出國報告（出國類別：其他）

參加全球核能婦女會 2010 年會及參訪韓國核能及重工業設施

服務機關：核能研究所
姓名職稱：武及蘭
羅彩月
派赴國家：韓國
出國期間：99 年 5 月 9 日~99 年 5 月 16 日
報告日期：99 年 6 月 15 日

摘　要

本次公差目的爲參加全球核能婦女會(WiN Global)2010 年會，順道參訪韓國斗山重工、大宇造船廠、現代汽車、新古里電廠等設施。WiN Global 2010 年會以 “Nuclear Power Pivotal Choice For Green Growth” 核電爲綠能之重要撰擇爲主題，於 5 月 9 至 14 日假韓國釜山(Paradise Hotel Busan)之會議廳舉行，由韓國分會 WiN Korea 主辦，有來自 28 國，約 300 人參加。台灣分會由原能會、台電公司、核資中心、亞瑞華公司及本所共同派員，組成 9 人代表團出席，此行主要任務有：(1).出席 WiN Global 理事及執行理事會討論會務，表決有關討論提案；(2).出席全球核能婦女會 2010 年會，與各國核能界女性交流並發表論文；(3).參訪韓國核能及工業發展現況；(4).拜訪外交部駐釜山辦事處。

目　　次

摘　要

一、目 的

(一)本次公差之目的如下：

1.出席全球核能婦女會(以下簡稱 WiN Global)理事會討論會務，表決有關討論提案。

2.出席全球核能婦女會 2010 年會，與各國核能界女性交流，並主持二節會議(邱絹琇)。

3.出席年會活動，報告國家報告(武及蘭)、發表論文(3 篇)及擔任 Plenary Session III (Theme: Strategic action for the promotion of radiation medicine)的講員(羅彩月)。

4.參訪斗山重工、大宇造船廠、現代汽車、新古里電廠，了解韓國核能及工業發展現況。

5.拜訪外交部駐釜山辦事處。

(二)行程

日期	行程
5 月 9 日(星期日)	去程(桃園—釜山)
5 月 10 日(星期一)	參訪斗山重工、大宇造船廠
5 月 11 日(星期二)	WiN Global 年會
5 月 12 日(星期三)	WiN Global 年會
5 月 13 日(星期四)	WiN Global 年會
5 月 14 日(星期五)	參訪現代汽車、新古里電廠
5 月 15 日(星期六)	拜訪外交部釜山辦事處
5 月 16 日(星期日)	返程(釜山—桃園)

(三)我國代表團名單

WiN Taiwan 由會長武及蘭率團九人與會，名單如下：

姓名	服務單位
武及蘭	核能研究所保健物理組
羅彩月	核能研究所同位素應用組
邱絹琇	原子能委員會綜合計畫處
范盛慧	原子能委員會輻射防護處
陳怡如	台電核能技術處組長
杜美鈴	台電核能發電處視察
陳玲琬	台電後端處核能工程師
陳婉玉	財團法人核能資訊中心
呂雪芳	亞瑞華公司(Areva), 台灣

台灣代表團與 WiN–Global 2010 大會主席(右四)之合影

武及蘭、羅彩月、邱絹琇、陳怡如、陳婉玉、及呂雪芳等六人，係由各單位之出國計畫下派遣，其餘三人係向核能學會申請部份補助，不足額度由自費參加者負擔。

(四)WiN Global 簡介

全球核能婦女會 (Women In Nuclear Global, 簡稱 WiN Global, 網址 http://www.win-global.org/) 於 1993 年初在捷克成立，旨在聯合全球核能、輻射防護、核醫等相關專業領域之婦女，互相交流，並與民眾溝通，進而促進大眾對原子能民生應用的了解和支持。

自成立以來，WiN Global 即迅速成長，目前有會員 3080 人，遍及 80 個國家。WiN Global 設理事會爲順利推展會務，另設置執行理事會，負責推動各項會務；現有 15 名執行理事(包含理事長)，任期 2 年，可連任三屆共 6 年。理事長由理事會推薦，經會員大會認定，任期 2 年，可連任二屆共 4 年。歷任理事長爲瑞士籍 Irene Aegerter (1993-1996)、瑞典籍 Agneta Rising (1996-2000)、法籍 Annick Carnino (2000-2004)，日本籍小川順子(2004-2008)，現任理事長爲美籍 Cheryl L. Boggess (2008-2012)。

WiN Global 成立迄今已 18 年，現有會員已達 3080 人。如此大規模的組織並無固定的秘書及行政人員，全是靠執行理事來推動會務，可見得執行理事工作量很重。由於 WiN Global 組織日趨龐大，必須有策略規劃，並陸續建立各項制度，目前 WiN Global 除了章程之外，有下列規章制度：

1.Board membership process--已完成；

2.Basic procedure for conducting meetings--已完成(此項由 WiN Taiwan 執行理事陳怡如負責)；

3.WiN award process--尚未定稿；

4.Start a chapter--尚未定稿；

5.Member process--正在尋找負責人選；

6.Election process--正在尋找負責人選；

由於 WiN Global 會務推動是靠自願軍，目前已成立 3 個委員會，成效簡述如下：

1.strategic planning committee--已訂定了 strategic plan，於 2009 年經理事會核准。

2.messaging committee--正在草擬 Q&A，預定今年(2010)底完成，由法國 Dominique 領導。

3.communication committee--正在做 benefit 調查，由加拿大 Susan 領導。

WiN Global 的決策機關是理事會，由各國家分會(national chapter)派一位代表，再加上執行理事、及前任會長組成；執行理事會所擬訂的議案，提交理事會表決。WiN global 目前最大的困難是沒有固定的秘書及行政人員，法國 Dominique 願意支援整理會員名冊、出版 WiNFO、重新更新網站。韓國也表示願意共同支付網站費用，其餘的事還要找 WNA 談。執行理事原則上每月開會乙次，理事原則上每季開會乙次，會議紀錄也是需要有自願軍來做。此外 WiN Global 還未正式註冊，沒有法人身分，不能收款、簽約，仍有待以後努力。

WiN Global 年會

WiN Global 每年召開會員大會一次，原則上由歐洲、美洲、亞洲/非洲輪流主辦，年會中除由各國代表報告自己國家的核能現況及活動外，也是執行理事及理事面對面溝通開會的機會。此外主辦單位也提供技術交流平台，以增加出席率，會中安排兩天技術報告，以及論文海報。專題報告係就核能安全、核能科技的發展、放射性廢棄物管理、核醫應用、輻射防護、核能教育及兩性平權等議題進行經驗交流，使會員們對全球的原子能民生科技之現況有概括了解，並互相學習溝通的經驗。今年本所同位素組羅彩月博士發表一篇論文，物理組詹美齡副組長及保健物理組武及蘭會長各發表一篇海報論文。WiN Taiwan 代表團帶去的 WiN Taiwan 單張簡介及禮物放在論文海報旁邊，供人自由拿取。

WiN Global 年會歷年之主辦情形彙整如下：

屆	年 度	主 辦 國	辦 理 情 形
18	2010/5/9-14	南 韓/釜山	約有 300 人參加，會前參訪斗山重工、會後參訪古里核電廠。WiN Japan 今年也是 10 週年，故會後有些人轉往日本青森參加慶祝。WiN Taiwan 9 人代表團與會。
17	2009/7/19-24	美國/華府	約有 600 人參加，會後參訪 TMI/Calvert Cliffs 核電廠、會前參訪 NRC、並安排與國會議員溝通。WiN Taiwan 6 人代表團與會。
16	2008/5/26-30	法國/馬賽	約有 300 人參加，會前參訪 Marcule 園區、會後參訪 Cadarache 園區。WiN Taiwan 6 人代表團與會。
15	2007/4/21-26	印尼/巴里島	本由中國主辦，後因台灣名稱問題，改由印尼主辦。約有 150 人參加，會前參訪 Bandung 研究用反應爐、Yogyakarta Kartini 研究用反應爐。WiN Taiwan 10 人代表團與會。會後參觀巴里島(我們未參加)。

14	2006/5/29-6/2	加拿大/Waterloo	約有 500 人參加，會前參訪 Pickering 核電廠，會後參訪 Bruce 核電廠
13	2005	捷　克	我國賴惠京(會長)、陳文芳、謝瀛春與會
12	2004/5/18-21	日本/東京	約有 300 人參加，會後參訪 KK 核電廠。WiN Taiwan 16 人代表團與會。
11	2003/6/15-20	美國/拉斯維加	約有 600 人參加，與 WIN US 會員大會一併舉行，會後參訪亞卡山、WIPP
10	2002	法國/巴黎	邱絹琇(全球常務理事)、賴淑瑛(副會長) 與會
9	2001/5/14-18	南韓/首爾	約有 95 人參加，會後參訪靈光核電廠、KAERI、NETEC。
8	2000	芬蘭/赫爾辛基	我國黃祝卿、蘇碩懿與會
7	1999/5/21-24	美國/華府	約有 600 人參加，與 WIN US 成立大會一併舉行，會後參訪 Calvert Cliffs 核電廠
6	1998/4/22-24	台灣/台北	約有 60 人參加，會後參訪 INER
5	1997	西班牙/瓦倫西亞	我國王小佗與會
4	1996	俄羅斯/聖彼得堡	我國賴惠京、杜美鈴與會
3	1995/6/15-19	瑞典/戈登堡	約有 60 人參加，會後參訪 Ringhal 核電廠及 Forsmark 低放處置場 SFR
2	1994	德　國	我國邱絹琇(會長) 、陳蜀瓊(副會長)與會
1	1993	法　國	我國邱絹琇、高莉芳與會

我國參與 WiN Global 的情形

我國分會 WiN Taiwan 創會會長邱絹琇於 1994 年起擔任理事，1998 年升任執行理事，至 2004 年三期任滿後轉任理事，由 WiN Taiwan 第二屆會長陳怡如接任執行理事(2004-2010)，積極參與會務的規劃及執行，今年陳怡如任期屆滿，執行理事改選，邱絹琇再度當選，於本屆年會中交接，陳怡如改任理事。

我國於 WiN Global 創會之初，1993 年夏即派員赴巴黎出席第一屆年會，旋於次年初在國內成立分會-WiN Taipei, R.O.C. (2003 年更名爲 WiN Taiwan) 。並於 1998 年主辦第六屆年會，是 WiN Global 首次在歐洲以外的國家召開年會，有來自 11 個國家 60 位代表參加；WiN Global 在簡訊 WiNFO 中稱此舉爲「從西方到東方」，引發歐美會員對亞洲地區核能發展有嶄新的認識，並邁開 WiN 組織活動全球化的腳步。自首屆起，我國核能界婦女出席年會從未間斷：除增進各國對台灣之認識進而互相交流、擴展外交外，對首次出席年會的我國代表提供了一個增廣見聞的難得機會，也激勵大家對核能發展的使命感與建立清晰的願景。

全球核能婦女會獎 WiN Award

全球核能婦女會獎 (WiN Award) 設立於 1996 年，由會員提名，經執行理事會、理事會議審核定案，每年選出一名 (或一小組) 在致力民眾對核能或輻射應用之溝通、教學、指導等有重要貢獻者，於年會時頒贈獎狀。此獎項雖爲獎勵女性而設，但得獎人不限女性。近年來競爭非常激烈，今年有 5 位候選人，並依據 WiN Award Position Paper 來評選，得獎人爲韓國 Dr. HyunSuk Suh。韓國曾 3 次獲得 WiN Award，得獎者都是醫生。

二、過　程

(一)主辦國簡介

主辦國承辦會議通常有宣揚國威、提供交流平台等目的，2010 年南韓總統李明博所親自主導「綠色成長(Green Growth)計劃」，並由六十位官員、專家與企業界人士所共同組成的委員會來推動，宣誓將於 2050 年達到 100 % 能源自主(Energy Independency)的目標，方法包括(1)把能源密集度從現有每千美元 0.317 噸油當量，減至 0.101 噸；(2)提升再生能源比例則由現有 2.7 % 到 30 %；(3)核電比例也將由現有的 24 % 的發電量比率，提高至 41 % 以上，以期能達成能源獨立的終極目標。配合此一政策之執行，本年度 WiN Global 2010 年會就選用 “Nuclear Power Pivotal Choice For Green Growth” 做爲會議之主題。

韓國於去年底得到阿拉伯聯合大公國(United Arab Emirates, UAE)4 部核能機組的標案，在今年 WiN Global 年會中充分展現出舉國興奮與驕傲；並在會前安排參訪斗山重工、大宇造船廠，會後安排參訪現代汽車、新古里電廠(新古里 3、4 號機是 APR1400 參考廠)，讓與會人員對韓國核能工業界的實力留下深刻印象。韓國目前有 20 部核能機組在運轉，施工中有 8 部，全國在推動節能減碳的政策下，積極發展核能。

主辦單位 WiN Korea，在現任會長朴世文女士(服務於 KHNP)及董事長 Dr. Seong-Woon Hung(醫界的前輩)的擘劃之下，成立各個委員會來籌辦 2010WiN-Global Meeting。WiN Korea 於 2000 年成立，2001 年即主辦第 9 屆 WiN Global 年會，當時韓國有 WiiN (Women interested in Nuclear)及 WiN (Women in Nuclear)兩個組織，前者是一般民間支持核能的婦女組織，會員有千人以上；後者是在核能界服務的婦女組織，有相當多會員來自醫界。韓國政府積極動員醫界參加 WiN，是一個相當正確的策略，有助於提升民眾對核能的信任，更可貴的是醫界願意配合。韓國曾 3 次獲得 WiN Award，得獎者都是醫生。

2001 年第 9 屆 WiN Global 年會在韓國的首都首爾舉行，本次(第 18 屆)在第二大城釜山舉行，會場安排在釜山海雲台的 Paradise Hotel 舉行，來自 28 個國家約 300 人參加參與此次盛會。會場有贊助者 KHNP、KINS、KNF 等之展示攤位，韓國參加會議者有很多年輕人，朝氣蓬勃。

(二)2010 WiN Global 年會情況報告

1.WiN Global 執行理事會(5 月 9 日 8:30-13:00)

由理事長 Cheryl Boggess 擔任主席，出席的人有：加拿大 Susan Brissette、法國 Dominique Mouillot、芬蘭 Kathe Sarparanta、瑞士 Irene Aegerter、IAEA Gabriele Voigt、日本 Keiko Chitose、韓國 Se-Moon Park，南非 Ntebatse Matube、台灣陳怡如，今年新當選的 4 位執行理事瑞典 Monica Bowen- Schrire、韓國 B.J.Min，西班牙 Isabel Gomez-Bernal，及我國邱絹琇均出席，缺席者爲中國、西班牙、澳洲、巴西共 4 位。

今年 2 月在 PIME 會議上，執行理事對於某些議題有很激烈的討論，討論議題包括：

(1)理事長報告會務：包括會員人數、各國分會數、執行理事與理事之參與率，目前執行理事在全球各洲之分配很平均。來自 IAEA 執行理事對於中國之執行理事很少參與，也有了說明。

(2)法國 Mouillot 報告 Messaging Committee 已做出來 9 大項 Q&A 之成果，利用 5 月 13 日下午之 Messaging Committee workshop，由出席者依把題目順序，逐一 review、修改，並分配工作，預定今年底完工。

(3)加拿大 Susan 報告 Communication committee 正在做 WiN benefit 調查，由於回答者不踴躍，分析其結果不具代表性，Susan 呼籲翻成各國語言，以利調查，日本與我國首先響應，並討論是否可用 facebook、wikipedia、WiNFO on a blog----等方式來增加溝通。

(4)WiN Global 之行政秘書工作：WiN France 提供清理會員名單及 database 之服務、更新 website、出版 WiNFO。WiN Korea 也願意出錢更新 website。執行理事要組一個工作小組去和 WNA 談相關事務，此外會員入會之核准程序應予文件化。

(5)會中爭議最大的是 WiN Global 是否設立副理事長，雖在本次表決通過設立副理事長之職位，但設幾位、如何選舉，仍有待先草擬辦法。

(6)未來之會議：2010 年 9 月將於 WNA 或 IAEA 會議前/後舉行執行理事與理事會議。2011 年會由 WiN Bulgaria 主辦，南非準備辦 2012 年會。

2.WiN Global 理事會（5 月 9 日 14:00-18:00）

由理事長 Cheryl Boggess 擔任主席，出席的人有澳洲 Karyn Laxale、巴西 Patricia Wieland、保加利亞 Mariana Yotova-Dicheva、加拿大 Susan Brissette、芬蘭 Karin Rantamaki 及 Kathe Sarparanta、法國 Dominique Mouillot 及 Stephanie Fourquier、德國 Ingeborg Hagenlocher、匈牙利 Judit Bacs、日本 Keiko Chitose 及 Junko Ogawa、韓國 B.J.Min 及 Se-Moon Park、斯洛伐克 Anna Kollarova、斯洛維尼亞 Helena Janzekovic、南非 Ntebatse Matube、西班牙 Isabel Gomez-Bernal、Ines Gallego Cabezon、瑞典 Monica Bowen -Schrire、瑞士 Irene Aegerter、台灣陳怡如及邱絹琇、美國 Carrie Phillips、IAEA Gabriele Voigt 及 Eva Gyane，和前任會長 Annick Carnino。

報告及討論事項：基本上與執行理事會同，但 WiN Global 之行政秘書工作及設副理事長等仍有爭議的事項暫時保留。IAEA 的 Eva Gyane 並呼籲捐款支持開發中國家之癌症腫瘤治療基金，WiN Taiwan 於次日捐款美金 200 元。




執行理事及理事會議

3.WiN Global 會員大會(5 月 11 日)

(1)WiN Global 會務報告

理事長 Cheryl Boggess 報告會員人數、各國分會數、執行理事與理事之參與率等，並由 Dominique Mouillot 報告 Messaging Committee 成果，以及 Susan Brissite 報告 Communication Committee 之成果。本年度工作成果包括：

①strategic plan--已完成

②Basic procedure for conducting meetings(此項由陳怡如負責)--已完成

③WiN award process--尚未定稿

④Start a chapter--尚未定稿

大會尚安排了二項特殊的報告：(A)IAEA 在 UAE 舉辦研討會時，WiN IAEA 及 WiN 有代表參加，當時 Eva Gyane 曾製作一個簡報介紹 WiN，在本會議中播出該片。內中有我國提供 Winner 張欣(原子能委員會)及羅彩月(核能研究所)之工作照片及安排民

眾參觀核二廠及減容中心之照片。(B)德國 Ingeborg Hagenlocher 播放由各國 Winner 的兒女/孫子女所說支持核能的錄影帶，其中有 2 則來自 WiN Taiwan 張欣的女兒及羅彩月的兒女。



會員大會

(2)專題演講

本屆大會安排三位專題演講：韓國水力與核電公司(Korea Hydro & Nuclear Power, KHNP)社長 Jong Shin Kim、KINGS nuclear graduate school 董事長 KunMo Chung 及 IAEA Gabriele Voigt 演講。重點摘錄如下：

KHNP 總經理 Jong Shin KIM 在 5 月 11 日下午專題演講時表示，1970 年代韓國決定要發展核能，並在古里建第一部機，1980 年代自 CE 和 Framatome 引進技術，開始發展第 2 代反應爐 OPR-1000，今明年商轉的新古里 1、2 號機即是此機型；2000 年開始發展第 3 代反應爐 APR-1400，並在新古里興建 3、4 號機，去年韓國獲得 UAE 的標，出售 4 部 APR-1400，並正在進行 APR+之設計，以符合歐美之安全標準，以利行銷歐美。韓國核能產業中，設計國產化佔 95%、設備國產化佔 79%。韓國之核能機組績效良好，2009 年 CF 爲 93.4 %，深得民眾信任。目前 KHNP 還有 8 部機組要興建，韓國在推動低碳社會，對於缺乏自產能源的韓國，則必須仰賴核能。

韓國前科技部部長 KunMo Chung 表示依據 IAEA 之預測到 2030 年，核能機組會增加 300 部，因此他認爲核能的挑戰有：

①核安--韓國之核能機組績效良好，2009 年 CF 爲 93.4 %，仍應繼續努力，不能大意。

②保防--防止核武擴散

③核廢棄物有適當的處理

④保爭取民眾接受及支持核能

⑤給予無碳能源在租稅上之優惠

⑥培植核能專業人才--估計每部機要 330 位專業人才，預測到 2030 年要增加 300 部機，以及退休遞補人力，核能專業人才非常欠缺。

有鑑於此，韓國在古里電廠附近成立 KINGS nuclear graduate school，預定於 2012

年春開始招生，修習 engineer 碩士學位、及 technology 博士學位，課程有別於一般研究所，而以實務爲主，屆時歡迎各國青年來此進修。Dr. Chung 被任命爲該校之董事長，並期待韓國成爲電力設施出口國、以及建立以科技爲基礎的文明。

Dr. Chung 認爲有下列良好的環境才能順利發展核能：

①核發執照之不確定性減到最低

②核能機組設計之標準化及最適化

③合理的採購合約條款

④把工業界的能力整合起來

⑤防止核武擴散的核燃料循環

⑥建設性的全球合作

(3)各國分會會務及核能概況報告(country report)

分會會務報告分二階段舉行，第一階段由 WiN Korea 理事會主席 Seong-Woon Hong 及我國邱絹琇小姐二人共同主持，第二階段由 WiN Japan 會長 Junko Ogawa 與 Win Brazil 的 Patricia Wieland 二人共同主持。依照國名之英文字母順序，各國報告核能發電概況及各國 WiN 活動；我國由武及蘭報告，內容如附錄二。

第一階段報告人：澳洲 Karyn Laxale、IAEA Eva Gyane、巴西 Patricia Wieland、加拿大 Susan Brissette、芬蘭 Karin Rantamaki、法國 Dominique Mouillot、德國 Ingeborg Hagenlocher、匈牙利 Judit Bacs、日本 Reiko Morisaki；**第二階段報告人**：巴基斯坦 Khalida Gill、菲律賓 Emerita Barrenechea、羅馬尼亞：Maria Cvatamanu、斯洛伐克 Helena Cabanekova、斯洛維尼亞 Helena Janzekovic、南非 Ntebatse Matube、西班牙 Ines Gallego Cabezon、瑞典 Monica Bowen -Schrire、瑞士 Irene Aegerter、台灣武及蘭、泰國 Pariya Phuaksuk、UAE Monira Al Kuttab、美國 Carrie Phillips、韓國 Sook Kyung Lee。其中，WNA 的 Irina 認爲她不能代表 UK，故不出去報告。

主席團邱絹琇及 Seong-Woon Hong

武及蘭報告台灣之 Country report

country report 會場

(4)頒發 WiN Award

今年有 5 位候選人，並依據 WiN Award Position Paper 來評選，得獎人爲韓國 Dr. HyunSuk Suh。頒獎的場面很盛大，主持人 Eun Kyung Park 教授穿著盛裝(韓國傳統服飾)，好像韓劇的王后，由理事長 Cheryl Boggess 頒發獎狀，及主辦國所加做的獎杯，並請得獎人 Suh 醫生致詞。



WiN Award 頒獎

(4)閉幕式(5 月 13 日)

閉幕式亦由專人主持，並由 WiN Korea 會長朴世文女士開場，介紹大會工作人員，並感謝她們的辛勞；中除安排精彩的表演外，此次年會韓國主要籌辦人員並逐桌與各國代表合影留念。


閉幕式會場

(三)、專題報告(5 月 12~13 日)

2010 年會中安排了四場專題報告及座談，相關主題如下表所列，台灣代表團成員各自參加有興趣之主題，各場專題報告及座談均討論熱烈，圓滿結束。重點摘錄如下：

Plenary Session I:

Nuclear Power Plant Construction and Operation(核電廠建造與運轉)

1. Soon Heung Chang: Safety Enhancement of Nuclear Power Plant

1953 年艾森豪提出 Atom for peace，現在應改爲 Atom for climate，但是解決氣候問題的方法很多，只是不能缺少核能。核能累積了 14000 多反應爐年之運轉經驗，績效相當良好，但是要核能復甦一定要先確保核能安全，現在核能安全有下列挑戰：(1)technical 方面，有 75%的核電廠已有 30 歲，面臨老化問題，此外還有保安、禁止核武擴散等問題(2)由於績效相當良好很容易造成自滿，而核安文化就是在強調要虛心，不可驕矜自

滿(3)人力短缺：估計到 2010 年全球核能界人力短缺 43,800 人，2030 年人力短缺 99,000 人，必須加緊人才培育(4)PA-必須贏得民眾支持(5)面對經濟壓力-核能界需要資金來解決上述問題。未來各公司都需要增建機組，而且要繼續維持良好的安全文化，繼續分享相關知識，訓練高級之專業人才，而政府、企業界及管制單位對安全的管理有各自的角色，必須各盡其職。

2. Kye-hong Min : Radioactive Management in Korea

韓國核廢棄物管理政策是：(1)安全第一(2)減量(3)污染者付款。採取之措施有：(1)把低放與高放分開(2)LLW 廠址不會自動變成高放廠址(3)用公投(4)補助地方。

2008 年韓國立法成立後端基金，2009 年成立 KRMC 公司專責處理核廢棄物，KRMC 辦公室設在 Yongin，在大田和 Wolsong 也有辦公室。2008/7-2012 在 Wolsong 進行第一階段之 LLW 處置場之建設，接下來要做第二階段之 LLW 處置場之建設，以及提出高放處置之 proposal。目前 LLW 第一階段之處置場建設進度爲 64.6%，將來由各電廠將核廢棄物運至 Wolsong 碼頭，再送進處置場之設施內。

3.TaeWoon Kim：介紹核能工業本土化

1971 年韓國興建古里核電廠，1978 年古里 1 號機商轉，1980 年代韓國就規劃從美國技轉，韓國方面參與者有 KEPCO、KOPEC、KNF、KPS、KAERI、Doosan、Hyundai。於是他所屬的斗山重工設立鑄造、鍛造廠房、核能廠房，以生產蒸汽產生器、RPV 等核能重件。Doosan 也有做火力機組的鍋爐等。自建廠以來，產品除供應本國使用外，也外銷。中國秦山、美國 Sequoya 即採用 Doosan 的蒸汽產生器，西屋在中國建 AP-1000 亦由 Doosan 供應核能重件。韓國設立 2030 年要成爲低碳社會之願景，包括：(1)低能源消費(2)採用清潔能源(3)採用綠色能源(4)可支付的能源供應；而核能即是低碳能源，但發展核能仍有許多困難有待克服。

4. Irene Aegerter：介紹瑞士新建電廠之情況

瑞士現有 5 部機，3 部屬第一代，2 部屬第 2 代，已經相當老，需要新机組 2 部，但有 3 家提出要建廠之計劃。依据瑞士法律規定，申請建廠要準備安全、保防、EIA、除役、核廢棄物處理之文件送給核管單位及地方政府審查，還要公投決定。瑞士之地方政府也有反核的，如 Berne，至於人民對核能的態度，据調查雖有 70.3%支持有核電廠，但只有 52%支持新建機組。看來要新建核能機組還有一段路要走。

5. Irina Borysova: Global Cooperation in Nuclear Industries

現在有 13 個國家在增建 55 部新核能機組，現在有好些個國際組織，如 WANO、WNA；本人所屬的 WNA，代表 180 個公司會員，每年年會約有 800 人參加，WNA 下有 15 個 working group，共同研討當前最需要解決之議題，並特別介紹 3 個：(1)**Nuclear Law and Contracting WG**，旨在準備新建電廠之合約訂定 guideline。(2)**Cooperation in Reactor Design Evaluation and Licensing WG (CORDEL)**，爲反應爐設計評估及核照之合作計畫。(3)**Nuclear Supply Chains WG**，收集新建電廠所需之供應鍊，以確保電廠之工期。希望 WNA 之會員好好利用。

6. Joni Falascino: The Leadership Journey: A Westinghouse Perspective on Leading the Nuclear Renaissance

据估計能源需求每年成長 1.5-2.1%，到 2050 年需增加 1280 GWe，而核能對環境影響最小，所以這些電力有部分要以核電供應。據 NEI 表示目前全球有 56 部机組在施工中，作爲一個反應爐供應商，西屋公司正在擴充設備、辦公室、廣徵人才、研發技術以爭取領導地位。西屋推出 **successful service culture**，認爲要貼進顧客、顧客成功就是西屋公司成功。西屋公司員工有 14000 人分佈 15 國，在 12 個地方新開設辦公室，在技術方面除了 AP600、AP1000 之外，也加入第 4 代反應爐、IRIS、PBMR 研究計畫。結語：自 1898 年發展核能以來，女性對核能貢獻很大，西屋公司將以貼進顧客的需要作決策，並符合全球之標準。

7. Milene Prazska:介紹斯洛伐克之核能概況

斯洛伐克 50%電力來自核能，現有 4 部機組運轉中、2 部機組施工中，2 部機組關閉。施工中的 Mochovce 3、4 號機組係於 1980 年得到 site permit，建了一半停下來，1993 年決定續建，到了 2002 年 SE 更換供應商，兩部機組預定於 2012 年、2013 年底商轉。另斯洛伐克與捷克合資成立 JESS，股權分別爲 51:49，共同投資興建 Jaslovske Bohunice 電廠。

Plenary Session II:

Nuclear, the Energy Source of the Future (核能，未來之能源)

1. Moon-Hee Chang: National Plan for Future Nuclear System Development

韓國核能科技的發展採取：引進→本土化→改良→創新四部曲。對於用過核燃料擬予以再處理，預定於 2012 年開始做 inactive test，2016 年開始做 active test。韓國除了

從事鈉冷式快速爐、高溫氣冷爐研究之外，也參加了國際 GIF、INPRO、GNEP 計畫。未來除繼續研發用過核燃料再處理、第 4 代反應爐之外，將繼續研究氫能。

2. Goon Cherl Park: Extension for Nuclear Energy Use for Future

韓國核能裝置容量 17,716MW(佔 26%)，發電量 142,937GWh(佔 35.5%)，是全球第 5 大核能國，**核能就是「漢江奇蹟」的基石**。展望未來，各國對核能的需求很大，據 IAEA 預估到 2030 年要增建 300 部机，需要很多核能人才，而韓國的核能設施也邁向行銷全球，如中東、亞洲、歐洲。展望未來的趨勢是區域性電網、氫能時代，因此中小型的机組需求會增加。核能可應用於海水淡化、區域供熱系統(REFUNA)、海洋上應用(如核能破冰船、浮動電廠等)、核子潛艇等。由於韓國缺乏再生能源，故應積極進行氫能研究。近年所進行之計畫有：(1)興建 8 部新機組(2)Nu-Tech 2015 計畫(3)核燃料循環計畫(4)未來反應爐(VHTGR /SFR，SMART)

註：**SMART** 是 **S**ystem integrated **M**odular **A**dvanced **R**eac**T**or，整合核能與海水淡化之反應爐

3. Seung-Kyoo An : The Development Strategy for Sustainable Nuclear Power

韓國將持續發展核能，因爲核能是綠色能源、永續、又有經濟性。

在反應爐技術之改良方面：已由 OPR-1000→APR-1400→APR-1400+，工期 36 個月，爐心熔毀率 1.0x10-6/Ry，並且要申請歐盟與美國之反應爐設計執照。

此外，正推動 Nu-Tech 2012、SMART，以及加入國際 ITER、GIV 計劃。

註：Seung-Kyoo An 提到推動 Nu-Tech 2012、而 Goon Cherl Park 提到的是推動 Nu-Tech 2015，感覺上 Park 說的比較完整、update。

4. Yeong-Kook Oh : Status of the Fusion Energy Development as a Future Vision Energy

宇宙中 99%能源來自核融合，如果人類可成功完成核融合，則將無能源供應缺乏之虞，這是 21 世紀的挑戰。15 年前韓國即開始研究，有 KSTAR(Korea Superconducting Tokamak Advanced Research)計劃，近年參與了在法國 Cadarache 的 ITER(International thermonuclear experimental reactor)計劃，參與者有 EU、美、俄、中、日、印、韓。韓國由於有 KSTAR 的經驗，ITER 的一些組件由韓國製造，第 23 屆 Fusion 會議將於 10 月 11-16 舉行，籲請有興趣者踴躍參加。

5. Ingeborg Hagenlocher: Fusion, yet Another Auspicious Alley to Sustainable Energy

Supply

2006 年 EU、美、俄、中、日、印、韓共同合作研究核融合，2007 年 10 月簽約，由 EU 出資 5/11，其他 6 個單位各出 1/11。ITER 有員工 458 人，其中 60.5%來自 EU、6.6%來自法國、7%來自韓國。

核融合 ITER 研究計劃目前尚無具体成果，套句名言“ We can not afford not doing it”。

6. Vuvu Msutwawa-Qupe: Demystifying Nuclear Technology: a Sustainability Challenge for Africa

Vuvu 認爲要發展核能必須得到大眾支持，做事只能順勢而爲，如果門關了，就不容易進去。人們對於自己了解的東西會認爲它是真理，何況大眾也想得到知識，故核能界應該開誠佈公把核能的知識與民眾分享。一般人對知識的自然反應是相信，懷疑不是自然反應，而婦女最適合去做這種溝通分享。

7. Karin Rantamaki: Nuclear Future in Finland

芬蘭有 2 部 BWR、2 部 VVER 在運轉中，1 部 EPR 在施工中，預定 2012 年商轉。核能發電佔 27.9%，水力 15.6%，進口電力 15%。芬蘭有 3 家公司擬建新機組，TVO 擬建 1000-1800MW，Fennovoima 擬建 1500-2500MW，Fortum 的計劃未被接受，但此建新機組計劃仍待國會通過。

芬蘭的大型研究計劃有：核能安全 SAFIR2010、核廢棄物管理 KYT2010 及核融合 Tekes Fusion Energy Cooperation 2007-2011。

Plenary Session III:

Strategic Action for the Promotion of Radiation Technology(輻射技術之推廣策略)

這次主要討論的議題爲促進核能技術之策略性作爲(Strategic action for the promotion of radiation technology)，舉辦的方式爲先由座長做一簡單介紹後，由每一位 speaker 各發表十分鐘演講，再由聽眾提出問題討論。主席爲韓國 KIRMS 的 Dr. Jae-Seon Lee，座長爲來自德國的 Dr. Ingeborg Hagenlocher(瑞士 WiN 的前任會長)，共邀請七位演講者參與本次的座談，分別來自韓國、日本、菲律賓及台灣，包括韓國首爾國立大學的 Professor Myung Chul Lee 及 KAERI 的副總裁 Dr. Jae Joo Ha，服務於日本 NIRS(National Institute of radiological Science) 的 Dr. Reiko Imai，任職於菲律賓 St. Luke’s Medical Center 的 Dr. Emerita Barrenechea，韓國的 Ajou University 的 Professor Mison

Chun， 韓國 Ewha Womans Univerity 的 Professor Re-Na Lee，以及來自台灣核能研究所的羅彩月博士，大家針對核醫及放射治療的發展與策略提出看法，整理如下:

近年來大家對於癌症引發之危機意識高漲，依據 2006 年 Nature Reviews Cancer 期刊發表的文章，統計並預估自 1975-2050 年的全球每年之癌症人數，預測至 2020 年將有 16.5 millions 的新增案例，到 2050 年將增至 27 millions，這個數字再加以細分成已開發(developed country)及開發中國家(developing country)，發現 1975 年全球新增癌症人數 5.9 millions，約有一半來自已開發中國家，但隨著環境之惡化，開發中國家的新增癌症人數逐年遞增，預估至 2050 年時，全球 27 millions 的新增癌症患者將有 60%以上來自開發中國家，因癌症而死亡之人數也逐年上升，預測至 2030 年 80%的癌症死亡案例將來自中低收入的國家。有關於對抗癌症之戰爭，IAEA 本於使命(Atom for peace, Health and Prosperity)，除了 2000 年與韓國合作，在亞洲地區進行 Re-188 HDD/Lipiodol 之肝癌放射治療之廣工作外，近年來更是推出 Programme of Action for Cancer Therapy(簡稱 PACT)，放射治療是癌症治療的基本方法，但非洲及亞洲部份國家之醫療水準不足，至今仍無法使用 radiotherapy，統計資料顯示開發中國家短缺了約 5000 台放射治療的機器，IAEA 對 PACT 計畫設定之目標爲：

(1)Enable low and middle income countries to introduce or expand existing infrastructure and capacity in radiotherapy in a sustainable way

(2)Improve or accelerate access to effective radiotherapy services, as an essential part of multidisciplinary cancer care

(3)Move IAEA's radiotherapy to a public health model where RT is integrated into a broad cancer capacity building effort

(4)Use radiotherapy as an anchor to help countries build comprehensive cancer control programmes that include: prevention, early detection, treatment and palliative care。

本項 PACT Model demonstration countries 包括有阿爾巴尼亞(Albania)、尼加拉瓜(Nicaragua)、斯里蘭卡(Sri Lanka)、葉門(Yemen)、坦桑尼亞(Tanzania)及越南(Vietnam)。放射治療儀器設備不停地朝更高精準性放射治療儀推進，從傳統 Co-60 therapy unit 進步到 Linear accelerator for conventional radiotherapy ，再推到 Linear accelerator for highly precise radiotherapy，現在則是 Cyclotron Synchrotron for charged particle therapy，隨著儀器朝更高科技與高技術演進，更好的分工(infrastructure)及穩定的電力供應將扮演更重要的因素。

有關於核子醫學的推廣策略，由次核醫在臨床診療上扮演第二線的工作，對如何推廣核子醫學，與會演講者的一致看法包括：

(1)教育(education)及資源分享(resource sharing): 提升核醫科醫師與相關醫療人員之工作品質與業能力，並與其它科別醫師提供必要之資訊，介紹核醫的進展與功能，並建立對話機制，以建立合作平台。且應對一般大眾介紹核醫的優點，包括早期診斷與治療之功能，資訊應公開，使大眾了解核醫是一項安全有效的診療工具。

(2)Coordination with other organizations：在醫院或臨床，核醫應加強與其它部門的跨領域合作，包括腫瘤科、神經科、精神科、內科等等；同時也加強區域性或國際間合作，與國外學術單位合作，人員與技術之交流，透過國際組織或學會(包括 WHO, IAEA, SNM, EANM 等)之力量，將問題或意見表達，尋求可能援助或合作伙伴，共同解決問題。如同 IAEA 之 PACT 計畫，對於有能力生產放射生核種之國家，亦應幫助開發中國家，以提升其醫療水準，並降低治療費用。

(3)Political, economical, social and cultural issues：政府應協助子能科技之推展，以我國衛生署爲例，爲因應國際 Mo-99 核種之缺貨，開放臨床以 F-18 NaF 取代 Tc-99m MDP 之應用，並爲促進 PET 與 cyclotron 之應用研究，衛生署亦允許執行 GMP 精神之 PET center 可以調劑 PET radiopharmaceuticals Stimulate scientific activity。我國對於原子能生科技之促進，原子能委員會與國科會共同成立 Mutual foundation，鼓勵學術界參與原子能之研究，核能研究所亦提供獎學金給予碩、博士研究生，一方面鼓勵其參與核能研究，再則也爲栽培未來的核能研發人才而努力。

(4)Co-operation with industrial and radiopharmaceutical companies：除了例行之核醫藥物應用研究外，臨床亦應與工業及核醫藥廠等密切合作，與研發單位密切配合，共同解決臨床之問題，提供疾病之最佳診斷與治療方案。

(5)Relationship with government-relaxing tariff：爲促進核能科技之發展，各國政府應提出相關之鼓勵措施，包括獎勵投資、稅賦減免等優惠，吸引更多的人參與核能應用研究。

Plenary Session IV:

Perception and Human Resources for Nuclear Renaissance(核能復甦之人力資源)

1. Dominique Mouillot: Perception and Human Resources for Nuclear Renaissance in France

法國估計所需人力：工程師 13000 人、技術員 10000 人。除了從正常教育体系培

養出人才之外，還要加強訓練，使其他科技領域的人進入核能；並吸引國際人才、訓練並賦予學位，使之進入核能。除了培養人才之外，也要積極和年輕人溝通，引導他們對核能工業界的興趣，而投身於此。

Dominique 介紹 ONET 在做什麼，ONET 有員工 2200 人，Dominique 就是老板。

2. Byung Joo Min:"Nuclear HRD and Woman Scientists and Engineers in Korea"

Dr. Min 是韓國女科技人協會(The Association of Korean Women Scientists and Engineers ，KWSE)的會長，她介紹有關這個組織：

①宗旨

* 鼓勵女性參與科技之領域
* 藉資訊與知識交流支持女科技人之科研活動
* 促進女科技人之福利、維護女性科技人之權益
* 促進女科技人之間建立更密切的關係與友誼

②組織與會員

* 1993/9/20 成立，到 2009/12/1 有會員 1194 人
* 會員資格：有科學或工程學士學位或同等學歷，並在科技領域工作 3 年以上
* 設立會長 1 人、副會長 4 位，本屆會長爲 Dr. B.J.Min
* 獲教育與科技部核准設立基金，使 KWSE 成爲非營利組織；KWSE 亦是國立韓國科技學會(KOFST)之會員
* 陸續成立釜山支部、Gwangju 支部、Daegu/Gyeongbuk 支部
* 於 1995/10 開辦 Daeduk Innopolis 托兒所、2008/3 開辦 SinSeong 托兒所，目前共有 2 間托兒所，有 300 名兒童

③主要成果

* 開發及維護女科技人資料庫(2000 年迄今)
* 主辦 2003 及 2009 BIEN(International Symposium for Women Scientists and Engineers)
* 主辦 13th (International Conference of Women Scientists and Engineers, ICWES)(2005/8)
* 透過會議來促進與國內和國際女性科技人之交誼(net-working)(2008)
* 加強女科技人的社會、文化方面知識、能力(2007-2008)
* 提出科學教室發展專案：培植有科學創意之學生並協助學生之母親(2009)

* 與大田市合作進行 KWSE 科學調查課程(2004 迄今)
* 編撰科學教育數位化之內容(2004)
* 設立網站以介紹科學的點子應用於日常生活中(2004-2005)

我們已把 KWSE 介紹給吳嘉麗老師，希望台灣女科技人可以和她們交流。

3. Junko Ogawa：Gender Equal Participation for Nuclear Field in Japan

Junko 報告日本科技界女性很少，位階較低；就是科技學門的學生中，女性很少，東京大學推出"科學是你的朋友"專案，並要找出 role model 讓年輕人可以效法。

Junko 又報告了 KK 廠地震後之情況：第 6、7 號機已恢復運轉，第 1、5 號機不久將恢復運轉，而第 2、3、4 號機仍繼續停機評估並進行改善。

4. Susan Brissette：加拿大如何鼓勵年輕女性加入核能

WiN Canada 透過各種活動建立年輕女性對核能的興趣，並提供 role model、導師來指導年輕女性進入核能、科技領域。

專題報告及羅彩月報告

(四)、論文發表(5 月 12~13 日）

爲配合與會者申請公費出席年會，主辦單位 WiN Korea 在本屆年會首次徵求論文，分爲 6 個主題，發表方式爲口頭發表及海報論文二種型式。六組論文發表相關資料彙整如下表。頭論文發表分二梯次舉行，分別爲/12 及/13 下午點至 5 點，分三個場地同時舉行，每組各有 6-7 篇的論文，台灣代表團邱絹琇小姐受邀擔任第 4 組 Radioactive Waste Management Technology 的主持人，與韓國 Hee-Jung Im 二人共同持；本所羅彩月博士於第 3 組 Radiation Protection and Application 發表 "Evaluation of the Potential of a New Radio-Thermogelling Emulsion 188Re-ECD/Lipiodol/Hydrogel for Treatment of Hepatoma" 論文。

日期	論文分組(Oral)
	I Special Workshop on Prospects of Nuclear Power Plant Construction and Operation **Key Note Speech:** In-Soon Chang, Former President of KAERI , Korea, "Korea's Nuclear Technology Creating Legend and Making History"

5/13 上午 5/13 上午	1.Zakia Begum, AEC, Bangladesh, “"Present Status of NPP in Bangladesh” 2.Jin Kang, Doosan HI, Korea, “Advanced Design Features for UAE Nuclear Power Plant Components” 3.Irina Borysova, WNA, UK, “International Standardization of Nuclear Reactor Designs” 4.Hyo Won Kim, Doosan HI, Korea, “Manufacturing Process of APR1400 5.Sunmi Jeong, KHNP, Korea, “Pilot study for Long-Term Plans of Reactor Vessel Internals” 6.Gül Bahire Göktepe, Turkish AEA, Turkey, “Prospects of Nuclear Power for the Environmental Benefits of the Turkish Energy Scene”
	II Advanced Technology of Nuclear Power, Fuel and Materials 1.Youngok Lee, KOPEC, Korea, “Equipment Qualification for Safety-Related Equipment in Nuclear Power Plant” 2.Mee Jeong Hwang, KAERI, Korea, “A Trip Model Construction and the Application Plans of the Model” 3.Yeong Hwa Lim, KHNP, Korea, “Development of Plant Reliability Data Information System and Its Application for CANDU Type” 4.Eui-Jin Kim, Doosan HI, Korea, “The Performance Evaluation of Moisture Separation Equipment for Nuclear Steam Generator” 5.Hye-Young Shin, KHNP, Korea, “Ageing Management Program for Thermal Aging Embrittlement” 6.Ai Melani, KAIST, Indonesia, “Quenching Experiment on Vertical Tube Using Carbon Nano Tube (CNT) Nanofluids” 7.Sang Hee Kang, KHNP, Korea, “Performance Analysis of a Passive Auxiliary Feedwater System in APR+”
	III Radiation Protection and Application 1.Emerita Andres Barrenechea, St.Luke's MC, Philippines, “Thyroid Cancer Profile in the Philippines – the Efficacy of Radioactive Iodine Ablation” 2.Jae-Seon Lee, KIRAMS, Korea, “The Development of Novel Biomarkers for the Increase of Radiotherapy Efficacy” 3.Tsai-yueh Luo, INER, Taiwan, “Evaluation of the Potential of a New Radio-Thermogelling Emulsion 188Re-ECD/Lipiodol/Hydrogel for Treatment of Hepatoma” 4.So Hyun An, EWU, Korea, “Impact of Breathing Biofeedback on Patient's Dose Distribution in Respiratory-Gated Treatment” 5.Eunok Han, Deagu Health College, Korea, “Analysis of the Factors on the Radiation Safety Management of PET-CT in Medical Centers” 6.Jihye Baek, EWU, Korea, “Evaluation of Volume Measurement Accuracy of 3D Ultrasound System Prostate Radiotherapy” 7.Yoon-jin Oh, EWU, Korea, “Skeletal Maturity Scores for Korean Children Using TW3 Method”
5/13 下午	**IV Radioactive Waste Management Technology** 1.Bernard Rottner, ONET Technologies, France, “Immobilisation of Radwaste In Synthetic Rock : An Alternative to Cementation” 2.Hee-Jung Im, KAERI, Korea, “In situ and On-line Measurements of the Lanthanide Ions in High Temperature for a Practical Application in Pyrochemical Processing” 3.Milena Prazska, AMEC Nuclear Slovakia s.r.o., Slovakia, “The Progressive Technology for the Removal, Retention and Fixation of the Radioactive Sludge Sorbents and Non-Standard Radioactive Waste into the SIAL® Matrix” 4.Maha Aziz, WGI, United States, “Modularization Design of the Liquid and Solid Waste Management System”

	6.Mi-seon Jeong, UST, Korea, "The Pseudo-Colloid Migration of four-Member Radionuclide Chains in a Fractured Porous Medium"
	V Policy, Nuclear Safety, Security, safeguards and Environmental Issues 1.Eva Gyane, IAEA, Austria, ""The IAEA's Nuclear Safety Security and Safeguards Programme" 2.Sun Yeong Choi, KAERI ,Korea, ""An Analysis on Human-related Unplanned Reactor Trip Events in Korea" 3.Sofya Hambaryan, IAEA, Austria, "Safeguards Implementation Under Comprehensive Safeguards Agreements and Additional Protocols" 4.Patricia Wieland, CNEN, Brazil, "Operational Risks Management at Industrial Irradiation Plants" 5.Yanti Fristikawati, Atma Jaya Univ., Indonesia, "Legal Perspective of Environmental Protection from Nuclear Activity in Indonesia" 6.Helena Janzekovic, Slovenian NSA, Slovenia, "Toward Harmonisation of Radiation and Nuclear Safety in the European Union" 7.Eun-ha Kwon, KAERI, Korea, "Evaluating the Level of Nuclear Nonproliferation Credibility Using the AHP"
5/13 下午	**VI Human Resources, Cooperation and PA** 1.Tri Murni Soedyartomo Soentono, NNEA, President WiN-Indonesia, "To Go to Welfare Families and the Nation is Accompanied by a Clean and Green Environment with a Nuclear Technology Solutions" 2.Cristina Bucur, SNN-Cernavoda NPP, Romania, "Nuclear Power Generation Alternative for a Clean Energy Future in Romania" 3.Youngmi Nam, KAERI, Korea, ""Human Resources Development for Nuclear Personnel in Korea" 4.Helena Loner, WiN-Switzerland, "What is More Ethical - to use nuclear energy or to ban it ? " 5.Maria Vatamanu, NEN Co. (SNN SA), Romania, "Rejuvenation of the Staff – Preparing Young Employees to Become Specialists in Procurement Sector as Strong Support of Nuclear Energy Development" 6.Ju-young An, KNEF, Korea, ""Projects of KNEF for Promoting Next-Generation Understanding – Nuclear Energy Exploration Olympiad" 7.Gisele Marie Aucoin, AECL, Canada, "Training 500 Trades Personnel to Dismantle and Re-build a Nuclear Reactor"

台灣代表團參加場次之重點摘錄如下：

Session I：核電廠施工及運轉

1. In-Soon Chang: Korea's Nuclear Technology Creating Legend and Making History

韓國從 1978 年開始第 1 部機商轉，迄今已有 20 部機運轉中，8 部施工中，而且核能技術可以出口，這 30 多年來的努力，創下優良成效，且寫下核能歷史嶄新的一頁。

2. Zakia Begum: Present Status of NPP in Bangladesh

孟加拉是個缺電的國家，主要能源是天然氣，擬興建 Roopur 核電廠，500MW 級的 2 部，預定於 2015-2017 年商轉，目前有俄羅斯提 proposal，但是仍待加強 PA 以建立起民眾對核能的支持。

3.Jim Kang: Advanced Design Features for UAE Nuclear Power Plant Components

Kang 小姐報告斗山重工爲 UAE 之 4 部核電機組從明年 3 月開始製造其組件。並介紹 APR1400 之組件如反應爐槽、蒸汽產生器、壓力器、反應爐內部組件、IHA、FHE…等。

4. Irina Borysova: International Standardization of Nuclear Reactor Design

Irina 介紹 WNA 對於標準化的看法：認爲標準化可(1)降低風險(2)生產容易(3)使大眾有信心；因此 WNA 在推動(1)反應爐設計執照國際化(2)安全要求國際化(3)電廠執照程序標準化；但是要標準化、國際化也會面對很多困難：(1)要尊重各國的管制人員；(2)每個國家有不同的法律，不易修改；(3)管制人員對反應爐設計的知識要增加。

目前 WNA 有 2 個計劃與標準化、國際化有關，分別是

①MDEP(multinational design approval program)於 2008 年成立，有 10 個國家參加，要將 EPR、AP1000 之反應爐設計執照國際化，由這些國家的管制人員一起審查，將來一起核照。

②COREL (Cooperation in Reactor Design Evaluation and Licensing WG)

參加這個 WG 有電力公司、vendor，目的是各國執照程序標準化及文件標準化、安全要求標準化及國際化。主要針對(a)反應爐設計執照(b)廠址執照(c)建廠執照及運轉執照 3 類執照，分 3 階段進行：

(a)兩國/多國同時進行執照審查，互相交流分享。

(b)A 國若已核准，B 國只要審查其中有規定不同的地方即可

(c)ABC 三國可組成執照審查小組，一起進行審查。

WNA 相信這些標準化的作法必有利於核能之發展，並鼓勵更多國家參與。

5. Hyo Won Kim: Manufacturing Process of APR1400

金小姐與 Kang 小姐都是在斗山重工是做 APR1400 的設計，她們兩位都介紹自己的工作。金小姐介紹反應爐槽、蒸汽產生器的生產與組合。

6. Sunmi Jeong: Pilot Study for Long Term Plants of Reactor Vessel Internals

Jeong 介紹她在古里電廠依據 EPRI AP-913 做 life cycle management(LCM)，KHNP 發展出 long term assets management(LTAM)，旨在改善電廠設備之狀況以確保電廠安全。KHNP 是以美國 Exelon 作爲其標竿學習對象。

古里電廠#2、3、4 機組從 2007 年到 2009 年陸續做了 LCM，並挑選幾個 pilot，而 Reactor Vessel Internals 是其中一項，分析各組件之老化、劣化情形，講者表示執行成果良好，有助於確保電廠安全。

Session III：輻防與輻射應用

Concurrent technical session III 主要討論的議題爲輻防與輻射應用，由七位來自菲律賓、台灣及韓國研究人員分別針對：(1)菲律賓的甲狀腺癌治療現況(2)偵測提高放射治療療效的 Biomarker 最新發展(3)放射治療之影像定位技術研究(4)銖-188 溫感性水膠應用於肝癌治療研究(5)以放射診斷技術探討韓國兒童骨骼成熟度等發表研究報告，摘要如后。

碘-131 爲貝他核種，半衰期 8 天，衰變時會釋放貝他粒子，伴隨也會放出加馬射線。相較於加馬射線，貝他粒子的穿透力較低，但殺傷力強。碘-131 因與天然碘元素在體內之新陳代途徑完全相同，臨床上，放射性碘-131 元素主要應用於甲狀腺(Thyroid)功能之診斷及治療，自 1950 年代至今，臨床醫師常利用碘-131 對於甲狀腺的攝取以及掃描分析，可得到甲狀腺之形狀大小、頸部腫塊與甲狀腺的關係，其對異位性甲狀腺組織(如先天性舌下甲狀腺)及協助甲狀腺結節之鑑別(良性或惡性)，更有無可取代的地位。放射性碘-131 之治療機制，乃因其可選擇性集中於甲狀腺組織及釋放貝他射線之特性，造成甲狀腺細胞之改變並抑制其功能。放射性碘-131 元素用於甲狀腺癌之治療，有無可取代之地位，尤以分化良好之濾泡細胞癌。其治療一般會先做手術切除，爲不傷害到周圍重要的組織，或多或少會有一些正常的甲狀腺組織殘留，因此須配合口服 30-100mCi 不等之碘-131 來做清除性治療(ablation therapy)，以去除殘餘的組織，並降低再發之機率。

Dr. Barrenechea 報告菲律賓對於已分化之甲狀腺癌應用放射性碘治療之療效，甲狀腺癌佔該國女性癌症機症之第四位，男性則爲第十七位，女性甲狀腺癌發生率約爲男性之五倍，好發年齡屆於四十至五十歲之間。以六百八十八位患者之治療分析，大多患者對於甲狀腺切除術、放射性碘清除及終生服用甲狀腺賀爾蒙等三者合併療法反應良好，患者投與 100mCi 之 I-131 用於清除頸部殘餘之癌組織其治療率高達 78%，如果有肺部轉移之癌症患者投與 150mCi 之 I-131，其治療率降爲 48%；如果患者有骨轉移者，必須投與 200mCi，甚而增加四至五倍劑量，才有辦法延長其存活。此時，合併化療或體外放射治療都是臨床上可以考慮之選項，以延長病人之存活。近來，新的治療工具不斷地被開發，例如使用輻射增敏劑、NIS symporter、Y-90 dotatate 或

somatostatin 等，或許可以對反應不佳之甲狀腺癌患者提供更多治療選擇。

細胞老化(cellular senescence)的觀念始於 Hayflick and Moorhead(1961)對於 culture cell(WI-38)細胞自我複製次數極限的觀察，後來發現壓力(stress)也可以誘發細胞老化，稱爲 premature senescence，一般認爲細胞老化與細胞凋亡(apoptosis)是細胞自我複製機器受到 stress 之後之處理形式。近期研究顯示，引導癌細胞 premature senescence 可能是增加放射治療療效之有效策略，韓國 Dr. Jae-Seon Lee 開發新的 biomarker—CD(Cathepsin D)及 eEF1 (eukaryotic elongation factor1 beta 2)可用於放射治療之診斷與預測。實驗利用人類乳癌細胞株 MCF-7 經游離輻射照射後，利用蛋白質體分析(comparative proteomic analysis)探討細胞老化的現象，發現 CD 有 up-regulation 現象。反之，eEF1B2 則出現 down-regulation，其它的 elongation factor eEF1A1 亦有 down-regulation 之情形發生，這些蛋白質之變化亦可見於給予過氧化氫或抗癌藥物(例如 camptothecin, etoposide, doxorubicin)之後的細胞老化反應， 植入動物體之腫瘤經放射治療後亦可看到 CD 及 eEF1 含量的變化，上述發現證實 CD 及 eEF1 具有潛力可當作放射治療之預測功能。本實驗僅止於細胞及少數之腫瘤模式試驗，Dr. Lee 也表示距離臨床應用仍有一段距離。

韓國的 Dr. Rena Lee 實驗室發表三篇研究報告，介紹 breathing biofeedback 對於 respiratory-gated treatment 時病人劑量分佈之影響，以及應用 3D 超音波系統於前列腺癌放射治療之體積量測準確性評估，利用不同形狀之前列腺及膀胱假體模型，比較 CT, MRI 及 3D ultrasound 三種造影系統量測所得體積，以做爲前列腺放射治療之重要參考數據，實驗結果顯示應用 3D Ultrasound scanner，可以得到較高準確性之前列腺體積量測數據。另外，Dr. Lee 亦應用歐美國家開發之 Tanner-Whitehouse (TW3) method，在她所服務之首爾 Ewha Womans University Medical Center 分析韓國兒童(7-17 歲)之骨骼成熟度分數(skeletal maturity score)，並與他國之數據比較。實驗結果顯示，韓國男童及女童之骨骼成熟度分數與中國之數據近以，相較於以往，男生及女生之骨年紀(bone age)分別增加 0.9±0.5 yrs 及 0.7±0.8 yrs。

核能研究所羅彩月報告近期之研發成果，結合 Re-188 ECD/Lipiodol 結合溫感性水膠(temperature-sensitive hydrogel)形成之 radio-thermogelling emulsion 應用肝癌動物模式之治療成果，實驗結果顯示 Re-188 ECD/Lipiodol/hydrogel 可以改善腫瘤直接注射可能導致之藥物漏出問題，並可以有效延長動物之存活率，爲具潛力之新治療用核醫藥物，簡報資料參見附錄三。

Session Ⅳ：放射性廢棄物管理技術

該分組主要討論的議題爲放射性廢棄物管理技術，由六位來自美國、法國、斯洛伐克、巴基斯坦與韓國的研究人員分別對中低放射性廢棄物的處理，以及高放射性廢棄物(用過核燃料)的處理與處置發表研究報告，摘要如下。

法國 ONET 公司推出一項針對中低放射性廢棄物減容的新技術，以 2000˚K 高溫焚化的方法處理污泥、土壤、砂石、飛灰、蒸發濃縮廢液、混凝土塊、石棉等放射性廢棄物。一般常用的水泥固化法會造成廢棄物體積增加 2 至 5 倍，而此項新技術則可將廢棄物體積減小到一半甚至到五分之一。該技術之設計目標有三: 1) 減容，2) 以廢棄物作添加物以減少無污染材料的使用，3) 快速冷卻以避免岩錠因熱約束(thermal constraints)效應而分解。ONET 已完成工業級試車，將兩噸的模擬廢棄物經處理減爲 250 公斤的岩錠，過程符合環保規定與工業爐的適用性，並已向法國國家放射性廢棄物管理局 ANDRA 提出應用該技術處理廢棄物的申請，以便未來能將產出物(岩錠)送至國營之中低放射性廢棄物地表處置場作最終處置。

在用過核燃料高溫化學處理過程中，可經由高溫 LiCl 或 LiCL-KCl 熔鹽電解液回收可重複使用的物質。在此過程的電解還原步驟中，許多鑭系金屬因還原度較低而溶於熔鹽中，因而影響了回收的效率。韓國原子能研究所 Dr. Im 針對此問題，運用光譜技術分析與觀察鑭系金屬在高溫熔岩中的物理與化學作用，以提供改善回收效率研究之參考。該研究使用置於隔離箱中、經特殊設計可同時吸收並量測螢光光譜之溫控爐；所有的實驗均在溫控爐與隔離箱內進行。從鑭系化合物光譜中某些過渡區的強度(intensity)與分岔型態(splitting pattern)可推斷該鑭系離子所處的環境。該研究顯示，高溫下熔鹽的光譜研究，可在流程線上直接偵測化學成分、估算熔鹽中之鑭系物質的化學結構與能量位階、鑒定價數，並現場觀察其反應過程。

斯洛伐克 AMEC 公司開發了一項名爲 SIAL® Matrix 的濕式放射性廢棄物固化技術，特色爲：可在室溫下進行、時間短、產出物可長期貯存或進行最終處置，處理對象爲放射性汙泥、廢樹脂，吸收劑(sorbents)等。該技術使用可攜式調拌機，在室溫下調拌 30-60 分鐘後靜置數小時即達固化，形成鋁矽酸鹽的聚合膠體。該技術已先後獲准在斯洛伐克與捷克使用，實際運用於四座核電廠數以噸計的汙泥、廢樹脂與硼酸鹽等放射性廢棄物之固化。(按：聚合膠體長期暴露於放射線下是否產生劣化仍是值得關注與探討的問題)

美國 URS 公司爲南德州計畫(STP)的第 3、4 號核電機組(與我國核四同型)設計模組化的放射性廢液與固體廢棄物之處理系統。該系統運用現有技術減少放射性與化學汙

染，模組化的設計可縮短工期以配合加速之建廠時程，除符合法規與該廠的特殊需求外，亦參考了美國電力研究所提供的相關建議，並進行廢棄物廠房的結構分析。其廢液處理以 100%回收(零排放)爲目標。除處理系統本身外，該設計並包含必要之周邊零組件，如補助管道(ancillary piping) 、電線與儀控等全套配備。此設計的特色爲：模組化或橇裝(skid mounted)節省安裝的時間，更爲未來隨技術進步而需更新設備時提供拆裝之便利與彈性。

核能電廠的放射性廢液中通常含有大量的銫-137 與鍶-90，移除該二核種可顯著降低廢液的放射性。此外由於鍶 90 只放射 betta 粒子，是用途很多的純 betta 射源，具有高度的回收價值。巴基斯坦原子能委員會 Dr. Gill 介紹利用模擬廢液以溶劑萃取法回收鍶 90 的過程與成果。實驗結果顯示鍶的淬取率的高達 97%。

深層地質處置是目前多數國家對高放射性廢棄物最終處置的主要選項。當廢棄物容器有破損時，放射性核種在抵達生物圈前會通過層層的工程與自然障壁。通常核種在通過工程障壁時會以溶質的形式傳輸，即使有些核種會與工程障壁的材料(如膨潤土) 結合產生擬膠體(pseudo-colloid)，但也會被工程障壁所濾除。然而當溶質被移動中的自然腐植膠體所吸附時，則可能在破裂孔隙介質(裂縫岩層)中形成擬膠體，此時基於親水(hydrochromatic)效應膠體的傳輸速率會較溶質的速率高，且由於體積過大膠體也不易滲入周圍的岩層中。這兩項機制均會助長核種的傳輸，因此有必要以較精確的運算模式來評估擬膠體對生物圈的影響。韓國原子能研究所Jeong以此作爲在韓國科技大學攻讀博士的研究主題，擬建構一數學模式以觀察當擬膠體存在時，錒系四成員衰變鏈在裂縫岩層中的現象。首先需以較實際的工程障壁與裂縫間的入口邊界條件來建構新模式，目前只以簡單的固定邊界條件求得初解，而最後將把觀察擬膠體影響的模式與全系統評估模式整合，做整體評估。

Session VI：人力資源、合作、PA

1. Tri Murni Soedyartomo Soentono:To Go to Welfare Families and the Nation is Accompanied by a Clean and Green Environment with a Nuclear Technology Solutions

. 印尼之電力需求持續增加，到 2050 年要增加 35,000MWe，雖然有豐富的煤、油、天然氣，仍不夠用，須發展核能。目前核能的應用主要在於醫療、農業…等輻射民生應用方面。

2. Cristina Bucur: Nuclear Power Generation Alternative for a Clean Energy Future in Romania

羅馬尼亞 Cernavoda 核電廠 2 部機減少了本國 CO2 排放量，經由嚴格的環境監測，核電廠並無輻射物質外釋，核能是清潔的能源。

3. Youngmi Nam: Human Resources Development for Nuclear Personnel in Korea

韓國在 1950-1960 年代送 200 位同仁到國外去訓練，這些人是當時發展核電的基礎。目前韓國的訓練機構有：(1)KAERI 的 NTC，訓練 R&D 人員(2)KINS 的 INSS，訓練核管人員(3)KHNP 有 2 種訓練機構，總公司的 KNPEI 做一般及進階技術訓練、及管理訓練；在 4 個電廠各有訓練機構，訓練運轉維護人員。

韓國還參加國際訓練，如 ANENT(Asian Network for Education in Nuclear Technology)、ANSN(Asian Network for Nuclear Safety)、ENEN(European Nuclear Education Network Association)、WNU(World Nuclear University)。

4. Helena Loner: What is More Ethical - to use nuclear energy or to ban it?

通常使用科技是中性的，無所謂道德不道德。

由於瑞士要增建核能機組，在與民眾溝通時，會面對一個問題：使用核能是更有道德？還是不使用核能更有道德？所謂道德/倫理是指能源使用對社會的責任、對環境之影響產生正面或負面的結果；而且要把各種能源來做比較。

就歷史發展的角度來看，有 3 個階段：(1)1990 年以前，核能被認爲談不上道德；(2)1990-2000 年有更廣泛探討，例如能源不足卻不使用核能、如果電價很貴使用核能可以降下來卻不使用核能、核能對環境比較少不良影響卻不使用核能…這樣是不是更有道德？(3)2000-2009 年核能被認爲比較少邪惡。在台灣還是有人認使用核能遺害子子孫孫，這些論述值得參考。

5. Maria Vatamanu: Rejuvenation of the Staff – Preparing Young Employees to Become Specialists in Procurement Sector as Strong Support of Nuclear Energy Development

羅馬尼亞 Nuclerelctrica Company 除運轉 Cernavoda-1,2 號機之外，也生產 Candu 型核燃料，近年，該公司晉用了 100 名員工，其中有 40%是 35 歲以下(稱之 young generation)，這些年輕人中 30%是男性，70%是女性，WiN Romania 在帶領年輕女性方面扮演了重要的角色。爲訓練他們成爲專業採購人員，這些人除了具備經濟、商學學識的基本條件外，還要懂合約，訓練的重點還包括：

(1)與公司 partner 合作要有良好的態度

(2)態度冷靜、以公司的利益爲主

(3)行爲舉止優雅、服飾合宜、給人好印象

(4)在合約談判時有幽默、機智而不失仁慈

(5)在團隊工作中可服從領導、又有獨當一面的能力

(6)願意不斷學習。

6. Ju-young An: Projects of KNEF for Promoting Next-Generation Understanding – Nuclear Energy Exploration Olympiad

韓國於 1992 年成立 KNEF(Korea Nuclear Energy foundation)，以促進下一代對核能的了解，有 3 種活動：

(1)核能教育：包括中小學教師之核能教育、舉辦核能科學營、提供大專學生核能教育或核能設施見習、小學生奧林匹克、印製及分送核能教育資料

(2)文化活動：包括舉辦核能節慶、中小學生作文/海報比賽、舉辦音樂會

(3)展覽會：能源體驗展(讓中小學生親眼看、親手摸)、在博物館或 EXPO 設置永久性展覽區、科學與能源參觀(安排至核能設施參訪)

7. Gisele Marie Aucoin: Training 500 Trades Personnel to Dismantle and Re-build a Nuclear Reactor

韓國 Wolsong -1 是加拿大的重水式反應爐，AECL 現在幫 Wolsong -1 做延壽(執照更新)，包括訓練 500 名韓國人學習延壽有關工作。有些設備要拆除，有些設備要新裝，有些必須使用機器人去操作， 而且所做的事要留下紀錄。韓國人和加拿大人如何溝通，也是一個挑戰。

海報論文計有 33 篇，分爲二梯次於 5/12 及 5/13 下午 5 點至 6 點進行討論，其中本所發表二篇論文，題目如下，論文相關資料參見附錄三。

1. Meei-Ling Jan, INER, Taiwan, “Preliminary Phantom Result of a Prototype System for Positron Emission Breast Imaging”
2. Jyi-Lan Wuu, INER, Taiwan, “Solid Waste Clearance Experience in Taiwan”

羅彩月發表論文


現場聆聽


武及蘭的海報


論文海報會場

(五)、參訪及拜會活動

1.參訪斗山重工(Doosan Heavy Industries & Construction)和大宇造船廠

南韓斗山集團(DOOSAN)目前是南韓最大的財團，爲一家很有競爭力的跨國公司。公司成於 1896 年，至今已有 109 年的發展歷史，是南韓具有最悠久歷史的公司。公司業務涉及重工業、服務業、消費品等多領域。斗山集團對世界經濟環境的快速適應性促使它成爲不同行業的領導者，從最尖端的技術到快速消費品，都擁有世界級的質量和技術。如：擁有世界排名第一的海水淡化工廠－斗山重工業 (Doosan Heavy Industries & Construction Co., Ltd.)；世界排名第一的社會基礎設施－斗山產業開發 (Doosan industrial Development Co., Ltd.)；世界排名第二的大型船用發動機－斗山發動機 (Doosan Engine Co., Ltd.)等。

5 月 10 日早上 7:30 在旅館門口集合，分乘 3 輛巴士出發往 Changwon 斗山重工。斗山重工佔地 1100 畝，成立於 1962 年，生產水力電廠、火力電廠、燃氣複循環、核能電廠、海水淡化廠之設備，已生產了 60 部核能機組、300 部各型發電機組，其產品行銷全球。我們到達時，由副總裁 TaeWoon Kim 代表該公司歡迎 WiN Global 會員來訪，首先安排參觀展示館，並由專責人員帶領我們參觀鍛造 (forging) 廠及核能廠。鍛造廠房於 1982 年成立，我們參觀時生產線上正在做 RPV 之鍛件。核能廠於 1976 年承建靈光 1、2 號機之核能重件，我們參觀時生產線上正在做蒸汽產生器，解說人員表示斗山重工現在產能還要擴充，以因應日漸增加的訂單。斗山重工除供應南韓之核能機組外，並供應中國三門及海陽各 2 部 AP1000 之重件，如 RV, SG, RVI, IHP；並擔任西屋公司的下包，供應 SG。

轉往 Geoje 參訪世界第二大造船企業韓國大宇造船海洋工程公司 Daewoo Shipbuilding and Marine Engineering (DSME)。

海工裝備是**韓國**造船業的一大優勢。台灣海陸運輸公司旗下之清雲實業(Bluesky LNG Corp.)即委託大宇造船製造現今世界上最大型的冰洋級液化天然氣運輸船(Ice-class LNG carrier)日前已在韓國完成命名典禮，並在 2006 年進入市場營運。公司利制度完善，爲照顧員工，生活區內設有員工宿舍、學校及醫院等設施，信賴與熱情(Trust and Passion)是他們的口號。

國際金融危機使全球造船市場出現了歷史罕見的低迷和不景氣，韓國造業亦不例外，雖然大環境相當不理想，2009 年幾乎沒有接單，但韓國越是在產業低谷時期，越注重研發高科技的低碳船舶產品，以節能環保爲代表的低碳船舶技術正成爲韓國造船

業的研發重點。隨著景氣復甦，大宇造船 2010 年接獲 4 億美元訂單，為埃克森石油美孚公司在俄羅斯的油氣開發項目建造海上平台。我們乘坐巴士在廠區繞一圈，看到工作人員皆相當年輕，工作人員之基本安全配備皆依規定執行，有好幾艘船在興建中，十分忙碌卻井然有序。

斗山重工和大宇造船廠參訪活動

2.參訪現代汽車和新古里電廠

現代重工業株式會社是南韓現代集團的主要公司，於 1972 年在北韓半島東南端的蔚山市(Ulsan)成立是一個世界級的綜合型重工業公司，是南韓重工業的搖籃，有 8 個事業部，其中“造船事業部”與“發動機事業部”具有世界最大的生產規模。本次 WiN Global 安排會員們於 5 月 14 日參訪位於蔚山市的現代汽車公司。

現代汽車首重於品質之提升，每年將其獲利之 5%投資於研發，以追求其 world best R&D capabilities，並進而躍升爲世界最好的汽車製造業者(leap as world best automaker)爲其職志。參訪行程安排簡報介紹及生產線實地參觀，現代汽車公司以成爲全球汽車業之 leader 爲 vision，在德國、捷克、美國、土耳其、印度、中國設置區域性辦公室，產品行銷全球，一年賣出 2 百多萬台車，是全球第 4 大汽車公司。我們參觀了小轎車之裝配線，又到碼頭看到成千上萬等待出口的新車。現代汽車廠就像一座城，有住房、餐廳、超市，留下很深刻的印象。

接下來第二個參訪的地點爲新古里核能電廠。古里電廠是韓國最早興建的核能機組，在 1970 年代選擇的是 PWR 機組，共建了 4 部，資料如下。在古里電廠附近成立新古里電廠，準備建 6 部機組，1、2 號機是韓國國產 OPR-1000，於 2005 年 7 月 1 日得到建廠許可(CP)，1 號機預定於今年底商轉，2 號機預定於明年底商轉，現在 1 號機在準備 fuel loading。3、4 號機是韓國國產 APR-1400，於 2008 年 4 月 15 日得到建廠許可，3 號機預定於 2013 年 9 月商轉，4 號機預定於 2014 年 9 月商轉。另外還規劃了 5、6 號機，也是採用 APR-1400。

我們先到達展示館，設計以環境爲主題，我們拍了團體照之後，接受歡迎，然後去到一個山丘往下望，可以看到古里及新古里全貌，從外表看來新古里 1、2 號機整個

已經完成，整整齊齊，後來才知道 1 號機還沒裝填燃料，2 號機才在裝設反應爐內部組件；較遠的 3、4 號機還在施工中。古里 1-4 部機所挖出來的岩磐，各放一塊石頭在這山丘上作紀念，實在很有意義。

古里與新古里機組比較

Attribute	**Kori 1**	**Kori 2**	**Kori 3**	**Kori 4**
Electric Output	556 MWe	605 MWe	895 MWe	895 MWe
Commercial Start	04/1978	07/1983	09/1985	04/1986
Reactor Supplier	Westinghouse	Westinghouse	Westinghouse	Westinghouse
TG supplier	General Electric	General Electric	General Electric	General Electric
AE	Gilbert	Gilbert	Bechtel	Bechtel
Construction	Westinghouse	Westinghouse	Hyundai	Hyundai
Attribute	**Shin Kori 1**	**Shin Kori 2**	**Shin Kori 3**	**Shin Kori 4**
Electric Output	1000 MWe	1000 MWe	1400 MWe	1400 MWe
Commercial Start	12/2010	12/2011	09/2013	09/2014
Reactor Supplier	Doosan	Doosan	Doosan	Doosan
TG supplier	Doosan	Doosan	Doosan	Doosan
AE	Kopec	Kopec	Kopec	Kopec
Construction	Hyundai	Hyundai	Hyundai	Hyundai

現代汽車

新古里電廠

3.拜訪外交部駐釜山辦事處

由於中華核能婦女委員會(WiN Taiwan)的會員均熱心參與會務及相關活動，每年都有數位會員自費出席 WiN Global 年會，今年亦不例外，有 3 人自費前往，WiN Taiwan 亦援例向中華能學會及外交部申請補助，因作業疏失，未趕上外交部申請補助之時限，外交部 NGO 委員會於是安排代表團拜訪外交部駐釜山辦事處(相關聯繫書函參見附錄

四)。

韓國近年來核能工業發展十分迅速，今年係第二次主辦 WiN Global 年會，順此次出席年會之便，WiN Taiwan 代表團就近拜會駐釜山辦事處，了解我國在釜山地區的外交工作，並就核能相關之國內與國際現況進行交流。當日，由羅添宏處長親自接待，代表團與辦事處人員先行餐敘，餐敘前代表團致贈代表處人員紀念品(包括核研所五件式西式紙盒餐具組、壓克力盒裝五只入咖啡匙、WiN Taiwan 的 T-恤、茶包等)餐後一同致辦事處座談，由羅處長簡介辦事處業務，其轄區包括釜山、大邱、蔚山、光州、慶州、金泉、浦項、安東、永川、馬山、鎮海、晉州、順天、靈光、木浦、麗水、濟州等十七個華僑協會，約 8,000 名華僑，另有釜山、大邱等 2 所華僑中學共 163 名學生及釜山、大邱、蔚山、光州、馬山、濟州等 6 所華僑小學共 453 名學生，主要負責服務僑胞、簽證業務與推廣我國文化與外交工作，例如駐釜山辦事處為促進我國與韓國之藝術文化交流及推展我國觀光曾於 98 年 5 月假釜山市龍頭山公園內釜山塔 Book Café 舉辦我國水彩畫大師陳陽春教授畫展，獲得熱烈迴響。為續配合政府文化外交政策及提升我國藝術家知名度，再度邀請陳大師於 99 年 5 月 27 日至 6 月 2 日在釜山市立美術館以「台灣之美」為主題舉辦畫展，展出畫作 40 幅。羅處長亦表示近期釜山一所大學之 EMBA 課程邀請他去演講，經由介紹，學員了解台灣的進步與成果，原本安排至大陸參訪之行程，也在我國代表處之協助，轉而至台灣參訪。羅處長亦提到近期國際詐騙集團利用國人來韓協助詐騙集團領錢，韓國政府為遏止此類案件逐漸氾濫，各地法院乃加重其刑期，目前仍有多人遭韓方判刑，對此，辦事處除了痛心外，並呼籲國人勿受騙上當，對於不幸受罰之同胞，亦需盡力幫助這些人及其家屬，駐外人員常需 24 小時待命，外交工作相當繁重與辛勞。



拜訪外交部駐釜山辦事處與羅添宏處長及辦事處人員座談

4.團體照：(5 月 12 日 13：30)

在 Constitution 廳拍團體照。


台灣代表團
陳怡如

三、心得

1.今年 WiN Global 的主辦國南韓，與台灣一樣，95%以上的能源仰賴進口，但在南韓去年所提出的「綠色成長計劃(Green Growth)」，南韓的官員宣稱將追求在 2050 年時，能源供應達到完全地自給自足，對此一宣誓，我們雖沒有百分肯定，卻是抱持樂觀態度。參照韓國的核能發展，1970 年代晚期他們引進西屋公司設計的 System-80 型壓水式機組技術，合約內簽訂允許南韓可以此爲基礎自行發展新機組的條件，他們開始學習與研究，於是有 APR-1400 機組的誕生。現在韓國已具備完全自主設計、製造設備與建廠的能力，近年韓國計畫再擴大核能工業版圖，並取得許多國家之核能設施建造合約。本次會議安排韓國核能界之菁英，參與各項議題，介紹該國之核能工業發展現況，並介紹韓國的核能發展策略，讓人充分感受到韓國對核能重視。同樣位於亞洲地區的台灣，當年他們到台灣來見習，現在他們已有自主設計與輸出核設施之能力，我國的能源發展策略(包含核能等)及未來競爭優勢，亦應做長遠的規畫。

2.我們在會議過程中吸收到很多訊息，全球核能婦女會 Messaging Committee，針對不同的群組及主題編撰核能溝通宣導資料，把溝通所觸及的題目以淺顯易懂的文字，分爲一般、核安輻防、廢棄物環境等等數類，提供輻射、核能等正確知識，可供我國作核能溝通與教育之參考。

3.針對輻射應用之推廣策略，包括與會來賓的一致看法：(1)教育(education)及資源分享(resource sharing)：對病患與專業醫療人員要教育，對人才培育亦應積極投入；(2)Coordination with other organizations：國內外各研究單位與學會等積極合作；(3)Political, economical, social and cultural issues：政府應協助子能科技之推展；(4)Co-operation with industrial and radiopharmaceutical companies：除了例行之核醫藥物應用研究外，臨床亦應與工業及核醫藥廠等密切合作；(5)Relationship with government-relaxing tariff：爲促進核能科技之發展，各國政府應提出相關之優惠獎勵措施。近年來，我國政府積極推動核醫產業之發展，前述看法值得參考。

4.韓國非常鼓勵學生及新進員工參與核能相關會議，此次 WiN Global 會場上有很多年輕的韓國女性參與，我國亦須積極規劃人才培訓計畫，以補足未來核能人力需求。同時，韓國爲推廣其文化，在 WiN Global 的會議規畫階段，即提議幫出席本次 WiN Global 的會員訂製韓服，由 WiN Korea 補助一半費用，雖然最後因支持本項活動者未到最低門檻而作罷，但在晚會等正式場合，節目主持人都穿著正式韓服出場，亦安排韓國傳統音樂與舞蹈，讓與會的來賓對於韓服的美麗留下深刻印象。雖然我們常講韓國文化與我國有密切

關係，但當他們努力在爲自己的文化包裝與推廣，全球都在瘋韓流時，都被我們仍應佩服他們，並應更深一層省思我們的做法。

5.世界核能協會(World Nuclear Association, WNA)的代表 Irina Borysova 在本次大會上介紹 WNA 對於標準化的看法，認爲標準化可(1)降低風險(2)生產容易(3)使大眾有信心；因此 WNA 在推動(1)反應爐設計執照國際化(2)安全要求國際化(3)電廠執照程序標準化；但是要標準化、國際化也會面對很多困難：(1)要尊重各國的管制人員；(2)每個國家有不同的法律，不易修改；(3)管制人員對反應爐設計的知識要增加。相信這些標準化的作法必有利於核能之發展，雖然仍在規畫階段，但未來我們亦應注意此一發展，鼓勵電廠積極參與。

6.WiN Global 很鼓勵以榜樣角色(role model)最爲學習的對象，回顧核能發展中有很多女性，如居禮夫人、吳建雄女士、1976 年 Robert Kankus 是第一位女運轉員、Gale de Planque (1991 年擔任 NRC 委員)…等，美國有 9000 位核能工程師，其中 1000 位爲女性，各國核管機關中有許多女性主管。核能界自開始以來就有許多卓越的女性在其中貢獻、耕耘，是我們引以爲傲。日本科技界女性很少，位階較低；爲鼓勵女性投入科技學門，東京大學推出“科學是你的朋友”專案，並要找出榜樣角色讓年輕人可以效法。在韓國，則有韓國女科技人協會鼓勵女性參與科技之領域，並藉資訊與知識交流支持女科技人之科研活動，增進福利、維護權益，並促進女科技人之間建立更密切的關係與友誼。台灣亦有女性科技人及婦女新知等組織，未來 WiN Taiwan 亦應積極與相關婦女團體合作，推廣核能應用與相關之教育。

7.目前 WiN Taiwan 在 WiN Global 各項活動中相當活躍，積極投入各項法規之制定，對大會的活動亦都在能力範圍內予以支持，讓台灣的核能婦女團體受到重視，本次大會有關於輻射技術之推廣策略(Plenary Session III)即邀請本所的羅彩月博士在此論壇發表台灣的核醫發展現況與展望，感謝各核能機構及外交部長期對 WiN Taiwan 的支持，希望能持續讓我們在全球核能婦女舞台上扮演更多推廣與柔性外交的角色。

.

四、建議事項

1.深耕核能研發能量，積極拓展應用研究

本所屬政府之核能研究機構，擔負起人才培訓之重責，原能會與國科會之科發基金確可吸引更多人力投入核能研發，本所提供獎助學金亦可鼓勵年輕人參與核能研究，但目前國內之核能教育仍不普遍 ，應仿效美國、法國之作法，與高中合作，在大學開設核能通識課程，推廣核能基礎教育。核能相關研發人員應深耕研發能量，亦應與國內各學術領域建立定期之溝通管道，並與國際學術機構建立合作聯盟，積極拓展核能之應用研究。本所可與台電公司、國內大學(如清華大學)合作，結合產、官、學的設備資源，教授核能相關實務課程，其方式建議：(1)由大學教授核能基礎及相關理論課程；(2)台電公司提供實務實習課程，選修學生可利用寒暑假至電廠相關單位，實習、輻射防護、廢棄物處理…等實務作業；(3)本所開放所內實驗室，提供核醫藥物研究、核能安全模擬分析、輻射度量、廢棄物處理…等實習；(4)核能獎學金除了提供給大專院校外，亦可推廣至高中生，鼓勵高中生就讀大專院校之核能相關科系。

2.核能界面臨人力老化，應積極培訓人才

核能人力老化/退休是全球性的問題，台灣亦不例外。因應核能復甦，新人力資源的加入與經驗傳承爲當然重要的議題，而面對青黃不接的人力缺口，如何有效、有制度地延攬退休技術人力，亦爲各方思考的重要議題。韓國爲解決此一問題，已開設各項訓練課程，也包括去年秋季成立之 KINS-KAIST 國際核安碩士學程，以及韓電將於 2012 年推出的 KINGS 國際核能技術碩博士學程，並積極參加各項國際訓練，培訓人才，我國未來若繼續增加新機組，應可蒐集國外相關資訊，作爲強化人力資源的參考。

3.積極並持續進行核能宣導活動

國內核能界應持續進行溝通與教育活動，增加核能可見度及改善社會大眾對核能之印象，宣導層面可包括各級學校，社區、社團等。同時配合製作淺顯易懂之資料，例如用漫畫方式或圖書介紹核能安全、民生應用、廢棄物處置…等知識。

4.與核能相關之學會應積極投入核能發展及溝通宣導工作

A.建議中華核能學會積極運用會員之專業能力，投入核能人才培訓、民眾溝通活動，促進社會大眾對核能之了解與提昇接受度。更期望學會能與產、官、學、研等單位共同建請

政府支持發展核能，並促使產官學研合作積極培訓人才。

B.中華核能學會婦女委員會應儘速更新網站資料，提供新知。並積極召募新會員，以及鼓勵會員參與會務及 WiN Global 會議。

C. WiN Korea 有許多醫界的會員，有助於提升民眾對核能及相輻射相關應用的信任，更可貴的是韓國醫界願意配合；中華核能學會與婦女委員會亦應考量積極召募醫界的會員，或尋求雙方的合作，致力於核能與輻射應用的溝通與教育活動。

D.中華核能學會與婦女委員會能考量仿效法國及韓國，尋求贊助廠商協助辦理各類相關活動。

伍、附錄

一、WiN Global 2010 年會議程

二、WiN Taiwan country report

三、發表之論文

四、與外交部聯繫書函

附錄一 WiN Global 2009 年會議程

The 18th 2010 WiN Global Annual Conference

NUCLEAR POWER
PIVOTAL CHOICE FOR GREEN GROWTH

9-14 May 2010

Paradise Hotel Busan, Korea

Organized by Women in Nuclear-Global & Women in Nuclear-Korea
Hosted by Women in Nuclear-Korea
Sponsored by Korea Ministry of Education, Science and Technology
Korea Ministry of Knowledge Economy

PROGRAMME

Sunday 9 May *(Sydney Room)*

8.00~17.00 Registration

Executive and Board Meeting

8.00 Coffee with Pastry

8.30 Executive Meeting (Executive members only)

10.00 Coffee Break

10.10 Executive Meeting

12.00 Lunch (for Executive and Board meetings attendees)

13.00 Board Meeting (Board members, Executive members, Chapter representatives and their guests only by pre-application)

15.00 Coffee Break

15.10~17.00 Board Meeting

Welcome reception

18.00 Cocktail and Finger Foods

Monday 10 May

8.00~17.00 Registration

Technical and Cultural Tour (Optional)

7.30 Meeting at the Hotel lobby and departure for Changwon(Doosan Heavy Industries & Construction)

9.00 Tour of Doosan Heavy Industries & Construction

10.30 Departure for Geoje
Box Lunch (offered by Doosan)

13.00 Tour of Daewoo Shipbuilding & Marine Engineering Shipyard

14.00 Tour of Oedo Island & Hallyeosudo Marine Nat'l Park by excursion ship

17.00 Departure for Busan

21.00 Arrive at hotel

Tuesday 11 May *(Grand Ball Room)*

7.50~17.00 Registration

7.30 Coffee with Pastry

Opening

Chair : Yun-sil Lee, KIRAMS, Vice President of WiN-Korea

08.40 Opening Remarks (Se-Moon Park, President of WiN-Korea)

Welcome Speech (Seong-Woon Hong, Board Chair of WiN-Korea)

Presentation of the daily programme (Se-Moon Park, President of WiN-Korea)

WiN-Global General Assembly

Chair: Cheryl Boggess, President of WiN-Global

09.00~10.30 General Assembly

10.30 Coffee Break

Presentation of Country Reports I

Moderators: Seong-Woon Hong, Board Chair of WiN-Korea
Jessie Chiu, AEC, WiN-Taiwan

10.50 Presentations by 12 countries (in alphabetical order)
Presentation will last 6 minutes for each country (highlights only)

Australia, Austria(IAEA), Bangladesh, Brazil, Bulgaria, Canada, Czech Republic, Finland, France, Germany, Hungary, Indonesia

12.10 **Luncheon** (sponsored by KEPCO : 7min. of sponsor's video)

Opening Ceremony

Chair : Se-Moon Park, President of WiN-Korea

13.40 Photo Panorama of WiN-Global (presented by Eva Gyane, President of WiN-IAEA)

14.00 Welcome Speech (Cheryl Boggess, President of WiN-Global)

Congratulatory Speech (Jung Hyun Kim, Vice Minister, Ministry of Education, Science and Technology)

Congratulatory Speech (Gabriele Voigt; Message from Mr. Yukiya Amano, IAEA General Director)

14.20 Video Messages (interpretation by Ingeborg Hagenlocher, Former President of WiN-Switzerland)

Key Note Speeches

Chair: Re-Na Lee, Professor, School of Medicine, Ewha Womans Univ., WiN-Korea

14.30 KunMo Chung, Former Minister, Ministry of Science and Technology
Theme: "Vision and Strategy with Nuclear and Renewable Resources in Korea for Green Growth"

14.50 Gabriele Voigt, Director, Office of Safeguards and Analytical Services, IAEA
Theme: "Human Resources and Gender Balance in the IAEA"

15.10 Jong Shin Kim, President of Korea Hydro & Nuclear Power Co.
Theme: "Nuclear Expansion in Korea and Overseas"

15.30 Coffee Break

Presentation of Country Reports II

Moderators: Junko Ogawa, President of WiN-Japan/ Patricia Wieland, Division Head, CNEN, WiN-Brazil

15.50 Presentations by more than 15 countries (in alphabetical order)
Presentation will last 6 minutes for each country (highlights only)

Italy, Japan, Pakistan, Philippines, Romania, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, *UAE*, UK(WNA), USA, Korea

17.30 Adjourn

WiN-Award Ceremony and Opening Reception

18.30 WiN Awarding (by Cheryl Boggess, President of WiN-Global)

18.40 Awardee's Speech

19.00 Standing Buffet with Korean Musical Performance
"Hanultari Samulnori"

Wednesday 12 May *(Grand Ball Room)*

7.30~17.00 Registration

7.30 Coffee with Pastry

Technical Session

Plenary Panel Session

8.30 **Plenary Session I** *Nuclear Power Plant Construction and Operation*

Chair : Sungeun Kim, Assistant Professor, Korea Univ., WiN-Korea

Moderator: Käthe Sarparanta, TVO, WiN-Finland

- Soon Heung Chang, Vice President of KAIST, Korea
  "Safety Enhancement of Nuclear Power Plants"
- Kye-hong MIN, President & CEO, KRWMC, Korea
  "Radioactive Waste Management in Korea"
- TaeWoo Kim, Vice President of Doosan HI, Korea
- Irene Aegerter, President of WiN-Switzerland
- Irina Borysova, WNA, UK
- Joni Falascino, Westinghouse, WiN-USA
- Milena Prazska, AMEC Nuclear, WiN-Slovakia

10.10 Discussion (Questions and Answers)

10.30 Coffee Break

10.50 **Plenary Session II** *Nuclear, the Energy Source of the Future*

Chair : Hee-Jung Im, KAERI, WiN-Korea

Moderator: Annick Carnino, Former President of WiN-Global

- Moon Hee Chang, Senior Vice President of KAERI, Korea
  "National Plan for Future Nuclear System Development"
- Goon-Cherl Park, Professor, Seoul National Univ./President of KNS, Korea
  "Extension of Nuclear Energy Use for Future"
- Seung Kyoo An, President & CEO, KOPEC, Korea
  "The Development Strategy for Sustainable Nuclear Power"
- Yeong-Kook Oh, Division Head, NFRI, Korea
  "Status of the Fusion Energy Development as a Future Vision Energy"
- Ingeborg Hagenlocher, Former President of WiN-Switzerland
  "Fusion - Yet Another Auspicious Alley to Sustainable Energy Supply"
- Vuvu Msutwana-Qupe, NECSA, WiN-South Africa
  "Demystifying Nuclear Technology: a Sustainability Challenge"
- Karin Rantamäki, VTT TRC, President of WiN-Finland
  "Nuclear Future in Finland"

12.00 Discussion (Questions and Answers)

12.30 **Luncheon** *(Capri Room)*

13.30 **Group Photo**

Concurrent Technical Session

14.00 **Concurrent Session I Special Workshop** on *Prospects of Nuclear Power Plant Construction and Operation*
(Sponsored by Korea Atomic Industrial Forum)

(Grand Ball Room #1)

Chairpersons: Irina Borysova, WNA, UK/ Young Mi Nam, KAERI, Korea

Key Note Speech: In-Soon Chang, Former President of KAERI , Korea
"Korea's Nuclear Technology Creating Legend and Making History"

- Zakia Begum, AEC, Bangladesh
  "Present Status of NPP in Bangladesh"
- Jin Kang, Doosan HI, Korea
  "Advanced Design Features for UAE Nuclear Power Plant Components"
- Irina Borysova, WNA, UK
  " International Standardization of Nuclear Reactor Designs"

Coffee Break

- Hyo Won Kim, Doosan HI, Korea
  "Manufacturing Process of APR1400"
- Sunmi Jeong, KHNP, Korea
  "Pilot study for Long-Term Plans of Reactor Vessel Internals"
- Gül Bahire Göktepe, Turkish AEA, Turkey
  "Prospects of Nuclear Power for the Environmental Benefits of the Turkish Energy Scene"

14.00 **Concurrent Session II** *Advanced Technology of Nuclear Power, Fuel and Materials*

(Grand Ball Room #2)

Chairpersons: Maha Aziz, WGI, USA/Sun-Ju Choi, KAERI, Korea

- Youngok Lee, KOPEC, Korea
  "Equipment Qualification for Safety-Related Equipment in Nuclear Power Plant"
- Mee Jeong Hwang, KAERI, Korea
  "A Trip Model Construction and the Application Plans of the Model"
- Yeong Hwa Lim, KHNP, Korea
  "Development of Plant Reliability Data Information System and Its Application for CANDU Type"
- Eui-Jin Kim, Doosan HI, Korea
  "The Performance Evaluation of Moisture Separation Equipment for Nuclear Steam Generator"

Coffee Break

- Hye-Young Shin, KHNP, Korea
  "Ageing Management Program for Thermal Aging Embrittlement"
- Ai Melani, KAIST, Indonesia

"Quenching Experiment on Vertical Tube Using Carbon Nano Tube (CNT) Nanofluids"

- Sang Hee Kang, KHNP, Korea
  "Performance Analysis of a Passive Auxiliary Feedwater System in APR+"

14.00 **Concurrent Session III** *Radiation Protection and Application*
(Grand Ball Room #3)

Chairpersons: Patricia Wieland, CNEN, Brazil/Yun-Sil Lee, KIRAMS, Korea

- Emerita Andres Barrenechea, St.Luke's MC, Philippines
  "Thyroid Cancer Profile in the Philippines – the Efficacy of Radioactive Iodine Ablation"
- Jae-Seon Lee, KIRAMS, Korea
  "The Development of Novel Biomarkers for the Increase of Radiotherapy Efficacy"
- Tsai-yueh Luo, INER, Taiwan
  "Evaluation of the Potential of a New Radio-Thermogelling Emulsion 188Re-ECD/Lipiodol/Hydrogel for Treatment of Hepatoma"
- So Hyun An, EWU, Korea
  "Impact of Breathing Biofeedback on Patient's Dose Distribution in Respiratory-Gated Treatment"

Coffee Break

- Eunok Han, Deagu Health College, Korea
  "Analysis of the Factors on the Radiation Safety Management of PET-CT in Medical Centers"
- Jihye Baek, EWU, Korea
  " Evaluation of Volume Measurement Accuracy of 3D Ultrasound System Prostate Radiotherapy"
- Yoon-jin Oh, EWU, Korea
  " Skeletal Maturity Scores for Korean Children Using TW3 Method"

Poster Session (Posting from the morning)
(Sydney Room)

17.00 **Poster Session I** *Prospects of Nuclear Power Plant Construction and Operation*
Poster Session II *Advanced Technology of Nuclear Power, Fuel and Materials*

Chairpersons: Sunhee Park, KAERI, Korea/Yu Jung Choi, KHNP, Korea

- K-A0006 Eun-Young Choi, KAERI, Korea

"Simultaneous Measurment of Oxide Concentration in LiCl/Li2O Molten Salt for Electrochemical Reduction of Uranium Oxide Using Square Wave Voltammetry"

- K-A0023, Kwi Lim Lee, KAERI, Korea
  "A Safety Analysis of Passive Decay Heat Removal Systems"
- K-A0026, Eun Hee Lee, KAERI, Korea
  "Synthesis and Characterization of Ni-Fe-B Powders by a Co-precipitation"
- K-A0049, Eun Hee Lee, KAERI, Korea
  "Stability of Magnetite Suspensions with Poly (acrylic acid)"
- K-A0033, Seung Ok Yang, KEPCO, Korea
  "Development of the Automated Scanner for Ultrasonic Testing of Vessel Nozzle Welds in Nuclear Power Plant Using Six Sigma Methodology"
- K-A0034, Yu Jung Choi, KHNP, Korea
  "Elimination of Post Accident Sampling Requirements in OPR-1000 of Korea"
- K-A0037, Eunjin Chun, KHNP, Korea
  "Development of Structural Life Management System for Safety-Related Structures of NPP"
- K-A0044, Hyun joo Yoo, KEPCO, Korea
  "The Development of ISIMS Version 2"
- K-A0051, Seon jeong Park, KOPEC, Korea
  "Differences in Approach Between Nuclear and Conventional Seismic Standards"
- K-A0052, Jea Myoung Noh, KEPCO, Korea
  "Maintenance System for Nuclear Power Plant Structures in Korea"
- K-A0057, Dong Hee Park, KEPCO, Korea
  "Simulation of Strong Ground Motion Using Stochastic Method"
- K-A0058, Dong Hee Park, KEPCO, Korea
  "The Seismic Network for Nuclear Power Plant Sites of Korea Electric Power Cooperation"
- K-A0061, Gyoung-Ja Lee, KAERI, Korea
  "Electrochemical Detection of Trace Uranium in Aqueous System Using Uranium-Cupferron Complex"
- K-A0063, Sook-Kyung Lee, KEPCO, Korea
  "An Introduction to Optimization Study for the Operation of Engineered Safety Feature Atmosphere Cleanup Systems in Nuclear Power Plants in Korea"
- K-A0065, Se-Moon Park, KHNP, Korea
  "Seismic Monitoring System for Earthquake Safety of Nuclear Power Plant in Korea"

18.00 Adjourn

19.00 **Gala Dinner** hosted by the Mayor of Busan *(Grand Ball Room)*

Thursday 13 May *(Grand Ball Room)*

7.30~17.00 Registration

7.30 Coffee with Pastry

Technical Session

Plenary Panel Session

8.30 **Plenary Session III** *Strategic Action for the Promotion of Radiation Technology*

Chair: Jae-Seon Lee, KIRAMS, WiN-Korea

Moderator: Ingeborg Hagenlocher, Former President of WiN-Switzerland, Germany

- Myung Chul Lee, Professor, Seoul National Univ., Korea
  "Strategic Action for the Promotion of Radiation Medicine"
- Jae Joo Ha, Vice President, KAERI, Korea
- Mison Chun, Professor, Ajou Univ., Korea
  "Future and Promotion in Radiation Oncology"
- Re-Na Lee, Professor, Ewha Womans Univ., Korea
  "Strategic Action for the Promotion of Radiation Technology-Radiologic Physics"
- Emerita Barrenechea, Senior Consultant, St. Luke's MC, Philippines
  "Strategic Action for the Promotion of Radiation and Nuclear Medicine"
- Reiko Imai, Physician, NIRS, Japan
- Tsai-Yueh Luo, Associate Researcher, INER, Taiwan
  "Strategic Action for the Promotion of Nuclear Medicine"

10.00 Discussion (Questions and Answers)

10.20 Coffee Break

10.40 **Plenary Session IV** *Perception and Human Resources for Nuclear Renaissance*

Chair: Soyon Kim, National Police Hospital /Vice President of WiN-Korea

Moderator: Dominique Mouillot, President ONET/President of WiN-France

- Byung Joo Min, KAERI/President of KWSE
  "Nuclear HRD and Woman Scientists and Engineers in Korea"
- Seong Kyung Cho, Professor, MyongJi Univ., Korea
  "Nuclear Risk and Risk Communication"

- Carol Berrigan, NEI, USA,
- Junko Ogawa, Professor Tokyo City University, President WiN-Japan
- Käthe Sarparanta, TVO, Finland
- Monira Hisham Al-Kuttab, Director of FANR, UAE
- Susan Brissette, Bruce Power, President of WiN-Canada

12.00 Discussion (Questions and Answers)

12.20 **Introduction of 2011 WiN-Global Conference**

12.30 Luncheon *(Capri Room)*

Concurrent Technical Session

14.00 **Concurrent Session IV** *Radioactive Waste Management Technology*

(Grand Ball Room #1)

Chairpersons: Jessie Chiu, AEC, Taiwan/Hee-Jung Im, KAERI, Korea

- Bernard Rottner, ONET Technologies, France
  "Immobilisation of Radwaste In Synthetic Rock : An Alternative to Cementation"
- Hee-Jung Im, KAERI, Korea
  "*In situ* and On-line Measurements of the Lanthanide Ions in High Temperature for a Practical Application in Pyrochemical Processing"
- Milena Prazska, AMEC Nuclear Slovakia s.r.o., Slovakia
  "The Progressive Technology for the Removal Retention and Fixation of the Radioactive Sludge Sorbents and Non-Standard Radioactive Waste into the SIAL® Matrix"

Coffee Break

- Maha Aziz, WGI, United States
  "Modularization Design of the Liquid and Solid Waste Management System"
- Khalida Akhtar Gill, Pakistan AEC, Pakistan
  "Solventextraction Recovery of Strontium From High Active Waste(HAW) "
- Mi-seon Jeong, UST, Korea
  "The Pseudo-Colloid Migration of four-Member Radionuclide Chains in a Fractured Porous Medium"

14.00 **Concurrent Session V** *Policy, Nuclear Safety, Security, safeguards and Environmental Issues*

(Grand Ball Room #2)

Chairpersons: Eva Gyane, president WiN-IAEA/Sun Yeong Choi, KAERI,

Korea

- Eva Gyane, IAEA, Austria
  "The IAEA's Nuclear Safety Security and Safeguards Programme"
- Sun Yeong Choi, KAERI ,Korea
  "An Analysis on Human-related Unplanned Reactor Trip Events in Korea"
- Sofya Hambaryan, IAEA, Austria
  "Safeguards Implementation Under Comprehensive Safeguards Agreements and Additional Protocols"
- Patricia Wieland, CNEN, Brazil
  "Operational Risks Management at Industrial Irradiation Plants"

Coffee Break

- Yanti Fristikawati, Atma Jaya Univ., Indonesia
  "Legal Perspective of Environmental Protection from Nuclear Activity in Indonesia"
- Helena Janzekovic, Slovenian NSA, Slovenia
  "Toward Harmonisation of Radiation and Nuclear Safety in the European Union"
- Eun-ha Kwon, KAERI, Korea
  "Evaluating the Level of Nuclear Nonproliferation Credibility Using the AHP"

14.00 **Concurrent Session VI** *Human Resources, Cooperation and PA*
(Grand Ball Room #3)

Chairperson: Helena Loner, Switzerland/Youngok Lee, KOPEC, Korea

- Tri Murni Soedyartomo Soentono, NNEA, President WiN-Indonesia
  "To Go to Welfare Families and the Nation is Accompanied by a Clean and Green Environment with a Nuclear Technology Solutions"
- Cristina Bucur, SNN-Cernavoda NPP, Romania
  "Nuclear Power Generation Alternative for a Clean Energy Future in Romania"
- Youngmi Nam, KAERI, Korea
  "Human Resources Development for Nuclear Personnel in Korea"

Coffee Break

- Helena Loner, WiN-Switzerland
  "What is More Ethical - to use nuclear energy or to ban it ?"
- Maria Vatamanu, NEN Co. (SNN SA), Romania

"Rejuvenation of the Staff – Preparing Young Employees to Become Specialists in Procurement Sector as Strong Support of Nuclear Energy Development"

- Ju-young An, KNEF, Korea
  "Projects of KNEF for Promoting Next-Generation Understanding - Nuclear Energy Exploration Olympiad"
- Gisele Marie Aucoin, AECL, Canada
  "Training 500 Trades Personnel to Dismantle and Re-build a Nuclear Reactor"

Poster Session (Posting from the morning)
(Sydney Room)

17.00 **Poster Session III** *Radiation Protection and Application*
Poster Session IV *Radioactive Waste Management Technology*

Chairpersons: Mun ja Kang, KAERI/ Kyeong Sook Kim, KEPCO, Korea

- F-A0022, Meei-Ling Jan, INER, Taiwan
  "Preliminary Result of a Prototype System for Positron Emission Breast Imaging"
- F-A0023, Carlos Eduardo Gonzalez Ribeiro Alves, CNEN, Brazil
  "Nuclear Medicine Facilities Assessment Through Inspections in Brazil"
- K-A0005, Hae-June Lee, KIRAMS, Korea
  "Heat Shock Protein 27 Targeted Heptapeptide Sensitizes Tumors with Radio-and Chemo-Resistance"
- F-A0005, Jyi-Lan Wuu, INER, Taiwan
  "Solid Waste Clearance Experience in Taiwan"
- K-A0010 , Ji-Hyeon Lee, UST, Korea
  "Study of the Long-term Coper Corrosion"
- K-A0029, Kyeongsook Kim, KEPCO, Korea
  "The Analysis of Hydrogen Isotopes"
- K-A0069, Jong-goo Kim, KAERI, Korea
  "Analysis of Trace Water in Heavy Water Using FTIR"
- K-A0070, Young Rang Uhm, KAERI, Korea
  "Fabrication of Low Density Polyethylene Coated PbO Nanoparticles and IT Dispersed Polymer Sheet"

17.00 **Poster Session V** *Policy, Nuclear Safety, Security, safeguards and Environmental Issues*
Poster Session VI *Human Resources, Cooperation and PA*

Chairpersons: In-Young Noh, KAERI/ Mi Jung Hwang, KAERI, Korea

- F-A0028, Chantel Janet De Beer, ARC-OVI, South Africa

"Colonization of Tsetse Flies as a Prerequisite for the Use of Sterile Insect Technique in South Africa"

- F-A0034, Yukiko Endo, Toyko City University, Japan
  "Effective Method in Education to Use Large Scale Cloud Chamber
  Ichiro TODA (RADO Corporation)"
- K-A0007, Eunju Jun, KAERI, Korea
  "Lessons From Successful Nuclear Power Program of the Republic of Korea"
- K-A0025, Gye-Hwi Lee, KINS, Korea
  "Public Communication of Korean Nuclear Regulatory Organization"
- K-A0028, Sun Yeong Choi, KAERI, Korea
  "Applications of Piping Failure Frequency with OPDE(OECD/NEA Piping Failure Data Exchange) Database to Korean Nuclear Safety Research"
- K-A0064, Kwangho Lee, KEPCO, Korea
  "Assessment of Design Difference Effects for CANDU6 Safety Analysis"
- K-A0071, Sunhee Park, KAERI, Korea
  "Development of a Computer Program to Compare the Two Different Versions of Computer Codes"
- K-A0072, Sunhee Park, KAERI, Korea
  "The Basic Concept of Uncertainty Analysis MODULE, SAUNA"
- K-A0073, Sunhee Park, KAERI, Korea
  "The Status of MIDAS/SMR Code Development for SMART Reactor"
- K-A0074, Yeonhee Hah, KINS, Korea
  "Korean Activities for Regulatory Capacity Building in Asia"

18.00 Adjourn

19.00 Closing Reception (with musical performance of "the SafeGuard")

Friday 14 May

Technical and Cultural Tour (Official)

7.30 Departure for Gyeongju

9.30 Tour of Bulguksa Temple, Tumuli Park and Cheomseongdae Observatory in Gyeongju

12.00 Departure for Ulsan

13.30 Hyundai Motor Company Factory Tour

15.00 Departure for Busan

17.00 Tour Shin-Kori NPP(APR 1400) construction site

18.30 Dinner

20.30 Arrival at Hotel or Departure for Seoul (for Aomori Tour Participants)

Saturday 15 May

Cultural Tour (Optional: Expenses paid by the participants)

Seoul Tour (details on the website)

Sunday 16 May~

For Aomori Tour Participants only

Departure for Aomori
(Programme will be posted on the website of WiN-Japan linked with the website of 2010 WiN-Global Conference)

(for WiN board members only)

The 18th 2010 WiN-Global Annual Conference

Special Workshop
on WiN-Global Activities

Miami Room, Paradise Hotel Busan

Wednesday 12 May

14.00 ~ 17.00 **Workshop on the Activity of Communication Committee**

Chair: Susan Brissette, President of WiN-Canada

Thursday 13 May

14.00 ~ 17.00 **Workshop on the Activity of Messaging Committee**

Chair: Dominique Mouillot, President of WiN-France

附錄二　WiN Taiwan country report

2010 WiN-Global Annual Conference
Country Report

WiN Taiwan
Jessie J. Chiu, Atomic Energy Council

1. Introductory of WiN Taiwan

Number of WiN Member (national/global): 132/36. Chapter founded in 1994.

WiN Taiwan operates as a special division under the Chung Hwa Nuclear Society. Since its founding in 1994, members of WiN Taiwan have grown from 22 to 132 (among them, 36 are global members). WiN Taiwan has seven steering committee members by election, including chair and vice chair (i.e. president and vice president). The current (2008–2010) president and vice president are Jyi-Lan Wu of INER, and Shung-Hwui Fan of AEC, respectively. Past presidents who do not wish to be included in the ballots for biannual elections are invited to serve as advisors to WiN Taiwan.

2. Nuclear Situation in Taiwan

Number of NPP`s: 6 units in operation; 2 under construction. Number of Research Reactors: none.

General. In 2009, 99.4% of Taiwan's energy sources relied on imports. Electricity generation totalled 229.7 terawatt-hours (TWh) which was contributed by: coal 38.40%, co-gen 17.3%, LNG 20.1%, oil 2.7%, nuclear 18.1%, hydro 3.1% and wind & solar PV 0.35%.

Power consumption dropped 3.6% across Taiwan during 2009 as a result of the global recession, with industrial electricity use down 6.3%. Nonetheless, nuclear power contributed 18.1% to the total supply – compared to 17.1% in 2008. The three nuclear power plants at Chinshan, Kuosheng and Maanshan, operated by state-owned utility Taiwan power Company (TPC), with two operating units at each site, generated 41.57 terawatt-hours (TWh) of electricity (gross) in 2009 – setting a new record high for the third consecutive year.

NPP Performance. Performance wise, the average capacity factor for all six units in 2009 was 92.17%, also best record ever in Taiwan's nuclear power operation. The annual average number of abnormal events was 1.33 per unit (or 8 events for all six units), and the average number of automatic scrams was 0.17 per unit (or only 1 scram for all six units) in 2009. New records were also set at Maanshan-2 for a refueling outage of 28.48 days, a full day shorter than the record set at Kuosheng-2 in 2008, and for continuous operation of 542 days, breaking the old mark of 538 days set at Chinshan-1 in 2005.

During the two-year time from July 2007 to July 2009, power uprates of the MUR (Measurement Uncertainty Recapture) type were accomplished on all six units, adding 56 MWe to the existing installed capacity of 5,144MWe, which amounts to an annual increase of 0.44 TWh in electricity generation, equivalent to 0.28 million metric tons of CO2 emissions reduction.

Construction of Lungmen Plant. Construction continues at the fourth nuclear power plant "Lungmen" housing two ABWR units with 95% completion for construction and 37% completion for test runs as of 28 February 2010. The project has encountered significant delays first due to the

suspension in 2000, then the rising price of construction materials, finding new subcontractors to replace the bankrupted and negotiating new contracts to succeed the expired. Completion and testing of the integrated distributed control and information system (DCIS) has been one of the greatest challenges of the project. Commercial operation dates have been reset to December 2011 and 2012 for Lungmen-1 and -2, respectively.

Nuclear Regulatory Activities. The AEC started a rigorous safety review upon receipt of a 20-year license renewal application from TPC for the Chinshan plant in July 2009. Some of other major reactor regulatory activities include: 10-year integrated safety assessment for Chinshan-1, continuing review of transient analysis methodology licensing applications, and a first-time maintenance rule inspection for all nuclear plants. For the Lungmen plant, focuses were on the pre-operation test inspection of pre-requisite systems and the initial test program and turnover process inspection. In the area of radiation protection, significant efforts were devoted to the implementation of the mammography quality control program, a special safety inspection of radiation sources at all academia and research institutes, and strengthening of self management in NDT radiation safety.

Nuclear and Related R&D Focuses. Major research focuses of the Institute of Nuclear Energy Research (INER) include: time limited comprehensive safety assessment for Chinshan and Kuosheng NPPs, nuclear power uprate for all three NPPs, NPP license renewal related studies, development of decommissioning and decontamination technology, commercial-grade item dedication for nuclear safety-related applications, development of solid oxide fuel cells, cellulosic ethanol, high concentration photovoltaic (HCPV) systems, wind power generation systems, and the integrated model of energy technology and macro-economy, and development and commercialization of radiopharmaceuticals. In addition, about 140 person-years were devoted to technical service activities for NPPs including the construction of the Lungmen plant in 2009.

Government Reform. On 12 January 2010 the Legislative Yuan passed a set of four laws paving the way for a reform of the Executive Yuan that will reduce the number of cabinet- level agencies from 37 to 27. The AEC and its affiliated organizations are among those to be affected by this reform. According to the current plan, the AEC is to be transformed into a nuclear safety regulatory entity of a lower tier, and its research arm INER will become an administrative corporation, both under the Ministry of Science and Technology (MOST). The MOEA will become the Ministry of Energy and Economic Affairs. Decisions on these and other major reshufflings will be finalized in the coming months. The reorganization will take effect on 1 January 2012, and a two-year transition ending in December 2013 will allow all agencies to adjust themselves to the new operations.

3. Situation of Waste Management

Repository for L&ILW: in site selection phase. Repository for spent fuel: in planning phase.

On-site dry storage prior to final disposal has been recognized as a favorable option for the spent nuclear fuel management. An application for constructing a spent fuel dry storage facility at Chinshan plant was submitted by the TPC in March 2007. After rounds of review by a technical review team, the Fuel Cycle and Materials Administration (FCMA) of the Atomic Energy Council (AEC) accepted the application and issued a construction license in December 2008. The TPC is ready to commence the construction work pending approval of its water and soil reservation plan by the county government, which is expected to happen very soon.

As required by law, a candidate site for a low-level waste final disposal facility will be determined through a referendum on multiple recommended candidate sites. In March 2009, the Ministry of Economic Affairs (MOEA) announced two recommended candidate sites, as determined by its site selection committee, located in Nantien village of Taitung County and Donguiyu Islet of Pescadores. However, the county government of Pescadores subsequently claimed the site as a natural reserve, which by law must be excluded in the siting process. The siting committee is now working on recommending additional potential site(s) to re-establish a list of multiple recommended candidate sites.

FCMA has also started on establishing a personnel qualification system for radioactive waste management, qualifying not only regulatory staff but also facility operators. The corresponding regulation was promulgated in April 2009, with sunset clauses to cease current practices in two years.

4. Activities for Mentoring and Training

During July and August 2009, the Atomic Energy Council conducted two 2-day summer camps on nuclear energy for high school teachers in Taipei County. Lectures included "Radiation in our everyday life", "Is nuclear power safe?", "Possibilities of a nuclear accident", and "Getting to know radioactive waste". There were also hands-in demo and DIY on radiation detection, as well as a trip to visit Taipower's North visitors Center, Kuosheng NPP, a nearby wind power station, and the Juming Museum. A total of 103 teachers participated in the event. Among them, 66 were women.

In addition, over 10 (half-day and one-day) training sessions were provided to school teachers by WiN members via the sponsorship of the AEC. The half-day sessions were focused on nuclear energy and radiation, while in the one-day sessions, other clean energy options, such as solar and wind, were also introduced.

As part of its research project on communication and education of nuclear energy and radiation, WiN Taiwan held an informal forum on November 12, 2009. Experts in different levels/areas of education and an environmental activist were invited to exchange ideas and opinions on the subject. One of the conclusions and recommendations of the forum led to the development of teaching materials on energy (including nuclear) to be included in the science and technology textbooks for 5th-8th graders.

5. Activities for Public Acceptance

A public opinion survey on nuclear power and government's nuclear policy was carried out during October 2-16, 2009. The survey, sponsored by the State-owned Enterprise Commission of the Economic Affairs Ministry, was conducted by All Dimension Survey & Research. Results are based on telephone interviews with a total of 2,301 people aged 20 and over using the CATI system; 1,228 of the respondents represent nation-wide population, and others (1,013) represent the population of the municipalities where the nuclear power plants are located. Fifteen questions were asked covering subjects of global warming, costs of energy sources, world trend on nuclear energy development, and perception and acceptance of nuclear power. In the answers to nearly all of the questions, there exists a consistent gap between the two groups of respondents: those representing nation-wide population are more knowledgeable about energy facts and have more positive attitudes towards nuclear power than those representing residents living near NPPs. About 54% of the former support adding new units to the existing NPP sites, whereas only 33% of the latter agree. Operation

safety and waste management were viewed as most concerned issues for nuclear power by both groups.

Another telephone poll on safety perception and attitudes towards nuclear power was carried out during March 11-22, 2010, as part of a research project sponsored by a mutual fund of the National Science Council and the Atomic Energy Council. Telephone interviews were conducted with 1,490 people aged 20 and older; 1,084 represent the population of the whole country, and others (406) represent residents of the municipalities where nuclear plants are located. For attitude towards nuclear power, 58%/54% respondents are supportive, and 31%/33% are against. But when asked about future development of nuclear power, 52%/44% support continuation and 40%/46% are against. A wider gap between answers of the two groups on the latter question can be viewed as a NIMBY effect. While 55%/55% respondents agree that NPPs have good safety records (and only 13%/20% disagree), overwhelmingly high percentages (83%/66%) thought the government did not provide sufficient information. In terms of policy making on nuclear energy, 69%/75% respondents prefer decisions be made through referendum, 16%/8% support decisions made by the Executive Yuan, and only 8%/5% support decisions by the Legislative Yuan. However, when asked about participation in nuclear policy making, 51%/41% prefer to let the government make decision while overseen by the democratic body and works, 37%/35% would like to see participation by NGOs, and only 6%/12% would personally take part in the process.

6. Highlights of WiN Taiwan Activities during July 2009 ~ April 2010

This part of the report has been prepared based on the four key elements of WiN Global's strategic plan. WiN Taiwan's activities and achievements as summarized below may fall under more than one of the key elements.

Organization – structure and sustainability

WiN Taiwan holds Steering and Advisory Committee meetings approximately once every two months. The issue of "whether to become a separate (independent) entity from its mother society" was again debated during 2009. Having studied the organizational structures and operations for similar female groups of various professionals and analyzed the pros and cons, the committee has decided to maintain the status quo.

WiN Taiwan finances itself, and as such seeks sponsorship for implementing special projects or activities. Following successful implementation of a research project on communication and education in 2009, WiN Taiwan received another grant to continue further research activities on the same subject during 2010-11.

Benefits and Development – networking, training and education

WiN Taiwan Annual Meeting—*8 July 2009.* WiN Taiwan and ANS-Taiwan Section held a Joint Annual Meeting at the Institute of Nuclear Energy Research (INER) in TaoYuan. Nearly 40 WiN members attended the event. To celebrate WiN Taiwan's 15th anniversary, President Jyi-lan Wuu gave a special slide show at the general assembly to recollect memories of WiN Taiwan's development and activities since 1994.

Two assemblies totaling nearly 80 people joined together after separate business meetings for a series of presentations. Mr. Hon-Fu Hsu, Head of the Training Division at Taipower's Nuclear Generation Department, presented Taipower's plans for bridging the workforce gap in nuclear power. Dr. Szu-Li Chang, adjunct professor of the National Tsing Hua University and Ph.D. in nuclear engineering of the Massachusetts Institute of Technology, spoke about her unconventional career and life experience which was very enlightening and inspirational. A parent of two home-schooling children, Dr. Chang has recently been devoting herself full-time to K-12 education in nuclear science. The last on the morning agenda was a speech on "Nutriology of the New Century" by Dr. Fung-Ying Wang, author of a book of the same title, and an expert in food inspection.

Two field visits were organized in the afternoon: a technical tour at INER's Environmental and Energy Technology Center, and a cultural tour to the Temple of Sansha which has been known as the "palace of oriental arts".

WiN Global Annual Meeting—*20~23 July 2009.* A delegation of six members, led by WiN Taiwan President Ms. Jyi-lan Wuu, attended the 17th WIN Global Annual Meeting held in Washington, D.C., USA. The delegation was represented by members from the utility (TPC), government authority (AEC), research (INER), academics (NTHU), industry (AREVA Taiwan) and information service (NIC).

Networking with Women Scientists—*31 October~1 November 2009.* Two WiN Taiwan representatives attended the 6th Female Physicists and Chemists Joint Symposium. One served as a session chair, and the other gave a presentation on WiN. Female members of the physics and chemistry learned societies take turns to host the biannual event. This time the symposium was organized by women chemists. The two-day event was held in the Experimental forestry of the National Chung Hsing University to combine the in-door conference with outdoor activities. About 80 people attended the event.

New Year's Party—*6 February 2010.* To welcome the new year of the Tiger while bidding farewell to the year of the Ox, an after-work party was held with light meal and karaoke contests. About 15 people attended the party.

Spring Seminar —*25 February 2010.* Mr. Chi-Ping Chen, Chief of Medical Applications Section of AEC's Radiation Protection Department, was invited to give a talk entitled "Not too little, not too much, and right on target! —Introducing AEC's Medical Exposure Quality Assurance Program". The speech, with special focus on the rate of breast cancer in Taiwan and its diagnosis using mammography, attracted nearly 50 people; about 30 of them were women.

Communication – strategies, tools and channels

Science Fair—*25 July 25 ~01 August 2009*. WiN Taiwan, sponsored by the AEC, operated two stands "Who's the Nuclear Knowledge King" and "Monsters Inc" at the week-long science fair held at an athletic park in Jia-yi County. A demonstration entitled "How much do you know about radiation?" was also presented twice a day. The fair was one of the summer K-12 activities organized by the National Science Education Center (NSEC).

Power Generation Summer Camps—*July~August 2009.* As part of a summer camp series on Energy Technology and Application offered at the NSEC, two 2-day camps on power generation

were offered to children of Grades 3-6 in July and August. WiN Taiwan was able to try out its newly developed 3-hour teaching module "Nuclear Power–our invisible friend" during each camp.

One-hour Teaching Modules—*September~December 2009.* A series of 18 one-hour (some are two-hour) teaching modules on various nuclear energy and radiation topics have been developed for use by K-12 teachers.

Seminars on Energy and Atomic Science—*throughout 2009.* Through the channels established for K-12 physics education programs, a total of 47 seminars were delivered by WiN members to K-12 students and teachers at their schools throughout the year of 2009. Over 20 nuclear energy and radiation related subjects were available for the school to specify under the "Let's talk about energy and atomic science!" series activities. Similar efforts continue into 2010.

Education Website "Yuan Lai Ru Ci"—*November 2009.* As part of a research project conducted by a team of WiN Taiwan members, a nuclear and radiation education website named "Yuan Lai Ru Ci—So that's what it is all about" has been initiated to provide general knowledge of atomic energy applications and green energy technology to children, school teachers as well as the general public. Four major sections are planned: "Atom Secret Land", "Green Energy", "Atom Classroom", and "Atom Academy". The website (currently at http:/www.nucl.nthu.edu.tw/nu_info/) is targeted for completion by the end of 2011.

WiN Taiwan Newsletters—*January 2010~* WiN Taiwan launched the publication of monthly newsletters as a new project for 2010. Four issues of electronic WiN Taiwan Newsletter have been published as of April 2010.

Television Series—*25 March 2010.* Members of WiN Taiwan met with a director and his staff of a film making company to discuss potential cooperation in making a series of 30-minute videos on various nuclear and radiation application topics. The company will apply for funding under a special program launched by the National Science Council to promote film making of popular science subjects thereby fostering science education for the general public. WiN Taiwan's role will be to suggest topics, recommend experts to each topic and help along side of the production process. If successful, the series will have guarantee broadcasting on a TV channel (such as the Taiwan Public Television Service) and be widely distributed for education.

WiN Taiwan country report 簡報

Country Report

WiN Taiwan

May 11, 2010

Jyi-Lan Wuu

2010 WiN-Global Annual Conference

Activities of 2009

- **Organization**
- **Benefits and Development**
- **Communications**

2010 WiN-Global Annual Conference

Organization

- Growing in members
  National members: 132 **Global members:** 36
- Steering and Advisory Committee meetings once every two months.
- Successful implementation of a research project on communication and education in 2009 led to continuation of the project into 2010-11.

2010 WiN-Global Annual Conference

Benefits and Development

- **WiN Taiwan Annual Meeting** held jointly with ANS-Taiwan Section on July 8. About 80 participated.

- **WiN Global Annual Meeting**
  Six members attended the 17th Global Conference held in Washington D.C. in July.

- **Networking with Women Scientists** 31/Oct~1/Nov
  Two representatives took part in the 6th Female Physicists and Chemists Joint Symposium.

2010 WiN-Global Annual Conference

Benefits and Development

- **New Year's Party** February 6. About 15 people attended the party with food and karaoke.

- **Spring Seminar** 25 February.
  "Not too little, not too much, and right on target! – Introducing AEC's Medical Exposure Quality Assurance Program"

2010 WiN-Global Annual Conference

Communication

- **Science Fair**
  - Games & Demos

- **Seminars**
  - Variety of subjects on energy & atomic science
  - K-12 teachers and students
  - Total 47

- **Summer camps**
  - students and teachers

2010 WiN-Global Annual Conference

Communication

- **Teaching modules**
  18 one-hour modules for use by K-12 teachers.
- **WiN Taiwan Newsletters *January 2010~***
  WiN Taiwan's new project for 2010.
- **Education Website "Yuan Lai Ru Ci"**
  http:/www.nucl.nthu.edu.tw/nu_info/

Future plan for 2010

- **Continue** many projects and activities that are going have been done well, such as research project, training for school teachers, WiN Taiwan newsletter…
- **Television Series:** WiN Taiwan is exploring possibility of making a series of 30-minute videos on various nuclear and radiation application topics.
- **Gender Mainstreaming** and **Collaboration** with female organizations

Remarks

Nuclear Power in Taiwan

- **Nuclear Power Plants and Performance**
  - Number of reactors in service: 6
  - Share of electricity from nuclear: 18.1 %
  - Average capacity factor: 92.17 %
- **Construction of Lungmen NPP**
  - GE ABWR (1350 MWe) X 2
  - 95% completion of construction
  - 37% completion for test runs
  - Integrated DCIS: biggest challenge

Government Reform

- AEC is to be transformed into a nuclear safety regulatory entity of a lower tier, and its research arm INER will become an administrative corporation, both under the newly formed Ministry of Science and Technology (MOST).
- The reorganization will take effect on 1 January 2012, with a two-year transition ending in December 2013.

Thank you for your attention!

附錄三、發表之論文

1. Plenary Session III: Strategic Action for the Promotion of Radiation Technology

   羅彩月發表之 “Strategic Action for the Promotion of Nuclear Medicine in Taiwan”

2.論文發表 III Radiation Protection and Application

   羅彩月發表之“Evaluation of the Potential of a New Radio-Thermogelling Emulsion ^{188}Re-ECD/ Lipiodol/Hydrogel for Treatment of Hepatoma ”

3.海報論文 武及蘭發表之 “SOLID WASTE CLEARANCE EXPERIENCE IN TAIWAN”

4.海報論文 詹美齡發表之 “Preliminary Phantom Result of a Prototype System for Positron Emission Breast Imaging”

1. Strategic Action for the Promotion of Nuclear Medicine in Taiwan

Strategic action for the promotion of nuclear medicine in Taiwan

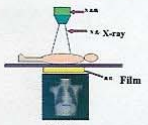
Tsai-Yueh Luo
2010/05/13
行政院原子能委員會核能研究所, Taiwan.

Contents

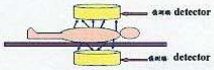
- What 's Nuclear Medicine?
- Government's Strategy for Promotion of National Medical Health Care in Taiwan
- Research and Development of New Radiopharmaceuticals in Taiwan

What is Nuclear Medicine?

- Nuclear medicine is a branch of medicine that uses radioactive isotopes (**radionuclides**) for the diagnosis and treatment of diseases, ex. brain, thyroid, heart, GI tract, urinary system, bone, cancer.
- **Radiopharmaceutical** = Isotope + Drug

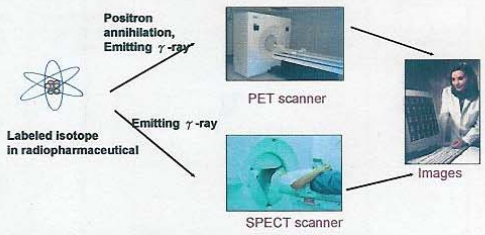


X-ray



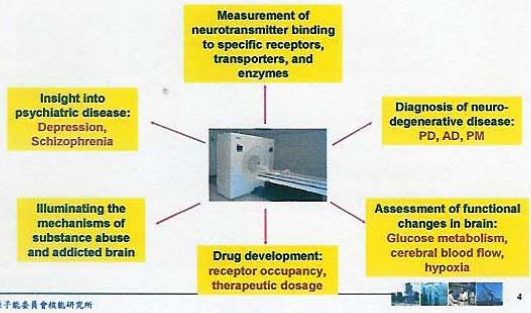
Nuclear medicine imaging

The Principle of Nuclear Medicine Imaging



- The characteristics of radiopharmaceuticals :
  - With radioactivity, dosage decay is depended on half-life
  - Tracer amount, no pharmacological effects

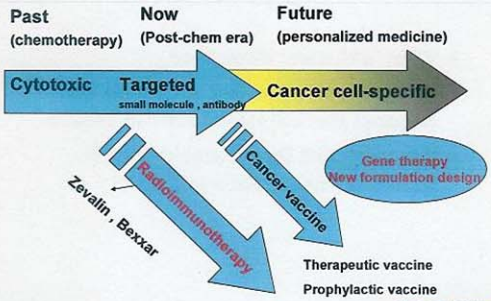
The Roles of Nuclear Medicine Imaging in Exploring the Brain's Function



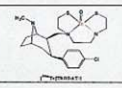
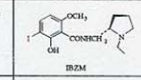
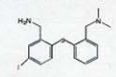
The Status of National Medical Health Care in Taiwan

- The 15th Anniversary of Taiwan's National Health Insurance : (1) universal and wide range coverage (2) care for socially and economically disadvantaged groups (3) consistent level of quality.
- Promote the elevation of medical or industry standards: cGMP, PIC/S , GCP, GLP
- Allow domestic hospitals to dispense PET-related radiopharmaceuticals, ex. F-18 FDG, F-18 NaF, C-11 chemicals,O-15 chemicals,----
- To establish the mutual foundation between Atomic Energy Committee and National Science Committee at Taiwan to promote the nuclear medicine researches.
- INER setup the scholarship to attract more graduate students involving the radiation-related projects.

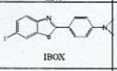
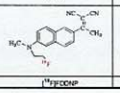
New Drugs Research at Taiwan



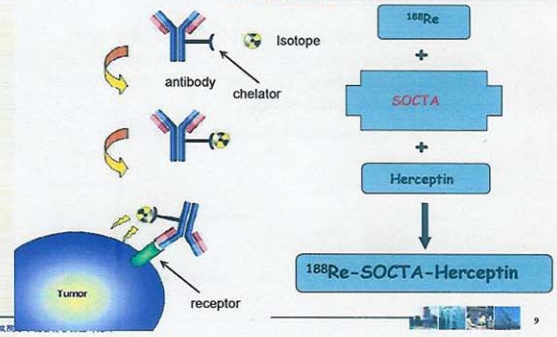
The CNS Tracers Developed in INER-1

Targeting	Product Name	Chemical Structure	PET Tracer	SPECT Tracer	Developing status
Dopamine transporter	TRODAT-1 Kit			☆	Commercialized
Dopamine D_2 receptor	[^{123}I]IBZM			☆	Clinical study
Serotonin transporter	[^{123}I]ADAM			☆	Clinical study
	[^{124}I]ADAM		☆		Animal study

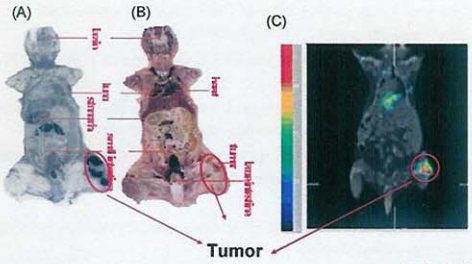
The CNS Tracers Developed in INER-2

Targeting	Product Name	Chemical Structure	PET Tracer	SPECT Tracer	Developing status
Norepinephrine transporter	[^{123}I]MIPP			☆	Animal study
Hypoxia	HL-91			☆	Clinical study
β-amyloid	[^{123}I]IBOX			☆	In vitro study
	[^{18}F]FDDNP		☆		In vitro study

Radioimmunotherapy for breast cancer treatment

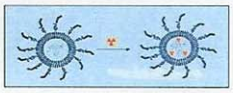


Posterior whole body autoradiogram (A), photogram (B) and micro-SPECT/CT images (C) of a representative SCID mouse bearing subcutaneous HER-2/neu positive BT-474 human breast cancer xenografts at 24 h post-injection of ^{188}Re-SOCTA-Herceptin.

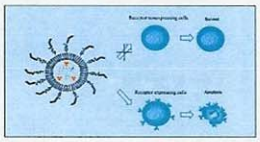


New Drug delivery system strategy for disease treatment

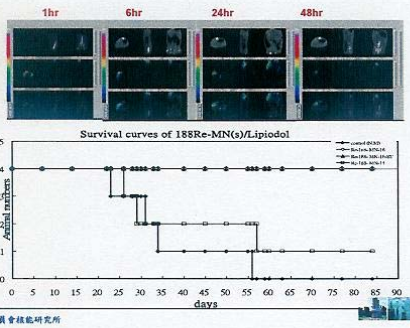
Preparation of Combined Drug



Combined Drug for Cancer Therapy



The new therapeutic radiopharmaceuticals of ^{188}Re-MN-16ET/Lipiodol in hepatoma animal model



How to promote nuclear medicine?

I. The role in government and hospital

- Government should create more friendly environments for nuclear medicine, ex, more insurance payment, translational research,-----
- Inspire the research and afford more financial supports in new drugs and instruments.
- Shorten the licensing/application time for IND and NDA to promote new drug research.
- Nuclear medicine **enhance the cooperation with different departments**, ex. neurology, psychology, cancer therapy.

II. New Drugs Strategy at INER

1. Based on the goals of improving healthcare using nuclear medicine, INER plans to perform registration trials and commercialization of I-123-IBZM, I-123-ADAM and F-18-FDDNP, Re-188 liposome----- in the future.
2. By integrating domestic resources and collaboration with domestic researchers and physicians in neurological, psychiatric and nuclear medicine areas, INER continuously develops projects for exploring the mechanisms of Parkinson's disease, Alzheimer's disease, depression, and cancer treatment ...etc.
3. Develop **targeted radiopharmaceuticals** to reduce the side effects for cancer therapy
4. Automatic manufacturing procedures design for the new radiopharmaceutical
5. To establish molecular imaging platform for providing drug evaluation service to domestic pharmaceutical industry.

Thanks for your attentions !!

2. Evaluation of the Potential of a New Radio-Thermogelling Emulsion ^{188}Re-ECD/Lipiodol/ Hydrogel for Treatment of Hepatoma

Evaluate the potential of a new radio-thermogelling emulsion ^{188}Re-ECD/Lipiodol/hydrogel for treatment of hepatoma

Tsai-Yueh Luo
2010/05/12
Institute of Nuclear Energy Research
Taiwan

Contents

- Introduction
- Methods
- Results and Discussion

Introduction

- Hepatocellular carcinoma: the most primary malignant tumor of liver.
- In Western Europe and the USA: incidence rate 0.2-0.7%
- In Asia and sub-Saharan Africa: 5.5%.
- Main Causes of Death in Taiwan for 2008: Malignant tumors is the first one.
- Liver cancer also takes the top rank among the leading causes of cancer deaths.

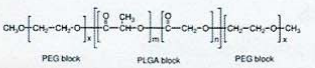
- The prognosis of hepatoma is poor because the tumor is detected at a late stage.
- Treatment of hepatoma: surgery, percutaneous intratumoral injection of alcohol, cryosurgical ablation, hepatic arterial embolization (TAE).
- Unresectable liver tumor: TAE or internal radiation with ^{90}Y-microspheres, ^{131}I-Lipiodol.
- However, accurate catheterization of TAE is quite dependent on operator's skill and special equipment. In order to simplify the treatment procedure, the **intratumoral injection** method was chosen instead of TAE in our research.

- **^{99m}Tc-ECD**: a lipophilic agent for brain perfusion.
- ^{188}Re shares the same chemical characteristic as ^{99m}Tc.
- **^{188}Re-ECD/Lipiodol** radiopharmaceutical was developed in INER.
- ^{188}Re-ECD/Lipiodol was proved to accumulate in the hepatoma site of N1S1 hepatoma animal model via **intratumoral injection** pathway.
- **However, some of the drug might leakage from the injection site during intratumoral injection.**

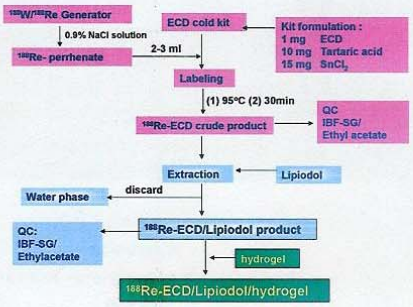
- **Thermosensitive hydrogel** or emulsions are newly developed drug delivery system.
- In this report, we introduce a new **radio-thermogelling emulsion ^{188}Re-ECD/Lipiodol/hydrogel and evaluate the potential for treatment of hepatoma.**

Polymeric materials undergo a change of physical states between sol and gel states upon heating and cooling

PEG/PLGA/PEG triblock copolymers



Scheme for the preparation of ^{188}Re-ECD/Lipiodol/hydrogel



SD-rat hepatoma animal model

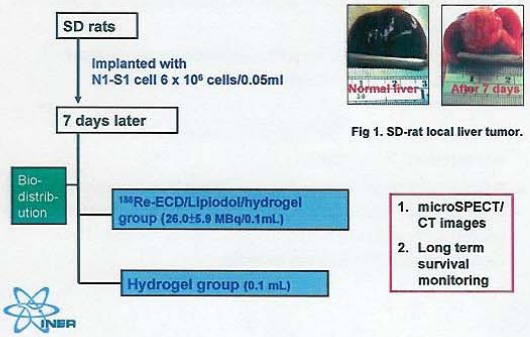
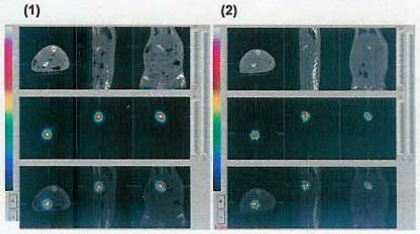


Fig 1. SD-rat local liver tumor.

The scintigraphic images of ^{188}Re-ECD/Lipiodol/hydrogel in hepatoma SD rat model. The images were taken at: (1)one hour (2)24 hours post-injection via intra-tumoral pathway.



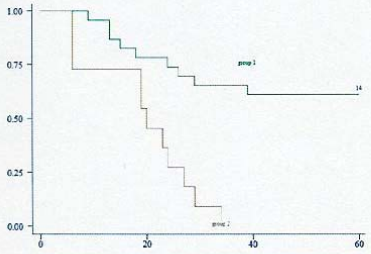
Percentage of injected activity per gram of tissue (%ID/g) of ^{188}Re-ECD/Lipiodol/hydrogel at 0.5, 1, 3, 6, 24, 48 and 72 hours postinjection in SD rats bearing hepatoma. Data are expressed as mean ± S.D. of three to four rats.

%ID/g	0.5 h	1 hr	3 hr	6 hr	24 hr	48 hr	72 hr
Blood	0.48±0.11	0.40±0.09	0.19±0.03	0.14±0.04	0.09±0.06	0.10±0.08	0.10±0.10
Brain	0.27±0.16	0.18±0.07	0.15±0.02	0.30±0.11	0.09±0.03	0.19±0.27	0.10±0.08
Lung	0.58±0.08	0.53±0.14	0.17±0.05	0.22±0.12	0.08±0.02	0.05±0.03	0.06±0.02
Heart	0.21±0.06	0.15±0.06	0.11±0.02	0.19±0.16	0.06±0.03	0.04±0.02	0.04±0.01
Liver	1.63±0.15	0.82±0.20	0.54±0.29	0.28±0.06	0.22±0.03	0.20±0.10	0.15±0.07
Tumor	24.44±7.71	13.81±6.10	8.69±3.13	6.75±3.17	4.48±1.79	2.35±1.61	1.57±0.20
Spleen	0.33±0.02	0.20±0.02	0.16±0.04	0.10±0.03	0.09±0.05	0.08±0.04	0.05±0.01
Kidney	10.12±5.23	7.59±1.31	4.00±0.71	4.14±0.68	2.64±0.20	0.92±0.20	0.78±1.25
Stomach	0.63±0.73	0.55±0.35	0.30±0.16	0.29±0.11	0.23±0.05	0.21±0.13	0.35±0.29
Small intestine	0.89±0.21	1.07±0.76	0.71±0.64	0.41±0.12	0.34±0.27	0.32±0.15	0.16±0.06
Muscle	0.31±0.10	0.29±0.13	0.22±0.06	0.26±0.13	0.21±0.13	0.19±0.18	0.13±0.08

Radiation Absorbed dose estimation of ^{188}Re-ECD/Lipiodol/ hydrogel calculated by OLINDA/EXM

	Estimated Absorbed Dose	
Organs	mSv/MBq	rem/mCi
Adrenals	1.02E-01	3.76E-01
Brain	6.39E-02	2.36E-01
Breasts	9.96E-02	3.68E-01
Gallbladder Wall	1.02E-01	3.78E-01
LLI Wall	1.02E-01	3.78E-01
Small Intestine	1.02E-01	3.77E-01
Stomach Wall	1.01E-01	3.75E-01
ULI Wall	1.02E-01	3.77E-01
Heart Wall	4.30E-02	1.59E-01
Kidneys	1.35E+00	5.00E+00
Liver	1.55E-01	5.73E-01
Lungs	6.67E-02	2.47E-01
Muscle	1.01E-01	3.72E-01
Ovaries	1.02E-01	3.78E-01
Pancreas	1.02E-01	3.76E-01
Red Marrow	7.15E-02	2.65E-01
Osteogenic Cells	1.61E-01	5.96E-01
Skin	9.94E-02	3.68E-01
Spleen	5.19E-02	1.92E-01
Testes	1.01E-01	3.73E-01
Thymus	1.01E-01	3.72E-01
Thyroid	1.01E-01	3.72E-01
Urinary Bladder Wall	1.03E+00	3.81E+00
Uterus	1.03E-01	3.82E-01
Total Body	1.13E-01	4.18E-01

The survival curves of the xenotransplanted hepatoma rats treated with ^{188}Re-ECD/Lipiodol/hydrogel (Group 1) and Hydrogel (Group 2) individually (p=0.0002).



Discussion

- Injection of hydrogel needs experience to control the sol-gel character.
- ^{188}Re-ECD/Lipiodol/hydrogel injection is effective in treating xenotransplanted liver tumor in rats.
- **^{188}Re-ECD/Lipiodol/hydrogel is a potential candidate for hepatoma therapy**
- The more animal experiments need to be performed to determine the best therapeutic dose.

Many Thanks for Your Attentions.

3. SOLID WASTE CLEARANCE EXPERIENCE IN TAIWAN

The 18th 2010 WiN Global Annual Meeting
May 9-14, 2010
Paradise Hotel Busan, Korea

SOLID WASTE CLEARANCE EXPERIENCE IN TAIWAN

J.L. Wuu, Jeng-Jong Wang & Ing-Jane Chen
Institute of Nuclear Energy Research, Atomic Energy Council, Executive Yuan

I. OBJECTIVE

The Fuel Cycle and Materials and Administration (FCMA/Taiwan) enacted the "Regulations on Clearance Level for Radioactive Waste Management" (the Regulation) on Dec. 29, 2004. Article 4 of the Regulation states that radioactive waste with activity limit or specific activity limit in accordance with the stipulations of clearance level (referred to IAEA RS-G-1.7) shall be allowed for release. Article 6 of the Regulation provides another compliant way to release the waste, that is "Based on the radiation dose evaluation of the radioactive waste, the annual individual effective dose not exceeds 0.01 mSv and the collective dose not exceeds 1 person-Sv, a radiation dose evaluation report and release plan shall be submitted to the competent authority for approval prior to implementing release of waste." In 2006, two release plans of concrete blocks and metal wastes of the Institute of Nuclear Energy Research (INER) had been firstly approved by the FCMA with compliance to Article 4 of the Regulation.

II. METHODS

The clearance measurement processes for the radioactive solid wastes (dismantled concrete blocks and metal) are divided into three phases.

II.A. Dismantled Concrete Blocks

Phase 1: The concrete blocks' surface are scanned by a plastic scintillation detector to find out the hot-spot and the hot-spot will be treated for decontamination.

Phase 2: The surface dose rates of concrete blocks are determined using a sodium iodide detector to confirm the surface radiation is comparable with the background radiation.

Phase 3: The concrete blocks are sampled to determine the specific activities, and the results are compared with the clearance limits to decide if the concrete blocks can be released.

All the concrete blocks are broken to 5 cm diameter before release. And for the purposes of QA, each concrete block that has been broken is sampled to verify the specific activities using a Clearance Analysis System equipped with 3 germanium detectors, and the results must be less than the clearance limits.

II.B. Metal Wastes

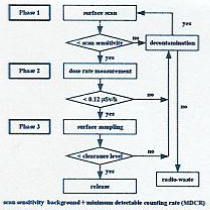
Phase 1: The metal is sampled and the radionuclides contained are determined by an HPGe detector. The MDA of the measurement are set less than 20% of clearance limits.

Phase 2: The surface radiation of the metal is determined using a plastic scintillation detector and a sodium iodide detector, and the counting rates(cps) and dose rates(μSv/h) are recorded. All the data less than the minimum detectable counting rate(MDCR) and the background variation(i.e. $B+3\sigma$) will be judged as "pass," otherwise, it will be regarded as "potentially contaminated," and will be treated for decontamination.

Phase 3: Metal waste, which is judged as "pass" in Phase 2, will then be collected in a stainless container(34cmx34cmx36cm), and the gross activity is determined using a Waste Curie Monitor equipped with 5 plastic scintillation detectors. The specific activity of each nuclide is then determined by the nuclide composition, and compared with the clearance limit. Only the specific activities of metal wastes that are less than the clearance limits will be released.

For the purposes of QA, metal wastes with specific activities less than the clearance limits are sampled by 10% into a standard 55 gallon tank to verify the specific activities using a Clearance Analysis System equipped with 3 germanium detectors.

The measurement process of dismantled concrete blocks and metal wastes are shown in figures 1 and 2 respectively.



scan sensitivity background + minimum detectable counting rate (MDCR)

Fig. 1. Measurement procedure of dismantled concrete blocks

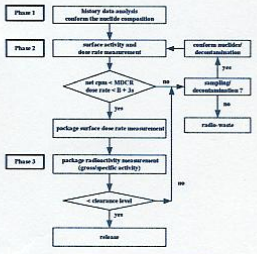


Fig. 2. Measurement procedure of metal wastes

III. RESULTS

III.A. Dismantled Concrete Blocks

The TRR wet storage tank structure is shown as figure 3. It was dismantled by being cut to six parallel layers from the top to the bottom. The first layer contained 4 top pillars; the 2nd to 6th layers were each cut into 16 pieces. In the dismantling, the non-concrete part (e.g. the stainless steel inside lining) was removed. The parts containing higher radioactivity of the cut-out concrete blocks were removed according to the assessment results of surface radiation measurement and core sampling. Only the ones whose preliminary surface measurement results less than 0.2 μSv/h and surface smear counting results less than the lower detection limit could be moved out from the TRR house for temporary storage and release applications.

The cut-off concrete blocks weighed 0.6 ~ 25 tons; more than half of them weighed over 10 tons. A three-phase measurement was applied for these concrete blocks according to the approved release plan. In each measurement phase, if the concrete measurement result was found to be larger than the threshold limit, the concrete was to be partially removed, inspected and measured to make sure that it fitted the threshold limit. Then, the next measurement phase could start. Only the concrete blocks that had passed all the three measurement phases could be released. The measurements of concrete blocks were executed from December 2006 to July 2007 and in this period of time there were about 1200 tons of concrete blocks qualifying for the clearance level and were crushed into gravel in two batches. About 3,477 tons concrete blocks were knocked off, because their measurement results could not meet with the clearance level; it was only 0.29 % of the total weight. The knocked-off gravel will be considered as low-level radioactive waste.

The total manpower (including outsourcing) required in the release operations were 9.26 man/years. The whole cost is NT$ 26,086,318 dollars (not including expenses for tank dismantling and cutting). The concrete blocks handled weighed 1,200,000 kg in total (not including concrete blocks and gravel that had been cut out). The average handling fee was NT$ 21.7 dollars per kilogram.

III.B. Metal Wastes

The measurements of metal wastes were executed from 2007 to 2009. In the first phase, the historical data and the sample analyses results showed that the radionuclides possibly contained in the metal wastes were Co-60, Cs-137and Am-241. In the second phase, 116,229 kilos of metal wastes were measured and preliminarily screened. Among them, 110,449 kilos of metal wastes had a smaller net counting rate than the MDCR. In the third phase, 110449 kilos of metal wastes went through a total activity measurement and the results were all less than 0.1Bq/g. In addition, for the purpose of quality assurance, 10 % of the wastes were randomly sampled and measured. The measurement results were all less than clearance level(0.1Bq/g). The 110,449 kilos of metal wastes were all tendered for sale and then sold for re-use. The clearance rate was as high as 95%.

The 110,449 kilos of metal wastes were sold for NT$1,193,323 dollars. The cost of human resources was estimated as NT$ 2,123,000 dollars. Based on INER's service charge policy for the storage and disposal of non-flammable metal wastes, the handling fee is NT$734 per kilo. If the 110449 kilos of metal wastes were sent for disposal instead of clearance, the cost would be NT$81,070,000 dollars. Thus, in this case, it was known that the economic benefit brought about by clearance was around NT$80,000,000 dollars.

IV. CONCLUSION

The measurement processes and acceptance criteria for the solid waste release plans described above are pretty complicated and conservative, because these are the first time for Taiwan to freely release the regulated wastes, although the contamination level is almost negligible. With some special situations in Taiwan, the public acceptance of the nuclear power is still controversial. Due to efforts by the utility (Taipower Company) and the Authority (Atomic Energy Council), the operational safety of a Nuclear Power Plant will be no longer an issue for the public; the radioactive waste management still needs to be communicated and solved in the near future. A briefing media has been produced as a bridge toward the public, and we hope everything will go smoothly.

These two real and successful cases can be a reference for future release operations of radioactive waste for nuclear facilities. It would be helpful for Taiwan to carry out the policy of radioactive waste reduction and effectively relieve the pressure of storing the waste from operating/decommissioned facilities and facilitate the re-use of resources.

REFERENCES

1. IAEA, Application of the Concepts of Exclusion, Exemption and Clearance, IAEA Safety Standards Series No. RS-G-1.7, IAEA, Vienna, 2004.
2. IAEA, Intenational Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, IAEA Safety Series, No. 115, 1996.
3. Fuel Cycle and Materials and Administration, "Regulations on Clearance Level for Radioactive Waste Management", FCMA, Atomic Energy Council, Executive Yuan R.O.C., December 2004.
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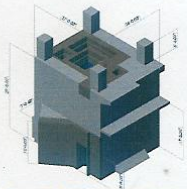

Fig.3. TRR wet storage tank structure

Fig. 4.Metal Waste Stored in Building #031

Fig. 5.Clearance procedures for concrete blocks

Fig. 6.Clearance procedures for metal waste

Session IV Radioactive Waste Management Technology :POSTER

SOLID WASTE CLEARANCE EXPERIENCE IN TAIWAN

Jyi-Lan Wuu, Jeng-Jong Wang & Ing-Jane Chen

Institute of Nuclear Energy Research, Atomic Energy Council, Executive Yuan
No. 1000, Wunhua Road, Jiaan Village, Longtan Township, Taoyuan County 32546, Taiwan (R.O.C)
TEL: 886-3-4711400 ext 7646, E-mail: jlwuu@iner.gov.tw

ABSTRACT

The Fuel Cycle and Materials Administration (FCMA/Taiwan) enacted the "Regulations on Clearance Level for Radioactive Waste Management" (the Regulation) on Dec. 29, 2004. Article 4 of the Regulation states that radioactive waste with activity limit or specific activity limit in accordance with the stipulations of clearance level (referred to IAEA RS-G-1.7) shall be allowed for release. While Article 6 of the Regulation provides another compliant way to release the waste; that is "Based on the radiation dose evaluation of the radioactive waste, the annual individual effective dose not exceeds 0.01 mSv and the collective dose not exceeds 1 person-Sv, a radiation dose evaluation report and release plan shall be submitted to the competent authority for approval prior to implementing release of waste." In 2006, two release plans of concrete blocks and metal wastes of the Institute of Nuclear Energy Research (INER) had been firstly approved by the FCMA with compliance to Article 4 of the Regulation. In 2007, 1200 tons of dismantled concrete blocks of TRR wet storage tank had been free released from INER. From 2007 to 2009, there were about 110.4 tons of metal qualifying for the clearance level were delivered for recycling use. This paper describes the real clearance experience about the measurement processes and acceptance criteria for these two release plans.

I. INTRODUCTION

After over 20 years' argument, IAEA published the RS-G-1.7[(1)] report about the recommendation of solid waste clearance in August, 2004. It was based on the Basic Safety Standards of IAEA Safety Series, No. 115[(2)], 1996. That is the annual individual effective dose not exceeds 0.01 mSv and the collective dose not exceeds 1 person-Sv. The Fuel Cycle and Materials Administration (FCMA/Taiwan) enacted the "Regulations on Clearance Level for Radioactive Waste Management [(3)]" (the Regulation) on Dec. 29, 2004. The Regulation provides two compliant ways to release the waste: 1. activity or specific activity measurement in accordance with the stipulations of clearance level (referred to IAEA RS-G-1.7) and 2. radiation dose evaluation. Both methods require submitting a release plan or report to the competent authority for approval.

At present, two release plans have been submitted to FCMA with compliance to Article 4(with measurement) of the Regulation by the Institute of Nuclear Energy Research (INER). The "Release Plan for the Dismantled Concrete Blocks of TRR Wet Storage Tank" had been approved in April, 2006 and was executed since December 2006; till July 2007, there were about 1200 tons of concrete blocks in accordance with the clearance level. There were about 350 tons of concrete that had been crashed into gravel and delivered as recycled concrete. The other 850 tons of concrete were delivered in September 2007. The other "Release plan of Metal Waste Stored in INER's Extra-low Level Waste Temporary Storage Area" had been approved in October, 2006. The measurements of

metal wastes were executed from 2007 to 2009, and there were about 110.4 tons of metal qualifying for the clearance level were delivered for recycling use.

This paper describes the measurement processes and acceptance criteria for the two release plans in Taiwan. In the conclusion, this report illustrates the special situations of public acceptance in Taiwan which may be the most difficult part in the solid wastes release program.

II. METHODS

The clearance measurement processes for the radioactive solid wastes (dismantled concrete blocks and metal) are divided into three phases.

II.A. Basic principles

(1)The surface activities of all wastes are measured, and the net counting rates should be less than the minimum detectable counting rate, MDCR.[4]

(2)The surface dose rates of all wastes should be less than the background radiation(<0.12 μSv/h).

(3)The specific activity of wastes should be less than the clearance levels of all the radionuclides contained, and the minimum detectable activity (MDA) of the measurement instruments must be less than 20% of clearance levels.

II.B. Measurement instruments

(1)A plastic scintillation detector was used for measuring the surface activities of wastes, whose sensitivity for Cs-137 was about 2 cps per nSv/h.

(2)A sodium iodide detector was used for measuring the surface dose rates of wastes, which responded from 50 nSv/h to 10 Sv/h.

(3)The specific radioactivity of dismantled concrete block was sampled and measured by a germanium detector with a 60% counting efficiency. The gross activity of metal waste was measured by a Waste Curie Monitor equipped with 5 plastic scintillation detectors. For the purposes of QA, both measured concrete blocks and metal wastes by the germanium detector or the Waste Curie Monitor were re-sampled to verify the specific activities using a Clearance Analysis System equipped with 3 germanium detectors.

II.C. Dismantled Concrete Blocks

The measurement process of dismantled concrete blocks is divided into three main phases.

Phase 1: The concrete blocks' surfaces were scanned by a plastic scintillation detector to find out the hot-spot and the hot-spot will be treated for decontamination.

Phase 2: The surface dose rates of concrete blocks were determined using a sodium iodide detector to confirm the surface radiation comparable with the background radiation.

Phase 3: The concrete blocks were sampled to determine the specific activities, and the results are compared with the clearance limits to decide if the concrete blocks can be released.

All the concrete blocks were broken to 5 cm diameter before release. And for the purposes of QA, each concrete block that had been broken was sampled to verify the specific activities using a

Clearance Analysis System equipped with 3 germanium detectors, and the results must be less than the clearance limits.

II.D. Metal Wastes

The measurement processes of metal wastes were also divided into three main phases. During Phase 1, the contaminated radionuclides of metal wastes were determined from the source history of the metal. During Phase 2, the surface activities and dose rates of the metal wastes were determined to confirm that the surface radiation comparable with the background radiation. During Phase 3, the activities of metal wastes were measured and compared with the clearance limits to decide if the metal wastes could be released. More detailed measurement procedures are as following:

Phase 1: The metal was sampled and the radionuclides contained were determined by an HPGe detector. The MDA of the measurement were set less than 20% of clearance limits.

Phase 2: The surface radiation of the metal is determined using a plastic scintillation detector and a sodium iodide detector, and the counting rates(cps) and dose rates(μSv/h) are recorded. All the data less than the minimum detectable counting rate(MDCR) and the background variation(i.e. $B+3\sigma$) would be .judged to be "pass," otherwise, it would be regarded as "potentially contaminated," and would be treated for decontamination.

Phase 3: Metal waste which was judged to be "pass" in Phase 2, would then be collected in a stainless container(34cm×34cm×36cm), and the gross activity was determined using a Waste Curie Monitor equipped with 5 plastic scintillation detectors. The specific activity of each nuclide was then determined by the nuclide composition, and compared with the clearance limit. Only the specific activities of metal wastes that were less than the clearance limits should be released.

For the purposes of QA, the specific activities of metal wastes which were less than the clearance limits, were sampled with 10% into a standard 55 gallon tank to verify the specific activities using a Clearance Analysis System equipped with 3 germanium detectors.

The measurement process of dismantled concrete blocks and metal wastes are shown in figures 1 and 2 respectively.

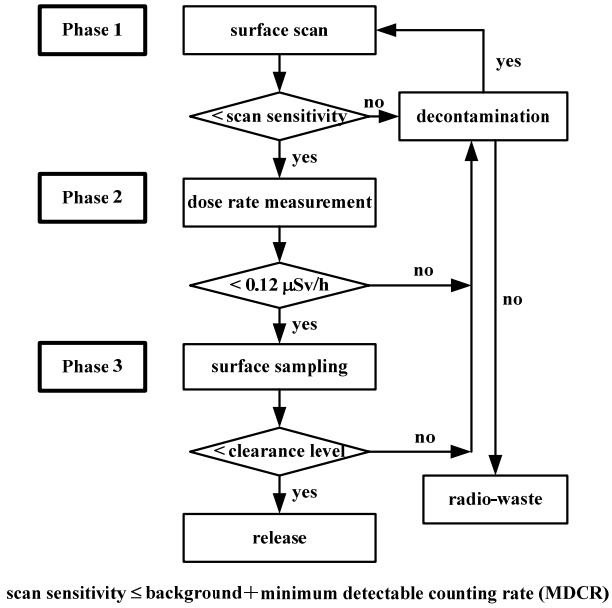

Fig. 1. Measurement procedure of dismantled concrete blocks

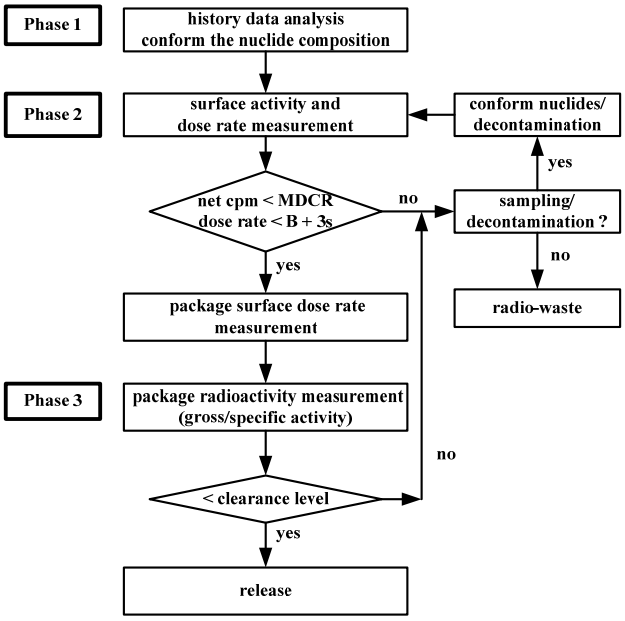

Fig. 2. Measurement procedure of metal wastes

III. RESULTS

III.A. Dismantled Concrete Blocks

The TRR wet storage tank structure is shown as figure 3. It was dismantled by being cut to six parallel layers from the top to the bottom. The first layer contained 4 top pillars; the 2nd to 6th layers were each cut into 16 pieces. In the dismantling, the non-concrete part (e.g. the stainless steel inside lining) was removed. The parts containing higher radioactivity of the cut-out concrete blocks were removed according to the assessment results of surface radiation measurement and core sampling.

Only the ones whose preliminary surface measurement results less than 0.2 μSv/h and surface smear counting results less than the lower detection limit could be moved out from the TRR house for temporary storage and release applications.

The cut-off concrete blocks weighed 0.6 ~ 25 tons; more than half of them weighed over 10 tons. A three-phase measurement was applied for these concrete blocks according to the approved release plan. In each measurement phase, if the concrete measurement result was found to be larger than the threshold limit, the concrete was to be partially removed, inspected and measured to make sure that it fitted the threshold limit. Then, the next measurement phase could start. Only the concrete blocks that had passed all the three measurement phases could be released. All the Phase 1 measurement results fulfilled sensitivity requirement; the Phase 2 measurement results showed that the concrete blocks surface dose rates were 0.08 ~ 0.11 μSv/h; the Phase 3 measurement results of 604 concrete blocks samples showed that most of the concrete blocks contained only Cs-137; the largest Cs-137 radioactivity was less than 0.098Bq/g; the sampling assessment results showed only few concrete blocks contained Co-60 and Cs-137; measurement results of the four top pillars and the concrete blocks containing Co-60 were given in Table 1.

Before being released, the concrete blocks were temporarily stored and crashed into 5 cm diameter blocks and then delivered to gravel manufacturers for reuse. The concrete blocks were broken one by one, being sampled randomly and put into a 55 gallon barrel to be assessed by the clearance measuring system. Some concrete blocks were smaller so they were broken together and the samples were put into a barrel to be assessed by the clearance measuring system. The measurement results of the broken concrete blocks should be less than clearance level in order to be sent out. The 90s' of the sampling barrels results showed that the Co-60 radioactivity was smaller than the MDA, while the other 22 barrels appeared to contain Cs-137 and the maximum Cs-137 radioactivity was 0.0068 Bq/g.

After measurement and assessment, the concrete blocks that fit the clearance level were in total as much as 1,200 tons. About 3.477 tons concrete blocks were knocked off, because their measurement results could not meet with the clearance level; it was only 0.29 % of the total weight. The knocked-off gravel will be considered as low-level radioactive waste.

The total manpower (including outsourcing) required in the release operations were 9.26 man/years. The whole cost is NT$ 26,086,318 dollars (not including expenses for tank dismantling and cutting). The concrete blocks handled weighed 1,200,000 kg in total (not including concrete blocks and gravel that had been cut out). The average handling fee was NT$ 21.7 dollars per kilogram.

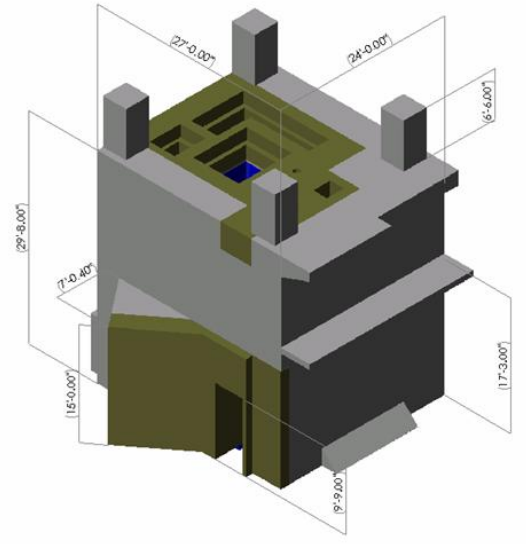

Fig.3. TRR wet storage tank structure

Table 1. Measurement results of top pillars and concrete blocks with measurable Co-60 (1)

Block No.	Max. sampling value (Bq/g)(2)		Block No.	Max. sampling value (Bq/g)	
	Co-60	Cs-137		Co-60	Cs-137
Top pillar 1	---(2)	0.006	2-12	0.030	0.077
Top pillar 2	---	---	2-13	0.021	0.087
Top pillar 3	---	---	4-10	0.021	0.062
Top pillar 4	---	---	4-16	0.006	0.046
2-4	0.009	0.019	5-2	0.044	0.048
2-5	0.019	0006	6-6	0.016	0.014
2-8	0.012	0.047	6-12	0.038	0.032

Note: (1)No measurable Co-60 showing for other concrete blocks.
(2)Max. sampling value means the maximum measured values of all the concrete blocks samples.

III.B. Metal Wastes

The measurements of metal wastes were executed from 2007 to 2009. In the first phase, the historical data and the sample analyses results showed that the radionuclides possibly contained in the metal wastes were Co-60, Cs-137 and Am-241. In the second phase, 116,229 kilograms of metal wastes were measured preliminarily screened. Among them, 110,449 kilograms of metal wastes had a smaller net counting rate than the MDCR. In the third phase, 110449 kilograms of metal wastes went through a total activity measurement and the results were all less than 0.1Bq/g. In addition, for the purpose of quality assurance, 10 % of the wastes were randomly sampled and measured. The measurement results were all less than clearance level(0.1Bq/g). The 110,449 kilograms of metal wastes were all tendered for sale and then sold for re-use. The clearance rate was as high as 95%.

The 110,449 kilograms of metal wastes were sold for NT$1,193,323 dollars. The cost of human resources was estimated as NT$ 2,123,000 dollars. Based on INER's service charge policy for the storage and disposal of non-flammable metal wastes, the handling fee is NT$734 per kilo. If the 110,449 kilograms of metal wastes were sent for disposal instead of clearance, the cost would be NT$81,070,000 dollars. Thus, in this case, it was known that the economic benefit brought about by clearance was around NT$80,000,000 dollars.

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These two real and successful cases can be a reference for future release operations of radioactive waste for nuclear facilities. It would be helpful for Taiwan to carry out the policy of radioactive waste reduction and effectively relieve the pressure of storing the waste from operating/decommissioned facilities and facilitate the re-use of resources.

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4.Preliminary Phantom Result of a Prototype System for Positron Emission Breast Imaging

Preliminary Phantom Result of a Prototype System for Positron Emission Breast Imaging

Meei-Ling Jan[1,*], Yu-Ching Ni[1], Hsin-Chin Liang[1], Tien-hsiu Tsai[1], Po-Hsiu Kuo[1], Fan-Pin Tseng[1], Li-Ting Huang[1], Sheng-Pin Tseng[1], Ching-Wei Kuo[1], Wei-Chih Lin[1], Hongdi Li[2], Wai-Hai Wong[2], Li-Han Shen[1]

[1] Institute of Nuclear Energy Research, Atomic Energy Council, Longtan, Taoyuan, Taiwan ROC
[2] Univ. Texas, M.D. Anderson Cancer Center, Houston, TX 77030-4095, USA
* Corresponding: Meei-Ling Jan, email:mljan@iner.gov.tw

F-A0022

Breast cancer in Taiwanese females

- Breast cancer is the most common cancer in Taiwanese females (Bureau Of Health Promotion Department Of Health, R.O.C.(TAIWAN), 2007).
- Taiwanese woman's age of getting breast cancer is about 10 years earlier than western one's, and the annual increasing has been 17-22%.
- Early detection has been one of the keys to recent declines in breast cancer mortality. Clinical trials have shown a significant effect of about 98% cure rate if the cancer is detected in earlier stage (stage 0).

Comparison of imaging detection modalities for breast cancer

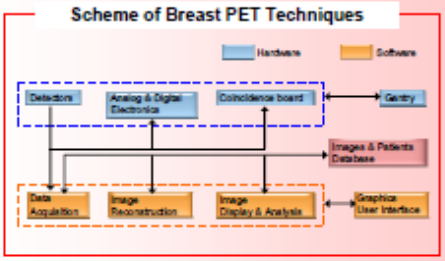
Comparison	Mammography	MRI	Breast-dedicated PET
Detection Modality			• Low cost • High sensitivity • No pain • could be performed to confirm therapeutical efficacy
	• Mammography has limitations to differentiate between benign and malignant breast abnormalities, especially in women with dense breast • During the procedure, the breast is compressed using mammography unit and caused uncomfortable.	•The lack of specificity of breast MRI can cause significant patient anxiety about needing an additional workup, as well as the additional cost of biopsy and further imaging. •MRI is an expensive exam.	

Breast-Dedicated PET prototype development

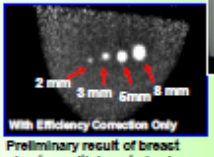
We present here preliminary images from a positron emission mammography prototype prototype system developed at our institute. The dedicated breast imaging system with 1.5 mm spatial resolution was especially designed for most oriental women who have denser breasts. Patients injected with positron-radioisotope labeled agent are scanned in prone position to maximize the effective field of view of breast imaging. Besides the prone-position inspection, the system offers acquisition mode for axially lymph nodes metastases imaging of of breast cancer. The system characteristics are listed below:


Photo of Breast-Dedicated PET prototype at INER, Taiwan

- Breast and axillary lymph node sites detectable, providing information of breast cancer metastasis.
- Special design, reducing the detection dead space of chest wall, increasing the detection area.
- Three-dimensional reconstruction method of planar tomography to improve breast cancer detection.
- Large detection area (196.5 x 98.5mm^2), covering the whole breast (at least E cup), short detection time, and low cost.



An anthropomorphic breast phantom inserted with 4 spheres in various diameters was used to perform the preliminary imaging validation. The breast phantom and the 2, 3, 5, and 8mm diameter spheres were filled with 9.76, 0.00072, 0.0045, 0.015, and 0.035MBq F-18-FDG solution, correspondingly, for a 5min scan with 200mm detector-to-detector distance setup. In the first image, only the larger 3 lesions were detected. After well system parameters alignment/tuning and applying a Monte Carlo-based detection-efficiency calibration, the 2mm lesion was clearly observed in the reconstructed image. Further development of basic technique improvements, such as high-precision physical models for planar tomography reconstruction, and development of testing/validation techniques of safety/effectiveness for class II, III medical imaging equipment for pre-market registration are currently underway.



Preliminary result of breast phantom with inserted spheres with various diameters


Photo of the breast phantom

附錄四、與外交部聯繫之書函

1.致外交部 NGO 委員會書函

中華民國核能學會婦女委員會 書函

地 址：32546 桃園縣龍潭鄉佳安村文化路 1000 號(保健物理組)
聯絡人：武及蘭 電話(03) 471-1400 分機 7646/傳真(03) 471-1171
電子郵件：jlwuu@iner.gov.tw

受文者：中華民國外交部 NGO 委員會

發文日期：99 年 4 月 22 日
發文字號：(99)核婦字 007 號
速別：最速件
密等及解密條件或保密期限：
附件：附件一 2010 WiN Global 年會議程、附件二代表團名單及行程

主旨：本會將組團出席 99 年 5 月 9 日至 14 日於韓國釜山舉行之全球核能婦女會(WiN Global)第 18 屆年會，擬於 5 月 15 日順道拜會貴部駐釜山辦事處，懇請 惠予協助安排為禱。

說明：

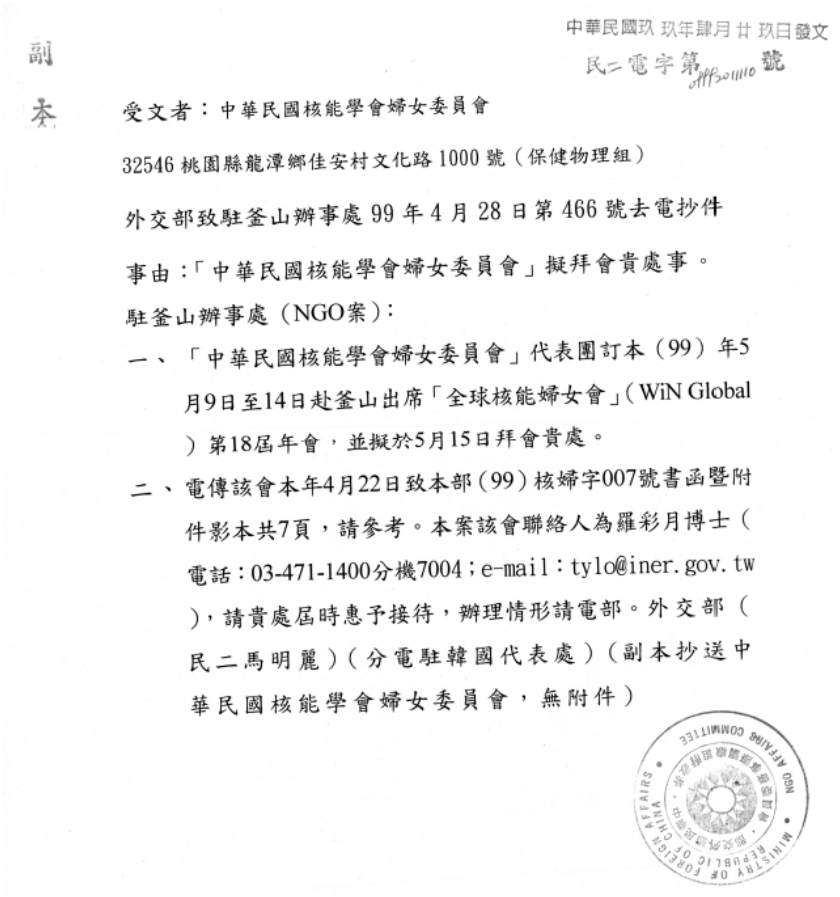
一、全球核能婦女會(WiN Global)目前有會員 2850 人，遍及 75 個國家。本委員會為該組織之台灣分會(WiN Taiwan)，自 WiN Global 成立以來持續積極參與，在其理事會及執行理事會均有代表。韓國的核能工業蓬勃發展，今年係第二次主辦 WiN Global 年會(議程如附件一)。

二、此行我國代表團擬順此次出席年會之便，就近拜會貴部駐釜山辦事處，了解我國在釜山地區的外交工作，並就核能相關之國內與國際現況進行交流，拜會者名單及行程如附件二。

三、感謝貴委員會多年來對本會參與 WiN Global 年會的支持與協助，期盼再就拜會釜山駐處乙事惠予協助安排是幸。

四、代表團聯絡人為羅彩月博士，國內聯絡電話：(03)471-1400 分機 7004；電子信箱：tylo@iner.gov.tw。

2.外交部 NGO 委員會回函



副本

中華民國玖 玖年肆月廿 玖日發文
民二電字第 0992011110 號

受文者：中華民國核能學會婦女委員會

32546 桃園縣龍潭鄉佳安村文化路 1000 號（保健物理組）

外交部致駐釜山辦事處 99 年 4 月 28 日第 466 號去電抄件

事由：「中華民國核能學會婦女委員會」擬拜會貴處事。

駐釜山辦事處（NGO案）：

一、「中華民國核能學會婦女委員會」代表團訂本（99）年5月9日至14日赴釜山出席「全球核能婦女會」（WiN Global）第18屆年會，並擬於5月15日拜會貴處。

二、電傳該會本年4月22日致本部（99）核婦字007號書函暨附件影本共7頁，請參考。本案該會聯絡人為羅彩月博士（電話：03-471-1400分機7004；e-mail：tylo@iner.gov.tw），請貴處屆時惠予接待，辦理情形請電部。外交部（民二馬明麗）（分電駐韓國代表處）（副本抄送中華民國核能學會婦女委員會，無附件）

3.外交部駐釜山辦事處回覆電報

駐 釜 山 辦 事 處 電 報

25414 APR 30 -8

專號：PUS122　　第 1 頁 流水號時間：

日期：99.4.29　方式：[E] F　本電：電文 1 頁，附件 0 頁，共 1 頁

擬辦		批示	

事由：中華民國核能學會婦女委員會擬拜會本處事。

外交部鈞鑒並請核轉中華民國核能學會婦女委員會：鈞部第466號電奉悉。

歡迎中華民國核能學會婦女委員會來釜山出席「全球核能婦女會」第18屆年會，並於5月15日拜會本處聽取業務簡報。本處聯絡人為劉秘書公漢，行動電話：010-4537-7961。

以上謹報請鑒察。

駐釜山辦事處（劉秘書公漢）

裝 訂