveys a differentiation on where the responsibility for water quality at the tap in homes lays. While there are ministerial ordinances concerning the standards for the structure and material quality of water supply equipment, they have not completely eliminated accidents occurring through such equipment.

Cases of occurrence of water quality accidents within buildings

In 1994, there was a mass infection of 461 people with cryptosporidium in a multiuse building in the city of Hiratsuka, Kanagawa Prefecture. Authorities suspected contamination of tap water because the people who were infected had drunk the water from the water tank. The investigation determined that the underground water tank, sump tank, and other facilities had an outdated design and inappropriate structure, and that the trouble was caused by an overflow of sanitary sewage from the sanitary sewage tank into the water tank due to failure of the sump pump at the time of occurrence.

In 2001, there was an incident in which tap water in a certain condominium turned yellow after a power outage. It was thought that the power outage resulted in a negative pressure in the condominium standpipe, and subsequent backflow of the hot water remaining in bathtubs. As there was a high incidence of defects among the backflow prevention devices on the storage-type water heaters in the building, modifications were made in the structure and material of the check valves to prevent backflow. It is not clear, however, whether the backflow prevention equipment on the line from the condominium units to the outside functioned abnormally.

There were also complaints about service water quality from people living near a hotel. An investigation revealed installation of illegal cross connections. It was concluded that drinking water for the hotel (supply to the third and higher floors based on chlorination of groundwater) had flowed backward into the utility water distribution pipes.



Experimental apparatus for detecting malfunctions of backflow preventers

Research concerning water supply in buildings

In Japan, research in this area funded by expenditures for scientific studies under the Ministry of Health, Labour and Welfare may be exemplified by two studies: one concerning abnormality monitoring and management for water supply equipment, and another consisting of a fact-finding survey of water storage facilities (particularly unregulated small-scale ones), and preparation of a manual for their operation and maintenance for their installers. The former proposed a methodology for detection of water quality concentrations and quantities beyond a certain level as well as the development of techniques for sensing abnormalities affecting backflow prevention devices. The World Health Organization, too, has prepared a document entitled "Water Safety in Public Buildings." As these activities suggest, there is a widespread recognition of the importance of maintaining high levels of water quality in order to assure the safety of drinking water.

**** Director,***
Department of Architecture, Hygiene and Housing, National Institute of Public Health

ICUS & AIT Organized the 5th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia

The Asian Institute of Technology (AIT), Thailand, and the International Center for Urban Safety Engineering (ICUS), Institute of Industrial Science (IIS), the University of Tokyo, Japan, co-organized the Fifth International Symposium on New Technologies for Urban Safety of Mega cities in Asia (USMCA-2006) at Phuket on November 16 – 17, 2006. The symposium was sponsored by the Japan Aerospace Exploration Agency (JAXA), Japan; the Center for Sustainable Urban Regeneration, the University of Tokyo, 21st Century Center of Excellence Program (COE), Japan; the Geo-Informatics and Space Technology development Agency (GISTDA), Thailand; Siam City Cement, Thailand; and Index International Group Co., Ltd., Thailand.

The two-day long program of the symposium was arranged in two plenary and ten technical sessions, in which four keynote speeches and twelve special lectures were delivered by invited distinguished academicians and researchers from several Asian countries. The symposium was inaugurated by Dr. Pennung Warnitchai, School of Engineering and Technology (SET), AIT and it was followed by the welcome address of Prof. Worsak Kanok-Nukulchai, Dean of SET, AIT and the opening speeches of Dr. Takashi Moriyama, JAXA, Dr. Surachai Ratanasermpong, GISTDA and Prof. Taketo Uomoto, ICUS. The keynote speakers for the plenary sessions were Prof. Tsuneo Katayama (Department of Architecture, Tokyo Denki University, Japan), Dr. Suvit Vibulsresth (GISTDA), Dr. Absornsuda Siripong (Marine Science Department, Chulalongkorn University, Thailand) and Prof. Mehedi Ahamed Ansary (Department of Civil Engineering, Bangladesh University of Engineering and Technology, Bangladesh).

A total of 64 papers were presented in technical sessions covering a wide range of issues in the areas of urban safety including flood risk management, sustainable infrastructure management, earthquake, fire, tsunami, disaster mitigation and environmental impacts. Several presentations were made on newly developed advanced tools and methodologies for addressing these issues.

For the first time, ICUS prepared the Excellent Young Researcher Award to encourage activities of young researchers in the field of urban safety engineering. The winners of this award were Dr. Hong Huang (IIS, the University of Tokyo), Ms. Kulapramote Prathumchai, Geoinformatics Center (AIT), and Dr. Kawin Worakanchana (IIS, the University of Tokyo.)

The next symposium will be held at Dhaka, Bangladesh on December, 2007. Further information will be announced in ICUS web site soon.

(By Y. Kato)

Number of participants per country

Country	Number of participants	Country	Number of participants
Australia	1	Pakistan	1
Bangladesh	2	PR China	2
India	1	Singapore	5
Japan	31	Thailand	45
Malaysia	1	Uganda	1
Nepal	1	Vietnam	1
		Total	92

Symposium participants in a group photo

JAXA representative shares his view of USMCA 2006

I would like to extend my sincere appreciations and congratulations to all people belonging to the organizing agencies who worked very hard to make the 5th International Symposium on New Technologies for Urban Safety of Megacities in Asia (USMCA 2006) a success, specially to the Asian Institute of Technology (AIT) and the Institute of Industrial Science, the University of Tokyo. It was my great pleasure to deliver the Opening Speech in this event during which views and experiences on new technologies for natural disaster mitigation and urbanization technologies were shared and exchanged.

One of the Japan Aerospace Exploration Agency (JAXA) main emphases is the use of space technology to cope with environmental problems, prevent and mitigate risks of disasters, improve quality of life, and bring about better future for the next generation. This initiative is being taken together with its partners in the Asia-Pacific Regional Space Agency Forum. JAXA feels a strong commitment to achieving sustainable urban spaces and hopes to actively continue contributing to events such as USMCA.

(By T. Moriyama, JAXA)

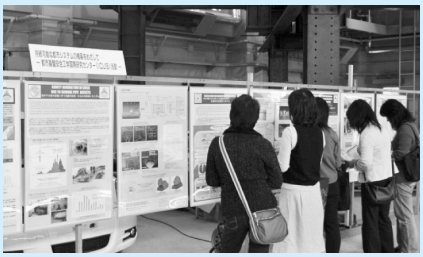
Dr. Moriyama Delivers Opening Speech at USMCA 2006

ICUS joined Chiba Experiment Station Open House

On November 10, the Institute of Industrial Science, the University of Tokyo organized the 'Open House' of Chiba Experiment Station. Under the splendid weather, there were 650 visitors altogether.

ICUS joined the event by presenting its research progress on "Towards the Establishment of a Sustainable Urban System". Panels were prepared to make an easy-to-understand explanation to visitors, including pupils from local primary and secondary school.

(By R. Kuwano)



ICUS Exhibition

1st Transdisciplinary Federation of Science and Technology Symposium

The first Transdisciplinary Federation of Science and Technology Symposium was held on December 1-2, 2006 at the Campus Innovation Center in Tamachi, Tokyo. The nonprofit organization was established to merge essential technologies from various fields. Forty-three academic societies join the organization whose total number of individual members reach 60,000.

On the morning of the second day, a session on disaster risk was convened by Prof. Y. Yasuoka, IIS. ICUS members were invited as speakers:

- Prof. Meguro explained the importance of structuring researches on disaster and its countermeasures and infrastructure system for proper disaster management.
- Dr. Yoichi Kitsuta, a emergency physician of the Univ. of Tokyo Hospital (a member of project team with ICUS) presented the implementation of an advanced technology into a major medical incident management and support.
- Dr. Miyazaki introduced a future infrastructure information database for disaster management.

Prof. Yasuoka, Prof. Meguro, Dr. Kitsuta and Dr. Miyazaki delivered speeches

After their presentations, the necessity of information exchange with other organizations at a time of a disaster and proper data preparation, i.e. collection, processing, analysis and command systems, were discussed.

(By H. Kanada)

RNUS Activities

Training Program on Infrastructure Maintenance and Non Destructive Testing

Jointly organized with the Sirindhorn International Institute of Technology, RNUS staffs led by Dr. Raktipong Sahamitmongkol made a demonstration of non-destructive testing machine for the inspection of reinforced concrete structure on November 8, 2006 at Bang Pakong Power Plant.

This activity was a part of the training program for technical staffs of the Electricity Generating Authority of Thailand in order to explain the importance of good maintenance practices as well as the deterioration processes and inspection procedures of concrete structures.

Demonstration of corrosion detection at a damaged structure

Located in Bang Pakong district, Chachoengsao Province, the Bang Pakong Power Plant is presently Thailand's biggest and most modern thermal power plant employing state-of-the-art technologies for power generation and environmental management. With an aggregate capacity of 3,600 Megawatts, Bang Pakong plays a vital role in securing well over 25 percent of Thailand's electricity needs.

RNUS Seminar

On November 13, 2006, RNUS organized the seminar on "Modeling of Concrete Properties and Nonlinear Structural Analysis".

Associate Professor Toshiharu Kishi, IIS, the University of Tokyo gave the presentation 'Microscopic Approach to the Governing Mechanism of Concrete Properties – Fluidity, Heat Generation, Strength, Water Movement, and Microstructure'. He discussed the different mechanisms of concrete as well as the relationship among them and subsequently the modeling of concrete behavior was explained.

Dr. Yasushi Tanaka, Research Associate from Nagaoka University of Technology presented 'Constitutive Model for Non-linear Analysis of Reinforced Concrete Structures.' In the presentation, fundamentals and techniques for simulation of structural response of RC structure were discussed.

(By R. Sahamitmongkol)

Dr. Y. Kato gave a memorial gift to Dr. Toshiharu Kishi.

IIS seminar was arranged by ICUS

The IIS seminar was held on October 3, 2006 organized by the Foundation for the Promotion of Industrial Science. This seminar was arranged by ICUS, the theme was "Towards safer and more comfortable urban space."

Dr. Kuwano delivered a presentation on the causes and mechanisms of ground depression. Dr. Ooka presented the prediction and control of heat-island effect. Dr. Miyazaki introduced the detection of landslides by satellite remote sensing and real time 4D system for disaster information. Prof. Meguro outlined a new proposal on how to change low earthquake-resistant houses to strong ones and how to educate people and organizations to prepare against earthquakes.

About 40 people attended the seminar. Certifications were given during the closing session.

(By H. Kanada)

ICUS members instructed their topics

Certification was given

MOU between ICUS and SIIT was signed

On October 25, 2006, the Memorandum of Understanding (MOU) between the International Center for Urban Safety Engineering (ICUS) and the Sirindhorn International Institute of Technology (SIIT), Thammasat University was signed.

SIIT has been one of the regional partners of ICUS in promoting the importance of urban safety especially in central areas of Thailand. Several joint activities and collaborative research projects have been carried out by ICUS and SIIT in the last few years. The signature of this MOU will strengthen the relationship between these two parties and bolster collaborative activities in the region

(By R. Sahamitmongkol)

Prof. S. Tangtermsirikul, Deputy Director of SIIT and Prof. T. Uomoto, Director of ICUS

Delegation of Thai scholars visited ICUS

A delegation of 24 members of the Council of Deans of Engineering of Thailand visited the Institute of Industrial Science (IIS) on October 23, 2006. Their fields of expertise covered a broad spectrum including Civil, Mechanical, Industrial, Electrical and Computer Engineering, among others. At IIS, they were received by a group of professors led by the institute President, Prof. Maeda. Research activities, on-going projects and collaborative schemes of the institute were introduced to the guests.

In the afternoon, the delegation split in four groups and alternately visited the Collaborative Research Center for Computational Science and Technology with Prof. C. Kato, the Collaborative Research Center for Advanced Mobility (ITS Center) with Prof. Suda, the Nanoelectronics Collaborative Research Center with Lecturer Iwamoto, and ICUS with Prof. Uomoto.

At ICUS, a brief introduction of the center activities was given by Prof. Uomoto and then the following talks were delivered:

- *"Sustainable Tsunami Disaster Mitigation System for the Indian Ocean Rim Region and others" by Prof. Kimiro Meguro*
- *"Real Time Bridge Remote Health Monitoring System" by Dr. Sanae Miyazaki*
- *"Integrated Information System for Total Disaster Mitigation" by Dr. Miho Yoshimura*

At the end of the visit, group pictures were taken.

(By P. Mayorca)

Dr. Miyazaki explained about real time monitoring of bridges

Inauguration Ceremony of BNUS and Seminars

The Bangladesh Network Office for Urban Safety (BNUS) was inaugurated by the honorable Vice Chancellor, Prof. Dr. A. M. M. Safiullah of Bangladesh University of Engineering and Technology (BUET) on December 6, 2006, at the 4th floor of the Civil Engineering Building, BUET, Dhaka. Prof. T. Uomoto and Prof. K. Meguro of ICUS attended the ceremony with Prof. Md Hossain Ali, Dean of Civil Engineering Faculty, Prof. Md. Mazharul Haque, Head of the Civil Engineering Department and Dr. Munaz Ahmed Noor, project manager of BNUS.

Attendants of the ceremony with Vice Chancellor

BNUS staff members

Prof. Uomoto presented a talk on 'Importance of Maintenance of Existing Concrete Structures' at the Institution of Engineers, Bangladesh, organized by Engineering Staff College, Bangladesh (ESCB) and BUET on December 5, 2006. Prof. Meguro also delivered a talk on 'Recent Developments of Earthquake Related Activities in Japan' on December 6, 2006 at the seminar room of the Department of Civil Engineering, BUET.

VISIT TO JAPANESE EMBASSY IN DHAKA

Prof. Uomoto, Prof. Meguro and Dr. Munaz Ahmed Noor (BNUS, BUET) visited the Japanese Embassy in Dhaka on December 6, 2006. The professors explained ICUS activities and the plan to cooperate with BUET to Ambassador Masayuki Inoue and other embassy staff members. They also asked for support to the activities of ICUS, especially the international symposium which will be held in Dhaka in 2007.

(By T. Uomoto)

Meeting at the Embassy of Japan in Bangladesh

ICUS Activities

- *All ICUS members attended the USMCA 2006 held at Phuket, Thailand on Nov. 16-17.*
- *Prof. Uomoto visited Istanbul, Turkey from Oct. 15 to 18 to join the field inspection of an undersea tunnel across the Bosphorus strait. He traveled to Udon Thani, Thailand from Oct. 24 to 27 together with Dr. Sahamitmongkol in order to join the Thai Annual Concrete Conference and sign a Memorandum of Understanding with the Sirindhorn International Institute of Technology, Thammasat University. He attended the 2nd Asian Concrete Federation International Conference from Nov. 19 to 23 at Bali, Indonesia together with Drs. Kato, Kanada and Sahamitmongkol. Prof. Uomoto visited Sydney, Melbourne, and Gold Coast, Australia from Nov. 26 to Dec.2 to give a seminar on concrete deterioration and hold meetings with teaching staff at Monash University.*
- *Professors Uomoto and Meguro visited Dhaka, Bangladesh from Dec. 4 to 7 to hold a seminar at the Bangladesh University of Engineering and Technology and meet the Japanese Ambassador to Bangladesh.*
- *Prof. Meguro visited Singapore from Dec. 2 to 3 to attend the meeting of the Board of Directors of the World Seismic Safety Initiative.*
- *Dr. Oki was promoted to Professor on Nov.1st. He retired from ICUS and returned to the 5th Department of the Institute of Industrial Science, the University of Tokyo.*
- *Dr. Oki visited Bangkok/Phitsanulok, Thailand from Oct. 15-22 to carry out observations there.*
- *Dr. Ooka attended the 6th International Thermal Manikin and Modeling Meeting held at Hong Kong, China, from Oct. 15 to 19.*
- *Dr. Kato stayed at AIT for his research work and teaching duties at RNUS from Oct. 23 to Dec. 8.*
- *Dr. Yoshimura held a series of four lectures for introducing earthquake engineering at Hayashi-cho elementary school in Tokyo in December. About seventy students learned the meaning of seismic vulnerability and importance of countermeasures through small-scale experiments.*
- *Dr. Kanada visited Seoul, Korea from Nov. 3 to 5 to join the 2006 Korea Concrete Federation Autumn meeting.*
- *Dr. Mayorca traveled to Lima, Peru from Oct. 14 to 22 to introduce PP-band retrofitting technique for masonry structures to several governmental agency representatives.*
- *Dr. Sahamitmongkol stayed at AIT for his research work and teaching duties at RNUS during Sept. 9-Dec. 18 and Dec.29-Mar.24.*
- *The RC-39 Committee met on October 10. After the meeting Drs. Kuwano and Miyazaki gave talks on their respective research activities.*

Awards

- *Drs. Kanada and Sahamitmongkol received the "Best Concrete Research Award" at the 2nd Asian Concrete Federation International Conference for their papers: "Radiography of Reinforced Concrete Structures Using Compton Backscattered Laser Photons Beam" and "Effect of Mix Proportion and Cover Thickness on Electromagnetic Properties of Concrete Measured by Radar Method", respectively.*
- *Dr. Worakanchana (Meguro laboratory) received the "Excellent Young Researcher Award" at USMCA 2006 for his paper: "Voronoi Applied Element Method: Theory and Application for Linear and Non-linear Materials."*

Editor's Note

The word that showed social conditions in 2006 was "Life (Inochi: 命)". This word was chosen by a public advertisement company based on an interview survey carried out in all Japan. The reasons why people chose "Life" may be classified into the following four categories: 1. Imperial prince "Hisahito" birth; 2. frequent occurrence of suicide (child suicide cuased by bullying, suicide of senior citizen because of hard living conditions, etc.); 3. frequent occurrence of painful accidents and events (deaths in traffic accidents caused by drunken drivers, cruel murders, sudden deaths by natural disasters such as tornadoes, etc.); 4. frequent occurrence of events that make life feel uneasy (execution of nuclear test in North Korea, increase of medical treatment expense load for senior citizens due to medical care reforms, doctor shortage, etc.). (Reference: http://www.kanken.or.jp/event/index.html)

The year 2006 ended with two unhappy news that symbolized the above issues: the suicide of adolescents who worried about being bullied and a murder by the victim's relative. It is very difficult to find the actual reasons behind these events and to take countermeasures against them. However, I think that "Communication" and "Consideration" are important key words to solve these problems. It is very difficult or impossible to guess what other party thinks. However, it is most important to make our best effort to guess it in order to make an excellent interpersonal relationship. Then, do not forget to try to guess others' thinking as mentioned above. You cannot communicate with the other party when thinking that you completely understood other party's thinking. Modesty is always important. This is also important for ICUS. We tackle several problems in the field of urban safety such as aging of structures, natural disasters, environmental destruction, etc. At this time, we should not only pay attention to the object in the concrete problem but also to the thinking of the users in the city. I am wishing that our activity is useful for the improvement of our "Life".

(By Y. Kato)

Priest writing the kanji character for 'Inochi' or Life (Photo courtesy of the Sankei Shinbun)

If you would like to contribute an article to ICUS newsletter or have any comment or suggestion, please contact the editorial committee at icus@iis.u-tokyo.ac.jp.

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