세계원자력여성기구 대회개최 및 협력기반 구축사업

A Study on the Promotion of cooperation with 'Women In Nuclear(WIN)—Global'

연구기관
한국원자력연구소

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요 약 문

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- 여성문제에 대한 IAEA 사무총장 자문활동에 기여
- 학계, 의료계, 산업체의 여성 원자력 전문 활동 고취

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IV. 연구개발 결과 (제9차 세계 WIN 연차 대회 개최)
세계 WIN의 회장인 Annick Carnino가 이번 연차 대회에 참석하지 못하였기 때
문에 급변 제 9회인 세계 WIN 대회는 Irene Aegerter가 의장을 맡아 환영사를
하였으며, 한편 본 WIN 대회를 준비하는데 헌신적인 공헌을 한 몇몇의
WIN-Korea의 주요 회원들을 소개하였다.
Aegerter가 의장은 세계 WIN의 회원국은 현재 56개국이 참여하고 있으며, 회원
수는 약 2000명이 넘는 것으로 보고하였고, 세계 WIN의 목격과 세계 WIN의 로
고인 미소짓는 원자의 의미에 대해서도 설명을 하였다. 또한 원자력 에너지의 바
른 사용에 대해 WIN은 모든 가능한 노력을 경추하여야 한다고 강조하였다.
이전의 WIN 총회와는 달리 제 9회 WIN 연차 대회에서는, 국가별 현황들이 형
식적, 절차적으로 보고된 것이 아니라, 최근 원자력 현안들에 대하여 토론하는
방식으로 진행된 점이 두드러진 특징이었다. 또한 중국, 페란도, 체코 및 슬로바
키아 공화국에서의 WIN의 인터넷 상태, 생명 연장, 방사선 프로그램들과 원자력
의 특별한 경우들이 설명되었다. 총회에 이어서, 특별 강연과 초청 강연이 있었
으며 방사선 가공 음식의 실제 등과 같은 많은 문화적 행사들이 대회기간 동안
에 진행되었다.
연차 대회 후에는 외국으로부터 온 회원들을 위하여 한국 수력 원자력 주식회사
영광 원자력 발전소, 원자력 환경 기술원, 한국 원자력 연구소의 하나로 연구로
등을 방문하였다.
또한 아시아 지역 WIN-Asia 설립을 위한 사전 대회를 충격에 연이어 개최하였으며, 중국, 일본, 한국, 몽고, 타이완 및 베트남 등이 참석하였다. 지난 세계 WIN의 회장이었던 Agneta Rising은 WIN-Asia 설립에 대하여 많은 격리를 보였으며, 또한 각 국가들은 아시아 지역 WIN의 발전을 위하여 참여국들 중에서 한국을 거점국가로 선정하는 방안이 제안되었다.

V. 연구개발결과의 활용계획

- 국내 원자력 관련기관에서 전문적으로 종사하고 있는 여성인력에게 세계 WIN과 WIN-Korea의 취지에 대하여 보다 적극적인 홍보.
- 여성의 원자력 분야 진출방안 강구
- 제 2회 WIN-Korea의 연차 대회 개최
SUMMARY
(영문요약문)

I. Title of Project
A Study on the Promotion of cooperation with 'Women In Nuclear(WIN)-Global'

II. Objects and Importance of Project

Importance of Project
- Advancement in the status of women specialized in nuclear through international cooperation.
- Arrangement for the invitation of 9th-Win-Global International Conference to Seoul, Korea.
- Supporting the IAEA Direct General on consulting activity regarding imminent problems women are confronting.
- Advocation of women’s activities in the area of scholastics, health science, industry as professionals.

Objectives of Project
- Investigations on the possible cooperation with WIN-Global association.
- Organization of practical information program for women in nuclear in and outside of nation.
- Enhancement of international relationship between WIN-Korea and WIN-Global
- Preparation of 9th-Win-Global International Conference to Seoul, Korea.

Final Objectives of Project

Contributions for the people to understand better on nuclear by the international cooperations with WIN-Global and providing the detailed informations through the complete investigations and Establishment of internet net working for supporting the women in nuclear in sharing the informations world widely.

III. Scopes and Contents of Project

- International collaboration with WIN-Global
- Evaluation on current status for the foundation of WIN~Korea and investigation on the 1st to 8th WIN~Global conferences for the arrangement of 9th WIN~Global conferences
- Manifestation on the roles of WIN~Korea and WIN~Global
- Encouragement of active participation for WIN~Global activities

○ Establishment of internet net working for effective communication through the internet net working between women in science in Korea and other foreign countries.
- Preparation and Organization of Women in Korea
- Foundation of WIN~Korea Home Page in Net
- Assembly of data for the net work construction in Korea

○ Enhancement of international cooperation between WIN~Korea and WIN~Global
- Invitation of 9th WIN~Global Conference in Seoul, Korea
- Enrollment of one of the Executives and Strengthening the activity of WIN~Korea as member of Board members
- Characterization on main movements of WIN~Global through the active participation in international activities.

○ Arrangement for the 9th WIN~Global conference
- Operation of Organizing Committee and Supporting Committee and Secretariat
- Supporting the 9th WIN~Global Confernece.

IV. Research Results

- The 9th WIN~Global Meeting
  Irene Aegerter, as an acting Chairperson of this 9th WIN Global General Assembly, welcomed all participants and introduced several WIN~Korea key members for their dedicated contribution to prepare this 9th Annual Meeting. Because Annick Carnino, President of WIN Global was absent at this meeting.
  It was reported that, at present, 56 countries represented WIN Global
members and the number is slightly over 2,000. She further reiterated the goal of WIN Global and the real idea of smiling atom (WIN Global logo). She then stressed that WIN should continue to make every possible effort for the right use of nuclear clean energy.

Unlike previous WIN General Assembly, from the 9th WIN Meeting, country reports were not formally allocated but general debates regarding current nuclear issues were highlighted. WIN Internet Status, Lifetime Extension, Radiation Programs and Special Cases of Nuclear in China, Finland, Czech Republic and Slovak Republic were presented.

A preliminary meeting to establish WIN-Asia as a regional structure was separately held after the closing of General Assembly. China, Japan, Korea, Mongolia, Taiwan and Vietnam were presented. Agneta Rising, as the immediate past president of WIN Global, attended at the meeting and gave remarks encouraging such establishment. Each proposed participating countries named a contact point for further progress.

Following the General Assembly, there were special presentations and invited presentations. Many social events were also arranged during the meeting such as demonstration of radiation-processed food.

A post-annual meeting tour was arranged for the participants from abroad that include visits to Young-Gwang Nuclear Power Plants of Korea Hydro & Nuclear Power Company, HANARO Research Reactor of Korea Atomic Energy Research Institute and Low-level radwaste management demonstration facility of Nuclear Environment Technology Institute of KHNP.

V. Applications of Research Results

○ More active public information of the goal in WIN-Global and WIN-Korea to Korean women specialist in nuclear
○ Study on advanced gender plan into nuclear field
○ Hold the second WIN-Korea annual meeting
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제 1 장 서 론

제 1 절. 연구개발의 필요성

가. 연구개발의 경제·사회·기술적 중요성

(1) 국제협력을 통한 우리 나라 여성 원자력 전문인의 위상제고

○ 우리 나라의 오늘에 이르기까지 40년에 이르는 원자력 연구개발 연혁을 기록하고 있고, 원자력발전에 있어서도 20년이 넘는 운전경험을 쌓고 있으므로 명실공히 국제적 원자력 선진대열에 진입하고 있음. 그러나 아직도 원자력에 대한 일반 국민의 인식과 이해는 만족할 만한 수준에 이르지 못하고 있어 국가 원자력사업의 추진에 어려움을 겪고 있는 실정임.

○ 원자력의 국민이해 증진을 위해서는 무엇보다도 원자력계에 직접 증가하고 있는 원자력 전문인들의 숭직한 노력이 필요함. 특히 여성원자력전문인들의 국민이해 증진활동은 여성 특유의 입장으로 접근할 때에 보다 효과적일 수 있음.

○ 외국에서는 일찍부터 여성원자력전문인들의 모임이 결성되어 원자력 사업의 국민이해 증진을 위하여 노력하고 있고 각국의 여성원자력 전문인의 모임을 결속하는 세계여성원자력전문인의 조직(WIN-Global)이 결성되어 있어서 활발한 활동을 펼치고 있음. 그러나 우리 나라에는 아직 그러한 조직이 결성되어 있지 못한 입장이어서 국제적으로 우리 나라 여성 원자력 전문인의 위상이 제고되어 있지 못한 실정임. 이와 함께 다른 나라처럼 세계 WIN과의 유대 관계가 직접적으로 형성되어 있지 못한 실정임.

○ 이와 관련하여 우선 세계 WIN의 국내 조치로서 여성원자력전문인의 모임을 구성하고 본이어 세계 WIN에 회원으로 정식 가입함으로서 여성원자력전문인협회를 통한 국제협력을 강화하고 나아가 우리 나라 원자력 기술능력의 위상을 높일 필요가 있음.

(2) 세계 WIN 연차 대회의 국내개최

○ 세계 WIN은 현재 세계 56개국이 회원국으로 가입되어 있으며 약 2천명의 회원을 거느리고 있음. 이는 IAEA와 같은 유엔기구를 제외하고는 원자력 전문인 모임으로서 가장 규모가 큰 것임. 우리 나라의 원자력을 이해하는 여성 모임(WIIN)을 중심으로 몇몇 인사들이 1998년부터 개인간으로 세계 WIN의 회원으로 가입하여 있음. 세계 WIN은 매년 회원국에서 연차대회를 개최하고 여성으
로서 세계 원자력 사업에 어떠한 기여를 할 수 있는지를 협의하고 있음.

- 세계 WIN 연차 대회는 97년 스페인, 98년 대만, 99년 미국에서 개최되었고 2000
년에는 핀란드에서 개최되었음. 세계 WIN 본부는 우리 나라 여성 원자력전문인
들이 모임을 조직하여 세계 WIN의 정규회원으로 가입할 것을 권유하고 있으며
아울러 2001년도 세계 WIN 연차 대회를 한국에서 개최할 것을 적극 지지하고
있음. 이와 관련하여 2000년 5월 4일 런던에서 열린 세계 WIN 임시위원회는
2001년도 제9차 세계 WIN 연차 대회를 한국에서 개최할 것을 만장일치로 지지
하였음. 이 사항은 2000년 6월 15일 핀란드의 헬싱키에서 열린 제8차 세계 WIN
연차 대회에서 확정되었음. 그리므로 2001년도 세계 WIN 연차 대회의 한국개최
를 WIN-Korea가 추천되어 수행하여야 할 임무임. 현재 우리 나라 원자력 기관에
중시하고 있는 여성전문인들은 약 120 여명에 이르고 있음.

- 따라서 동 연구과제를 통하여 우선 WIN-Korea 결성을 추진하고 나아가 제9
차 세계 WIN 연차 대회의 한국개최를 충실히 준비하고자 함. 즉, 대회 개최
에 따른 행정 지원을 수행하는 동시에 개최에 수반하는 경비 지원이 필요함.

- 세계 WIN 연차 대회 개최는 우리 나라 원자력 위상을 높일 수 있는 좋은 계
기가 될 것으로 전망됨. 또한 각국으로부터 다수의 원자력 전문인들이 박차하
게 되므로 외화의 국내 유입에도 기여하게 될 것임. 이는 국가경제에도 직접
기여하는 것이 될 뿐만 아니라 우리 나라 원자력 기술의 해외 진출의 계기로
삼을 수 있다는 이점이 있음.

(3) 여성문제에 대한 IAEA 사무총장 자문활동에 기여

- IAEA는 2001년 초반에 사무총장 자문기구로서 여성문제 특별자문위원회를 구성
할 계획임. 자문위원회는 세계 각 지역을 고려하여 8명으로 구성할 계획이며 우
리 나라에서는 WIN-Korea 명예회장인 신영순 박사가 위원으로 추천되어 있음.
이 위원회는 원자력 기관에서 종사하고 있는 여성 전문인들의 평등교육 및 지위
향상, 그리고 직업적 배려 (예컨대 여성 전문인에 대한 방사선 피폭의 차등 규
정)등을 실드 있게 고려하는 역할을 할 것으로 기대됨. 따라서 WIN-Korea가
IAEA 사무총장 자문 활동을 위한 기술지원에 기여할 수 있음.

(4) 학계, 의료계, 산업계의 여성 원자력 전문 활동 고취

- 여성 원자력 전문인은 원자력 기관뿐만 아니라 학계, 의료계, 산업계에서도 폭넓
게 활동하고 있음. 이들의 결속을 통하여 원자력의 사회적 위상을 높일 수 있으
며 무분별한 반핵 주장에 대응하는 논리를 제시할 수 있음. 이는 사회의 여론을
올바른 방향으로 이동하는 발판이 되는 것임.
제 2 절. 연구개발 목표
가. 연구개발의 총론 목표

(1) 세계 WIN과의 협력 방안 조사 연구

○ 세계 WIN 연차 대회에 적극 참여함으로써 여성 원자력 전문인들의 사회적 역할에 대한 세계동향 파악
○ 지금까지 개최된 세계 WIN 연차 대회 개최실적 등을 평가함으로써 향후 우리나라의 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출
○ 세계 WIN 연차 대회의 한국개최에 따른 준비 작업

(2) WIN-Korea와 WIN-Global 간의 효율적인 정보공유 체계 구축을 위한 기반 마련

○ 정보화시대에 부응한 WIN-Korea 및 WIN-Global 간의 정보교류 네트워크 구성을 위한 기반 마련
○ 우리 나라를 포함한 각국 WIN의 조직, 인력과 사업 등 총체적인 자료를 수집함으로써 네트워크 구축을 위한 기본자료로 활용
○ 각국 WIN 사업의 실적 평가 분석 등을 통한 효율적 사업추진 방안 모색

(3) 국내 원자력전문여성과 주요국 원자력전문여성간의 국제협력 증진 강화

○ 원자력산업은 기술적, 경제적 관점에서 국제적인 인적, 물적 정보의 교환과 상호 이해가 필수적으로 요구되는 분야이며 다른 에너지원과 달리 기술집약산업인 원자력발전은 국가간의 활발한 기술협력에 대한 정보교류가 필요함
○ 이에 국내 여성원자력전문인과 WIN-Global 회원국의 원자력전문인들의 여성원자력전문인들과 예산정책 및 기술개발, 원자력의 대국민 홍보에 대한 경험을 교환하기 위해 각종 원자력관련 국제회의 참가, 인적, 물적 정보교환을 통하여 국제간의 원자력홍보 및 정책동향을 파악하고 이를 바탕으로 대국민 이해를 높이기 위한 정보제공을 통한 국제협력 증진

(4) 제9차 세계 WIN 연차대회의 국내개최 확정에 따른 준비

○ 2001년 5월 제9차 세계 WIN 연차대회 서울에서 개최될 예정인 바, 이 대회를 성공적으로 개최하고 내실 있는 회의가 되도록 하려면 사전에 구체적인 계획을 수립하여 준비해야 함
동회의 개최를 위한 조사연구와 회의준비를 위한 정부차원에서의 지원이 있어야 할 것입니다. 특히 2001년의 세계대회는 우리 나라의 원자력 위상을 세계 각국에 전파할 수 있는 좋은 기회이므로 사전에 착실한 준비가 이루어져야 할 것입니다.

KAERI와 세계 WIN의 공동 조사연구 사업이 발판이 되어 2001년 세계 WIN의 행사준비를 완화하게 추진하였습니다.

(5) 세계 WIN 연차 대회 국내개최 지원

2001년 4월 우리나라에서 예정되어 있는 세계 WIN 연차 대회의 성공적인 개최를 위해 행정지원을 수행하는 동시에 이에 따른 개최 경비 일부 지원 (개최 경비 중 상당분부는 국내 원자력 관련기관으로부터 지원 받음)
나. 연구개발의 연차별 목표 및 내용

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-항후 우리 나라가 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출 | -여성 전문인들의 역할에 대한 세계주체 파악 및 항후 우리 나라가 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출 |
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-WIN 관련 자료 수집을 통한 네트워크 구축을 위한 기존자료 활용  
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| 세계원자력여성전문가기구(WIN-Global)와의 협력을 통한 국내 여성 원자력전문가 네트워크 확보 | -세계 WIN과의 협력을 통하여 여성 원자력전문가의 국제협력 산업계 진출 확대 | -세계 WIN과의 협력 |
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제 2 장 국내·외 기술개발 현황

가. 지금까지의 연구개발 실적

○ 지금까지 세계 여성원자력전문인협회와의 협력을 통한 여성의 원자력 전문직
  진출 방안 연구개발 보고서는 없는 실정임

나. 연구 개발하려는 기술 또는 내용의 기술발전주기 (Technology Life Cycle)를
  세계 수준과 비교할 때 현재 어느 단계에 해당되는지 표시함.

■ 개념정립 단계  □ 기업화 단계  □ 기술의 안정화 단계

다. 현 기술상태의 취약성

○ 국내 원자력업체에 직접 종사하고 있는 여성의 수가 점차 확대되고 있지만 여성
  전문인력의 진출기회 향상을 위한 별다른 조치가 취해지지 않은 상태이며 또한
  현장에서 일하고 있는 여성 전문인들은 간의 정보교환 등을 위한 기본적인 네트워크
  구축이 이루어지지 않았으며 또한 우리 나라 여성 원자력 전문인들이 세계
  원자력 사회에서 적극적인 역할을 수행하기 위한 효과적인 참여방안에 대한 연
  구가 현재까지 수행되어 있지 않음

라. 앞으로의 전망

○ WIN-Korea의 결성 지원 및 2001년 5 월 제9차 세계 WIN 연차 대회의 성공적
  개최 지원으로 우리 나라 여성 원자력전문인과 세계 원자력 전문 여성들과의 정
  보교환 활성화 등 협력 증진

○ 학계, 의료계 및 산업계에서 복면계 활동하고 있는 여성원자력전문인들의 결속
  을 강화함으로서 원자력의 사회적 위상 제고

○ 여성전문인력의 원자력 분야 진출증대 방안 강구

○ 여성원자력전문인 간의 정보교류 네트워크 구축으로 여성 원자력전문직 활동에 대
  한 정보 및 경험 교류
제 3 장 연구개발수행 내용 및 결과

제 1절 연구 수행 내용

가. 세계 WIN과의 협력 방안 조사 연구
   (1) 세계 WIN 연차 대회에 적극 참여함으로써 여성 원자력 전문인들의 사회적
       역할에 대한 세계적 화두
   (2) 지금까지 개최된 세계 WIN 연차 대회 개최실적 등을 평가함으로써 향후 우
       리 나라의 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출
   (3) 세계 WIN 연차 대회의 한국개최에 따른 준비 작업

나. 국내 여성 원자력 전문인 및 원자력 선진국 여성 원자력 전문인간의 효율적인
   정보공유 체제 구축을 위한 기반 마련
   (1) 정보화시대에 부응한 국내 여성원자력전문인 및 원자력 선진국 여성원자력전
       문인간의 네트워크 구성을 위한 신속한 정보 공유 시도
   (2) 우리 나라를 포함한 각국 WIN의 조직, 인력과 사업 등 총체적인 자료를 수집
       함으로써 네트워크 구축을 위한 기본자료로 활용
   (3) 각국 WIN사업의 실적평가 분석 등을 통한 효율적 사업추진 방안모색

다. 국내 원자력 전문여성과 원자력 선진국 원자력 전문여성간의 국제협력 증진
   강화
   (1) 원자력은 기술적, 정책적 관점에서 국제적인 인적, 물적 정보의 교환과 상호이
       해가 필수적으로 요구되는 분야이며 다른 에너지원과 달리 기술검증산업인 원
       자력사업은 국가간의 활발한 기술협력에 대한 정보교류가 필요
   (2) 이에 국내 원자력전문여성과 WIN-Global 회원국들에 속하는 원자력선진국들
       의 여성들과 에너지정책 및 기술개발, 원자력의 대국민 홍보에 대한 경험을
       얻기 위해 각종 원자력관련 국제회의 참가를 통한 국제협력 증진

라. 제9차 세계 WIN 연차 대회의 국내개최 확정에 따른 준비
   ○ 2001년 5월 제9차 세계 WIN 연차 대회의 서울 개최가 확정되었으므로 2001년
      우리 나라 회의를 성공적으로 개최하고 내실 있는 회의가 되도록 구체적인 계
      획을 수립하여 준비함.
마. 세계 WIN 연차 대회 국내개최 지원

○ WIN-Korea에서는 2001년 5월 우리 나라에서 열리는 세계 WIN 연차 대회의 성공적인 개최를 위해 행정지원을 수행하는 동시에 이에 따른 개최 경비 일부 지원함 (개최 경비 중 상당부분은 국내 원자력 관련기관으로부터 지원 받았음).

제 2 절 연구 개발 실적

가. 세계 WIN과의 협력 방안 조사 연구

(1) 세계 WIN (WIN-Global) 연차 대회에 적극 참여함으로써 여성 원자력 전문인들의 사회적 역할에 대한 세계동향 파악

(가) WIN-Global의 설립 과정


초대 회장은 스위스의 Irene Aegerter여사가 맡았고 2대회장은 1997년부터 스웨덴의 Agneta Rising 여사가 맡았다. 3대회장은 2000년 6월부터 IAEA의 Annick Carnino 여사가 맡게 되었다.

(나) WIN-Global의 현황

2000년 6월 현재 WIN-Global은 세계 51개국에 걸쳐 2000여 명의 회원을 거느리고 단체로 성장하였다. 국내에 WIN 조직을 별도로 갖고 있으면서 WIN-Global에 회원으로 가입한 국가는 22개국이다. 아르헨티나, 벨라루스, 브라질, 불가리아, 카나다, 체크 공화국, 핀란드, 프랑스, 핀란드, 인도네시아, 일본,
한국, 멕시코, 루마니아, 러시아, 슬로바키아, 스페인, 스위스, 대만, 우크라이나, 미국, 그리고 Nordic WIN(노르웨이, 덴마크, 스웨덴)이 이에 속한다.

원자력계에 직접 종사하고 있는 여성 전문직의 단체는 아니지만 에너지문제에 깊은 관심을 가지고 있는 단체로서 WIN-Global에 회원으로 가입한 국가는 일본, 한국, 스웨덴, 스위스, 미국 등이다. 일본의 WEN (Women Energy Network), 한국의 WIIN 이 이에 속한다. 다만, 한국과 스위스의 경우에는 원자력과 환경문제에 깊은 관심을 가지고 있는 원자력 비전문의 여성단체이다. 이러한 경우에는 협동회원(Associate Members)으로 참여하게 된다.

WIN-Global의 회원이 있는 국가는 호주, 오스트리아, 벨기에, 철레, 중국, 크로아티아, 덴마크, 독일, 아이슬란드, 인도, 이스라엘, 카자흐스탄, 리투아니아, 몽골리아, 나미비아, 네덜란드, 노르웨이, 파라과이, 필리핀, 폴란드, 슬로베니아, 터키, 영국, 우루과이, 베네수엘라, 베트남이다. 이들 국가에서는 원자력계에 직접 종사하고 있는 전문직 여성이 개인자격으로 WIN-Global의 회원으로 가입하였다.

(다) 세계 WIN 연차대회 (WIN-Global Annual Meeting)


우리나라는 2001년 대회를 유치하기 위하여 이미 지난 3월 당시 WIN-Global 회장인 스웨덴의 Agneta Rising에게 지원을 당부하는 서한을 보냈으며 4월 초순에는 각 집행위원에게 지시 요청 서한을 보낸바 있다. 우리 나라 WIIN은 “From West To East”라는 전략으로 세계대회를 동서양에서 번갈아 갖는 것이 세계 원자력산업의 조화 있는 발전을 위하여 바람직하다는 주장을 내세웠다. 우리 나라와 같이 원자력산업이 활발한 입장에서 세계 WIN 연차 대회를 이체야 개최하는 것은 오히려 늦은 간이 있는 일이다. 멕시코와 프랑스도 2001년 세계 대회를 개최하겠다고 제안한바 있으나 2000년 6월의 세계 WIN 연차 이사회에
서 만장일치로 한국 개최가 결정되었다. 이보다 앞서 2000년 5월 4일 런던에서 있은 세계 WIN 집행위원 이 문제를 협의한 결과 집행위원 거의 모두가 한국 개최를 지지한바 있다.

(라) 세계 WIN 상 (WIN-Global Award)


WIN 인터넷 사이트에 등재된 신영순 박사의 수상 소개내용은 다음과 같다.

Third WIN Award to Shin Young-soon

"Dr. Shin, President of Women Interested In Nuclear (WIIN) in Korea, is also the president of Shin General Hospital. With high reputation and social position, Dr. Shin has played a leading role in organizing WIIN which has 8000 members in 15 local branches in 1997. Since its inauguration in December 1995, WIIN has conducted many activities to facilitate the public understanding of nuclear power."

(3회 WIN 국제상, 신영순 박사에게
한국의 원자력을 이해하는 여성 모임 총재인 신 박사는 申病院 원장이기도 하다. 사회적 명망이 높은 신 박사는 1997년 현재 15개 협의회에 8천 여명의 회원을 거느린 WIIN 창립을 위해 주도적인 역할을 하였다. 1995년 12월 창립된 WIIN은 그 동안 원자력발전에 대한 일반 국민의 이
해를 중진하기 위해 많은 활동을 하였다.

(마) 우리 나라 여성 인권역전문인들이 WIN-Global과의 유대를 갖는 것은 늘은 감이 있으나 당연히 필요한 일이다. 여성인권역전문인의 위상을 높이며 여성인권역전문인으로서 인권에 대한 국민이해증진에 기여할 수 있는 세계적 주역에 동참할 필요가 있기 때문이다. 더구나 우리 나라는 인권역

사업에 있어서 세계선진국들과 어깨를 나란히 하고 있는 입장이지만 지금까지 여성인권역전문인의 활동 상황은 미약한 실정이었다. 이번 기회에 우리 나라 여성 인권역 전문인의 역할과 사명을 제정립할 필요가 있다.

(2) 지금까지 개최된 세계 WIN 연차 대회의 개최실적 등을 평가함으로써 향후 우리 나라의 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출


(나) 제6차 타이베이 대회

제7회 세계 WIN 연차 대회가 타이완의 타이베이에서 WIN-타이베이 주관 아래 1998년 4월 22-24일 열렸다. 아르헨티나, 벨지아, 런던, 프랑스, 독일, 일본, 리투아니아, 한국, 스웨덴, 미국 등 11개국에서 60여명의 대표가 참석하였다. 개회식은 회장인 Agneta Rising의 사회로 진행되었다. 본회의에서 Agneta Rising이 회장으로 연임되었으며 한국의 WIIN 총재인 신영순 박사에게 제3회 WIN 국제상이 수여되었다. 한국의 WIIN에서는 신
영순 총재를 비롯하여 박춘수, 최민숙, 문정수, 윤요진, 최수남씨 등 일부 WIIN 회원들이 5명이 참석하였다.

① 국가보고와 파넬토론


제1일 회의가 끝난 후에는 대만원자력위원장 C P Hu 및 PECL 회장 K C Liu가 공동 주최하는 공식 만찬이 있었다. 세계 WIN 연차 대회를 공동 후원하고 있는 대만 핵종합소 (INER), 대만전력공사 (Taipower), FMCA 의 대표들도 자리를 함께했다.

4월 23일에는 중산(용담)에 있는 대만 핵종합소 시설을 방문하였다. 프리스마 코팅 시설, 폐기를 감응시설, 사이클로트론 시설 등을 시찰하였다. 타이베이로 돌아오는 도중 도쿄사원을 관람하였다. 4월 22일 오후에는 Agneta Rising을 포함한 몇 명의 WIN 대표들이 기자회견을 하였다.

② 원탁토론

(다) 제7차 위성톤 대회


다음날인 5월 22일(토)에는 WIN 전체회의가 계속되었다. 세계 WIN 연차 대회를 포함하는 회의였다. 국가보고와 일반 토론이 진행되었다. 토요일 오후에는 WIN Breakout Session이 있었다. 잠시 간언을 들는 세션이었다. 고문위 방사성폐기물 (사용후핵연료)의 영구처분을 위한 유카(Yucca)산맥 국제 프로젝트에 대한 설명과 세 전년의 원자력 전망에 대한 강연이 있었다.

일요일인 다음날에는 오전에 주최측에서 주선한 관광 프로그램이 있었다. 버지니아주 마운트 버논 (Mt. Vernon)을 방문하는 프로그램이였다. 위성톤 대통령이 살던 옛 저택이 있는 곳이었다. 오후에는 각자 자유시간이었다. 명색은 ‘위성톤 탐험 자유시간’ (Free time to explore DC) 이었다. 5월 24일 (월)에는 산업시찰이 마련되었다. 메리랜드주에 있는 ‘캘비트 클리프스’ (Calvert Cliffs) 원전을 시찰하는 것이었다.

(라) 제8차 랜싱키 대회

① 이사회

2000년도 제8차 세계 WIN 연차 대회는 6월 14-17일 핀랜드의 랜싱기에 서 열렸다. 첫날인 6월 14일에는 아침 일찍 로비사 (Loviissa) 원전을 시찰하는 프로그램이 준비되었다. 로비사 원전은 러시아가 제공한 480 MWe의 VVER이다. 시찰중 우리 나라 신영준 박사는 지방 신문 및 방송기자와의 회견을 가지기도 했다. 우리 나라 원자력 사업에 대한 관심 이 초점이었다.

오후에는 라디슨 호텔에서 이사회가 열렸다. 22개 이사국 중 19개 이사국이 참가하였다. 우리 나라 이사로는 신영준 박사가 참석하였다. 이사회
에서는 2001년 세계 WIN 연차 대회를 한국에서 개최하는 안건이 반장 일치로 가결되었으며 우리 나라 WIIN의 세계 WIN 협동위원 가입이 승 인되었다. 또한 새로운 이사국으로 'WIN-Japan'이 설립된 일본과 'U.S. WIN'이 결성된 미국이 자동적으로 선임되었다.

6월 15일에는 연차대회가 열렸다. '와나 사타마'라고 하는 헬싱키 부두가의 회의장 겸 전시장 전용 시설에서 열렸다. 개최식에서는 WIN-Finland 회장인 Anneli Nikula 여사가 개회사를 하였고 핀란드 원자력학회장이 환영사를 하였다. 오전의회에서는 여러 가지 토론이 열리되었으며 신임 회장으로 IAEA의 Annick Carminio 여사를 선임하였다. 오후부터는 각국의 Country Report가 있었다. 우리 나라는 신영준 박사가 보고하였다.

6월 16일에의 오전 세션이에서는 국가보고가 계속되었으며 오후에는 특별 강연이 있었다. 핀란드 에너지협회 (Finergy) 회장이 "지구 기후 변화와 북극의 입장"에 대하여, 그리고 핀란드의 원자력발전 사업과 폐기물 관리 사업에 대한 강연이 있었다. 자료 토론에서는 원자력발전에 대한 신뢰 구축 문제가 충분적으로 다뤄졌다. 참가자들은 작년 12월 원전을 폐쇄하기 시작한 스웨덴의 경우와 최근 원전 폐쇄 정책을 철회한 독일의 경우에 대하여 우려를 표명하고 일반 대중의 이해 증진을 위해서는 원자력계 스스로가 신뢰 구축에 모범이 되어야 함을 강조했다.

6월 17일에는 '올킬루오토'원전 시찰이 있었다. 이 원전은 스웨덴의 아세아 아름이 제공한 것이지만 미국 기술이 상당히 가미된 것이므로 이스 탕하우스 원전이란 소리를 듣고있는 것이다. 발전소를 시찰하기 전에 인근 라우마 마을을 관광하였다. 이 마을은 유네스코의 세계문화유산으로 지정된 유서 깊은 곳이다.

(2) 국가보고

2) 각국대표 또는 기관이나 단체의 대표는 대회 세션 중 국가보고를 구두발표 하도록 되어있다.

4) 구두발표 대신 포스터 발표를 할 수도 있다. 발표내용을 프린트하여 포스터 형식으로 게시하는 것이다. 구두발표 내용을 보완하기 위해 포스터 발표를 겸용할 수도 있다.

4) 국가보고 내용은 그 나라의 원자력 사업 중 특기사항과 WIN 국내
활동을 중점으로 보고하는 것이다. 국가보고의 내용은 2 파트로 구분
하도록 하고 있다.
- 첫째 파트에 포함될 내용은
  * 가동중인 원전의 기수 (최초 원전 및 최근 원전 가동 연도)
  * 전체 발전 용량중 원전의 점유율
  * 연구용 원자로 가동 기수 및 대표적인 원자력연구소
  * 원자력 기술의 발전 이외의 응용
  * 영구 가동 중지한 원전 기수
  * 영구 폐쇄한 원전 기수
  * 건설중인 원전 기수
  * 계획중인 원전 기수
  * 최근의 에너지 정책 (간략하게)
  * 일반 대중의 견해 추세 (원전, 폐기물 등에 대한)
  * WIN 회원 수 및 창립연도

- 둘째 파트에 포함될 내용은
  * 작년도 국가 원자력 사업의 중요 사항과 앞으로의 추세
  * WIN의 주요 활동
  * WIN의 주요 업적
  * WIN의 주요 사업계획 및 목표
  * 일반대중의 여론에서 남녀 차이

3. 사전 전시
- 대회 기간 중 WIIN의 활동 및 우리 나라 여성 원자력 과학자들의 활동
  내용을 중심으로 사전 전시회를 가졌다. 14 장의 사진을 전시하였다. 이와
  함께 우리 나라 원자력 사업을 소개하는 비디오를 계속 상영하였다.

(3) 세계 WIN 연차 대회의 한국개최에 따른 준비 작업

2001년도에는 제9차 세계 WIN 연차 대회가 우리 나라에서 개최될 예정으로 원
자력 비전문인 모임인 ‘원자력을 이해하는 여성 모임’ (WIIN)에서 준비하고 있
었으나, WIN-Global이 원자력 여성 전문가들의 모임인 것을 고려하면, 이에 상
응하는 국내의 원자력 여성 전문가 모임의 결성이 요구되며 세계 WIN 연차 대
회에서의 우리 나라 원자력 여성 전문가들의 역할은 매우 중요하다. 따라서 세
계 WIN 연차 대회를 성공적으로 개최하고 향후 원자력 여성 전문가들간의 국제 교류의 장이 되기 위하여 원자력 여성 전문가의 모임(WIN-Korea)을 결성하였다.

(가) WIN-Korea 창립 (2000년 11월 7일)
원자력 업무에 직접 종사하고 있는 여성 원자력 전문인의 모임인 WIN-Korea의 창립총회가 2000년 11월 7일 한국과학기술회관에서 있었다. WIN-Korea는 여성과 차세대 층에게 원자력에너지와 방사선 이용에 대한 음바른 이해를 증진하며 여성 원자력 전문인들 간에 서로 정보와 경험을 교류하는 네트워크를 구성하기 위한 모임이다.

① WIN-Korea의 결성
○ 준비위원회 모임 : 원자력 여성 전문가들의 대화 장구를 만들어 원자력 홍보 분야뿐만 아니라 원자력계 발전을 위한 여성의 역할을 부각시키고 남성들과 더불어 우리의 원자력 산업이 한 차원 발전할 수 있는 계기를 마련하고자 원자력 관련 기관의 여성 전문가 몇 명이 회합을 가지고 WIN-Korea 결성을 원칙적으로 추진하고자 합의함.
○ 회원모집 : 국내 원자력 관련 기관에서 종사하고 있는 여성 전문인의 현황을 파악하고 발기인 일동 명의로 설립취지문 및 가입신청서를 송부하여 희망자에 한하여 회원 등록을 받음. 2001.2. 23일 현재 총 84명의 회원을 확보함
○ 창립준비위원회 결성 : 원자력 관련기관 (원자력문화계단, 원자력연구소, 원자력안전기술원, 한국전력기술주식회사, 한전전력연료주식회사, 원자력병원, 원자력학회, 한국전력공사)의 대표들이 모여 WIN-Korea 설립 준비 경과와 향후 계획 보고를 받고 총영합과 동시에 적극 지원을 약속함.
○ 창립준비위원 모임 : 2000. 9. 29일 12명의 회원이 모여 창립 준비 모임을 가짐. IAEA에서 WIN-Global 회장과 협의했던 사항이 설명되었으며, WIN-Korea의 규약이 검토되었고 조치가 논의되었음. 제2차 준비위원회 모임에서는 규약 완성을 위한 소위원회를 구성하여 위임하였고, WIN-Korea는 회장을 대표로 하고, 회장을 자문하는 명예회장을 두기로 하였음. 회장 산하에 감사 2인과 총무 1인을 두며, 회장을 보좌하기 위해 3명의 부회장을 두고, 운영부, 재정부, 홍보부, 사업부, 국제협력부를 두되 각 부에 3명씩의 부장을 위임키로 하였음.
○ 창립총회 개최 : 2000년 11월 7일 서울 역삼동 소재 한국과학기술회관에
서 창립 총회를 열고 기념식과 기념강연회를 가졌음. 현재 국내 각 원자력 전문기관에서 근무하고 있는 여성 원자력전문인 약 80 여명이 가입함으로써 세계 여성 원자력 전문인 단체 (WIN-Global)의 한국 지부로서 활동하게 되었음. 명예회장에 ‘원자력을 이해하는 여성모임(WIIN)’의 신영순 총재를 추대하고, 초대회장에 원자력병원 부원장인 홍성운 박사를 선임하였음. WIN-Korea의 운영 조직으로서는 회장 산하에 부회장 3인 (연구기관, 산업체, 학계 대표 각 1인)을 두었으며 행정지원 업무를 위하여 총무를 선임하였고 5개 사업 부서를 두어 각각 관련 사업을 개발하도록 했음. 5개 부서는 회원간의 네트워크를 담당하는 총무부, 세미나 및 학술행사를 관리하는 사업부, 국제협력부, 재정부, 홍보사업을 관리하는 사업부임.
(나) 세계 WIN 연차 대회 국내개최에 따른 준비


○ 운영위원회 개최 : 2000. 12. 8 한전 회의실에서 원자력 관련 기관의 대표들이 모여 세계 WIN 대회 개최에 따른 경비를 각 기관이 분담하여 지원할 것을 확인하였음.

○ 제1차 임원회 모임 : 2000.11.7 창립총회를 가진 후 12월 27일 첫 임원회를 개최하여 2001년도 사업계획, 회원 확장 건, 임원교체 건을 협의하였고 세계 WIN 연차 대회 준비와 관련하여 다음사항을 협의하였음.

- 기술 프로그램위원회 구성 : 세계 WIN 연차 대회의 주제강연, 초청강연, 특별강연의 검정체목을 정하고 국내외 연사를 선발하는 업무를 맡을 기술 프로그램위원회 (TPC) 위원을 위촉하였음. 기술 프로그램위원회에는 미국과 일본의 WIN 회장을 포함하였음.

- 초청 강연의 범위 : 다음과 같은 사항을 검증 주제로 하여 강연 제목을 정하고 강사를 교섭토록 함.

1) 한국의 원자력 발전사업과 폐기물 관리 사업

2) 원자력의 실생활 양용 확대
3) 여성 과학자의 사회적 역할

4) 한국 문화 소개


- 장소협의: 고속버스터미널 인근의 팔레스호텔

- 대회 안내문 제작: 대회를 소개하는 안내 리플릿(가급적 Advance Program 형식)을 만들어 국내 WIN 회원 및 각국 WIN 회원에게 발송함.


○ TPC 모임: 임원회에서 결정된 TPC 위원들이 2차례 모여 강연주제와 발표 자료를 다음과 같이 정하고 교섭함.

1) 한국의 원자력 발전사업 (한수원 최양우 사장)
2) 양성자방출 단층촬영 (PET)의 생활 이용 (KCCH 홍성운 핵의학과장)
3) 예방의학과 일상생활에 대하여 (차병원 안명옥 박사)
4) 여성 과학자의 사회적 역할 (KAIST 윤정로 교수)
5) 원자력 안전문화 정착을 위한 노력 (KINS 은영수 전문위원)
6) 원자력의 설생활 응용 확대(동위원소 관련) (KAERI 박경배 하나로 센터장,
원자력병원 은연숙 면역학연구실장)

또한 외국 강사로서는 1) 우리나라연구소 (Uranium Institute)의 역할과 원자력 이용 진흥 (우라늄 연구소 회장 Agneta Rising) 2) 미국의 새로운 원자로에 대한 일반의 인식 (미국 원자력에너지 연구소 Patricia Brynat) 3) 일본의 JCO 사고와 사회적 영향 평가 연구 (일본 CRIEPI 선임연구원 Tomoko Tsuchiya) 4) 여성문제에 대한 IAEA의 역할 (IAEA 원자력시설 안전국장 Annick Carnino)

○ 세계 WIN 연차 대회 준비 임원회 모임
- 특별강연 및 초청강연: TPC 위원장 세계 WIN 회장 측과 협의하여 다음과 같이 특별강연을 갖기로 하고 초청강연을 TPC에서 결정한대로 따르기로 하였음.

특별강연: 1) WIN 세계회장 (Annick Carnino)
2) Uranium Institute 회장 (Agneta Rising)
3) 미국 WIN 대표 (US-WIN 회장 Patricia Bryant로 교섭)
4) 일본 WIN 대표(WIN-Japan 회장 Ogawa가 추천하도록 함.)

- 국내 초청강연 예정자에게는 홍성운 회장 명의로 강연 참석서를 발송하였음.
- 강연원고(영문)는 늦어도 4월 15일 이전까지 TPC 위원장 또는 사무국이 접수하여 Proceeding (또는 CD-Rom) 작업을 추진하기로 함.
- 강연자에 대한 사례는 감사패를 제작하여 증정하는 것을 원칙으로 하되 외부강사에 대한 강연료를 지급하는 방안에 대해서도 TPC가 검토하기로 함.

- 예산안: 2000. 12. 8 한전 회의실에서 있었던 제1회 운영위원회의 에서는 WIN-Korea가 작성한 예산안을 국제회의 경제가 많은 원산측과 1월중 협의를 가지고 추진토록 권고되었음.

- 문화행사 (한복 쇼, 인상 소개, 김치 또는 한과 시연, 방사선 조사식품 및 식이 식품 소개, 사물놀이, 민속촌 관람, 코리아하우스 공연관람 등) 계획을 설
명하였음.

- 리플렛 제작: 사무국은 현재 Advance Information 용으로 4 page짜리 리플
  � Hansen 사무국을 발간하여 각국 WIN 회원에게 우수하였으며, Final Program은 확정된
  세부 프로그램 등 여러 내용을 취합하여 8 page짜리 팜플렛을 발간하였습니다.

- 세계 WIN 연차 대회 준비 및 진행을 원활하게 하기 위하여 집행위원회, 기술
  위원회, 운영위원회 및 사무국을 구성하였습니다.

나. 국내 여성 원자력 전문인 및 원자력 선진국 여성 원자력 전문인간의 효율적
인 정보공유 체제 구축을 위한 기반 마련

(1) 정보화시대에 부응한 국내 여성원자력전문인 및 원자력 선진국 여성원자력전
문인간의 네트워크 구성을 위한 신속한 정보 공유 시도
  ○ WIN-Global은 매년 회원국에서 연차대회를 개최하고 여성으로서 세계 원자
  력 사업에 여성을 기여할 수 있는지를 협의한다. 세계 WIN 연차 대회는
  97년 스페인, 98년 대만, 99년 미국에서 개최되었고 2000년에는 핀란드에서
  개최되었다. WIN-Global 본부는 우리 나라 여성원자력전문인들이 모임을
  조직하여 WIN-Global에 가입할 것을 권유하고 있으며 아울러 2001년도 세
  계 WIN 연차 대회의 한국 개최를 적극 환영하였다.

- 따라서 동 연구결과를 통하여 세계 WIN 연차 대회의 한국 개최를 추
  도하여 우리 나라 원자력 위상을 높일 수 있는 좋은 계기가 될 뿐
  아니라 국가 원자력 사업의 국민이해 증진을 위해서도 기여할 것으로
  전망된다. 또한 각국으로부터 다수의 원자력 전문인들이 활발하게 되
  민으로 원자력 선진국 여성 원자력 전문인들과의 네트워크를 통해 우리
  나라 원자력 기술의 해외 진출의 계기를 삼을 수 있다는 이점이 있다.

(2) 우리 나라를 포함한 각국 WIN의 조적, 인력과 사업 등 총체적인 자료를 수집
함으로써 네트워크 구축을 위한 기본자료로 활용

- 1992년 WIN-Global이 처음 출범할 때에는 가입한 회원을 대표하는 국가들이
  유럽을 중심으로 한 일부였다. 그러나 해를 거듭할수록 WIN-Global의 설립
  취지에 찬동하는 회원이 증가하였고 이에 따라 그 회원을 대표하는 국가의

(3) 각국 WIN 사업의 실적평가 분석 등을 통한 효율적 사업추진 방안모색

WIN-Global이 결정된 목적은 원자력에너지 및 방사선에 대한 일반 대중, 특히 여성과 차세대 어린이들의 이해를 여성 원자력전문인의 시각에서 증진하는 것이다. 이를 위하여 WIN-Global은 각국 국내조직이 중심이 되어 여성과 어린이를 위한 교육 프로그램의 개발, 원자력 시설 시찰을 통한 현장 경험의 증대, 교사들을 대상으로 한 세교육 프로그램 등을 적극 지원하고 있다. WIN-Global은 이와는 별도로 세계가 당면하고있는 원자력 현안에 대하여 의견을 개진하는 활동도 하고 있다. WIN-Global은 지구환경문제, 방사선 교육 문제, 여성 전문인의 지위향상 문제(전문직 진출 확대 포함)등에 대하여 성명서(Statement)를 작성하여 WIN-Global으로서의 입장을 천명하고 있다. 이러한 사항들은 우리 나라에서도 충분히 반영해야할 중요한 사항이므로 앞으로 WIN-Global과의 유대강화를 통하여 원자력 현안과 원자력국민이해증진에
- WIN-Global의 여러 국내조직 중에서 WIN-Japan은 여성 원자력홍보 요원의 양성 훈련에 많은 비중을 두고 있다. 여성의 시각과 여성의 언어로서 원자력 문제를 접근하고 설명한다면 많은 효과를 볼 수 있다는 생각 때문이다. 우리 나라에서도 각 원자력홍보관, 원자력연구기관 등에서 여성 원자력홍보요원을 양성함이 필요하다.


- 동구의 WIN 조직에서는 교사 및 여성 단체 대표들의 원자력시설 시찰을 다각도로 추진하고 있다. 동구의 원전이 대부분 구조변이 제공한 VVER형 또는 문제의 소지가 많은 RBMK형이기 때문에 안전을 위한 노력을 현장에서 보여주어 이해를 증진하는 노력을 기울이고 있는 것이다.

- WIN-Taipei는 사회주의도인사를 대상으로 한 원자력 이해증진 프로그램에 많은 노력을 기울이고 있다. Taipower와 AEC가 많은 지원을 해주고 있다. WIN-Korea도 다른 나라 WIN의 프로그램을 거울로 삼아 국민이해증진을 위해 노력을 기울여야 할 것이다.

다. 국내 원자력 전문여성과 원자력 선진국 원자력 전문여성간의 국제협력 증진 강화

(1) 원자력을 기술적, 정책적 관점에서 국제적인 인적, 물적 정보의 교환과 상호 이해가 필수적으로 요구되는 분야이며 다른 에너지원과 달리 기술집약산업인 원자력산업은 국가간의 활발한 기술협력에 대한 정보교류가 필요함
(2) 이에 국내 원자력전문여성과 세계 WIN 회원국들에 속하는 원자력전문국들의
여성들과 에너지정책 및 기술개발, 원자력의 대국민 홍보에 대한 경험을 얻기
위해 각종 원자력관련 국제회의 참가를 통한 국제협력 증진

라. 제9차 세계 WIN 연차 대회의 국내개최 확정에 따른 준비

○ 2001년 5월 제9차 세계 WIN 연차 대회의 서울 개최가 확정됨. 따라서 2001년
우리 나라 회의를 성공적으로 개최하고 내실 있는 회의가 되도록 구체적인 계
획을 수립하여 준비할.

- 동 회의 개최를 앞세워 사의한 조사연구회 회의준비를 위한 정부차원에서의
지원이 있었으며, 특히 2001년의 세계대회는 우리 나라의 원자력 위상을
세계 각국에 전파할 수 있는 좋은 기회이므로 착실한 준비가 이루어졌다.
- KAERI와 세계 WIN의 공동 조사연구 사업이 발원이 되어 2001년 세계 WIN
연차 대회의 준비가 원활하게 추진되었다.

마. 세계 WIN 연차 대회 국내개최 지원

○ WIN-Korea 에서는 2001년 5월 우리 나라에서 열리는 세계 WIN 연차 대회의
성공적인 개최를 위해 행정지원을 수행하는 동시에 이에 따른 개최 경비 일부
지원을 보완용(개최 경비 중 상당부분은 국내 원자력 관련기관으로부터 지원 받았음.)

- 국내 WIN 운영위원회를 열어 대회 개최에 따른 소요경비 확정 및 관관 분
담 협의하였다. (운영위원회는 안전기술원장, 원자력문화재단이사장, 한국수
력원자력발전회사 사장, 한전전력연구원장, 원자력연구소장, 원전연료(주)사
장, 전력기술(주)사장, 동위원소협회장, 원자력 학회장, 원산상근부회장, 원자
력병원장으로 구성)

- 원자력 선진국과 사전 연락: WIN 사무총장 및 미국, 일본의 WIN 회장 등
과 긴밀한 점검을 통하여 특별강연사 및 회원참여 도리를 확인하였다.
- 기타 회원국으로부터 한국 참여 확보: 동 유럽국 대표의 한국 초청하였다.
바. 제 9회 세계 WIN 연차대회 개요

(1) 대회 개요
- 연차대회 참석현황 : 이번 회의에는 현 WIN-Global 회장인 IAEA 소속 Annick Carnino 국장이 긴급한 개인사정으로 참석치 못하였으나 초대회장인 스위스의 Irene Aegerter 여사와 2대 회장인 스웨덴의 Agneta Rising 여사가 회장 대리로서 회의를 진행하여 이사회와 총회를 성공적으로 마칠 수 있게 되었음. 이번 연차대회에는 17개 국가에서 40여명의 WIN 회원들이 참석함으로서 지금까지의 연차 대회 중 가장 많은 외국 회원들이 참석하는 성황을 이루었으며 이것은 우리 나라의 원자력사업과 여성 원자력 전문인들의 위상이 그만큼 높아진 것을 의미하는 것이라고 평가할 수 있을. 국내 참가자들은 약 1백 명에 이르렀으며 다수의 WIN 회원과 함께 WIN-Korea의 목적에 찬동하는 국내 원자력계 인사들도 상당수 참석하였음.

- WIN-Global 집행위원회 사항 : 총회에서는 WIN-Global 집행위원 (Executives)으로 WIN-Korea 회장인 홍성운 박사가 새로 선임되었음. 이로서 세계WIN의 집행위원은 오스트리아(Annick Carnino), 브라질 (Patricia Wieland), 핀란드 (Anneli Nikula), 스웨덴 (Agneta Rising), 일본 (Ogawa Junko), 대만 (Jessie Chiu), 헝가리 (Csilla Tuba Toth), 프랑스 (France Bres-Tutino), 미국 (Patricia Bryant), 스페인 (Maria Teresa Lopez Carbonell), 그리고 한국의 홍성운 등의 10명으로 구성되어 되었음. 집행위원은 세계 WIN의 정책과 운영에 따른 주요 사항을 결정하는 최고의사 결정기구임.

- 이사회 사항 : 총회에 앞서 열린 이사회에는 전체 22명의 이사 중 12명이 참석하였음. 22개 이사국은 벨라루스, 오스트리아, 핀란드, 프랑스, 헝가리, 리투아니아, 슬로바크 공화국, 스웨덴 (Nordic WIN 포함), 스위스, 대만, 일본, 미국, 아르헨티나, 브라질, 불가리아, 크로아티아, 멕시코, 루마니아, 러시아, 스페인, 우크라이나, 그리고 한국임. 우리 나라에서는 WIN-Korea 명예회장인 신영순 박사가 우리 나라를 대표하는 이사인 참석하였음. 이사회에서는 슬로바크 공화국의 이사와 헝가리의 이사가 교체되었음이 보고되었음. 신임 WIN-슬로바크 공화국 회장인 Mariana Mancikova 여사와 신임 WIN-헝가리 회장인 Csilla Tuba Toth 여사가 새로운 이사로 활동하게 되었음.

- WIN-Asia의 구성 : 이번 대회에는 중국, 몽골, 베트남의 대표가 세계 WIN 연차 대회 연계에 있어서 처음 참석함으로서 아시아지역 WIN 활동에 활력성을 주는 귀중한 모멘텀이 되었음. 이를 계기로 하여 WIN-Asia 결성 준비회
의가 5월 15일 오후에 중국, 일본, 한국, 몽골, 대만, 베트남의 6개국 대표가 참석한 가운데 열렸음. 참가국들은 세계 WIN의 지역조직으로서 WIN-Asia의 설립을 적극 환영하였음. 다만 중국과 베트남은 WIN의 국내 조직이 아직 결정되어 있지 않은 상황이므로 WIN-Asia의 구성에는 원칙적으로 참동하지만 우선 시급한 것은 각기 자기 나라에서 WIN 국내 조직을 구성하는 것임을 설명하였음.

각국 담당자 선임 : WIN-Asia 설립 준비회의에서 세계 WIN의 전 회장이며 현 Uranium Institute의 회장인 Agneta Rising 여사는 세계 WIN의 활동을 보다 효율적으로 추진하기 위하여 세계 WIN의 지역기구로서 WIN-Asia의 설립은 매우 바람직한 것이라고 강조하고 앞으로 아시아 지역의 보다 많은 국가들이 참여하게 되기를 희망하였음. 준비회의에서는 각국의 연락 담당자 를 정하였으며 전체 Focal Point로서는 WIN-Korea의 민병주 박사를 선임하였음.

각국의 담당자

- 중국: Liang Huili 및 Zhang Yi (CNNC)
- 일본: Ogawa Junko (WIN-Japan 회장)
- 한국: 홍성운 (WIN-Korea 회장)
- 몽골: Balarmaa Baldorj (몽골 원자력위원회)
- 대만: Jessie Chiu (전 WIN-Taipei 회장)
- 베트남: Phan Thi Tuong Van (VAEC)

WIN-Asia의 장차 활동 계획에 대하여는 Focal Point인 WIN-Korea의 민병주 박사가 계획서를 작성하여 각국 연락 담당자의 검토를 받아 확정하기 하였음.

제6회 세계 WIN 상 : 종회에서는 제6회 세계 WIN 상 수상자로 선정된 일본 에너지 및 환경문제 평론가이며 일본 WEN (Women Energy Network)을 설립하는데 공로가 큰 Aomi Yuki 여사에 대한 시상이 있었다. 그러나 Aomi 여사는 간급한 개인사정으로 참석하지 못하였기에 Ogawa Junko WIN-Japan 회장이 대신 세계 WIN 상을 받았음. 또한 종회에서는 제5회 세계 WIN 상 수상자로 선정되었으나 2000년 6월 웰링턴에서 열린 제8차 세계 WIN 연차 대회에 참석하지 못하여 수상하지 못한 벨라루스의 Svetlana Vastchenko 여사에 대한 소개와 치하가 있었음.

(2) 일반 토의

이번 총회에서는 과거와는 달리 각국의 Country Paper를 발표하는 시간을 갖지 않도록 했음. 대신 현재 이슈가 되고 있는 몇 가지 문제를 부각하여 토론하고 의견을 나누는 시간을 갖도록 했음. 이를 위하여 이사회에서 WIN의 Internet 현황, 발전소의 수명 연장, 방사선 교육 프로그램 등을 토의 주제로 선정하였음. 이러한 주제에 대하여 각국 대표들이 나름대로의 견해를 밝히고 협력방안을 제시하였음.


수명연장 : 발전소의 수명 연장에 대하여는 미국, 헝가리, 체코 공화국이 각각 자국에서 추진되고 있는 계획에 대하여 설명하였음. 참가자들은 폐로를 하는 것보다는 수명연장율에 대하여 노력하는 것이 경제성이 있다는 데에 의견을 같이 하였음. 한편 플랜드는 2기의 새로운 원전을 건설키로 한 정부의 결정을 설명하고 이것이 세계 원자력 발전사업에 정신호가 되기를 바란다고 덧붙여 말하였음.

방사선 프로그램 : 방사선의 올바른 이해를 위한 노력에 대하여는 미국, 한국, 플랜드, 스위스, 슬로바크 공화국, 체코 공화국 등의 대표가 설명하였음. US-
WIN 회원들이 초등학교를 방문하여 방사선에 대한 설명을 함으로서 차세대의 이해를 높이고 있음은 좋은 보기가라는 의견이었음.


(3) 기타 행사

- 문화행사 : 이번 대회에는 과거의 어느 대회보다도 문화행사에 많은 노력을 기울여 외국 참가자들이 우리 나라의 전통문화을 이해하고 이해를 높일 수 있도록 노력을하였음. 한복 패션쇼, 사찰놀이 연주, 한과 및 전통 덕 시연, 인상 소개, 한국의 점 전통공연 관람, 만족한 관람 등의 프로그램이 추진되어 많은 찬사를 받았음. 이밖에도 지체장애자 이화아양의 피아노 연주, 제9차 세계 WIN 연차 대회의 마스코트인 김하영 어린이의 특별 출연 등도 많은 관심을 모았음.

- 기술시찰 : 대회 프로그램의 일환으로 한수원의 영광 원전 시찰, 원자력연구소의 하나로 및 동위원소 생산시설 시찰, 한수원 원자력환경기술원의 방사성폐기물처분장 관련 전시장 관람 등의 순서가 진행되었음. 영광원전 시찰에는 신미숙 국제협력부장 (한수원 본부소속)과 김현진 회원(영광원전 화학부 소속)이 수행하였으며 한수원 NETEC 시찰에는 박세훈 부회장 (NETEC 소속)이, KAERI 시찰에는 최선주 국제협력부장 (KAERI 소속)이 안내 설명을 담당하였음. 기술시찰에 참여하였던 WIN 회원들은 한국의 원자력 사업에 대하여 깊은 감명을 받았음.

※ 기술 프로그램의 일환으로 KAERI의 방사선 응용팀이 방사선 조사사품 (소시지등)과 자체 개발한 식이섬유 식품 (양갱등)을 총회기간 중 회원양에서 직접 소개하여 많은 관심과 찬사를 받았음.

사. 여성문제에 대한 IAEA 사무총장 자문 활동 지원

(1) 1998년 5월 베이징에서 열린 세계여성 대회에서는 여성 전문직의 사회 진출을 확대하는 방안에 대하여 결의문을 채택한바 있다. 결의문에는 우선 UN기관에서부터 여성 전문인의 진출을 확대함으로써 시범을 보이자는 내용이 정가되어 있다. 이에 따라 UN은 여성 전문진의 진출을 최대 30%까지 확대하는 방
안을 강구하게 되었다. UN은 산하 전문기구에서부터 이 문제를 심도 있게 검토하도록 하였다. UN 전문기구인 IAEA는 1999년부터 여성 전문적 고용 확대 방안을 강구하는 움직임을 보였으며 같은 해 9월 제 43차 정기총회에서는 이 문제를 위해 사무총장 특별자문기구를 구성하여 검토하도록 하는 권고사항을 채택하여(GC(43)/RES/21) 그 결과를 2001년 9월의 제45차 정기총회에 보고하고 하였다.

(2) IAEA에서 이 문제를 담당할 Focal Point로서 IAEA 직원중 여성으로서는 가 장 고위직에 있는 Annick Carnino 원자력시설안전국장을 위임하였으며 Carnino 국장은 지난해부터 금년 초반에 이르기까지 IAG-GI (International Advisory Group-Gender Issues)라는 위원회의 구성, 결의문 신청작업을 준비하여 왔다. 그리하여 8명의 위원이 선임되었으며 그 첫 회의를 2001년 7.3-4일 비엔나에서 개최하게 되었다. 8명의 위원은 1) Cintia Melazzo Dias (브라질 국가원자력위원회 위원장 특별 보좌관) 2) John Ritch (남성, 미국인, Uranium Institute 사무총장) 3) Gail de Plaque (미국, 에너지전략문제 기구 회장, 전 미국NRC 위원, 전 미국 원자력학회장) 4) Dana Drabova (체코 공화국 국가원자력안전국 소속) 5) France Bres-Tutino (프랑스 CEA 원자로 담당부서 소속, WIN 프랑스 회장) 6) Gabriella Lindholm (여성, 주오스트리아 스페인 대사) 7) 신영순 (신병원장, WIN-Korea 명예회장, WIIN 총재) 8) Carolyn Hannan (UN 여성문제 특별 자문위원), 그리고 Annick Carnino 국장이 실무 책임을 맡도록 하였다. 위원 구성에서 보듯이 아시아 지역에서는 유일하게 우리나라 신영순 박사가 위원으로 임명되어 앞으로 3년간 사무총장 자문위원으로 활동하게 되었다. WIN-Korea는 IAEA 사무총장 자문을 위한 신영순 명예회장의 활동을 지원하기 위해 각종 참고자료의 수집, 정리의 업무를 맡아하고 있다. (이번 회의에는 사정상 신영순 위원과 UN 대표 위원이 참석하지 못하였다. 다만 보고서는 제출하여 참고가 되도록 했다.)

(3) IAEA 사무총장 자문기구인 IAG-GI는 권고사항을 작성하여 2001년 9월 정기 총회에 보고할 계획이다. 이 권고사항의 내용은 1) 원자력 전문기관에서 여성 전문인의 채용을 30% 선으로 확대하도록 최대 노력하며 2) IAEA는 유능한 여성 전문인력을 확보하기 위하여 별도의 교육훈련 프로그램을 개발하는 노력을 기울이도록 한다는 것이다. 이 권고사항이 총회에서 채택이 되면 IAEA로서는 하나의 커다란 변화를 맞이하게 되는 것이며 아울러 IAEA 회원국들도 이 같은 조치를 준영할 가능성이 크게 된다.

(4) WIN-Korea는 신영순 위원의 활동을 지원하기 위하여 우선 국내 원자력 관련 기관의 여성 고용 현황을 파악하였다. 대상으로 삼은 원자력관련기관은 8개
였다. KAERI, KCCH, KINS, KHNP, NETC, KOPEC, KNFC, KEPRI만을 우선 대상으로 간주하였다. 이들 기관의 총 전문인력은 약 8천 5백명이며 그중 여성 전문인력은 180여명으로서 전체의 2% 가 조금 상회하는 상황이었다. 그리고 IAEA에 진출한 한국 여성 원자력전문인은 1인으로서 (안전조치 분야 P-3) 이는 2001년 7월 현재 전체 IAEA 진출 한국인이 최근 현저하게 증가하여 21명이 되지만 그럼에도 불구하고 여성 전문인의 진출은 상대적으로 미미하다는 현상을 보여주는 것이다.

(5) 신영준 위원은 여성 원자력전문인의 진출을 확대하는 방안으로서 다음 5개 항목을 제시하였다.

가. 대학 원자력공학과 여학생의 원자력 산업체 진출을 장려하기 위하여 특별 장학금을 마련한다.

나. 원자력 산업체는 여성 전문인의 고용을 확대하기 위하여 여성 전문인에 적합한 새로운 근무분야를 개발한다.

다. 원자력 산업체가 구조조정의 일환으로 추진하고 있는 아웃소싱에서 여성원자력 전문인은 제외한다.

라. 원자력 산업체는 최근 한국 정부가 제정한 보건보호법을 성실히 준수하도록 최선의 노력을 기울인다.

마. 여성 원자력 전문인의 자질 향상을 위하여 전문분야 재교육 기회를 제공한다.
제 4 장 연구개발 목표 달성도 및 대외 기여도

1. 연구 개발의 목표 달성도

| 번호 | 세부연구목표 | 달성내용 | 달성도 (%)
| --- | --- | --- | ---
| 1 | WIN-Global과의 협력방안 조사연구 | ○ 세계 WIN 연차 대회에 적극 참여함으로써 여성 원자력 전문인들의 사회적 역할에 대한 세계동향 파악 ○ 지금까지 개최된 세계 WIN 연차 대회 개최실적 등을 평가함으로써 향후 우리 나라가 세계 WIN 연차 대회에 효율적으로 참여하기 위한 방안 도출 ○ 세계 WIN 연차 대회의 한국개최에 따른 준비 작업 | 100 |
| 2 | WIN-Korea와 WIN-Global 간의 효율적인 정보공유체제 구축을 위한 기반 마련 | ○ 정보화시대에 부응한 국내 WIN 및 세계 WIN간의 정보교류 네트워크 구성을 위한 기반 마련 ○ 우리 나라를 포함한 각국 WIN의 조직, 인력과 사업 등 종합적인 자료를 수집함으로써 네트워크 구축을 위한 기본자료를 활용 ○ 각국 WIN 사업의 실적 평가 분석 등을 통한 효율적 사업추진 방안 모색 | 100 |
| 3 | 국내 원자력전문여성과 주요국 원자력 전문여성간의 국제협력 강화 | ○ 원자력사업은 기술적, 경제적 관점에서 국제적인 인적, 물적, 정보의 교환과 상호 이해가 필수적으로 요구되는 분야이며 담론 연구소원과 달리 기술집약산업인 원자력발전은 국가간의 협력된 기술협력에 대한 정보교류가 필요함 ○이에 국내 여성원자력전문인과 세계 WIN 회원국의 여성원자력 전문인들과 에너지정책 및 기술개발, 원자력의 대통령 홍보에 대한 경험을 교환하기 위해 관련 국제회의 참가, 인적, 물적 정보교환을 추진 | 100 |
| 4 | 제9차 세계 WIN 연차 대회의 국내개최 확정에 따른 준비 | ○ 2001년 5월 제9차 세계 WIN 연차 대회를 서울에서 성공적으로 개최됨의 회의가 되도록 하여 이번 사전에 구체적인 계획을 수립하여 준비함 | 100 |
| 5 | 세계 WIN 연차 대회 국내개최 지원 | ○ 2001년 5월 우리 나라에서 개최된 세계 WIN 연차 대회의 성공적인 개최를 위해 행정지원을 수행하는 동시에 이에 따른 개최 경비 일부 지원 (개최 경비 중 상당 부분은 국내 원자력 관련기관으로부터 지원 받음) | 100 |
2. 대의 기여도

○ 학계, 연구계, 의료계 및 산업체에서 종사하고 있는 여성과학전문인들의 적극적인 참여와 활동으로 여성들의 지위 및 역할 강화

○ 우리 나라가 제9차 세계 WIN 연차 대회의 첫차한 준비에 따른 성공적인 개최로 우리 나라의 원자력 위상 제고

○ 원자력 국제 기구에의 한국 여성 원자력 전문직 진출에 기여

○ 해외 원자력여성 전문가들과의 교류를 통한 원자력 국제이해 활동 수행으로 국제교류의 장 마련

○ WIN-Korea의 결성 지원으로 우리 나라 여성 원자력전문인과 세계 원자력 전문여성들과의 정보교환 활성화 등 협력 증진

○ 국내 여성 원자력 전문인 및 주요국 여성 원자력전문가들의 효율적인 정보 공유 체제 구축을 위한 기반 마련으로 신속한 정보 교류

○ 국내 원자력전문여성과 원자력 선진국 원자력 전문 여성이간의 국제협력 증진

강화
제 5 장 연구개발 결과의 활용계획

○ 국내 원자력 관련기관에서 전문적으로 종사하고 있는 여성인력에게 WIN-Global과 WIN-Korea의 취지를 적극적으로 홍보

- 우리나라 여성원자력전문인들이 세계 WIN과의 유대를 갖는 것은 다소 늦은 감이 있으나 당연히 필요한 일이다. 이는 여성원자력전문인의 위상을 높이며 여성원자력전문인으로서 원자력에 대한 국민이익증진에 기여할 수 있는 세계적 조류에 동참해야할 필요가 있기 때문이다. 다구나 우리나라는 원자력사업에 있어서 세계 선진국들과 어깨를 나란히 하고 있는 입장이지만 지금까지 여성원자력전문인의 활동실적은 다소 미약한 실정이다. 따라서 국내 여성원자력전문인의 역할과 사명을 재정립할 필요가 있다.

- 또한, 세계 WIN이 결정된 목적은 원자력에너지 및 방사선에 대한 일반 대중, 특히 여성과 차세대 어린이들의 이해를 여성원자력전문인의 시각에서 증진시키는 데 있다. 이를 위하여 세계 WIN은 각국의 WIN 조직과 연계하여 여성과 어린이를 위한 교육 프로그램의 개발, 원자력 시설 홍보 통한 현장경험의 증대, 교사들 대상으로 해당교육 프로그램 등을 적극 지원하고 있다. 세계 WIN은 이와는 별도로 전 세계적으로 당면하고 있는 원자력 현안에 대한 의견가진 등의 활동을 수행하고 있다. 이밖에 세계 WIN은 지구환경문제, 방사선 교육문제, 여성 전문인의 지위향상 문제(전문직 진출 확대 포함) 등에 대하여 성명서(Statement)를 작성하여 세계 WIN의 입장을 전달하고 있다. WIN-KOREA는 앞으로 WIN-GLOBAL과의 유대강화를 통하여 WIN의 취지를 국내에 널리 알려 원자력에 대한 국민 이해도 증진에 이바지하기 위해 최선의 다하고자 한다.

○ 여성의 원자력 분야 진출 방안 강구

- 국내대학원의 원자력공학과 여학생의 원자력 산업계 진출을 장려하기 위하여 특별 장학금을 마련한다.

- 원자력 산업계는 여성 전문인의 고용을 확대하기 위하여 여성합당계를 실시하거나 여성 전문인에 적합한 새로운 근무분야를 개발한다.

- 여성의 산업계가 구조적계의 이환으로 추진하고 있는 아웃소싱에서 여성 원자력 전문인은 계외한다.
- 원자력 산업계는 최근 한국 정부가 제정한 모성보호법을 성실히 준수하도록 최선의 노력을 기울인다.

- 여성 원자력전문인의 자질 향상을 위하여 전문분야 교육 기회를 제공한다.

○ 제 2회 WIN-Korea 연차 대회 개최

- 국내 여성 원자력 전문인들간의 효율적인 정보공유체계구축을 위한 기반을 마련하는데 중요한 역할을 한다.

- 국내 원자력 전문 여성과 원자력 전문선진국 원자력 전문여성간의 국제협력증진을 강화하기 위한 세미나 및 워크샵 등을 통해 정보교류를 촉진하게 한다.

○ 아시아 국가의 WIN 조직 설립을 우리나라 주도로 지원

- 2001년 5월 서울에서 개최된 제9차 세계 WIN 연차대회를 계기로 우리나라가 주도가 되어 대만, 일본 및 중국, 베트남 등의 아시아 국가들과 함께 WIN-Asia 설립을 추진하였다.

- 현재 아시아권에서 원자력 사업이 활발히 추진하고 있으며, 여성 원자력 전문인력의 수도 상당수에 이르고 있다. 그럼에도 불구하고 중국, 인도, 파키스탄, 인도네시아, 필리핀, 말레이시아, 베트남 등 아시아 각국의 WIN조직을 가지지 못하고 있다.

- 따라서 각국의 WIN 조직을 갖지 못한 국가에 대해서는 관련 국가의 여성 원자력전문인과 정보교류 및 경협 교환 등을 통하여 이들 국가의 WIN 국내 조직을 설립토록 지원하는 것은 바람직한 일이다.
Appendix I

The 9th WIN GLOBAL Annual Meeting
Seoul, Korea

Presentation Report
IAEAs Effort towards Gender Equality

by
Annick Carnino

Director
Focal Point for Gender Concerns
International Atomic Energy Agency (IAEA)
The 9th WIN GLOBAL Annual Meeting
Seoul, Korea

"IAEA’s Effort towards Gender Equality"

by
Annick Carnino

Director
Focal Point for Gender Concerns
International Atomic Energy Agency (IAEA)

I am deeply honoured to have this opportunity to be here with you today and present IAEA’s Efforts in Solving Gender issues in the field of nuclear, as they are of concern to us all. There is no doubt that significant progress has been achieved in gender equality over recent decades and they are in a continuous state of flux.

In the outset of my presentation, allow me to start by saying a few words about the Agency so that you have a clearer picture about the whole presentation. The IAEA is a Vienna-based organisation and one of out of twelve specialised agencies within the UN Family, which was created in 1957. “It seeks to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world”. Today, nuclear technology is used in a wide range of peaceful applications in such fields as medicine, water management, nuclear power generation and agriculture.

The UN Division of Advancement of Women (DAW) serves as an umbrella organisation for gender related issues within the UN and is the main policy co-ordinator in this regard. They have developed a WebSite: http://www.un.org/womenwatch and a joint UN organisations project to create a core Internet WebSite on global women's issues. Originally, it was created to monitor the results of the Fourth World Conference on Women, held in Beijing in 1995. The UN has taken on a commitment for Action to give real meaning to the ideals of women equality and women’s equal participation goal. Today, it serves as a gateway to all information on women produced by the UN agencies (providing on line information on various topics, such as current events, conferences, staffing, statistics, adopted resolutions on women, on-line fora and many other related material).
Nowadays, most of UN entities have their own department, division or working group on gender mainstreaming and empowerment dealing specifically with these aspects in their programmes. At the IAEA, we are certainly late in progressing towards these goals. As far as our scope of activities is concerned, we are trying our best to keep to the Resolution (A/RES/55/2), adopted by the General Assembly at its Special Session in September 2000.

*Sustainable development for women*

The IAEA works towards using nuclear techniques in support of sustainable human development: medical applications, agriculture programmes, electricity production etc. These activities lead to improvement of life in many developing countries, where almost two billion people world-wide suffer from chronic under-nutrition which affects mostly women and children.

It is known that health authorities world-wide are deeply concerned about the nutrition of the population and being aware of the importance of this issue, so is the UN. Over the last 15 years, many UN organizations like FAO, WHO, ILO, UNICEF and IAEA just to name a few, have through their various programmes made significant effort to eliminate malnutrition. The IAEA’s Division of Human Health has, through a global outlook on nutrition, paid specific attention to nutritional needs of women in developing countries and coordinated research projects for the improvement of infant growth, health promotion for adolescent girls, lactation measurements for nursing mothers and osteoporosis studies for aging women have been developed. IAEA has been for many years applying isotopic techniques as tools to evaluate human nutritional status and the nutritional quality of food.

*Women in the IAEA Secretariat*

In accordance with the resolution adopted at the General Conference of the IAEA in 1999, followed by Platform for Action approved by the UN General Assembly Special Session last year, an action plan has been developed to improve the representation and status of women in the Secretariat. The IAEA still has a long way to go before it reaches full gender equality. Although, the goal is right now impossible for our Agency to reach, the percentage
representation of women in the professional and higher categories increased during the period 1989 to 2000 from 12.6% to approximately 18.2%. One of the root causes for this low percentage is the lack of well qualified female candidates for our posts. Our Division of Personnel is making considerable efforts in recruitment by conducting recruitment seminars in different countries. Another root cause is the difficulty to find a job for the spouse. Furthermore, one of the major difficulties in improving that ratio is due to the limited number of women entering the nuclear field in general. In addition, we have a rotation policy whereby professionals have limited time contracts. In simple words, there are not enough women interested to enter the nuclear field. Therefore, we are trying to encourage women in this field by organising workshops. These workshops are based on the request by Member States and one such workshop was last hosted by the Czech Republic.

The IAEA has established a WebPage on the contribution of women in Safeguards. The aim was to promote interest in nuclear science and technology and to show young women scientists how women are involved in the Agency’s work. We plan to develop more Websites on and for women. A direct link with WIN will be added. We will endeavour to increase women’s understanding of nuclear activities and through wider availability of information to women in the public.

The IAEA produced a video entitled “Three Voices: Women in Nuclear Science and Technology.” It was made to present women’s contribution to nuclear field through the IAEA in order to support and speak to young women who are considering study or working in the nuclear field. Additional measures, such as the establishment of an internship or mentoring programme for young women studying towards a degree in science and technology, in particular from developing countries, are under consideration with the view of fostering their interest in the Agency’s activities.

The IAEA’s gender policy towards equality is oriented to recruit “well-qualified” female candidates, applying for positions in the Secretariat and recruitment from developing countries is fully supported.

A number of in-house staff support initiatives have also assisted in advancing the above policy. The IAEA Learning Resource Centre, a multi-media facility, where users can broaden
their professional and personal skills and develop their career options through self-training, offers a wide selection of video tapes, books, software and other instructional material. A sizeable proportion of these materials are focused on professional women who are indeed the ones visiting this centre most frequently.

Finally, the Director General has approved the establishment of an Advisory Group on Gender Issues to give advice on the content of the Agency's programmes in the field of gender concerns. Members are drawn from all continents and WIN (Women in Nuclear) will be represented. The first meeting of the Advisory group will take place in the near future. Our next step will be to "gender mainstream" our programmes.

Inter-Agency Meeting on Women and gender Equality (IAMWGE)

The IAEA is part of the IAMWGE which is a standing committee, representing all UN entities, where all representatives from the UN come together at their annual sessions to discuss current programmes and report on results achieved. Key issues regarding gender mainstreaming, as a tool for achieving gender equality, are discussed. The last one was the sixth session, which took place from 27 February to 2 March 2001 at UN Headquarters in New York. This meeting showed how gender mainstreaming has been incorporated in most of UN programmes and budgets. More information about the IAMWGE can be found at http://www.un.org/womenwatch/IAMWGE/.

The bottom line of under-representation of women at higher posts

I would like to make a few points to explain further the low representation of women at higher professional posts. According to our action plan, the goal is to achieve equity in representation at all levels in the Agency. However, it is impossible to achieve total equality in professional categories. The situation is easier to cope with at general staff post levels. Therefore, the IAEA tables show higher percentage of women's representation, oscillating around 60%. This is one factor that contributes to gender inequality, namely that men and women perform different jobs and so-called "women's jobs" are often assigned a lower value in terms of skill requirements and remuneration. When it comes to equity at senior
management positions, those are P and D posts in our case, it is a virtual absence from the most senior jobs. This problem of under-representation of women at higher posts is also referred as the “Glass ceiling” at the workplace. The term describes an invisible barrier and organizational prejudice, which blocks women from senior executive positions. (it can be seen on table two and three below)¹ This glass ceiling occurs at almost all workplaces, including private sector, politics, state sector and the third sector. It has become a general rule that the higher certain positions/posts is where less women occupy because the glass walls prevent them from climbing the ladder higher. This Glass ceiling is a reflection of social and economic gender inequality that still remains in our global society.

I am aware of the fact that there is still a lot of work towards women empowerment, especially in our industry. Although, the contribution of women over the past decades has been significant and is increasing in public life, we still have to face many more obstacles, in terms of employment, in comparison to the other sex. We should realise that responsibility and accountability for gender mainstreaming should rest with senior managers who should develop the necessary commitment and competencies to lead policy-making for gender mainstreaming.

In terms of women’s participation in public life, we have entered this century with a totally different starting point in comparison to the state of the previous turn of the century. Let us strive and make this 21st. century which translates women’s equality with men in participation and leadership into that where women and men equally enjoy these rights de facto in the nuclear industry as well as in all other industrial and commercial sectors.
Perspective on our nuclear future and
The role of the Uranium Institute

Agneta Rising

Chairman, The Uranium Institute
The World Nuclear Association
Perspective on our nuclear future and
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Chairman, The Uranium Institute
The World Nuclear Association

Thank you for the opportunity to address you today. This is a most exciting time to be in the nuclear industry, especially in Europe, as those who have been for many years telling everyone that nuclear energy is no longer wanted or needed now find themselves confronted by reality!

Perhaps it is not too much to speak of a crisis. This crisis is a result of the combined forces of population, economic growth, and energy consumption and the damaging effect on the biosphere that they have all together. I think you have all heard the statistics:

- Six billion people on planet Earth today, one third of them as yet without electricity, and another third just beginning to use it.
- Population in the developing world continuing to expand – with projections of two billion more people in the next quarter century.
- Energy demand doubling or even tripling in the next fifty years.
- Fossil fuel consumption and greenhouse gas emissions growing with little abatement – even in the face of a near-consensus of scientific opinion concerning the likelihood of serious environmental effects.

The problem is one of grasping, and acting upon, the reality that faces us. Governments and citizens alike are in a collective state of denial.

Those in the nuclear industry know that these trends call for far greater use of the technology we possess. But even we have difficulty grasping the urgency of the danger facing our societies. In a way, the Kyoto goals may have misled us. In one sense, those goals seem stringent – so much so that the US Administration has rejected them as too painful for Americans to endure. Yet these goals were really designed to constitute only the most modest first step on a path that will be truly difficult if the mountain is to be climbed.
Focus on these basics. A widely-accepted goal of climate control is to stabilize the build-up of greenhouse gases at double the pre-industrial level – about 550 parts per million. But even this highly ambitious goal has not been identified as “safe” – it is a level associated with projections of global temperature increase ranging from 1.5 to 4.5 degrees centigrade, as compared with the 20th Century when temperature rose by much less than that.

Holding the accumulation of greenhouse gases to a doubling is not an environmentalist’s ideal, which we can discount as being alarmist or utopian. The goal of stopping greenhouse gases at a doubling has been chosen solely because it is the one goal that meets a test I call “conceivable feasibility”: it might avoid catastrophic effect and it might be achieved – but only if humankind makes enormous changes in energy consumption. In short, very dramatic change might – but just might – bring us to safety.

But despite Kyoto and all the talk surrounding it, worldwide carbon emissions are rapidly expanding from their present 6 billion tonnes per year – at a rate projected to reach ten billion tonnes a year within 20 years and to continue to rise in the absence of fundamental change in human activity.

Arithmetic tells us that stabilizing greenhouse gases at double the pre-industrial level will entail meeting two ambitious goals in sequence. First, over the next 50 years, we must capture this rapid rise and return emissions to current levels. Then, over the second fifty years, we must cut worldwide emissions to half of current levels.

To put it graphically, today the curve for greenhouse gas emissions is heading almost straight up. In order to have hope of avoiding climate catastrophe in the lifetime of children born today, we must manage – even while world population expands and develops – to pull the curve back, first to current levels, and eventually to half of current levels of global emissions.

This is a challenge of such monumental proportions that few have yet grasped it. With population and energy consumption growing rapidly in the developing world, what this entails for the already-industrialized countries is a cut in carbon emissions, in the decades just ahead, of something on the order of 60-70% – at which point our children would still be well above the world average in per-capita emissions.

Mankind thus faces a future in which radical change is not just a speculative possibility. Radical change is absolutely inevitable. Either we will make a radical change in current patterns of energy consumption; or we will experience radical changes in the biosphere – changes that may sweep away, in a short span of history, the relatively stable earthly environment that gave rise to civilization as we know it.

In trying to face this problem today, many of our societies are severely handicapped because so few seem to understand both the severity of the problem and the measures available to deal with it.
As a general rule, on the political left we find those most concerned about the problem but also those most prone to impose their own ideological values on the search for a solution. Fantasies, and even conspiracy theories, abound concerning the supposed capabilities of wind, solar, and other renewables. Of course these do indeed offer promise, but only limited promise. On the right, and sometimes also in the union movement aligned with the left, we find more practicality as to the means of energy supply, but a strong resistance to accepting that the climate problem genuinely exists—and that a truly conservative position logically means that we should face it boldly.

Whereas perhaps the right tends toward fantasy about the problem and the left toward fantasy about the solution, what we desperately need is a merging of the strengths of left and right today: seriousness about the problem and seriousness about the solution. We will learn, soon enough, whether Humankind is capable of such collective wisdom.

As colleagues in the nuclear industry, we share a common belief that nuclear power—with its capacity for continuous, large-scale, climate-friendly electricity generation—should now be summoned to play a central role to meet our energy needs safely. For us, two relevant questions arise:

- First, is the nuclear industry itself ready for this challenge?
- Second, are the relevant governmental institutions, both national and multinational, ready for it?

The Nuclear Industry Worldwide

The Brightening U.S. Prospect

Looking at the world industry region-by-region, a good starting point is USA—not only because the United States has the largest nuclear establishment, generating 30% of the world’s nuclear electricity, but also because American trends so strongly affect the world. Just as 20 years of U.S. stagnation in nuclear plant construction have sent strong negative signals worldwide, a US nuclear revival now would help make the industry everywhere bolder and more vigorous.

Here, all signs are positive. Ironically, this optimistic prospect can be traced to the very market deregulation that was supposed to have sounded the nuclear industry’s death knell. Instead, deregulation led to a transformation in operational and corporate behavior. The leading index, of course, is capacity factor. Last year this measure for efficiency stood at 90% as against 54% in 1980—a steady rise that has, during a period of supposed stagnation, amounted to the same as the construction of dozens of new reactors without a single bucketful of concrete being poured.

Increased efficiency has coincided with even stronger safety performance and a streamlining in regulatory oversight. Perhaps even more important, consolidated ownership has changed nuclear decision-making by giving economies of scale and by focusing corporate strategy on what is necessary for a decision on building new plants.
For all of these components – operational cost, construction cost, cost of competitive sources – the signs are now positive.

A decision on building new plants also faces far less uncertainty in the process of approval. With three different advanced reactor designs having received generic NRC endorsement, licensing a new reactor will no longer be subject to legal challenge regarding the safety of design. Before construction begins, utilities will be able to obtain a single NRC license both to construct and to operate.

Still another favourable component is public and political psychology. In the USA, as in many countries, the nuclear industry has faced a paradox – that policymakers, in the face of a rather small body of strongly anti-nuclear opinion, have perceived public opposition to be overwhelming, and have acted accordingly. The Californian energy crisis has changed all this – precipitating strong pro-nuclear statements from respected voices like the CEOs of Sun Microsystems and Intel, shifting public opinion toward even greater open-mindedness regarding nuclear, and enabling policymakers to speak more realistically and boldly about available energy options. The Californian electricity crisis has helped reopen the energy debate everywhere.

As this debate intensifies, we should expect – and promote – increased public recognition that nuclear energy has gained in cost competitiveness even as the playing field remained sharply tilted against it. On a level field, each energy source would internalize its costs, just as all of the nuclear industry’s costs – including insurance, decommissioning, and waste management and disposal – have been incorporated in the price of nuclear electricity. Meanwhile, the fossil fuel industry has been permitted to use the biosphere as a public dumpsite, with absolutely no attribution of cost for its continuing erosion of human health and its degradation of the global environment.

Europe: Stronger Than Supposed

But what of Europe? How true is the widespread assumption that Europe has become a stronghold of anti-nuclearism – and indeed that the “Chernobyl syndrome” has pointed Europe toward a nuclear phase-out?

In fact; Europe’s nuclear prospects are surprisingly strong. Europeans continue to use half the world’s nuclear reactors to produce 30% of their electricity. They have closed no reactors for economic reasons, and only one for political reasons. Most important, the modest successes of Europe’s nuclear-phobes may well prove to have been Pyrrhic victories.

In Western Europe, the core nuclear countries are France at 75% of electricity, Belgium at 58%, Sweden at 47%, Switzerland at 36%, Finland at 33%, Germany and Spain at 31%, and the UK at 29%. All of these countries are generating nuclear power at record or near-record levels, and with the exceptions of Germany and Sweden, anti-nuclear activity has not seriously impacted upon government policy. In general, the absence of new construction is due to there being adequate capacity already. In the UK,
where old plants will soon require replacement, British Energy has made clear that “new build” is a primary option and expects government support once Prime Minister Blair has been reelected.

In assessing Germany, where “green” influence has seemed greatest, two points are important. First, the decision to phase-out nuclear was solely a consequence of coalition politics, whereby an ideological party – with great fervor but only single-digit voter support – gained a temporary stranglehold on national energy and environmental policy. Second, this decision was shown up by the practicalities of meeting power demands as being hopelessly unrealistic, so the government had to back down. The face-saving agreement has left the actual functioning of German nuclear plants entirely unaffected. Germany’s 19 power reactors continue to operate safely with world-leading capacity factors, and industry leaders have secured enough flexibility to meet near-term phase-out requirements through decommissionings already planned. Meanwhile, in the harsh light of public office, the Greens are losing public favor. Over the longer term, we have every reason to expect that Germany’s nuclear phase-out decision will not survive the unfortunate political coalition that produced it.

Further reason for encouragement can be found where I come from. Like Germany, Sweden experienced the political misfortune of seeing minority anti-nuclear opinion strongly magnified by the process of coalition building. The unfortunate result, after a prolonged struggle, was premature closure of one reactor at Barsebäck. But this sacrifice was not wholly in vain, for the surrounding debate saw Swedish anti-nuclearism strongly repudiated. Viewed broadly, nuclear power in Sweden has stronger public support than any time in the last twenty years.

Meanwhile, in both Sweden and Finland, progress continues toward the construction of permanent geological repositories acceptable to the surrounding communities. When this occurs, these repositories will represent a symbolic contribution to the world nuclear industry far exceeding their functional capacity. In a global context urgently in need of decisive action on the issue of nuclear waste, Scandinavian nations respected for moral authority and technological ability will have said “yes” to permanent storage.

Finland’s prime minister, Paavo Lipponen, has contributed additional leadership by speaking clearly about modern Europe’s need for nuclear power. Explaining Finland’s current plan to build a fifth reactor as having flowed from careful consideration of cost, environment, and energy independence and reliability, Lipponen summarized the European anti-nuclear political push as “economically absurd.” From my Swedish perspective, in the light of our experience, I would like to add that anti-nuclear politics is also environmentally absurd.

Turning east to Russia, successive Minatom Ministers have articulated a bold nuclear power aspiration as part of a national strategy for power production and export earnings. Many of the export earnings will come from freeing up supplies of natural gas for export, rather than burning them wastefully for electricity. Minatom’s plan is to
double Russia's nuclear capacity over 20 years, even while phasing out old reactors. For Russia, expanding nuclear production will partly be financed from accepting non-Russian spent nuclear fuel for long-term storage. Russian storage could solve repository issues for a number of other countries.

In summary, a survey of the European nuclear landscape shows a nuclear prospect far stronger than commonly assumed. Anti-nuclear events in Sweden and Germany, rather than showing a trend, may well, by demonstrating the shortsightedness of environmentalist fantasies, produce a useful counter effect, like inoculating a person with a mild form of disease to prevent them catching it seriously. Nor is there a trend to be found in the noisy anti-nuclear position of Denmark and Austria, other than the tendency of small countries with windmills and hydropower to expound moral nonsense, even while importing nuclear-produced electricity. Italy, the one major European country to renounce nuclear energy, has paid a stiff price by becoming the world's largest importer of electricity, most of it from France's nuclear plants - an anomaly the Italians may decide to reconsider in the decade ahead.

**Asia: Vast Climatic Import and Nuclear Aspirations Exceeding Resources**

Turning finally to Asia, we see two historically significant characteristics affecting prospects for nuclear power in the 21st Century.

First, we find little of the political opposition and none of the stagnation that has beset the industry in Europe and America. As between the two most advanced nuclear power producers, South Korea today has four reactors under construction and Japan three; and both continue to pursue national policies emphasizing energy reliability and independence. With current projects, Japan will draw almost even with France in reactor numbers, and South Korea will exceed Germany.

Meanwhile, China leads the world in "new build" with eight reactors under construction, while India has two. Other large countries like Indonesia and Vietnam are weighing nuclear power against the straightforward criterion of technical and economic feasibility.

Asia's second overarching characteristic is that it constitutes by far this Century's greatest growth market for energy - with all that projection entails in terms of economic opportunity and climate danger. For those concerned about climate change, China and India by themselves offer a clear point of reference. Together, these two countries alone represent 40% of the world's population and an even greater percentage of the expanded energy need projected for the 21st Century. The two Asian giants are alike in having burgeoning energy needs, large-scale potential for climate-damaging coal usage, and major nuclear power ambitions that are limited principally by financial considerations.

The very highest policy priority should be accorded to all action - even if on an individual basis and uncoordinated - to avert the creation of a vast carbon-burning energy infrastructure in the major population centers of Asia.
Are Today’s Institutions of Governance Adequate to the Challenge?

This brings us to the second question: whether our current governmental institutions, national and multinational, are prepared to lead us with both vision and action. Do we have institutions that will guide us in the 21st Century to meet the clean-energy needs of both humankind and the biosphere? I shall comment on three:

- First, the IAEA, which is the nuclear industry’s intergovernmental UN counterpart;

- Second, the UN climate negotiations, which have aimed to create greenhouse gas reductions and an incentive system to help reach those targets;

- Third, our international development institutions.

The IAEA

As to whether the IAEA has proven ready for this moment on center stage, my strong answer is “yes.” The Agency’s job is to patrol the playing field for world nuclear commerce – to ensure that this commerce is free of illicit activity and that reactor and related operations are subject to high standards of safety. Like any watchdog, the Agency cannot be responsible for every misdeed or mistake. But through rule-making and careful patrolling, it can establish a strong barrier of deterrence and a high likelihood that unsafe or illicit activity will be detected. In this, the Agency has distinguished itself in meeting world needs.

On safety, the IAEA’s contribution has been the construction of a comprehensive world regime. In 1996, the International Convention on Safety went into effect; and soon this achievement will be complemented by entry-into-force of the Joint Convention on Safe Management of Spent Fuel and Radioactive Waste. Through these and measures on early notification and response, the Agency has set safety high standards for the global industry – and procedures to promote adherence. Meanwhile, the Agency offers a wealth of assistance and advice for countries in need of it.

The Agency’s work on nuclear safety has been magnificently supplemented by the historic contribution of the World Association of Nuclear Operators. With a membership that includes operators of every commercial nuclear plant around the world, WANO is an exemplar of private-sector vision and responsibility – of which this industry can be justly proud. WANO underscores the nuclear industry’s admirable, if unappreciated, record in promoting worker and public safety worldwide.

On proliferation, the IAEA spent the entire 1990s developing, and then beginning to bring into force, expanded new authorities to equip the Agency with the information and site access needed to deal decisively with any nuclear activities related to weapons.
programs. The Agency did detect North Korea’s efforts at deceit, and its new powers will be greater.

To strengthen the Agency in overseeing compliance with the Nuclear Nonproliferation Treaty, the IAEA inspectorate has been equipped with better detection technology and greater access to national intelligence. The technique of taking and analyzing so-called “swipes” has become enormously powerful, enabling Agency inspectors to detect activities like reprocessing or enrichment from tiny samples taken miles, and months, away from the site of activity. Just enough information about these techniques is publicly known to bolster their effect without helping anyone to get around or defeat them.

The NPT – and the global IAEA inspection regime that supports it – constitute one of the great diplomatic and international security achievements in history. This achievement constitutes a critical foundation both for international security and for the world nuclear industry.

The UN Climate Negotiations

What of the UN climate negotiations? The world is keenly aware of the impasse in The Hague and of President Bush’s recent statements disparaging the Kyoto process. But where do matters stand? What have the participants created, where have they failed, what lies ahead?

Looking broadly there seem to be two overall achievements to date. First, in a short span of years we have attained virtual world consensus on the existence of a severe problem requiring a global regime. The full severity of the looming climate catastrophe may not yet be widely appreciated. But climate change is now a preeminent and permanent fixture on the global agenda. Second, the elements of a sound regime have been widely accepted through agreement on the so-called flexibility devices – emissions trading, joint implementation, and the clean development mechanism.

The adoption of a market-based approach to reducing emissions worldwide was a remarkable innovation. The Kyoto architecture would necessarily set national goals that demand restraint. But rather than imposing country-by-country command-and-control regulation, the Kyoto system invites markets to allocate least-cost reductions – across international borders – to achieve those goals.

Nor was this system an abstract creation of diplomats. Rather it was a proven import from the American experience in curtailing emissions of sulfur dioxide. Perhaps the new US Administration would like the protocol better if it appreciated how strongly many Europeans resisted an approach so permissive for both the profit motive and capitalist forces. As matters stand, President Bush is threatening to walk away from a treaty that reflects successful US diplomacy in advancing the American free-market philosophy.
There is, in this whole climate change endeavor, little room for ideology on any side. If the United States can be faulted for its current abdication of leadership, there is fault also to be laid at Europe’s door – precisely for allowing ideology to color this crucial process. The Kyoto goals may lie in the province of environmental ministries, but the means for achieving those goals are profoundly economic – the province of ministries of commerce, industry, trade, and finance. What we saw in The Hague was an effort led by environmentalists in the European Union – in collaboration with NGO’s and with other delegations led by environmental ministries – essentially to hijack the outcome by enforcing a narrow, unrealistic environmentalist ideology. This was a formula for failure.

One distortion was the effort to exclude nuclear as a technology relevant to the climate challenge. The extent of the environmentalists’ misguided energy – their sheer hypocrisy and deceit – is underscored when one considers that most of the population in the world, and most of the economic power, is represented by governments that wish to see nuclear included in Kyoto as a safe means of producing clean energy.

*Global Development Institutions*

Successful Kyoto outcomes alone cannot bear the brunt of guiding the developing countries toward a clean energy future. A third question about our institutions of governance is whether our global and regional development agencies are currently geared to the task at hand – that of providing strong, targeted and cost-effective support for the large-scale production of clean energy.

To underscore the need for their involvement, consider the scope of financial commitment required to meet development needs and the climate challenge. Over the next twenty years, the OECD projects a doubling of current world generating capacity of 3,000 GWe as well as the replacement of 600 GWe of old and worn out plants. A serious global effort that met only half of this need with nuclear power would entail the construction of some 2000 reactors over 20 years – or two reactors a week. This means a total investment of 2-4 trillion US dollars, at a rate of 100-200 billion dollars a year. Most of this must occur in the developing world.

Ultimately, energy must pay for itself. But its production facilities can be financed; and to this end the great apparatus of international development institutions should be galvanized into a central role to help facilitate widespread use of the most cost-effective clean energy. This criterion would dictate an enormous role for nuclear power.

For that to occur will require a revolution in attitude and policy. For years, these organizations have adopted an anti-nuclear posture that has been assimilated into institutional doctrine – a phenomenon based on a combination of prejudice and fear. If the Kyoto process saw a negotiation captured briefly by ideology, the current development agencies represent an institutional expression of the same ideology. The premises of that ideology must now be challenged and changed. Development institutions are no more than creatures of their member governments, and with the help of key
governments we should aim to reorient these agencies to meeting the world's most pressing challenge with the most effective technologies at hand.

*The Uranium Institute*

The Uranium Institute is the only international, non-governmental organisation concerned with the whole nuclear fuel cycle. It is a worldwide network of those involved in all stages of the production of nuclear-generated electricity, and promotes the peaceful use of nuclear energy as a means of supplying the world's growing energy demand while minimising environmental risks. We have some 75 members who represent all stages of the nuclear fuel cycle. The membership includes companies from most countries that have substantial civil nuclear power programs.

The Institute provides a forum for its members to exchange ideas, news and views. Its members' meetings, and particularly the several working groups on particular technical topics such as climate change and waste management, help communication among companies and others involved in the nuclear fuel cycle worldwide. Various UI publications and its news service provide both general overviews and detailed analysis of issues and topics related to the nuclear fuel cycle, all these are available on the web.

Monitoring of the outlook for the world's nuclear fuel markets is an important function of the Institute, and it publishes a market report about every two years, based on input from its members and other sources. *This has proven to be one of the best available analyses of the factors that affect the uranium market.*

The Institute also provides a link between the nuclear industry and the international organisations concerned with energy policy and related environmental issues, especially on the UN climate change and sustainable development negotiations.

The Institute is an independent, non-profit organisation. It is funded by membership subscriptions supplemented by income from its Annual Symposium.

*Other nuclear-related developments*

Many of us here are quite properly focused on producing electricity. But let us not forget that nuclear science is very much wider than this. When the nuclear age opened, optimists had hoped that atomic technology might hold marvellous and unknown benefits for humankind. What has happened over the years is precisely that.

Today, scientists and technicians are busy developing and spreading a truly dazzling array of nuclear sciences. These technologies promote agricultural productivity, enhance human nutrition, protect livestock health, preserve food, eradicate virulent pests, improve industrial processes, and help in the search for scarce water resources and the advancement of environmental science. Nuclear science is proving equally valuable in the developed world and in helping to advance the world's poorest countries.
I hope that what I have said is an encouragement to you, and also suggest some of the ways in which we can all go forward. Thank you.
Gender Equity and Women Scientists Role

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Gender Equity and Women Scientists’ Role

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I. Introduction

We are in the midst of accelerated technological innovations, as indicated by everyday words such as information society, knowledge based economy, and genetically modified organisms. The radical change in technology and attending social transformation, on the one hand, makes us uneasy and confused. It, on the other hand, offers superb opportunities to develop human potential and improve the quality of life.

The conventional discourse is that women will benefit most from the current technological development, leading to the activated social participation of women and narrowed gender gap. The coming era of high technology, it is said, will be characterized by femininity, feeling, and fiction, and women thus will not be handicapped by physical weakness in their access to the highly valued assets in the new era, i.e., information, knowledge, and ideas.

The history heretofore, however, alerts us to the danger of widening the gap between individuals, social groups, and nations at the juncture of rapid technological change. There does not exist any technological innovation intrinsically favorable to women compared to men. Many technological innovations, in actuality, have worked to maintain the status quo and even exacerbate the gender inequity. The awareness and active intervention is needed to take full advantage of the current technological innovations in realizing gender equity in the future. Technological innovations help those who help themselves.

II. Women Scientists and Engineers in Korea

A TV drama entitled KAIST was aired in 1999. The program dealt with the life of
science and engineering major students toiling in their studies and effectively captured their hopes, challenges, successes and frustrations in reaching out to a wide variety of audiences. The program was favorably received as being a well-balanced entertainment and education program.

It was difficult to ignore the feeling while watching the program that the status of women portrayed in the drama was different from reality. One of the main characters is young woman professor in the department of electrical engineering. In reality, however, it is extremely difficult to find women filling such positions in Korea. Women occupy very few professorships in science and engineering. Even in KAIST, there is no woman holding professorship in engineering. The number of girls majoring in engineering is low also and becomes even lower in graduate school.

Let me briefly describe an overall picture of women's representation in science and engineering in Korea. An overwhelming majority of women in science and engineering are involved in research and development (R&D) and teaching at secondary and higher educational institutions. And yet women remain to be a small minority even in the R&D sector, despite the significant increase in recent years. As of the end of 1999, women accounted merely for 9.7% of total R&D personnel in Korea. The number of women researchers has almost tripled from 4,346 in 1991 to 13,009 in 1999. The proportion of women has risen from 5.7% to 9.7% during the years.

A closer look, however, reveals less encouraging aspects behind the overall increase. A great majority of female researchers with graduate degrees (73.0%) work for colleges and universities, compared with a half (53.0%) for male researchers. A large part of woman researchers at universities consist of the graduate students at women's universities. The reality is that women graduates encounter much more difficulties in finding jobs and that university research positions are mostly part-time, low-wage, and temporary. The concentration of women researchers at universities thus implies the latent under- or unemployment of highly trained women scientists.

For prestigious positions at higher educational institutions, in contrast, women have fared worst in their representation; women constitute merely 3.8% of full-time faculty in natural sciences and engineering in 1998. The proportion of women faculty is higher at junior level positions and at 2-year junior colleges.
At the research institutes, women are more likely to be found at public (14.8%) and other institutes (19.8%), rather than at the government-supported institutes (6.0%). The public and other research institutes are engaged mostly in the routine testing and evaluation activities, while R&D activities in earnest are conducted by government-supported institutes and research wings of corporations. In the corporate sector women represent 6.2% of R&D personnel. In short, women account for a small fraction of full-time core research personnel in Korea.

Few women are found among field engineers in industry. As of 1999, women accounted for 0.2% of certified engineers— to be exact, 7 out of 2952—which require an extended period of experience as field engineers. Their specialties are limited to a few areas, such as data processing, environment, agriculture, chemical and ceramics, and transportation. Even in the secondary level teaching positions where participation of women tends to be active, a lower proportion of women teach math and science. The proportion decreases even further as the grades increase. For example, no women teach math or science currently in the 16 science high schools across the country.

As for the field of specialization, women scientists are concentrated in a small number of disciplines. Natural sciences are preferred over engineering, and computer science is strongly preferred in engineering. Included in the least preferred disciplines are physics, mechanical, civil, natural resources and energy engineering.

Stereotypes on gender roles substantially affect women’s choice in specialization and profession. Biology and chemistry have been traditionally considered appropriate for women’s major on the presumption that these fields have affinities with the housework, such as gardening, cooking and food processing. The stereotypical conception that women have no aptitude for handling tools and machines has been a serious obstacle to women’s career in engineering. The concentration of women in computer science certainly has something to do with the popular image that the field favors some ‘feminine’ properties.

Women’s presence as students in Korean higher educational system presents a sharp contrast to the employment status. In 1998, the percentages of women that have received the bachelors, masters and doctoral degrees in science are 38%, 32% and 23% respectively. In engineering, the percentages are 11%, 6.5% and 3.4%. In short, the number of women who actually take on related jobs is much lower than the number that
is trained in science and engineering.

In a nutshell, women scientists and engineers are severely under-represented, both in number and relative to women’s educational achievement and other professions. Women account for 14% of college professors, 15% of medical doctors, and 14% of journalist known to be unfavorable to women.

III. The Gender Inequity at Issue

The under-representation of women in science and engineering is not limited to this country. According to a renowned feminist scholar in the U.S., the field of science stands in shoulder to the military in systematically and completely excluding women. Only in the late 19th century were women allowed entrance into university and as graduate school became central in training elite scientists and engineers, women were rejected from admission once again. Those that persevered and gained admission into science and engineering studies were forced into work considered ‘feminine,’ i.e. invisible and low profile assistant positions. As jobs in science and engineering became highly specialized careers, women were excluded from participation and promotion due to reasons such as the lack of a doctoral degree while, at the same time, graduate school entrance was denied to women.

In the late 1960s, however, feminist movements rose against the exclusion of women in fields of science and engineering aiming at removing the barrier and allowing participation of women in such fields. Influenced by the feminist movement, research topics such as ‘women in science’ and ‘gender and science’ became rooted in the educational programs and the results of this research became fundamental in developing the policies to induce participation of women. Women and gender issues were the most actively discussed topics at the World Conference of Science held in Budapest under the sponsorship of UNESCO and the International Council for Science in June of 1999. Feminists admit that opportunities for women in science and engineering have increased greatly in the past 30 years. This trend indicates the need for a new perspective on gender issues in science and technology.

In Korea, women and gender issues in science and technology were virtually ignored until the 1990’s. The interest in the issues is rising at the moment. Attention was drawn to the issue of nurturing high quality women scientists and engineers in the ‘Brain
Korea 21st project, an ambitious policy initiative of the Ministry of Education for the development of highly trained human resources in preparing for the knowledge based society of the 21st century. The Korea Science and Engineering Foundation also started a funding program specifically for women scientists in the year 2000.

The gender issues in science and engineering are pressing in Korea for the following three reasons. First is the need for the improvement of women’s social status and elimination of gender inequality. The social status and empowerment of Korean women is ranked among the lowest by international standards. Improvement in social status can be achieved by encouraging the participation of women in professional occupations and no doubt, participation in the fields of science and engineering.

Secondly, Korea cannot but rely on the high quality human resources for overcoming the recent economic crisis and sustaining economic development. The under-utilization of women’s abilities, especially the idling of highly trained women in science and engineering, is a great social loss and a waste of educational investment. The rapid progress in the scientific and technological innovations cannot become reality without fully utilizing the abilities and inducing active participation of women who account for more than half of the population.

Last, but not least, active participation of women can contribute to a desirable development of science and technology. The modern science and technology is criticized as having been developed ‘of men, by men, and for men’ and therefore having contributed to the destruction of human life and the ecosystem. The direction and the social impact of scientific and technological development are contingent on the socio-cultural context and on the intentions of those involved in its development. Women have been excluded in the development and application of science and technology and therefore, the areas that concern women or are of interest to women have been sidetracked from the spotlight. From hereon, active participation of women with novel and alternative perspectives will possibly widen the scope of research and lead the scientific and technological development in the direction of improving the quality of life.

IV. What Is to Be Done?

The problem solving process starts with a precise awareness of the problem. It would be difficult to improve the current situation without a realization that low participation of
women in science and engineering is a social problem that needs to be overcome. The
greatest achievement in the past 30 years in countries that have placed an emphasis on
this issue is the widespread acknowledgement of the issue in the society.

Even though many people in Korea are aware that the number of women taking part in
science and engineering careers is extremely low, they have yet to realize that this
phenomenon is a serious problem. The gender inequity in education and employment is
considered customary and the small number of women scientists and engineers is
considered a natural consequence of the biological differences between men and women.

The official ban against unequal access to educational opportunities for women had
been removed after the liberation from Japanese colonial rule in 1945 and all colleges
and universities have been open to women since. An engineering college was
established at Ewha Women’s University in 1996 even before such a feat was
accomplished in the US. The law against discrimination of women came into effect on
July 1st, 1999. In spite of the legal and systematic equality, however, discrimination still
exists in the family, school and society.

What issue should be considered pivotal in training women as scientists and engineers
and activating their social participation in Korea? It is the employment opportunity
expansion program. As can be seen from the statistical data presented earlier, the critical
problem of women in science and engineering lie not in the supply of well-trained
women, but in the demand for them in the society. The problem that should receive
immediate consideration is that women who have passed the difficult training in science
and engineering are denied opportunities for employment. Not only passive efforts at
non-discriminatory employment but a variety of affirmative actions should be taken as
well.

In order to widen employment opportunities for women, social support for childbirth
and childcare should become more widely available as well. In a survey conducted on
October 1999 among scientists of both sexes, an overwhelming majority of both men
and women replied that housework and child rearing are the two most impeding factors
in women pursuing careers in science and engineering. The period when women ought
to gain experience as an active scientist overlaps with the period of childbirth and
childcare.
Margaret Rossiter, a pioneering and renowned historian of women in science, criticizes American society in the early twentieth century as follows:

American society, and especially its university faculties, became far more willing to educate women in science than to employ them, and were almost adamantly opposed to advancing or promoting any but the most extraordinary.

This observation aptly describes the current circumstances in Korea and perhaps in many other countries as well.

Careers in science and engineering are often described as a leaky pipeline. Science and engineering careers require rigorous education and training and a high level of professional commitment over an extended period. At various segments of the pipeline, consequently, people drop out but rarely drop in. Historically and worldwide, the dropouts are disproportionately women. At the threshold of the new high-technology era in the new millenium, the serious leakage of talented women in science is not to be neglected any more. Given the continued increase in the importance and social implications of science and technology, active career development of women in science and technology needs to be given priority in our strategic efforts to realize gender equity. Women scientists and engineers, I believe, ought to take the leadership in blocking this leakage. Women scientists should detect the holes in the pipeline and find ways of plugging the hole so that more women can follow with fewer obstacles in their way. Women scientists and engineers ought to take the leadership in inspiring talented girls to pursue careers in science and technology and guiding them to the pipeline. They should promote an interest in science and technology among women outside the pipeline and inspire them to actively support those passing through pipeline. As the few who have tenaciously and wisely made it though the leaky pipeline, women scientists and engineers active in their career are best qualified for accomplishing this mission. The critical minds and struggles of women have already achieved a greater participation of women in science and technology and there is no doubt that their continued efforts in the future will be the key in achieving gender equity.
References

Current Status and Future Prospects of Nuclear Industry in Korea

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1. Introduction

Good afternoon! It is a great pleasure to see women nuclear professionals gathered together from all over the world and to have the chance to address all of you on the current status and future prospects of the Korean nuclear industry.

The world today is riding the waves of great change as we head further into the information age. If we see the past as divided into the blue collar industrialization and the white collar service industry, today we face a changing era led by the people who control information technology—the gold collar workers. Scholars predict that the gold collar era will bring increased gender equality to the workplace. In other words, the future demands the skills and capabilities of women. There is no doubt that all of you assembled here, the women specialists of the nuclear industry, will make significant contributions to the growth and development of nuclear power.

As you are all well aware, nuclear power has played a meaningful part in the development of human civilization and promotion of our welfare, not only through production of electricity, but also through its far-reaching effects in medical, agricultural, and cutting-edge technical industries. Nuclear generation is now the main power source for countries all over the world, and with the decrease in use of fossil fuels, is an important part of
efforts to protect our natural environment.

The global nuclear industry has achieved continuous growth. As of the end of 2000, 433 nuclear generating units in 31 countries were in operation, and nuclear power accounted for about 18% of the world’s electricity demand.

However, the world’s nuclear industry has experienced ongoing difficulties with endless criticism of nuclear safety, opposition to selection of sites for nuclear facilities, and the problem of radioactive waste disposal. In addition, with the introduction of an open market system, competition against alternative energy sources like natural gas and coal presents further issues demanding attention.

Accordingly, international cooperation for the continued growth of the nuclear industry must now be more emphasized than ever, and the large role of the world’s women nuclear professionals promises more avenues for such networks of cooperation. In this context, I am confident that this conference will provide chances to unite the efforts of women nuclear professionals.

2. Nuclear Plant Operations and Future Prospects

Due to the scarcity of domestic energy resources, Korea is dependent on importation of 97% of its energy. Following the oil shocks of the 1970s, Korea was forced to develop other fuel sources and diversify its energy supply, with the result that we now have sixteen nuclear units in operation.

With an increase in the number of nuclear plants and the improvement in their operating capabilities, Korea was able to overcome the chronic electricity shortages that had plagued the industry until the 1970s, and from the 1980s on, the power supply and demand and electricity rates achieved a long-term stability. This was the driving force that enabled Korea’s economic development.

At present, the installed nuclear capacity is 13,716MW, accounting for
more than 28% of the country’s total installed capacity for electrical generation. Nuclear power generation last year reached 109 billion kWh, or 40.9% the total electrical generation. Last year, after only 23 years of nuclear power generation in Korea, the accumulated nuclear power production topped the 1 trillion kWh ceiling, marking a turning point in Korea’s nuclear energy production.

The future direction of Korean nuclear energy development is the continued safe operation of existing plants and a realistic level of continued construction for new nuclear power facilities in anticipation of increased environmental regulations and uncertainty in the worldwide energy supply. In the long-term nuclear power development plan, the 1,000MW class KSNP design will be continuously upgraded to enhance safety and economic efficiency. Also, development of the 1,400MW class Korean Next Generation Reactor (KNGR) plant design – now called APR 1400- will continue.

According to the 5th long-term development plan agreed upon in January 2000, by 2015 the installed nuclear capacity will reach 26,050MW comprising 28 units. At that time, the share of installed nuclear capacity among all the electrical generating facilities will increase to 33%, providing corresponding economic and environmental benefits. In line with the nuclear development plan, four KSNP units—Ulchin units 5&6 and Yonggwang units 5&6—are currently under construction. The plan to build two KSNP units at the Shin-Kori site, nearby the existing Kori site, was finalized last August. Shin-Kori unit 1 will be completed in 2008, and unit 2 in 2009. In addition, at the end of last year, the KNSP design was chosen for Shin-Wolsong units 1&2, and the detailed plan will be established within this year.

3. APR 1400 Project

The Korean Next Generation Reactor (KNGR) has been under development by the Korean government and KEPCO since 1992 as part of the national advanced technology development project. The reactor, an
 evolutionary PWR type generating electric power of 1,400Mwe, offers enhanced safety and economic competitiveness. Work on the KNGR is progressing in accordance with our mid- and long-term nuclear R&D program and the long-term power development plan.

Based on the self-reliance developed through past nuclear construction experience and feedback from current operating projects, the APR1400 is designed to meet the standards defined in the Korean Utility Requirements Documents (KURDS). Upon completion of the basic design phase in February 1999, KEPCO submitted the Standard Safety Analysis Report (SSAR) to the Korean regulator for review. More detailed design will be produced by December 2001 and the first APR unit will be launched by 2010.

The KNGR design ensures a high level of safety using such engineering principles as safety system simplicity, partial introduction of a passive system, prevention and mitigation of severe accidents, and human factor engineering. To achieve economic competitiveness, this design uses high power uprating, improved construction methods, equipment installation using the three-dimensional CAD system, and the extensive application of pre-fabrication and modularization.

4. KEDO LWR Project

South Korea is playing a central role in the KEDO LWR Project, which is supplying two light water reactors to North Korea in exchange for the freezing of its nuclear weapons facilities. This project aims to not only help North Korea overcome its power shortage, but also to contribute to improvement of the North-South relationship. This project is particularly significant because it stands to open a new phase in the Korean nuclear industry.

In 1996, KEPCO was officially designated as the prime contractor of the LWR project on a turnkey basis by the Korean Peninsula Energy Development Organization (KEDO). In accordance with the Pre-Project
Service (PPS) Contract signed by KEDO and KEPCO in January of 1996, KEPCO initiated surveys of the proposed site and the surrounding land and sea areas, including geological, meteorological, oceanographic, and ecological investigations. These surveys were completed in October, 1999. In August 1997, KEDO and KEPCO signed the Preliminary Works Contract, and we began early stage construction work for this historic project. This work, which brought a total of 300 technical personnel to the Kumho site, included site grading, installation of temporary power, water, and communications facilities, as well as the construction of housing, a restaurant, and other community facilities for the comfort of our staff working on the project.

In November of 1998, KEDO Executive Board Member countries signed a resolution to finance the LWR project, and in December 1999, KEDO and KEPCO signed the Turn-Key Contract (TKC). The TKC came into effect on February 3, 2000 following the finalization of the loan agreement between South Korea, Japan, and KEDO, and the fulfillment of the other conditions necessary for full-scale commencement of the project. At present, plant design and manufacturing of major components are rapidly progressing, and additional personnel and materials have been mobilized to the site. The LWR project is moving quickly down the path to successful completion.

5. **Nuclear Plant Safety**

At KHNP, nuclear safety is our top priority, and we have consistently made all possible efforts to improve plant operational capabilities. Our plant safety enhancement program includes safety reviews, regular safety inspections, and quality assurance and quality control measures.

All activities related to nuclear safety are strictly controlled by Korea’s regulatory authorities, the Ministry of Science & Technology (MOST) and the Korea Institute of Nuclear Safety (KINS). In addition, technical exchanges and safety advisory teams are invited from international nuclear organizations such as the International Atomic Energy Agency (IAEA),
Institute of Nuclear Power Operations (INPO), and the World Association of Nuclear Operators (WANO). In our aim for perfection in the assurance of nuclear safety, we exhaustively follow the recommendations made as a result of reviews by these international organizations.

Following recommendations from the IAEA, the South Korean government introduced and legislated a periodic safety review to frequently conduct comprehensive reviews of the nuclear power plants in operation. As the first example, the periodic safety review for Kori unit 1 was launched in May 2000, and periodic safety reviews for all other plants will be carried out in stages.

Design improvements are continuously being implemented to raise the level of safety for all units under construction and being planned. KNNSP design incorporates the latest domestic and international technologies as well as improvements acquired from past operating experience. Also, the APR1400 is being designed with additional safety margins.

The International Radiation Protection Agency’s new recommendation, called ICRP-60, was legislated in 1998 to reinforce radiation safety for workers and the public, and it will be fully implemented from 2003. A plan to introduce new concepts in radiation protection is currently being established.

6. Radioactive Waste Management

In KEPCO’s radioactive waste management plan, our fundamental objectives are first, to encourage positive recognition of nuclear power among the general public through safe management of radioactive waste; second, to safely manage radioactive waste until a repository for low and intermediate level waste is available; and third, to select a disposal site through mutual agreement between KHNP and the general public.

With the increase of operating nuclear plants and radio-isotope users, the volume of low and intermediate level radioactive waste (LILW) and spent
fuel continues to rise. As of the end of 2000, about 57,000 drums of LILW and 4,758 tons of spent fuel were stored at nuclear power plant sites.

According to the radioactive waste management plan developed by the Korean Atomic Energy Commission, KHNP will select a disposal site in agreement with local residents and put a repository for LILW in operation in 2008. By 2016, KHNP will also open a centralized interim storage area for spent fuel. Storage capabilities will be secured at each nuclear power plant site for safe management of radioactive waste until waste management facilities are open.

Furthermore, in order to expand storage capabilities within plant sites, we are progressing with high-temperature melting vitrification technology for LILW and development of technology for storage of spent fuel, such as high density storage racks, dry storage, and transshipment. These efforts are already bringing positive results.

7. Restructuring of the Electric Power Industry

In 1999, the South Korean government finalized and made public its plan to restructure the electricity industry. The industry, which had been virtually monopolized by KEPCO for forty years, will gradually be transformed into a competitive system.

In accordance with our short term plan, KEPCO's generation sectors have been divided into six generation companies, and competition among generation companies have been initiated in a wholesale market. The separated generation companies will then be privatized to increase efficiency and thus help reduce generation costs.

In the long term, competition will be introduced into the distribution sector by 2009, and transmission networks will be opened to guarantee non-discriminatory access.

The restructuring of the electricity industry aims to introduce competition,
to increase supply efficiency, and to enhance consumer benefits by extending the right to choose between electricity providers. Legislation of the Electricity Industry Restructuring Promotion Act and amendment of the Electricity Business Act have been completed, and at the beginning of April, the KEPCO’s generation sector was divided up into 6 generation subsidiaries.

After restructuring of the industry is complete in 2009, we can look forward to an electricity market operating within a freely competitive system that allows consumers to select their electricity providers.

As a link in the industry restructuring, privatization of the generation sector is now underway. The goals of this privatization are to stimulate competition between generation companies and thus enhance industry efficiency, promote effective financing of new generation facilities, and increase consumer benefits by reducing electricity prices and improving services.

All five generation companies, except the nuclear generation company, are subject to privatization. The nuclear sector will remain a public entity called “Korea Hydro & Nuclear Power Company” (KHNP) in consideration of domestic electricity supply and demand, promotion of nuclear power, construction of new nuclear facilities, the specific requirements of the KEDO LWR project, and so on. In order to promote internal competition, KHNP plans to introduce an independent business structure to each of the four nuclear site divisions in Korea.

8. Conclusion

In maintaining the steady development of the Korean nuclear industry, we face no problem more urgent than public understanding and acceptance of nuclear power arising from improvement of safety and reliability. I see this issue as a common problem which nuclear industries around the world should strive to overcome together.
Changes in today’s management environment, such as the introduction of competition into the electric power industry and implementation of the Climate Change Convention, offer us new challenges and opportunities. In order to achieve public acceptance of nuclear energy, our continuing goal is ease public concerns over nuclear energy by enhancing nuclear safety and reliability, and to secure nuclear power’s economic competitiveness.

In order to find a way out of these issues that face all nuclear industries, we must transcend the limits of the nation and strengthen the cooperative ties between nations. I truly believe that this is the only road toward realizing a renaissance of the nuclear industry in the 21st century.

Public opinion polls show that the contributions of women to nuclear power are seen to fall behind those of men. To see so many women professionals in the nuclear industry gathered together today gives me confidence that your strong initiative in forming active alliances and close relationships will contribute to altering this public opinion, and to forming new and affirmative recognition of women’s roles in developments in the nuclear industry.

In closing, I hope that this opportunity that brings together women from all over the world becomes an important forum for expressing your diverse opinions and publicly affirming mutual cooperation. Such a forum can only facilitate a new revival in the worldwide nuclear industry.

Thank you very much for your kind attention.
Radioisotopes for Improving Quality of Life

—The Future is Our Choice—

Kyung Bae Park
Korea Atomic Energy Research Institute
Radioisotopes for Improving Quality of Life

-The Future is Our Choice-

Kyung Bae Park
Korea Atomic Energy Research Institute

The Korea Atomic Energy Research Institute (KAERI), as the nation's sole comprehensive nuclear research institution, is making a great effort in developing technologies for an advanced nuclear reactor, proliferation resistant nuclear fuel cycles, and other advanced nuclear technologies. Since 1992, the Korean government has been encouraging 'Mid and Long Term Nuclear R&D Programs' to enhance the capability of nuclear technology development in a systematic and effective way. As a research project of the Programs, 'Study on Production and Application of Radioisotope' was launched with the goal of localization of the radioisotopes in great demands and radiopharmaceuticals, and the developments of new radioisotopes and application. With the initial criticality of HANARO in Feb 8, 1995, the RI production plan of KAERI was intensively reviewed and an emphasis was placed on the development of new radiopharmaceuticals, development of new radiation sources for industrial and therapeutic use, and the steady production of selected radioisotopes and radiopharmaceuticals.

Many different radio-pharmaceuticals have been clinically applied in the treatment of various malignant and benign diseases over the past 50 years. Only a small number of radiopharmaceuticals have been developed on a commercial basis and have become established as routine therapeutic agents. Falling into this category are $^{131}$I-iodide for thyroid disorders, $^{32}$P-phosphonate for blood disorders, $^{89}$Sr-chloride for pain control in metastatic bone diseases, $^{131}$I-MIBG for neuroendocrine tumors, $^{90}$Y or $^{32}$P-colloids for intracavitary therapy, etc. The applications of radionuclides in medical areas are extended to the treatment of intra-peritoneal metastases and malignant effusions, intracystic therapy, intrathecal therapy, radionuclide synovectomy, regional therapy of
liver tumors, and radio-immunotherapy.

Among the various therapeutic applications, the intracavitary therapy and regional therapy of liver tumors have been investigated in our center. Direct intracavitary administration is a means of delivering radiopharmaceutical with high concentration to tumors, which results in the eradication of tumors. Intracavitary therapy is applied to the peritoneal, pleural and pericardial cavities as well as to cystic brain tumors and to the spinal canal. A non-cancer application of the method is the intra-articular injection of radiocolloids to treat inflammatory joint disorders. Continuous efforts have been made to develop new biodegradable, biocompatible, therapeutic agents labeled with lanthanide radionuclides, such as $^{166}$Ho.

<Ho-166 based radio-pharmaceuticals>
Recently, several important therapeutic agents using have been newly developed at KAERI. They are $^{166}$Ho-chitosan complex ($^{166}$Ho-CHICO) for liver cancer treatment, the $^{166}$Ho patch for skin cancer treatment and devices for brachytherapy such as the stent and balloon. While the stent and the balloon are still under development, pre-clinical studies on $^{166}$Ho-chitosan complex and the $^{166}$Ho patch have been completed with very successful results and clinical studies are now being carried out at various hospitals. Development is jointly carried out between KAERI, hospitals and pharmaceutical companies.

<Holmium-166 Chitosan Complex>
To overcome the leakage problem at the administration site of radiopharmaceuticals, chitosan, which is deacetylated chitin (Poly-$\beta$ (1-4)-N-acetyl-D-glucosamine), was selected for the synthesis of soluble radiopharmaceuticals. As a result, $^{166}$Ho-CHICO can be easily prepared by reacting aqueous acidic solution of chitosan with $^{166}$Ho(NO$_3$)$_3$ or $^{166}$HoCl$_3$ at room temperature with a quantitative yield of more than 99 %.

The characteristics of $^{166}$Ho-CHICO are found to be similar to those of chitosan, which is biocompatible, biodegradable, non-toxic, soluble and viscous in acidic conditions, but
gel-forming at pH 6.0 and precipitating in alkaline condition. It is found that the in-vitro stability of $^{166}$Ho-CHICO is highly dependent on the radioactivity of the $^{166}$Ho used. A biodistribution study using a gamma camera in normal rabbits showed that most of the radioactivities are retained in the knee joint with negligible extra-articular leakage at even 72 hours after intra-articular administration. Also, the radioactivity concentration in tissues and whole-body autoradiography images showed that most of the administered radioactivity is localized at the administered site, and only slight radioactivity is detected from the liver, spleen, lungs, and bones. This is thought to be due to the characteristics of $^{166}$Ho-CHICO, which is a high viscous solution and displays gelatin characteristics at a neutral pH in the body, therefore, it can be retained in the administration site in tissue. The ease with which $^{166}$Ho-CHICO can be prepared as a kit form and its high in-vitro and in-vivo stability make it an attractive new agent for radionuclide therapy in malignant and benign diseases.

Clinical trials with $^{166}$Ho-CHICO in the treatment of liver cancer, peritoneal cancer metastasized from ovarian and stomach cancer, cystic brain tumor and rheumatoid arthritis in knee joints are being carried out. The typical CT, Angio and gamma imaging of pre and post treatment of hepatocellular carcinoma (6 cm) are shown in Fig. 1.
Fig. 1. Treatment of hepatocellular carcinoma with $^{166}$Ho-CHICO which was administered via the intrahepatic artery.

**<Holmium-166 Patch for Skin Cancer Treatment>**

A radioactive patch containing holmium-166 has been developed for skin cancer treatment. The flexible non-radioactive $^{165}$Ho-film can be prepared by dissolving polyurethane and $^{165}$Ho(NO$_3$)$_3$ in a solvent mixture of DMF and THF, and subsequently extruding the mixture on an aluminum dish and air drying it. The resulting $^{165}$Ho-film is easily converted to a radioactive flexible $^{166}$Ho-film by neutron irradiation in the "HANARO" research reactor. The radioactive patch practically applicable to the treatment of the superficial skin cancer can be prepared as a sandwich type patch by inserting the $^{166}$Ho-film between two polyester film layers. The disk type of the $^{166}$Ho-patch was applied to animal models and patients with malignant skin cancer (Fig. 2 and 3). Their efficacy and safety were investigated for several months. Skin tumors can be successfully treated with the $^{166}$Ho-patch in animal models and patients. The ease with which the $^{166}$Ho-patch can be prepared in various types, and also its safety and effectiveness, make it an attractive device for skin cancer treatment.

Fig. 2. Photographs of pre-treatment and post-treatment (3 months) of squamous cell carcinoma on the scalp.

Fig. 3. Photographs of pre-treatment and post-treatment (3 months) of Bowen’s disease.
Holmium-166 DTPA Filled Balloon

The use of a radioactive liquid-filled balloon for the delivery of sufficient radiation to the vessel wall is a promising method to prevent restenosis after arterial angioplasty or stent implantation. In the case of $^{166}\text{Ho}$, however, rupture of the balloon containing the $^{166}\text{Ho}^{+3}$ radioisotope would result in a dangerous radiological risk because of skeletal localization and bone marrow suppression. We developed $^{166}\text{Ho}$ labelled DTPA (diethylenetriaminepentaacetic acid) and investigated the possibility of using it as a liquid-radiation source which should show rapid urinary bladder excretion even in the worst case of balloon rupture. The renograms of rabbits obtained using gamma camera imaging showed that $^{166}\text{Ho}$-DTPA was quickly excreted via the urinary system within 30 min after administration (Fig. 4). The ease with which $^{166}\text{Ho}$-DTPA can be prepared from a kit form with high radioactivity concentrations (3.7-7.4 GBq/ml (100-200 mCi/ml)) and its fast urinary excretion make it an efficient liquid radiation source for radiation brachytherapy in the restenosis of the coronary artery using a liquid-filled balloon (Fig. 5).

Fig. 4. Whole-body images of a rabbit at 7, 12, 17 and 22 min after intravenous administration of $^{166}\text{Ho}$-DTPA.

Fig. 5. Representative micrographs of elastin-stained section from swine coronary artery.
Holmium-166 Coated Balloon

A new radioactive coated balloon, which prevents tumor ingrowth and restenosis by additional radiation treatment, has been developed. It is developed for the purpose of reduction of unnecessary radioactivity within a syringe and catheter and the delivery of sufficient radiation to the vessel wall. It is prepared by coating the surface of an existing balloon with $^{166}$Ho instead of being filled with beta sources. It only needs radioactivity on the outer surface of the balloon lower than a $^{166}$Ho-liquid filled balloon. The coating material is similar to that of a $^{166}$Ho-patch and its safety was found out to be safe.

<Holmium-166 Stent for esophageal cancer>

Esophageal cancer patients have difficulty in the intake of meals through the blocked esophageal lumen, which is caused by an ingrowth of cancer cells and this largely influences the prognosis. It is reported that esophageal cancer has a very low survival rate due to the lack of nourishment and immunity as a result of this. We have developed a new radioactive stent comprising of a radioactive tubular sleeve covering a metallic stent (Fig. 6). Scanning electron microscopy and autoradiography showed that the distribution of $^{165/166}$Ho (NO$_3$)$_3$ compounds in a polyurethane matrix was homogeneous. In an animal experiment, when the radioactive stent developed was inserted into the esophagus of a Mongrel dog, tissue destruction and widening of the esophageal lumen were observed. If it is inserted into the blocked or narrowed lumen, it can lead to the local destruction of the tumor due to irradiation effect with dilatation resulting from self-expansion of the metallic property (Fig. 7, 8 and 9). Accordingly, it is expected that restenosis of the esophageal lumen by the continuous ingrowth and infiltration of cancer after insertion of our radioactive stent will be remarkably decreased.

![Image of stent](image-url)

Fig. 6. Self-expandable metallic stent covered with Ho-166
Fig. 7. Image of X-rays at 3 days after stent insertion shows the retention of the stent within the esophageal wall.

Fig. 8. Biopsy at 7 weeks after the treatment with a 148 MBq (4 mCi) stent shows decreased inflammation without induction of a complication.

Fig. 9. Pathologic change of esophageal tissue at 4 weeks after the treatment with a 222 MBq (6 mCi) stent. It shows that the mucous membrane layer of the part adjoining to the stent is caved in.

The Best Choice to Keep Food Clean and Wholesome

<Food Irradiation as Safe Measurement for Safer Food, Improving Food Quality and Safety Needs>

Ready availability of food resources for increasing populations, particularly in the developing countries, is a serious concern around the world. A great portion of food produced goes to waste immediately at the farm, following in the market, and in home.
Proper packaging, processing and storage could make food much more available and encourage farmers to produce more. This could also help the international food trade. About one-quarter of all foods produced are lost by insects, bacteria and rodents. In addition, the recurrent food-borne illness due to microbial contamination urgently needs an effective food sanitation and preservation technique for food safety and security.

<Clean, Fast, Efficient and Energy-saving Technology>
Food irradiation is the process of exposing food to radiant energy in order to reduce or eliminate bacteria, therefore, making it safer and more resistant to spoilage. The carefully controlled radiation comes from either a Cobalt-60 source or an electron beam accelerator. It is a clean, fast, efficient and energy-saving technology.

Food irradiation also allows the complete disinfection of grain, spices, vegetable seasonings and dried fruits and inhibits sprouting of fresh vegetables that can be spoiled easily during transportation.

Irradiated food does not become radioactive and it does not remain residues or create toxic materials. In contrast, some chemical fumigants and preservatives such as ethylene oxide or methyl bromide not only leave toxins but are harmful to the environment, and will be banned their use gradually near future. Those facts increase the necessity of expanding the use of food irradiation by both government and private sectors in the world.

<Irradiation and Food Standards: Passports for International Trade>
Extensive studies proved that irradiated food is safe, wholesome and nutritionally adequate. This process will not introduce changes in the composition of food and presents no toxicological effect on human health. Increased recent global recognition of food irradiation helps protect public health and reduce trade barriers. The FAO/WHO Codex Alimentarius Commission adopted the first international standard for irradiated food in 1988. Presently, the health authorities in over 40 countries have approved irradiation with more than 50 food groups, including spices, grains, fruit, vegetables, fish, meat and meat products.
<Status in Korea>
Food irradiation in Korea first authorized by Government through the Presidential Decree No. 11,717 in June 1985. Followed by this legal basis, necessary regulations and standards have been enlisted in 1987. Cobalt-60 gamma rays are authorized for use of food irradiation.

Irradiation of food under any circumstances is prohibited. Irradiated foods must be packed by proper materials. The use of international logo for food irradiation on packaging materials is mandatory.

Until now, 13 food groups are authorized by the Korean Government. They are (1) Potato, onion, garlic (2) Chestnut (3) Fresh mushrooms (4) Dried mushrooms (5) Dried meats, fish and shellfish (6) Soybean paste powder, hot pepper powder, soybean sauce powder (7) Starch (8) Dried spices and their preparations (9) Dried vegetables (10) Yeast and enzyme foods (11) Powdered aloe (12) Ginseng products including red ginseng and (13) Sterilizing patient meal. It is also planned to obtain the permission of about 10 food groups for irradiation including meat and meat products in early 2001.

<Technology Transfer Encouraged>
The study of food irradiation at KAERI began in the early 1960s with the installation of Korea's first research reactor and a Cocalt-60 facility (10,000 Ci). In 1975, a large-scale gamma irradiation facility launched to operate in KAERI.

The application of irradiation techniques on disposable medical supplies and foods has been actively carried out since then. A commercial irradiation facility (presently 1 million Ci) was constructed by technology transfer from KAERI and has been operated from 1987. Also, a new gamma irradiation facility is being constructed this year. Each year, about 4,000 tons of foods are commercially processed by radiation in Korea. Besides, new technology using the irradiation has also developed in KAERI and transferred to different users. Those are, for example; the production of modified starch without any environmental problem, the production of processed meat without
carcinogenic coloring agents, the production of new food materials from seafood waste, the improvement of processing procedure of various fermented foods, and many others.

**The Future is Our Choice**

Present food irradiation technology has a great potential. Public understanding and consumer acceptance, however, is a prerequisite. Public’s support through educational outreach, governmental regulatory standards, and the future collaboration with consumers, companies, and governmental authorities will be required. The application of nuclear energy to the food industry will benefit public health, helping ensuring safety, and profits for producers and consumers.

Future is our choice.
Radiation and Women’s Health

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I. Introduction

Since the discovery of the X-ray, in 1895, studies of the health effects of radiation not only ionizing radiation but also nonionizing radiation have received continuous attention. Radiation has been used in medicine, science, and industry, as well as from the peaceful and military applications of atomic energy (Upton, 1986).

Radiation can be classified as follows: Ionizing radiation (Electromagnetic radiations of short wave length and high energy such as x-rays and gamma rays, and particulate radiations such as electrons, protons, neutrons, alpha particles, and other atomica particles) and Non-ionizing radiation (Of which wavelength longer than those of ionizing radiation such as ultraviolet radiation, visible light, infrared radiation, microwave radiation, and radiofrequency radiation). General health effect of radiation and women's health issues of radiation would be discussed.

II. Health Effects of Ionizing Radiation

A. Cellular Effects
Radiation passing through a cell may kill the cell, impair its ability to reproduce, damage its genetic material, or simply pass through the cell without interacting with cellular components. Free radical formation is the initial mechanism of cellular injury. Damage to the cell's DNA is the ultimate biologic effect (Ultimately cell death results from impaired mitosis. Cells with a high turnover rate such as intestinal mucosa, hematopoetic cells, skin and germ cells are the most sensitive. The linear energy transfer of the radiation varies with the energy and charge of the radiation as well as the density of the absorbing medium.

B. Sources of Ionizing Radiation
Life has evolved in the continuous presence of natural background radiation. The major sources of natural background radiations are as follows:(1) cosmic rays which varies with altitude; (2) terrestrial radiations which emanate from the thorium, uranium, radium, and other radioactive constituents of the earth's crust; (3) internal radiation emitted by the potassium-40, carbon 14, radium, radionuclides normally present in living cells, and (4) radon and its daughter inhaled in indoor air.

Additionally, the other sources of radiation is the artificial sources of radiation. The largest artificial source of radiation is x-rays and other diagnostic radiation. The other examples of artificial sources of radiations are radioactive minerals in building materials, crushed rocks, phosphate fertilizer. The radiation emitting components of TV sets, video display terminals and smoke detectors are other artificial sources of radiation. Lesser sources include radioactive fallout from nuclear weapons and nuclear accidents and radionuclides released in the production of nuclear power.

Radiation accidents such as the Chernobyl accident can be another source of exposure for workers(Lushbaugh et al, 1987) as well as public people although usual occupational radiation is lower than the natural background radiation.
<table>
<thead>
<tr>
<th>Source</th>
<th>(mSv)</th>
<th>Dose (mrem)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radon</td>
<td>2.0</td>
<td>200</td>
<td>55</td>
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<td>Cosmic</td>
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<td>27</td>
<td>8</td>
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<tr>
<td>Territorial</td>
<td>0.28</td>
<td>28</td>
<td>8</td>
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<tr>
<td>Internal</td>
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<td>39</td>
<td>8</td>
</tr>
<tr>
<td>Total Natural</td>
<td>2.94</td>
<td>294</td>
<td>82</td>
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<tr>
<td>Artificial</td>
<td></td>
<td></td>
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<tr>
<td>X-ray diagnosis</td>
<td>0.39</td>
<td>39</td>
<td>11</td>
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<td>Nuclear Medicine</td>
<td>0.14</td>
<td>14</td>
<td>4</td>
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<td>Consumer Products</td>
<td>0.10</td>
<td>10</td>
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<td>Occupational</td>
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<td>&lt;0.01</td>
<td>0.3</td>
</tr>
<tr>
<td>Nuclear fuel cycle</td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Nuclear fallout</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.63</td>
<td>63</td>
<td>18</td>
</tr>
<tr>
<td>Total artificial</td>
<td>3.57</td>
<td>357</td>
<td>100</td>
</tr>
</tbody>
</table>

Table. Average Amounts of Ionizing Radiation Received Annually from Different Sources by a Member of the U.S. Population.


C. Radiation Effects
Traditionally, there are 2 types of radiation effects; nonstochastic (effects for which there are dose thresholds) and stochastic which include the mutagenic and carcinogenic effects.

1. Acute Effects (Radiation Accident)
Acute health effects are dose dependent as follows
   a. Whole body effects- radiation sickness
      i. 1-100 rem: changes n chromosome morphology
      ii. 100-200 rem; vomiting, moderate leukopenia
      iii. 200-600 rem; vomiting, severe hematopoietic
          a) Leukopenia within one day
          b) Anemia within one week
          c) Thrombocytopenia within one month
          d) Immune dysfunction
          e) Epilation; 2-3 weeks post exposure (300 rem)
          f) Variable chance of death within 1-2 months
      iv. 600-800 rem: similar to 200-600 rem but with greater chance of death and a much period of convalescence in those who survive
      v. 800-3000 rem; denuding of the GI tract
         a) Fluid and electrolyte changes
         b) Malabsorption
c) GI bleeding
d) Sepsis
e) Nearly 100 % death within 2 weeks

vi. >3000 rem: CNS and cardiovascular damage prominent
   a) Confusion and disorientation
   b) Hypotension
   c) Hyperpyrexia
   d) Death in 24-48 hours

v. With increasing radiation dose organ system involvement progresses from hematopoietic to GI to CNS to cardiovascular systems
vi. LD50 at 30 days is 500-700 rem

b. Acute Local Effects
   i. Exposure to 300 R of low energy X-rays results in skin erythema
   ii. Gonadal exposure may produce temporary sterility

2. Delayed Effects (Stochastic Effects)
   a. Carcinogenesis
      i. Solid tumors and leukemia are associated with radiation exposure
      ii. Evidence for carcinogenesis is well established for doses of x-ray and gamma radiation exceeding 50-100 rads
      iii. Leukemia
            a) Radiologists (early 20 C) first documented association of cancer with radiation exposure
            b) Hiroshima and Nagasaki (1945)
            c) Radiation is associated with all types of acute leukemia and with chronic granulocytic leukemia
      iv. Bone Cancer
            a) Produced by the internal deposition of radioisotopes in bone ("bone seekers")
            b) Ra226 and Ra228; in luminous dial watch painters
   v. Thyroid cancer; papillary or follicular
   vi. Lung cancer
      a) Uranium miners exposed to radon daughters (alpha emitters; exert their effect when inhaled)
   vii. Liver cancer
      a) Thorotrast was a contrast medium containing an alpha emitting isotope of thorium
         i) Used in the 1940's
         ii) Scavenged by the reticuloendothelial cells of the liver
         iii) 10 % risk of liver cancer (angiosarcoma) in those who received Thorotrast
   viii. Breast cancer

b. Genetic effect
c. Congenital Effects
d. Cataracts: development of cataracts is seen with a dose for alpha, beta, and x-ray radiation is 500 RAD

D. Ionizing Radiation Standards
1. Radiation Protection
      i. Justification
      ii. Optimization: ALARA (As low as reasonably achievable)
      iii. Dose limits
   b. Facilities (Shapiro, 1972)
      i. Properly designed
      ii. Carefully plan and oversee its operating procedures
      iii. Radiation protection program
      iv. Workers adequately trained and supervised
      v. Emergency preparedness plan

2. Atomic Energy Act
   a. Most important Federal law regulating radioactive materials
   b. Nuclear Regulatory Commission (NRC); Federal agency that regulates the use and disposal of nonmilitary radioactive sources
   c. Department of Defense regulates military radioactive sources

3. Occupational whole body dose limits
   a. "ALARA"; the goal of all radiation protection program; keep each individual's radiation exposure "as low as reasonably achievable"

   NRC Regulations
   Annual 5 rem
   Cumulative average 5 rem/yr
   pregnancy (total) 0.5 rem

   b. Average annual dose for occupationally exposed workers

4. General population whole body dose limits
   
   NRC Regulations
   Annual 0.5 rem
   Cumulative average 0.5 rem/yr

E. Women's Health Issue
   a. Cases:
      i. Women surviving A-bomb irradiation
      ii. Women given radiotherapy to the breast for acute postpartum mastitis
      iii. Women fluoroscoped repeatedly in the treatment of pulmonary tuberculosis with artificial pneumothorax
      iv. Women employed as radium dial painters
   b. Characteristics
      i. 5-10 years after exposure
      ii. Dose dependent
      iii. Age dependent; reproductive age

2. Thyroid Cancer (Kreisel, 1995)
   a. Especially papillary carcinoma
   b. Cases:
      i. A-bomb survivors
      ii. Radiotherapy during childhood
      iii. Children affected by Chernobyl accident
   c. Characteristics
      i. Latent period: 10 years or longer
      ii. Children > Adults
      iii. Female > Male: Several times X

3. Cancers b/o natural background radiation (Low level radiation) (Mettler,
1995)
a.  <3 % of all cancers
b.  10% of lung cancers: b/o indoor radon
a.  Teratogenic and mutational effect:
   i.  Congenital malformation
   ii.  Delayed growth and development
   iii.  Mental retardation
   iv.  Decrement in intelligence and school performance

<table>
<thead>
<tr>
<th>Causes of Developmental Defects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic transmission (Mendelian)</td>
<td>20</td>
</tr>
<tr>
<td>Chromosomal abnormalities</td>
<td>5</td>
</tr>
<tr>
<td>Environmental causes:</td>
<td></td>
</tr>
<tr>
<td>Drugs and environmental chemicals</td>
<td>4-6</td>
</tr>
<tr>
<td>Ionizing Radiation</td>
<td>1-2</td>
</tr>
<tr>
<td>Infectious agents</td>
<td>1-2</td>
</tr>
<tr>
<td>Maternal metabolic imbalances</td>
<td>?</td>
</tr>
<tr>
<td>Interactions/combinations</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>65-70</td>
</tr>
</tbody>
</table>

b.  High Dose Exposure during Gestation (Sever, 1993)
   i.  Microcephaly
   ii.  Mental retardation
c.  Low Dose Exposure during Gestation
   i.  Increased risk for childhood cancers (Sever, 1991)
d.  Preconceptional Paternal Exposure
   i.  Congenital Malformation (Sever et al, 1988)
   ii.  Childhood Leukemia (Gardner et al, 1990)
e.  Natural background irradiation

<table>
<thead>
<tr>
<th>Types of Disorder</th>
<th>Natural Prevalence (per million live births)</th>
<th>1st Generation Radiation</th>
<th>Equilibrium Generation Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autosomal dominant</td>
<td>180,000</td>
<td>20-100</td>
<td>300</td>
</tr>
<tr>
<td>X-linked</td>
<td>400</td>
<td>&lt;1</td>
<td>&lt;15</td>
</tr>
<tr>
<td>Recessive</td>
<td>2,500</td>
<td>&lt;1</td>
<td>Very slow increase</td>
</tr>
<tr>
<td>Chromosomal</td>
<td>4,400</td>
<td>&lt;20</td>
<td>Very slow increase</td>
</tr>
<tr>
<td>Congenital defects</td>
<td>20,000-30,000</td>
<td>30</td>
<td>30-300</td>
</tr>
<tr>
<td>Complex etiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart diseases</td>
<td>600,000</td>
<td>Not estimated</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Cancer</td>
<td>300,000</td>
<td>Not estimated</td>
<td>Not estimated</td>
</tr>
<tr>
<td>Selected others</td>
<td>300,000</td>
<td>Not estimated</td>
<td>Not estimated</td>
</tr>
</tbody>
</table>

Table: Estimated Frequencies of Heritable Disorders attributable to Natural Background Ionizing
Irradiation

III. Health Effect of Non-ionizing Radiation: radiofrequency, infrared, microwaves and visible frequency

A. Biologic Effect
1. NIR cannot ionize molecules: NIR can impart energy to biologic molecules through molecular excitation which is dissipated in the form of heat.
2. Biologic effects of NIR are related to heating (thermal effect)

B. Ultraviolet (UV) radiation (wavelength 200-400nm)
1. Source: sun, welding arcs, tanning lamps, plasma jets, etc
   a. Major source: sun
      i. Midday: greatest
      ii. Summer > winter
      iii. Cloudy day > sunny day b/o reflection
      iv. Snow reflects 75% of UV
   b. Readily shielded by window glass, clothing, sunglasses, and sunscreens
2. Biologic effects
   a. B/O low penetration, primarily affect skin and eye
3. Eye effects
   a. photokeratitis (<300 nm), conjunctivitis
   b. cataracts
      i. Acute exposure to high energy UV (eg UV laser)
      ii. Chronic exposure to longer wavelength
3. Skin effects
   a. Erythema (280-320 nm)
   b. Photosensitization
   c. Pigmentation (300-400 nm)
   d. Skin aging (Senile elastosis)
   e. Skin cancer (290 nm) (Urbach, 1971)
      i. Incidence rate
      2/100,000 in dark-skinned populations vs 100/100,000 in South African whites, Australian
      ii. Decrease with latitude
      iii. High in outdoor occupations such as agricultural, forestry and marine workers

C. Visible light (wavelength 400-700 nm)
1. Source
   a. Sun: major source
   b. Laser
   c. Others: Heating tungsten, electrical discharge in a gas such as neon, mercury
2. Effects
   a. Flash blindness; due to bleaching of visual pigments
   b. Photochemical retinal damage by intense glue light (400-500 nm)
   c. Lasers (Light Amplification by Stimulate Emission of Radiation) produce retinal damage secondary to light focused on the retina by the lens
   d. Circadian effects (e.g. seasonal affective disorder)

D. Infrared radiation (wavelength 700-1,000,000 nm)
1. Heating effects (eg sun, stoves)
   a. Burns
   b. Cataracts
E. Microwave/radiofrequency (MW/RF) (wave length 1mm - 1m) (3MHz-300 GHz)

1. Health Effects
   a. Peak human absorption occurs at 3 x 108 Hz (UHF television range)
   b. Higher frequencies are reflected by the skin or absorbed superficially
   c. Lower frequencies penetrate deep into the body
   d. Testes are most vulnerable to heating effects
   i. Evidence of impaired spermatogenesis
   e. Cataracts
      i. Due to thermal effects (2.5 - 3 x 109 Hz)
      ii. Posterior cortical
      iii. Short latency

F. Electric and magnetic fields (0-300 Hz frequency)

1. Fields occur when electricity flows through wires
   a. High voltage electric power transmission lines
   b. Consumer products - electric blankets, TVs, computers, toasters

2. Biologic Effects
   a. Suggestion of a weak association between exposure to low frequency magnetic fields and various kinds of cancer:
      i. Childhood cancer: leukemia with high current power lines (Wertheimer & Leeper, 1979; Savitz, 1988; Washburn et al, 1994))
      ii. Adulthood cancers:
          a) brain tumors (Savitz & Loomis, 1995; Kheifets et al, 1995)
          b) leukemia (Li, 1996; Theriault et al, 1994; Floderus, 1993)
          c) breast cancer (Li, 1996; Loomis et al, 1994; Coogan et al, 1996)
      iii. Other: Alzheimer (Sobel et al, 1995; Sobel & Davanipour, 1996)
   b. No carcinogenic mechanism identified
   c. No accurate assessment of human risk
   d. Greatest risk - electricity in households

G. Video Display Terminals

1. Biologic Effects
   a. Miscarriage: 2X for women who used VDTs>20hrs/wk (Goldhaber et al, 1988)
   b. Ergonomic issues such as Carpal Tunnel syndrome and Musculoskeletal discomfort
   c. Eye strain

IV. Summary

As one of the physical agents of greatest concern with regard to women's health issues is ionizing radiation, especially reproductive risks. The health effects of ionizing radiation are widely diverse, ranging from rapidly fatal injuries to cancers, birth defects and hereditary disorders appearing months, years, or decades later. The radiation protection is the fundamental element in every aspect of radiation exposure including therapeutic radiation.
References


Medical Application of Radioactive Isotope

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Medical Application of Radioactive Isotope

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1. Nuclear Medical research in Korea

After the beginning of nuclear medicine in Korea in 1961, medical application of radioactive isotope has been expanded in research and clinical fields. Especially, as national medical board system of nuclear medicine was established 6 years ago, it is expected that there will be more active researching activity and greater developments of application in nuclear medicine.

Nuclear Medicine is an applied medical science of clinical use of radioactive isotope. Therefore, it is necessary of basic and clinical research of nuclear medicine before the clinical use of radioactive isotope. Research activity and product of nuclear medicine in Korea has been growing, continuously. In the beginning of 1980s, national academic activity was 30 to 40 scientific papers presented per year. Nowadays, about 200 papers were presented annually in the national academic meetings. Moreover, application fields of nuclear medicine have become more various. In the past, medical application fields were confined in the endocrinology, gastroenterology, and musculoskeletal system. Recently, application of nuclear medicine was widen in the challenging various medical fields, such as hematooncology, neurological science, cardiovascular systems, etc. Since the first oral presentation in the international academic meeting with the domestic results in 1988, international academic activity of Korea increased year by year. In 2000, 84 scientific papers were presented at the Society of Nuclear Medicine, the major international academic meeting of nuclear medicine. Those outstanding international academic achievements were the 4th rank of the all-participant nations in the view of the number of presented papers, following U.S.A., Japan, and Germany.

Medical research using radioactive isotopes was changed according to the situation of the age. In the 1960s, nuclear medicine was introduced first in Korea. Biophysiological application by the principle of tracer theory using radioactive iodine or radioactive iron was performed in the patients with thyroid disease or hematological disorders. In the 1970s, imaging equipments, such as gamma camera and scintigraphic
scanner, were introduced in Korea. Using these instruments, in vivo imaging of physiologic or pathologic status in the living patients was performed in the clinical fields, and in the late 1970s, quantitative analysis of in vivo physiology became to be possible with the introduction of computerized equipments. In the mid 1980s, Single Photon Emission Computerized Tomography (SPECT), that is, tomographic imaging equipment of gamma camera was introduced and in 1984, Positron Emission Tomography, that is, tomographic imaging equipment using positron emitting particles was installed in Korea, which means that biochemical and biofunctional imaging study came to be possible in live objects. With the outstanding developments of nuclear medicine in Korea, 99 nuclear medicine facilities and 6 PET centers have been established and were performing active clinical and research activities throughout the country in 2000.

2. Future of Nuclear Medical research

Future of nuclear medicine in Korea depends on the development of new radiopharmaceuticals, the development of better equipments and software, and widening the application fields in clinical research. Nuclear medicine is a clinical application science, however, it needs many fields of basic science, such as, biology, pharmacy, chemistry, physics, engineering, computer science, etc. Nuclear medicine is a real multi-modal and inter-disciplinary science.

Some of the promising and interesting fields of nuclear medicine in the future will be introduced in the followings.

1) Positron Emission Tomography (PET)

In most of human diseases, functional and biochemical changes precede structural disorganization. Genomic abnormalities precede all other changes in some cases. Until now, diagnosis of disease depends mainly on anatomical methods, such as, X-ray, ultrasonic imaging, CT, MRI, which methods cannot detect the initial changes of diseases. Nuclear medical is, however, imaging methods of functional or metabolic disorders. Especially, Positron Emission Tomography (PET) is a unique diagnostic method of imaging metabolic status of living human body, which means that PET can diagnose disease before the appearance of anatomical or structural disorder. After positron-emitting radiopharmaceuticals of glucose, amino acids, fatty acids, ligands for neuroreceptors, etc were injected in human body, those radiopharmaceuticals undergo biochemical metabolic process. PET can image those metabolic statuses in vivo without
any invasive hazards.

It is well defined that PET is useful to diagnose many diseases, such as cancers, cardiovascular disease, dementia, cerebrovascular disease, epilepsy, etc. PET is a non-invasive and cost-effective diagnostic tool in cancer patients in diagnosing cancer recurrence and staging, predicting prognosis of patients, and differentiating malignant diseases from the similar benign diseases. In many developed countries, the use of PET has become expanded and more popular, nowadays. In Korea, PET will be used more widely similar to the developed countries in good time. In a near future, PET will be an indispensable diagnostic method in the various medical fields.

2) Molecular Nuclear Medicine

Recently, molecular biology and genetic engineering have developed rapidly. Molecular nuclear medicine is one of the brand-new medical fields to conjoin the nuclear medical methods and newly developed molecular biologic techniques.

In a near future, gene therapy will be used widely. If only we have a DNA probe to bind a specific gene and radiolabeling techniques of the probes, we can image a specific genetic disorder or monitoring gene therapy. For an example, Herpes Simplex Virus thymidine kinase (HSV-tk) is used to monitor the gene therapy as a reporter gene in present-preceding studies. F-18-acyclovir, a radiolabeled pharmaceutical is metabolized to F-18-acyclovir-phosphate and trapped in the cells. If we transfer the therapeutic gene with the reporter gene, we can image the in vivo expression of a specific gene, which was transferred for the purpose of gene therapy. Many other systems of reporter gene are developed or will be developed soon. Furthermore, if we have double helix or anti-sense oligonucleotides to bind a specific gene and labeling with therapeutic radioisotopes, we will be able to treat a specific gene of genetic disorder. All the structure of human genome was established. Imaging of specific gene and therapeutic application will be promising medical fields in a future.

3) Therapeutic Application of Nuclear Medicine

Labeling pharmaceuticals with therapeutic radioisotopes such as I-131, Y-90, Ho-166, and Re-188, we can treat many kinds of diseases. Those therapeutic radioisotopes emit beta rays, which kill the cells in a few millimeters. Other various therapeutic radiopharmaceuticals are under development in order to treat a number of cancers, to prevent restenosis after coronary artery angioplasty, and to inhibit steroid non-responded active inflammation.

Until now, radioactive iodine therapy has been established to be effective in
patients with thyroid cancer. Radioactive iodines are transported into the thyroid cells by the sodium/iodide symporter (NIS). According to the recent reports, NIS gene could be transferred to the cancer cells and enhanced the radioactive iodine uptakes. That means that radioactive iodine could be used to treat cancer cells of non-thyroid origin, too.

3. Conclusions

Using a strong research tool of radioactive isotopes, nuclear medicine has a role to conjoin the clinical and basic medical science. Furthermore, nuclear medicine needs application of many scientific fields in basic and applied science. Nuclear medicine is a multi-modal and inter-disciplinary medical science.

One of the most promising and challenging scientific fields in medicine is, we can say, nuclear medicine. It is expected that many unsolved problems in the fields of medicine will be settled by the medical application of radioactive isotopes.
What Should We Learn From the JCO Criticality Accident?
Problems and Suggestions Concerning the Recovery of
The Public Confidence in the Nuclear Industry—

Tomoko Tsuchiya
Central Research Institute of Electric Power Industry
What Should We Learn From the JCO Criticality Accident?

- Problems and Suggestions Concerning the Recovery of
  The Public Confidence in the Nuclear Industry-

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1. Introduction

According to ‘The 13th Public Opinion Polls Relating to Energy Concerns’, the percentage of the respondents who answered, “nuclear power plants are safe (including ‘they are fairly safe’)” decreased dramatically from 32.7% in 1998 to 11.3%, the lowest since the survey began in 1989. It is a natural human reaction to have uneasiness about nuclear technology and its facilities after a severe event like the JCO criticality accident.

What should we learn from the accident? I will propose the way to recover public trust and confidence in the nuclear industry, based on the Tokai-mura Residents Survey, conducted by the Tokai Village Office on December in 1999.

2. Lessons Learned From the JCO Accident

The Tokai-mura Residents Survey consisted of the posted questionnaires (546 residents, the response rate of 38.3%), the interviews by visiting (82 household, 154 residents), the female group interviews (10 groups, 45 residents), and an interview to overseas residents (11 residents), and conducted from December 1st to 19th in 1999. The Tokai Village Office published the report of the results in March 2000.

1) The temporal, quantitative and qualitative differences in information obtained by the residents, and the amplification of anxiety
The results of the survey, first of all, revealed that the first acknowledgment of the occurrence of accident by individual residents were at different times. It was found out that some people who were not at home when the first report was transmitted by the village office or the television, due to their work or other reasons, were yet unacknowledged of the accident by the evening. This was caused by the total reliance of the emergency notification onto the public broadcasting vehicles, the village announcement system and the wired radio system via receivers per household, adopted in the village. If the sirens were sounded as suggested by a number of female respondents, most of the residents would have notified that something had happened.  

There was also a difference in the amounts of information received by the residents. The main sources of information after the occurrence of the accident were televisions and the receivers of the wired radio system, and therefore, the ones who could not access these media had extremely little knowledge about the accident and its circumstantial information, following the same pattern as the case of the first report discussed above.

During the accident, the residents were provided with insufficient information. For example, the first announcement through the village broadcasting was “the accident has occurred at the JCO.” However, a 42% of the respondents did not know where the JCO was. Further, the announcements from the village office that followed had merely repeated a same phrase of instructing the residents to “take shelters in houses.” Most of the female interviewees made complaints that they could not find out neither the meaning of ‘criticality’, or the ‘Do’s and Don’ts’ in the situation, until they were explained in the TV programs. Also, some nuclear professionals criticized that the village office did not make the data of radiation dose clear. Thus, there are various kinds of information the residents want to know in the emergency situation. In addition, a deficiency of necessary information does not only impede appropriate courses of actions by the residents, but also results in their psychological distress.
Lesson 1

Provide the residents with the information they want to know.

Needless to say, the local government and/or the industry should immediately inform the first emergency signal as thoroughly as possible to the local population. Taking into a consideration of various lifestyles of people, the emergency signal should be transmitted to certain populated spots, such as the public facilities including train stations and post offices, and also shopping sites like major supermarkets. Also, it should include ‘when’, ‘where’, and ‘what has happened’.

During the accident, it becomes necessary to keep the residents informed with the up-to-minute information so that they can understand the situation they are in. This should include ‘when’, ‘where’, ‘what is going on’, ‘how it is dealt with’, and of course, the detailed ‘Do’s and Don’ts’ for the residents. If all the residents were to be evacuated quickly, they are more likely to do so when they know ‘why they should do so’ and ‘who decide so.’ In addition, although it is useful to present scientific data such as the amount of radioactivity, it should be provided with the interpretation of it for the lay people to understand exactly ‘how dangerous the figures denotes’.

Lesson 2

Control the amplifying anxiety.

Anxiety is ‘contagious’ as such, and therefore, it is important that the government or the industry provides the residents with appropriate information at the right time.

Over 50% of the ‘lay’ residents acquired the information from people who “appeared to be very worried”, felt great anxiety. Moreover, the people who were particularly anxious had the tendency to make numbers of telephone calls.

On the other hand, the nuclear professionals and other residents working in nuclear related facilities could obtain necessary information as to what was happening, and what actions were to be taken, and thus, were able to deduce the best possible courses of action. They were hardly too anxious, as they obtained information from people
who “were relatively calm.” If they could provide some advices for the lay residents with the consideration of the feelings of the residents, the proliferation of anxiety could have been prevented. Unfortunately, in the case of the JCO accident, most of the residents could not get useful advices from the experts so that their uneasiness remained.

Lesson 3
Cooperate with the media
It is also extremely helpful to secure a cooperative relationship with the media on the emergency reportage, in order to take advantage of media’s capacity in the effective transmission of information. For example, the media can quickly translate official information into several other languages and also, can transmit them by the texts for the ones with hearing problems.

The JCO accident saw two opposing effects of media; it was useful for residents in grasping the situation of the accident, but at the same time, had accelerated the public’s increasing anxiety. Media was, however, not entirely responsible for the confusion, since the source of information, that is, the central government, the local authorities and the JCO, caused the disagreements in the contents of the press release, and delayed the official announcements. It is, therefore, advisable for each party to face these problems respectively, and to construct a cooperative relationship, with the foremost importance placed on the securing of safety of the residents.

Lesson 4
Design an effective measure to minimize information gaps between the residents.
It is essential to design a mean of providing information so that anyone can comprehend the situation and act accordingly, regardless of the familiarity with the nuclear-related knowledge. To construct such effective measures, it is required to introduce, not just the information hardware, but also certain human-ware of information such as a tie among the local people. Regardless of specialties, the general public has the ability to communicate with each other, in order to inform and
help out in comprehending the governmental policies and experts' advices. However, the close communal relationship is gradually disappearing due to the rapid development of local economy and the changes of lifestyles, etc., and even a small town like Tokai is no exception. Therefore, it is important to construct certain ties among the residents, and also a relationship between the lay people and nuclear professionals.

2) Persisting Anxiety and Problems in Mental Care Programs
Even after the removal of evacuation orders, many of the residents were still fearful, while the nuclear professionals could resolve their concerns immediately. Furthermore, 14.3% of the respondents expressed their persisting concerns in the questionnaires two months later. One of the causes for this lasting anxiety was perhaps in the insufficient care program offered after the incident.

Lesson 5

*Take the resident’s concerns into consideration.*

Approximately 16,000 residents, that is, about a half of the village population, visited the radiation dosimetry examinations, but only 50% of them were satisfied with the results. The free speech in the interviews and open answers of the questionnaires have revealed that there were numerous complaints about this health examination, such as “they did not show the data to me”, “there was no explanation”, and “they only said that there was no problem.” If there was some sort of explanation about the determinants of the examination results, or even handouts about such information, the uneasiness of many residents could have been reduced. To take the residents into consideration is to empathize with their concerns and to take actions for them willingly.

Lesson 6

*Carry out the outreaching approach from the experts.*

From the mid to the end of October 1999, the “Care for the Mind” program was put into practice by the Ibaraki Prefecture. However, the number of residents who felt
persisting anxiety was too significant, compared to the number of recipients of this service. This indicates that there was a hesitance in receiving the mental aids, perhaps due to the uncommonness of the mental counseling in Japan. Also, it should be realized that the state of trauma generally sets in gradually after an accident. Therefore, it is necessary for the assistants of a care program to actively reach out for the victims, and to schematize a long-running program, as proposed by the "Center of Care for the Mind" established after the Great Hanshin Earthquake.

After-care programs are as important as emergency termination actions, and should be included in the disaster countermeasures\(^4\). Also, it should be noted that the anxiety of the residents mainly consisted of the concerns about health and environmental effects. Female residents were particularly concerned about such effects to their children, and thus, there was a strong demand for a long-term health examination. From the viewpoints of the experts, it may seem meaningless to conduct a long-term health examination as an after-care for this particular incident. Nevertheless, as a useful tool in solving the anguish of the residents, its value should be taken into account\(^5\).

3. Toward the Recovery of Public Confidence

In spite of various problems generated from the JCO accident, most of the residents in Tokai evacuated or took shelters, in accordance with the instructions by the local government. This enabled the community to avoid secondary disasters such as panic and traffic accidents, sustaining certain degree of order in the village. Thus, the most valuable lesson learned from the JCO accident is that it is impossible to protect health and properties of residents from nuclear risks without collaborating with them.

Proposal 1

Collaborate with the residents.

In the results of the Tokai-mura Residents Survey, there were numbers of useful and practical suggestions made by the residents, including the previously mentioned introduction of sirens, appointing of retired nuclear experts to improve the disaster
countermeasures of Tokai, and inclusion of nuclear disaster countermeasures in the town planning. These suggestions are based on the residents’ direct experiences of the accident, as well as on the knowledge in their daily lives, and therefore, these are indispensable in improving the efficiency and effectiveness of disaster countermeasures. "Citizens often think of innovative ideas not seen or deliberately excluded by established decision makers or experts" and thus, a continuous effort should be placed onto the construction of community in which these ideas of the residents, technical knowledge of experts and the management abilities of the local authorities and the industry are integrated. For this purpose, various types of public involvement and deliberation processes among all the stakeholders would be valuable.

Proposal 2

Communicate with the residents about the risks and their management.

To obtain the residents’ apt assistance in the case of emergency, the nuclear industry should actively communicate with the residents at all times for the mutual understanding of each other, and openly discuss with them the risks and the management of these. Risk communication is to produce an informed public. They would be able to decide their actions and suggest useful improvements for risk management, according to their basic knowledge about nuclear-related science and technology and also to their experiences of the daily lives. Also, risk communication is useful for the government and professionals to understand the public. Knowledge of how the public perceives risks, what their concerns are, and how they tend to act in the emergency are helpful in improving the disaster countermeasures and risk management. In other words, discussions about risks is an important step toward the construction of an ‘equal partnership’ among all stakeholders, whereby the roles and responsibilities to secure the social safety are divided fairly.

The residents of Tokai have become strongly anxious of nuclear power, but are not necessarily thinking in the line of complete abolition of nuclear power. The residents do actually recognize the fact that the higher standard of living in Tokai is due to its
nuclear industry and that their lifestyles are built upon it. Therefore, a majority of them hope Tokai to be a ‘model community of the nuclear safety’ in future. This probably is common for many peripheral regions of nuclear facilities. What should the nuclear industry do to respond to this desire of the residents?

**Proposal 3**

**Trust the public.**

“Trust is always a two-way-street”\(^7\), and is a process achievable only through the joint effort of both parties. After the JCO accident, both of the government and the nuclear industry have made a lot of efforts to regain the public confidence through enacting legislations against nuclear disasters, providing information about physiological effects of radiation, and so on. These efforts are surely important improvement, but there are more pressing issues; which are to trust the public’s good sense and wisdom, and to “contemplate together” the nuclear issues with the local authorities and the residents. The public is expecting the industry’s changes and challenges this minute.

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3 It was actualized in the disaster drill executed by the Tokai Village Office in September 30, 2000.
4 This suggestion was indeed expressed in the Law of Special Measures for Nuclear Disaster Countermeasures.
5 Ministry of Education, Culture, Sports, Science and Technology and Ibaraki Prefecture have conducted the health examination for the residents in Tokai since April in 2000.
How to Improve Nuclear Safety Culture
Efforts of the Korean Government and its Regulatory Body –

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How to Improve Nuclear Safety Culture

- Efforts of the Korean Government and its Regulatory Body -

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1. Introduction

In this modern society, we are constantly exposed to various risks posed by the application of new technologies that have brought us a lot of benefits, comfort and conveniences in our daily lives so that we can enjoy high standard of living. We are now very concerned about how to assure safety from these unwanted risks and how to make our world safe. Safety has become a public concern close to a national obsession these days.

In every country, safety assurance is one of the main government functions. Through establishing and enforcing relevant laws and regulations, it tries to protect its citizens and environment from potential harmful effects that may be brought by the application of these new technologies. Nuclear energy is a good example. It emerged in the mid-20th century with a new promise of inexhaustible energy source that has many valuable application potentials. Through worldwide commercial application of nuclear power, it has contributed significantly to the development and expansion of world industry and economy. It also contributed greatly to the advancement of science and technology and to the enhancement of quality of life through the application of radiation and radiation sources in such areas as agriculture, medicine and in other industrial applications.

In the later part of the last century, however, we had experienced several major accidents like TMI and Chernobyl and radiological accident at Goiania that spread negative images about nuclear energy all over the world, and the credibility about safety was severely damaged. Public concern about the safety of nuclear energy and thus public opposition has been growing ever since, and we still see no end in sight.
This is a typical example of public acceptance issues, a major obstacle the world nuclear industry is faced with these days. How wisely we resolve this public acceptance issue will decide the future of nuclear energy. In this respect, we are now standing at a turning point for make-or-break.

Every country endeavors to assure safety through establishing relevant legal and regulatory system, developing regulatory requirements and enforcing the laws and regulations. Regulation and control by the government authority is definitely necessary and a must to assure safety. However, it is widely believed it alone may not be sufficient enough to achieve the quality of safety the public wants for nuclear energy. What else do we need now? That would be safety culture well established, understood and respected across the whole society – among nuclear industry, regulatory authority and other stakeholders.

The promotion of a good safety culture was initiated by the IAEA in the aftermath of Chernobyl accident (Safety Series No. 75-INSAG-4 “Safety Culture”, IAEA, 1991). Ever since, the importance of safety culture has been recognized and thus shared among other international bodies, countries and organizations involved in nuclear energy. Safety culture has been promoted as one of the major worldwide efforts so far. A lot of discussions and developments in this area have been made under the leadership of the IAEA. Much effort, however, has been paid to the safety culture in operating organizations, primarily focused on what the good safety culture is and how to promote it there: ways and means, steps and strategies, etc. It has made a great contribution to the improvement of nuclear safety worldwide, and it will continue to do so in the future, too.

The Korean Government and its regulatory body also have been endeavoring to promote safety culture in Korea in general, and particularly in nuclear related organizations and individuals in the past several years. This paper discusses the efforts of the Korean Government and its regulatory body and their role in establishing a Korean way of promoting safety culture, and experience gained from it.

2. Importance of Safety Culture
2.1 Concept of Safety Culture

Culture or a culture consists of the ideas, customs and arts that are produced or shared by a particular society. Therefore, culture may be perceived, expressed, shared and practiced differently among different group or people. This is what we call “cultural difference”. This concept of culture can be further extended to safety area in such a way INSAG-4 defines Safety Culture as:

*Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.*

Safety culture also applies to many areas of nuclear energy such as application of radiation and radiation sources in agriculture, medicine, and in other industries, not necessarily limited to nuclear power plants. Further, safety culture applies not only to nuclear area but also to industrial and personal safety issues that we encounter in our everyday lives.

All safety considerations are affected by common aspects of attitudes, beliefs and behaviors which are closely linked to a shared system of values and standards of a group or people.

2.2 International Promotion of Safety Culture

For the promotion of safety culture worldwide, international bodies like IAEA and OECD/NEA, and other international organizations such as International Nuclear Regulators Association (INRA) and Forum for Nuclear Cooperation in Asia (FNCA) have emphasized the importance of safety culture and developed safety culture assessment methodologies and various promotional strategies that include the IAEA’s services like ASCOT, OSART and development of safety culture indicators. One common and underlining view is we may develop principles and framework of good safety culture for international applications. But to make it more effective and practical in a particular country or society we have to take cultural difference into account. The upcoming INSAG document “Key Practical Issues to Achieve a Stronger Safety Culture” addresses this aspect:
What constitutes a good approach to enhancing safety culture in one country may not always be the best approach in other country.

International as well as national effort to develop and make safety culture more practical and pragmatic should continue. Even though the safety of nuclear power plant will be assured by laws and regulations it can be further strengthened and enhanced to such a level the public wants through establishment of a strong safety culture. It is no doubt that the future direction of nuclear power will largely be dependent on how much improvement we can make in public acceptance area.

3. Government Commitment to Nuclear Safety

The practical approach that the national government adopts towards nuclear safety has major effects on all organizations influencing nuclear safety. So the major role of the government in ensuring the nuclear safety at the national level can be summarized as:

1) Establishment of a regulatory infrastructure through legislation that includes establishment of regulatory body and legal basis for safety regulation,

2) Demonstration of its strong commitment to nuclear safety through legislation and its policies on the following aspects:
   - Broad safety objectives in the use of nuclear energy,
   - Independent regulatory body, ensuring its operation neither being interfered nor influenced by undue pressure from bodies involved in promoting nuclear energy,
   - Strong support for regulatory body that includes adequate powers, sufficient funds for all activities, and
   - Promotion and contribution to the international exchange of safety related information.

4. Regulator’s View on Safety Culture

4.1 Regulation and Safety Culture

Safety regulation is a duty of the national government mandated by relevant laws to assure the safety of nuclear facilities as well as the safety associated with nuclear activities with an aim to protect the workers, the public and the environment. It
constitutes a formal process implemented by the national regulatory authority based on relevant laws and regulations. The regulatory body establishes regulatory requirements, processes and detailed rules and procedures and conducts necessary safety reviews and inspections.

When deficiencies in safety or violations of the law are found it orders necessary corrections to restore the safety conditions and sometimes impose penalties in compliance with applicable laws and regulations. In this context, regulators may believe that desirable safety level can be always achieved and restored when necessary by means of rigorous regulatory enforcement. It is true in part but not always proven right.

We may improve the design, upgrade safety systems and strengthen safety standards and regulatory requirements to get added safety. However, the whole safety system equipped with defense-in-depth and multi-layered protection could collapse by complacent and careless operators lacking safety culture as we witnessed in many accidents like TMI, Chernobyl and as recently as in JCO accident in 1999.

Safety culture should be integral part of national safety philosophy together with defense-in-depth, operator's responsibility, efficient regulation and public awareness. However, it is generally agreed that safety culture can not be the subject of direct regulation. We can not penalize or punish anyone based on his status of mind, attitude, ideas or simply because he belongs to different culture in this modern democratic society.

Recently, however, regulators are getting interested in safety culture and there are increasingly active discussions on the regulation and safety culture.

4.2 The Role of the Regulator in Promoting Safety Culture

Regulators generally recognize the value of safety culture and support the role of safety culture in establishing safety management system of the licensees. Regulators are considering an indirect approach to oversight safety culture but it would be an effective way to monitor the degradations and shortcomings in licensee's safety management processes due to weakness of safety culture. It can be expressed in terms of measurable indicators (i.e., safety culture indicators developed as part of safety performance indicators) or warning signs. By being alert to the early warning signs, corrective action
can be taken in sufficient time to avoid adverse safety consequences.

It will be worthwhile for regulators to take the initiative in promoting safety culture in all organizations involved in nuclear energy applications. The most important factor in enhancing safety culture is top management’s awareness of safety and its strong commitment to it. In that regard, the regulatory body may advise the operating organizations to make a corporate level safety policy statement and declare it.

As part of fostering safety culture, the regulatory body may encourage the operating organizations to expand their communication with the regulatory body. The operating organizations will benefit from an open and frank dialogue with the regulatory body, especially when the dialogue focuses more on achieving fundamental safety objectives than on merely formal compliance with detailed rules and regulations. This type of dialogue will promote an inquiring and learning attitude – a key element in enhancing safety culture.

4.3 Safety Culture in the Regulatory Body

At the same time, regulators themselves should have high safety culture, too, because regulators have considerable discretionary authority in matters of nuclear safety. Safety culture in regulatory organizations may address the issues like organizational commitment to priority of safety matters, staff competence supported by well established education and training program, good internal communication and open, cooperative relations with operating organizations, the public and other stakeholders, well established and known system for acceptance criteria, timely regulatory decisions, etc. The regulatory body may introduce or develop its own internal quality management system to this purpose.

The regulatory body is expected to face many challenges and increasing pressure in the coming years to improve efficiency and effectiveness of its regulations under the rapidly changing nuclear industry environment. To achieve this objective without jeopardizing safety and to ensure stakeholder confidence in the regulatory body at the same time, the regulatory body should establish and be equipped with a strong safety culture of its own

5. Promotion of Safety Culture in Korea
5.1 Efforts of the Korean Government

**Legislation and Regulatory Frameworks**
The Korean Government has established a legal system through the enactment of legislation with an aim to regulate the safety of nuclear facilities and related activities. The legal system is consisted of the Atomic Energy Act, its Enforcement Decree and Regulation, and the Notice of the Minister of Science and Technology. The legislation provides the statutory basis for establishing an independent nuclear regulatory body ensuring its operation neither being interfered nor influenced by undue pressure from bodies involved in promoting nuclear energy. And the Government gives a strong support for regulatory body that includes adequate powers, sufficient funds for all activities.

**Nuclear Regulatory System**
The nuclear regulatory organization in Korea is consisted of three parts:

- **Nuclear Safety Commission**: The principal function is decision-making on major nuclear safety and regulatory policy and licensing issues

- **Regulatory Authority**: The Ministry of Science and Technology (MOST) is the regulatory authority of the Korean Government. It is responsible for establishing nuclear regulatory policies and implementing regulation with independent enforcement power. Promotion and control of nuclear industry is responsibility of the Ministry of Commerce, Industry and Energy (MOCIE). The MOST is also responsible for making nuclear research and development policies for peaceful uses of nuclear energy.

- **Regulatory Expert Organization**: The Korea Institute of Nuclear Safety (KINS) is a technical expert organization established to support the MOST with its technical expertise not only in the development of nuclear regulatory policy and standards but also in the enforcement of nuclear safety laws and regulations. KINS has 300 staff and its annual budget is about $35 million.

**Nuclear Safety Policy Statement**
In September 1994, the MOST formulated a nuclear safety policy statement and declared its major policies for the assurance of nuclear safety in Korea. The purpose of this statement was to improve the consistency, adequacy, and rationality of nuclear regulatory activities by notifying the public and other stakeholders of the government’s
basic policies regarding nuclear safety. In this statement the MOST reaffirmed that nuclear safety takes the top priority in the development and utilization of nuclear energy and it should be of the foremost concern to organizations and individuals involved in nuclear activities. The MOST also declared to develop safety culture for Korean audience based on INSAG-4, and set forth the five principles of regulation: Independence, Openness, Clarity, Efficiency and Reliability.

**Designation of Nuclear Safety Day**

In 1995, the Korean Government designated the 10th of September as “Nuclear Safety Day” with an aim to promote the awareness of nuclear safety and also to cultivate a working atmosphere for better compliance with safety principles. It was also intended to encourage people at all working levels in nuclear field to have a proactive attitude in assuring nuclear safety. The project was launched as part of a campaign to promote nuclear safety culture. The government sponsored the event with the Minister of Science and Technology as the host. At the ceremony best performing individuals and organizations were commended for their outstanding achievement and service in nuclear safety field and also a prize was awarded to the best safety slogan. It has got enthusiastic response and growing support every year, and it has become a national event. Then the government upgraded the event and expanded the commendation program.

Since the 3rd anniversary of Nuclear Safety Day in September 1997, the Prime Minister has hosted the event, and in 1999 the first medal was awarded to the Ulchin site general manager for his meritorious services in achieving the operational safety of nuclear power plants under his command and promoting safety culture among the people working at the site. It should be worthwhile to note that the former Ulchin plant manager who was awarded a grand safety prize in 1997 is now appointed to the president of the Korea Hydro & Nuclear Power Company(KHNPC).

Last year, around 30 people were awarded various kinds of commendation. They were selected as the best safety performing individuals from every sector of the nuclear community – nuclear industry, research organizations, hospitals, regulatory organizations and NGOs, etc.

It is widely recognized that outstanding safety performers who have got commendation, prize or a medal will have far better opportunity to get promotion. In this respect, the Nuclear Safety Day event is contributing greatly to the promotion of safety culture as a
great incentive in Korea.

**The Act to Support the Communities Nearby Electric Power Plant**
The Korean Government established the legal base to support the communities nearby nuclear power plants and developed a comprehensive program in intensive consultation with the local community residents. The program includes financial assistance for various community development projects. One of the projects is set up and operation of a surveillance team that is composed of local residents.

The team is designed to monitor radiation levels around the plant site, analyze samples and gather information about irregularities in safety conduct at the plant. They report findings, concerns and opinions directly to the local government and also to the national regulatory authority for appropriate action that is deemed necessary. Their activity is not part of regulation but it provides a good communication channel between local communities and regulatory body to resolve their safety concerns. The project is also expected to play a vital role in improving public acceptance of nuclear power in Korea.

**Nuclear Safety Charter**
The Korean Government is now developing a Nuclear Safety Charter with an aim to clearly set the nuclear safety to be the utmost prerequisite of nuclear energy development and utilization, and to advocate a sense of duty and responsibility among the people in nuclear field to ensure safety, and thus to achieve the confidence in nuclear safety among the citizen. A working group was set up in the Regulatory Policy and Systems Subcommittee of the Nuclear Safety Commission to that purpose. The Charter will be made public after a review at the Commission.

**5.2 Efforts of the Regulatory Body**
Most of the program and activities related to the promotion of nuclear safety culture in Korea have been launched under the regulatory initiatives and carried out with active role played by the regulatory body. The operating organizations and other industry organizations were participating in the programs and activities as partners. In this sense, the regulatory body has led the industry in promoting and establishing safety culture in Korea.

**Development of Safety Culture Indicators**
In 1995, the MOST made a decision that the safety culture of the operating organization
(KEPCO) that is directly responsible for the safety of nuclear power plant has to be assessed, and asked KINS to develop detailed assessment procedures. KINS developed a set of Korean Safety Culture Indicators based on the ASCOT Guidelines by the IAEA. But the ASCOT Guidelines were modified to be adapted to the Korean situation. For example, (1) ASCOT Guidelines assumed there were many operating organizations but there was only one in Korea. (2) ASCOT classification of levels and organizations was too broad to be applied in the field. So more specific classification was developed. (3) More detailed assessment criteria for key indicators were also developed to supplement the ASCOT Guidelines. The Korean Safety Culture Indicators were completed with 8 assessment areas, 43 key indicators supported by 181 specific questions.

In May 1997, a special inspection on safety culture was carried out using the Korean Safety Culture Indicators at each of the four nuclear power plant sites. The inspection was carried out in two parts:

1) Interview of 15 – 18 personnel per site to assess the level of safety culture establishment,

2) Questionnaire survey of 100 – 200 personnel per site in the form of self-assessment.

Inspection results showed:
- Operators fully understood the importance of safety culture and actively performed safety activities to establish the highest standard of safe culture,
- Improvement was needed in such areas as training of instructors, maintenance of simulators and training for new technology, etc.,
- High scores in areas such as (1) safety performance review, (2) site surveillance by plant managers, (3) manager’s attitude, and
- Low scores in areas such as (1) training and (2) operator attitude.

Lessons learned were:
- Since there was only one operating organization in Korea, as it was expected, the status and level of establishment of safety culture at each site were not greatly different,
- The effort to enhance safety culture at each site could not be caught by questionnaire. So interview would be a useful method to assess the status and level of establishment of safety culture.

Regulatory Review of Safety Culture Inspection:
- The Korean Safety Culture Indicators were proven adequate tool to assess the safety culture status of the operating organization,
- However, safety culture assessment administered by the regulatory body would not be appropriate and might not represent the real safety culture status due to strategic bias, and
- Safety culture should be self-assessed by operating organization.

The regulatory body decided it would not regulate safety culture directly and the Korean Safety Culture Indicators would be transferred to the operating organization to be used as self-assessment tool. In 1997, the operating organization set up safety culture assessment team and has been conducting self-assessment of safety culture on an annual basis using the Korean Safety Culture Indicators.

**Safety Culture in Regulatory Body**

1) Development of Quality Management Guideline for Regulatory Activities:
KINS has developed detailed guideline for quality assurance with an aim to carry out various regulatory activities systematically and in a well structured way. The development of the guideline was based on IAEA-TECDOC-1090, “Quality Assurance within Regulatory Bodies”. But necessary adaptation and modification were applied to improve its applicability to Korean situation. This guideline is expected to establish the consistency and confidence in regulatory activities and to achieve high quality in regulation. The guideline is in the final review process.

2) Mission Statement and Professional Ethics Statement:
In February 2000, KINS officially announced the Mission Statement that would clearly define the mission, duty and responsibility of the regulatory expert organization as part of the regulatory body of Korea. It would make a great contribution to establishing the organizational culture within KINS. And the Ethics Statement, which was announced at the same time, would help assure the objectivity and fairness in carrying out various regulatory activities.

**Committee on Nuclear Safety Enhancement**

The MOST announced May 3, 2001 it will set up a Committee on Nuclear Safety Enhancement, as part of its effort to develop a policy to enhance the level of nuclear safety. The Committee will prepare a safety improvement plan such as strengthening of accident prevention measure for nuclear facilities and at the same time develop a new
policy to promote nuclear safety culture more extensively. Also included is a plan to achieve the public confidence in nuclear safety through further expansion of safety information release to the public and the participation of NGOs interested in safety.

The Committee will consist of experts from university, research institute and industry, and also from citizens group. A member of the Nuclear Safety Commission will chair the Committee. The new safety improvement plan recommended by the Committee will be established as national policy through the deliberation at the Nuclear Safety Commission.

6. Conclusion

- Nuclear safety culture, promoted by international efforts under the leadership of the IAEA in the last decade, has made great contribution to achieving nuclear safety worldwide so far, and the efforts should continue in the future.
  ➤Continuing efforts for the promotion of safety culture

- Regulation and control by the national authority is definitely a necessity and a must to assure safety. But we still need a good safety culture to achieve the high quality of safety the public wants.
  ➤Rigorous regulation and good safety culture for ensuring safety

- Through the promotion and establishment of safety culture, high quality of safety would be achieved worldwide. That will in turn improve the public confidence in nuclear safety. Then the improved public acceptance of nuclear power will contribute to the revitalization of nuclear industry.
  ➤Safety Culture for the future of nuclear industry

- The Korean Government and its regulatory body have taken much of the initiatives to promote safety culture in Korea such as legislation for safety as well as regulatory infrastructure, development of policies and programs to promote safety culture. Safety culture has been promoted as an incentive to a certain degree under the regulatory initiatives in Korea.
  ➤Regulation as formal and punitive measure but Safety Culture as less formal and incentive
The regulatory body is expected to face many challenges and will be under increasing pressure to improve efficiency and effectiveness in this rapidly changing nuclear industry environment. To cope with this situation without jeopardizing safety, regulatory initiatives to promote safety culture not only in operating organizations but also in regulatory body itself would be a good proposition.

Regulatory Initiatives in Safety Culture Promotion

We will take care of nuclear power plant as a mother takes care of her home and family with mother’s way of safety.

Safety Culture as Mother’s Way of Safety
Effort to Open the Mystery of Korean Ginseng
- Related to Radioprotection and Immune Modulation -

Young-Soo Eun, Ph.D

Senior Advisor to KINS President
Korea Institute of Nuclear Safety
Efforts to Open the Mystery of Korean Ginseng
-Related to Radioprotection and Immune Modulation-

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(Abstract)
Ginseng is cultivated in shadow for 5 to 6 years and its root is used as natural tonics in oriental country. There are several kinds of ginseng products such as ginseng tea, white ginseng, and red ginseng. The biological activity of ginseng is summarized as follows: enhancement of brain activity, hypoglycemic activity, modulation of blood pressure, anti-stress and anti-fatigue activity, and antitumor activity. However the active substances and its mechanism of action have not been fully elucidated. In this present study, we isolated an radioprotective and immunomodulatory substance "Ginsan" from ginseng and examined its biological activity.

Ginsan is glucose polymer [poly (1→4)α-D-glucopyranosyl (1→6)α-D-glucopyranose]. Ginsan activated natural killer cells and macrophages to kill a broad spectrum of tumor cells and inhibited the metastasis of B16-F10 melanoma. Ginsan also protected bone marrow cells from $^{60}$Co- gamma irradiation and promoted its growth. The LD$_{50/30}$ of $^{60}$Co-gamma irradiation was 7.56 Gy in control and 10.76 Gy in ginsan treated Balb/c mice. The incidence of postoperative infectious complication in high risk patients in estimated to be between 25% and 30%, and it is mow more serious by the occurrence of antibiotics resistant Staphylococcus aureus. Ginsan exhibited anti-infectious activity through the activation of macrophages to produce nitric oxide (NO) and other inflammatory substances. The survival rate of mice challenged by Staphylococcus aureus was 20% and 60% in control and ginsan treated C57BL/6 mice, respectively. The intravenous administration of 1500 mg/kg body weight ginsan did not show any toxicity in mice.
In conclusion, ginsan is safe and well tolerated, and can be used as radioprotector, radiotherapeutic agent, antitumor immunomodulator, and anti-infectious agent.
Efforts to open the mystery of Korean ginseng
-Related to Radioprotection and Immune modulation

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Panax ginseng: The roots of Panax ginseng has been used as natural tonics in oriental country. It is cultivated for 5 to 6 years in shadow. There are several kinds of ginseng products such as ginseng tea, white ginseng, red ginseng. It has been known that Panax ginseng enhances many physiological activities, prevents cancer incidence, exhibits anti-stress and anti-fatigue activity, and modulates blood pressure. It has been also reported that ginseng extract and saponins enhanced immune response, however, no significant substances responsible for these effects have been isolated. Here, we isolated an immunomodulator “Ginsan” from Panax ginseng and elucidated its antitumor immunomodulatory and radioprotective effects.
Table 1. Activity of Panax ginseng

- Regulation of central nervous system
- Enhancing activity of brain function
- Antitumor and antitumorigenic activity
- Regulation of immune system
- Hypoglycemic activity
- Activation of hepatic function
- Prevention of heart attack and arteriosclerosis
- Modulation of blood pressure
- Amelioration of menopausal disorder and osteoporosis
- Anti-stress, anti-fatigue activity
- Anti-ulcer and anti-inflammatory activity
- Recovery of renal insufficiency
- Anti-oxidative and anti-aging activity
- Radioprotective and radiotherapeutic activity
- Detoxification of narcotics

◆ Ginsan: Ginsan was prepared as follows. The roots of Panax ginseng was extracted with methanol, then the residue was extracted with distilled water. The water soluble fraction was treated with 80% ethanol, and the precipitates were collected by dialysis membrane and freeze-dried. It was applied to sephacryl S-500 gel chromatography and DEAE-sephadex A-50 chromatography, successively.

Ginsan was composed of 6 kinds of polysaccharide being mean molecular weight about 150 KDa, consists of α (1→6) linked D-gluco -pyranose units with partly α (1→4) linked branches by chemical and spectral analysis.
Structure of Ginsan

◆ **Antitumor Immunomodulatory activity of Ginsan**

**Activation of NK cells:** Ginsan activates natural killer cells and macrophages to kill tumor cells. Natural killer (NK) cells are a morphologically and functionally distinct subset of lymphocytes endowed with the ability spontaneously to kill virally infected cells and a wide variety of tumor cells but spare most normal cells. Four hour $[^{51}C]^{1}Cr$ release assay was used to determine the activity of natural killer cells. Briefly, spleen cells ($1.5 \times 10^6$ cell/mL) were cultured with Ginsan for 5 days and then co-cultured with $[^{51}C]^1Cr$-labeled target cells, YAC-1 (effector cell : target cell= 100 : 1) for 4 hours in 96 well-U-bottomed microplates. The radioactivity released in the supernatant was determined by using γ-counter. The percentage of specific release was calculated as : % of specific release = (ER-SR) / (MR-SR) $\times 100$, where ER is the mean count from the experimental group, SR is the mean count from target cells incubated in medium alone, MR is the mean count from target cells treated with 0.5% triton X-100. The effector cells at 50 μg/mL Ginsan treated group exhibited 42.4% cytotoxicity to YAC-1 tumor cell, which is 10.3 times higher than 4.1% of the control. Ginsan activated NK cells activity 2 times and 15 times higher than that of OK-432 and lentinan,
Activation of macrophages: Macrophages are the source of inflammatory cytokines (IL-1, TNF-α, IL-6, IL-12 etc.) and participate as major effector cells in resistance against infectious agents and tumor cells. They are activated to become cytotoxic by a set of cytokine signals. Therefore, we examined whether Ginsan activates macrophages to induce effector molecules such as cytokines and exhibit cytotoxic effect to tumor cells. Peritoneal macrophages of C3H/HeN mice were isolated and seeded $2 \times 10^5$ cells/well in 96 well-U-bottomed microplates with or without Ginsan for 24 hrs at 37°C, 5% CO₂ incubator. The macrophages were washed with PBS to remove Ginsan and incubated with YAC-1 cells at $1 \times 10^4$ cells/well in the presence of 2μCi/well of $^3$H-thymidine. After 24 hours, the cells were harvested and the amount of radioactivity incorporated in the target cells were counted in a liquid scintillation counter. Macrophages cultured with 1, 10, 100 μg/mL of Ginsan inhibited the growth of YAC-1 tumor cells by 33.4, 40.9, 62.1%, respectively.
Inhibition of B16 melanoma metastasis: NK cells have been known as effector cells responsible for elimination of blood-born metastases. Thus NK cells can serve as the earliest cellular effector mechanism and can rapidly eliminate tumor cells from the blood stream or from lungs in experimental animals. To examine the effect of Ginsan on the inhibition of lung metastasis, Ginsan was intraperitoneally administered from 3 days after the tail vein injection of B16-F10 melanoma cells into the 5 weeks old C57BL/6 mice. The median number of lung colonies of B16-F10 cells was measured on day 18 after tumor inoculation. The median number of lung colonies decreased by 44.2% when 10mg/kg of Ginsan was intraperitoneally administered every other day for 18 days.
Figure. Inhibitory effect of Ginsan on the experimental metastasis of B16-F10 melanoma. The right is the lung of control mice and the left is the lung of Ginsan treated mice.

Inhibition of the growth of LLC tumor cells in vivo: In order to examine the antitumor activity of Ginsan on tumor bearing mice, Lewis lung carcinoma (LLC, \(2 \times 10^6\) cells/mice) were injected s.c. into C57BL/6 mice. 50 mg/kg of Ginsan were intratumorally injected 8 times every other day from 9 days after tumor implantation. The tumor size in Ginsan administered mice was reduced by 90% compared with the control at 24 days, and LLC tumor cells were regressed in 4 mice out of ten Ginsan administered mice.
Figure. Antitumor activity of Ginsan in C57BL/6 mice transplanted with LLC.

◆ **Radioprotective activity of Ginsan**: The most serious side effect of radiation therapy and chemotherapy in cancer patients is the immune suppression due to the death of bone marrow cells.

Ginsan stimulates spleen cells and bone marrow cells to proliferate, so we examined the in vivo effects of Ginsan on the protection and also on the recovery of bone marrow cells from sublethal doses of irradiation. Female BALB/c mice having 18~22 g weight were put in the acryl box, and exposed to $^{60}$Co γ-irradiation at a dose rate of 97.1 cGy/min. Five days after sublethal irradiation (4.5 Gy), the number of bone marrow and spleen cells in mice were measured by trypan blue exclusion method. The number of spleen cells and bone marrow cells in the irradiated control mice administered only phosphate buffered saline (PBS) was less than 10% and 62% of the nonirradiated normal mice, respectively. These values increased by 1.8 fold in
spleen and by 1.3 fold in bone marrow cellularity from mice injected with the Ginsan at 100 mg/kg 24 hours before irradiation. The number of white blood cells in peripheral blood decreased from \(3.463 \pm 0.236\) to \(0.476 \pm 0.034 \times 10^3/\mu L\). The number of platelets decreased from \(585.0 \pm 39.0\) to \(354.5 \pm 26.0 \times 10^3/\mu L\) and neutrophils and lymphocytes was also significantly decrease. The hematopoietic recovery in the Ginsan-treated mice was 2 fold faster than that of the irradiated control group, especially the number of neutrophils.

The number of GM-CFU was very low in the irradiated PBS control mice about 17% of the non-irradiated normal value, but GM-CFU in the Ginsan administered group before irradiation was up to 63~80% of the normal. It shows that GM-CFU in the Ginsan administered group is 3.7~4.7 times early recovered compared to the control group. To examine the regeneration of bone marrow stem cells, PBS or Ginsan at 100 mg/kg administered to mice 24 hours prior to lethal dose of irradiation (9 Gy). Nine days later, the number of nodules per spleen (endogeneous CFU-s) was counted microscopically following fixation with Bouin’s solution. The number of e-CFU was 0.6\pm0.3 per spleen in irradiated control mice and 24.3\pm2.6 per spleen in Ginsan treated mice.

The increase in the number of endogenous CFU-s has a good correlation to the survival rate of mice treated with radioprotective drugs. Therefore, to determine the survival elongation effect of Ginsan, mice were treated with Ginsan 24 hours before lethal irradiation and monitored 30 days. The \(L_{D50/30}\) of \(^{60}Co\)-\gamma ray in PBS treated control mice was 7.46 Gy, but it was increased to 10.76 Gy in the Ginsan treated mice. Dose reducing factor (DRF) of Ginsan was 1.44, which is higher than that of selenium (DRF=1.01), glucan (DRF=1.22) and WR-2721 (DRF=1.33).
Anti-infectious activity of Ginsan: Septicemia is an acute invasion of the bloodstream by microorganisms. It can be a serious, rapidly progressive, life-threatening infection that may arise due to localized infections of the respiratory, gastrointestinal tract, genitourinary system, or from the skin. Staphylococcus aureus is a major pathogen of this hospital infection.

We elucidated the anti-septicemic effect of Ginsan by using Staphylococcus aureus intraperitoneal challenge. C57BL/6 mice were challenged with 0.1 ml \(1.0 \times 10^8\) CFU/ml of S. aureus culture 3 hours after administration of Ginsan by intraperitoneal injection. Survival was recorded at 2 and 5 days after challenge.

The anti-septicemic activity of Ginsan on the S. aureus peritoneal sepsis was excellent as 60% survival, compared to control (17% survival), at 2 mg/kg of concentration.

Growth of staphylococci in blood was evaluated by colony enumeration at 24 hr after S. aureus infection. Blood samples of Ginsan treated (2 mg/kg) and untreated groups from infected mice were obtained by retro-orbital sinus
bleeding before sacrifice. Appropriate dilutions were made, and 0.2 ml each of blood dilutions were plated on blood agar plates. After incubation for 48 hr, colonies were counted and the results were expressed as the number of CFU per milliliter of blood.

The bacterial growth in blood from orbital sinus or plexus of infected mice reduced approximately 10 folds compared to control in Ginsan treated mice (2 mg/kg).

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**Figure.** Anti-infectious activity of Ginsan on the *S. aureus* peritoneal sepsis challenge.
Figure. Evaluation of bacterial growth in blood from orbital sinus or plexus of infected mice.
Appendix II

Photos
Participants of the 1st WIN Korea Annual Meeting, Seoul, Korea
WIN-Korea Official Members.

From right Ms Yoon-Sil Lee, Ms Choo-Ok Lee, Ms In-Young Noh, Dr. Myung-Ok Ahn, Ms Se-Moon Park, Ms Byung-Joo Min, Dr Sung-Woon Hong, Ms Yeon-Ok Yun, Ms In-Kyung Lim, Ms Nam-Sook Lee, Dr. So-Yeon Kim and Jin-Sil Sung
Welcome to Korea!

THE 9TH
WIN GLOBAL
ANNUAL MEETING
제9차 세계여성헌혈 자원봉사자 연합회 연차대회

14-17 May 2001 Palace Hotel Seoul Korea
WIN Board Meeting on May 14 morning at Palace Hotel, Seoul
A view of the participants to the General Assembly of the 9th WIN Global Annual Meeting.
Ms Agneta Rising, the immediate past President of WIN Global as the Acting Chairperson of the 9th WIN Global Annual Meeting appreciates WIN-Korea key members for their dedicated works preparing this meeting. From right Ms Agneta Rising, Dr Sung-Woon Hong, Dr Young-Soon Shin, Ms Byung-Joo Min
WIN members are visiting HANARO Research Reactor at Korea Atomic Energy Research Institute, Taejon.
Welcoming reception hosted by Mr Yang-Uoo Choe, President & CEO; Korea Hydro & Nuclear Power Company
Demonstration and sampling of radiation processed food during the meeting. Explanation by KAERI staff about radiation processed hams and sausages.
WIN members are visiting radioisotope production facility of KAERI
Korean traditional costumes fashion show during the meeting attracted many WIN members
Group photo of some of the participants from abroad and Women Interested In Nuclear members
WIN-Korea members from Korean nuclear power plants.
Center is Mr. Yang-Yoo Choe, President & CEO, Korea Hydro & Nuclear Power Company.
Some WIN national organizations’ representatives at the 9th WIN Global Annual Meeting
Opening remarks at the meeting by Ms Irene Aegerter, the first WIN Global President
WIN members are visiting Nuclear Environment Technology Center of KHNP during technical tour
Preliminary meeting to establish the WIN-Asia as a regional structure of WIN Global. Japan, Korea, China, Mongolia, Taiwan and Vietnam participated. 15 May 2001, Palace Hotel, Seoul, Korea
WIN members are treated to Korean traditional sweet rice cakes and are explained how to make
WIN members are treated to Korean traditional sweet rice cakes and are explained how to make
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제목/부제
세계원자력연합국대회개요 및 협력기관

연구책임자 및 부서명
(TRL, AR인 경우 주제자)
민병주 (해양연구설계기술 개발팀)

연구자 및 부서명
김대영, 김도영, 노인영, 민경란, 박선희,
송순자, 육홍선, 정준극, 최신영, 최선주, 한봉오

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참고사항
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서면 공개 ( )

보고서종류
보고서 번호

초록 (15-20줄내외)

○ 세계 WIN과의 협력 방안 조사 연구
  - 세계 WIN 연차 대회 현황조사 및 국내 WIN 창립을 위한 기본정보 수집
  - 여성 원자력전문인들의 역할에 대한 세계현황조사 파악 및 향후 세계 WIN활동에 대한 효율적 참여 방안 도출

○ 국내 여성 원자력 전문인 및 원자력 관련국 여성 원자력 전문가들 사이의 효율적 정보 공유 체계 구축을 위한 기반 마련
  - WIN-Korea 창립준비 및 창립
  - WIN-Korea Home Page 구축준비
  - WIN-Korea 관련 자료 수집을 통한 네트워크 구축을 위한 기본자료 수집로 활용

○ 국내 원자력전문여성과 원자력 관련국 여성원 원자력 전문 여성간의 국제협력 증진 강화
  - 제9차 세계 WIN 연차 대회 국내 개최
  - 세계 WIN 없는위원회 진출 및 이사회 활동 강화
  - 각종 원자력관련 국제회의 참가, 인적, 물적 정보교환을 통하여 홍보 및 정책동향 파악

○ 제9차 세계 WIN 연차 대회의 국내 개최 확정에 따른 준비 및 대회 개최
  - 조직위원회 및 운영위원회 구성, 사무국 운영
  - 제9차 세계 WIN 연차 대회 국내개회 지원

주제명키워드
(10단어내외)
여성원자력전문인, WIN-Korea,
**Title/Subtitle:** A Study on the Promotion of cooperation with 'Women In Nuclear(WIN)-Global'

**Project Manager and Department:** Byung Joo Min, Fuel Design Technology Development Team


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**Abstract (15–20 Lines):**

- International collaboration with WIN-Global
  - Evaluation on current status for the foundation of WIN-Korea and investigation on the 1st to 8th WIN-Global conferences for the arrangement of 9th WIN-Global conferences
  - Manifestation on the roles of WIN-Korea and WIN-Global
  - Encouragement of active participation for WIN-Global activities
- Establishment of internet net working for effective communication through the internet net working between women in science in Korea and other foreign countries.
  - Preparation and Organization of Women in Korea
  - Foundation of WIN-Korea Home Page in Net
  - Assembly of data for the net work construction in Korea
- Enhancement of international cooperation between WIN-Korea and WIN-Global
  - Invitation of 9th WIN-Global Conference in Seoul, Korea
  - Enrollment of one of the Executives and Strengthening the activity of WIN-Korea as member of Board members
  - Characterization on main movements of WIN-Global through the active participation in international activities.
- Arrangement for the 9th WIN-Global conference
  - Operation of Organizing Committee and Supporting Committee and Secretariat
  - Supporting the 9th WIN-Global Conference.

**Subject Keywords (About 10 words):** WIN-Korea, WIN-Global,