III. Development of Practical Tools

One of the major objectives of the RADIUS initiative was to develop two kinds of practical tools for urban seismic risk management, based on the experience of the nine case studies implemented worldwide. One of the tools is a set of Guidelines for Implementation of Risk Management Projects. It is expected that the guidelines will be used:

- To explain the philosophy and methodologies adopted by RADIUS;
- To assist in reading, understanding, and interpreting the RADIUS case study reports; and
- To provide general guidelines on how RADIUS-type Risk Management Projects can be implemented in other cities.

GHI developed the guidelines, based on the experiences in Quito (Ecuador), Kathmandu (Nepal), and the nine RADIUS case studies. The emphasis was put on:

A) How to involve decision makers, relevant organizations/institutions, communities, private sectors and scientists in a multidisciplinary way;

B) How to practically transfer scientific data into decision making information;

C) How to disseminate information and educate people, particularly through the mass media;

D) How to prepare a risk management plan as well as an action plan; and

E) What to do as the next step.

A computer programme for simplified Earthquake Damage Estimation was developed by the OYO Group (OYO Corporation and OYO International). It is intended that this programme will be used as a practical tool to aid users in understanding the seismic vulnerability of their own cities and encourage the start of disaster prevention programmes. The results of the application of the programme should be regarded as a preliminary estimation. The programme requires input of a simple data set and provides visual results with user-friendly prompts and help functions. Input data are population, building types, ground types, and lifeline facilities. Outputs are seismic intensity (MMI), building damage, lifeline damage and casualties, which are shown with tables and maps. Users can apply a historical earthquake such as Tangshan (1976, China), Kobe (1995, Japan), Kocaeli (1999, Turkey) and Chichi (1999, Taiwan) as a hypothetical scenario earthquake. The programme is available on CD-ROM and can be downloaded from the RADIUS home page, along with other outcomes, including guidelines and reports of the RADIUS project.

IV. Comparative Study on Urban Seismic Risk

In April 1998, the IDNDR secretariat and GeoHazards International (GHI) launched the Understanding Urban Seismic Risk Around the World (UUSRAW) project, with the participation of more than 70 member cities worldwide, that are seismically active. The study aimed:

A) To provide a systematic comparative assessment of the magnitude, causes, and ways to manage earthquake risk in cities worldwide;

B) To identify cities that are facing similar earthquake risk challenges and foster partnerships among them; and

C) To provide a forum in which cities could share their earthquake risk management experiences using a consistent, systematic framework for discussion.

The Earthquake Disaster Risk Index (EDRI) provided a framework for the UUSRAW project. The EDRI compared metropolitan areas according to the magnitude and nature of their earthquake disaster risk, which is analysed using five main factors, namely, "hazard", "vulnerability", "exposure", "external context" and "emergency response and recovery". The study

report includes (a) a summary of the assessments of earthquake risk and risk management in the participating cities; (b) a compilation of the city profiles; (c) a compilation of specific risk management efforts undertaken in the participating cities; and (d) a summary of the feedback received from the project participants throughout the course of the project. The project established a worldwide network of earthquake professionals that can support continued work in comparative urban earthquake risk assessment.

V. Information Exchange

More than 30 cities, all of which had carried out a seismic risk assessment or were in the process of doing so with independent resources, joined RADIUS as "Associate Cities" for information exchange and international cooperation. Most of the associate cities kindly wrote a "city report" and sent it to the IDNDR secretariat. The reports are presented on the RADIUS home page.

35 Associate Cities
Algiers (Algeria), Baoji (China), Beijing (China), Bogota (Colombia), Cairns (Australia), Calcutta (India), Dalian (China), Damascus (Syria), Gyumri (Armenia), Hefei (China), Istanbul (Turkey), Jabalpur (India), Kathmandu (Nepal), Khartoum (Sudan), Lima (Peru), Manizales (Colombia), Mumbai (India), Newcastle (Australia), Pereira (Colombia), Pimpri (India), Quito (Ecuador), St. George's (Grenada), San Juan (Argentina), Shiraz (Iran), Sochi (Russia), Spitak (Armenia), Suva (Fiji), Tai'an (China), Tangshan (China), Tehran (Iran), Tianjin (China), Tuscan Region (Italy), Ulaanbaatar (Mongolia), Urumqi (China), Yerevan (Armenia)

"IDNDR highlights" was published monthly by the IDNDR secretariat and sent to a number of governments and experts by e-mail. The progress of RADIUS was reported in the publication each month. The RADIUS Web site was created in early 1998, and the information on the initiative was fully revised and updated in 1999. This was carried out with the technical assistance of GHI. Available on the site are full reports of the nine case studies, reports from the three international institutes, city reports from the associate cities, the developed practical tools, the result of the comparative study, and the proceedings of the RADIUS symposium in Tijuana. The address of the RADIUS home page is: **http://www.geohaz.org/radius**
The IDNDR home page, which was created later, also started presenting the result of RADIUS. It now contains major information on RADIUS.
The adddress is: **http://www.idndr.org**

VI. RADIUS Symposium

Prior to the International RADIUS Symposium, there were two RADIUS workshops and more than ten conferences where the RADIUS initiative was presented. A RADIUS workshop was held from 18 to 19 September 1998 during the Second International Conference on Earthquake, Hazard, and Seismic Risk Reduction in Yerevan, Armenia, held from 15 to 21 September 1998, to review the progress of the RADIUS case studies and to discuss urban seismic risk reduction practices.

The IDNDR Programme Forum was held from 5 to 9 July 1999 in Geneva, as an essential event of the concluding phase of IDNDR. In the Forum, a thematic session on *"Towards Earthquake Safe Cities: How to Reduce Earthquake Damages"* was held, focusing on RADIUS and similar activities in the world. It was pointed out that RADIUS was one of the most significant and successful projects for IDNDR, establishing excellent integrated international cooperation. In the poster session on the same theme, exhibited were many reports, pamphlets, and posters from the RADIUS case-study cities as well as the associate cities for the entire week.

Figure 3: Session on "Towards Earthquake Safe Cities: How to Reduce Earthquake Damages" at the Programme Forum

An International IDNDR Symposium on "The RADIUS Initiative - Towards Earthquake Safe Cities" was held from 11 to 14 October 1999 in Tijuana, Mexico. It was the closing event for RADIUS to present and discuss the results of the case studies, developed tools, the comparative study on urban seismic risk, and reports of similar efforts. It was co-sponsored by the City of Tijuana, the United Nations Centre for Regional Development (UNCRD), the United Nations University (UNU), and the IDNDR secretariat, and endorsed by the International Association for Earthquake Engineering (IAEE), the International Association of Seismology and Physics of the Earth's Interior (IASPEI), and the World Seismic Safety Initiative (WSSI). The objectives of the symposium were:

- To present achievements of RADIUS, including, among others, results of the nine case studies, developed tools, and the results of a comparative study on urban seismic risk worldwide;
- To discuss and identify the lessons learned throughout the initiative and other similar efforts; and
- To propose future activities for earthquake safe cities in the 21st century.

About 300 people participated in the symposium and discussed how to make cities safer against earthquake disasters. They enthusiastically participated in discussions throughout the four days, and learned lessons from the nine case studies and other similar efforts in the world. The developed tools for RADIUS-type projects and the result of the comparative study on urban seismic risk were introduced and assessed.

Figure 4: Opening ceremony of the International IDNDR Symposium on "The RADIUS Initiative - Towards Earthquake Safe Cities"

VII. Cost

The total cost of the RADIUS initiative was approximately US$ 2.5 million, mostly spent from the IDNDR trust fund, which was mainly covered by a contribution from the Government of Japan. Several international organizations such as UNU and UNCRD collaborated in funding and organizing the seminars and the symposium. One of the training seminars was financed by JICA. From February 1996 to January 1998, Kenji Okazaki, the RADIUS manager, was seconded by the Japanese Government through JICA. In addition, almost all of the nine cities allocated some additional local funding, including in-kind contributions to carry out the case studies. The training seminar for technical experts was sponsored by JICA. Participation of some experts in the RADIUS related meetings was covered by a United Nations fellowship. Tijuana City allocated local funds to hold the Symposium there in October 1999. It was very generous of the regional advisers to have participated in many workshops and meetings on a voluntary basis. Many experts of both member and associate cities also worked on a voluntary basis to collect data on their city and to prepare their city report. A lot of people participated in the RADIUS symposium at their own expense.

VIII. Evaluation

Evaluation of the nine case studies was made in a simplified way at the final stage of RADIUS. This evaluation was subcontracted to Tobin & Associates, California, United States, which had not previously been involved in RADIUS so that it might fulfill the assignment objectively. A questionnaire was prepared just before the RADIUS symposium, and distributed to the representatives of the case-study cities during the symposium.

The nine case-study cities greatly raised public awareness as their activities were broadly covered by the mass media and information was disseminated to communities. They built up close partnerships between scientists and local governments. The outcome of