行政院原子能委員會

110 年年報

Atomic Energy Council, Executive Yuan
ANNUAL REPORT

2021

AEC

行政院原子能委員會 編印

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ANNUAL REPORT

核安・居安・平安　Nuclear · Home · Life Safety

AEC

行政院原子能委員會　編印

主委的話 Words from the Chairman

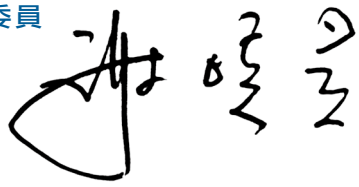
這一年來，原能會在全體同仁的共同努力下，完成了許多重要業務，包括執行核電廠安全及除役管制作業、審查核三廠除役計畫、督促台電公司積極興建室內乾式貯存設施、舉辦核安演習等，均積極秉持專業與安全守護的立場，為全民之核能安全把關。

為守護國人健康，原能會非常重視環境輻射的監測工作，密切關注大陸台山核電廠輻射異常事件，第一時間加強我國環境輻射的監測作業；也因應日本福島核災含氚廢水排放，組成跨部會平台運用現有資源，強化臺灣海域的輻射監測；及籌組食品輻射檢測國家隊加強檢測量能；另積極投入核醫藥物之生產，緊急供應予國內各醫院，補足國內核醫藥物之缺口，造福病患約57,900人次。

對於原能會向來極為重視的全民參與及社會溝通部分，110年在兼顧防疫規範下，除自辦兩場實體原子能科普展外，也首次籌辦線上科普研習活動，藉由網路無距離的限制，大幅增加原子能相關資訊之傳播效能。此外，辦理3次全民參與委員會會議，透過公眾參與及民眾溝通有關的專家學者或社會公正人士，強化原能會與社會大眾的溝通作為。

配合政府非核家園政策，「如期除役」及「核廢處理」是原能會的施政主軸，而「嚴守中立」及「公開透明」是我們歷年來努力所建立的形象。今後我們仍要在過去所奠定的基礎上更加精進，擴大民眾參與並取得信任，持續展現有感施政，讓原能會成為全民的原能會。

主任委員



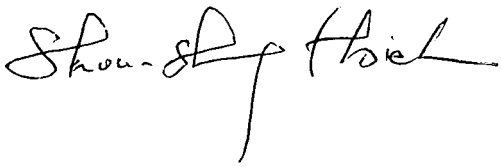
The Atomic Energy Council, with the help of all of our coworkers, has completed many significant tasks this year, including implementing nuclear power plant safety and decommissioning regulation, reviewing the decommissioning plan for Maanshan NPP, supervising Taipower's construction of an indoor dry storage facility, and organizing nuclear emergency exercises. To ensure that nuclear energy is safe for everyone, we have been actively upholding our professional and safety stance.

The Atomic Energy Council places a high priority on environmental radiation monitoring, pays close attention to the abnormal radiation incident at the Taishan nuclear power plant in China, and immediately strengthens environmental radiation monitoring in our nation to safeguard the health of the population. An inter-ministerial platform was established to make better use of existing resources to enhance radiation monitoring in Taiwan's sea area in response to the discharge of tritium-containing wastewater from the Fukushima nuclear accident in Japan. Also, a national food radiation testing team was established to improve testing capabilities. Additionally, we were actively involved in the production of nuclear medicine, which was quickly provided to numerous hospitals in Taiwan to address the nuclear medicine shortage, providing about 57,900 patients with the treatment they needed.

In 2021, the Atomic Energy Council, which has always attached great importance to public participation and social communication, organized two physical atomic energy science exhibitions as well as an online science study event for the first time following the regulation of epidemic prevention to increase the effectiveness of the dissemination of atomic energy-related information through the Internet without the restriction of distance. Additionally, three meetings of the Committee on Public Participation were held to improve communication between the public and the Atomic Energy Council through public participation and open dialogue with relevant experts, academics, and/or impartial public figures.

According to the government's nuclear-free policy, "On-Schedule Decommissioning" and "Nuclear Waste Management" are administrative pillars for the Atomic Energy Council. At the same time, our long-standing reputation has been "strict neutrality" and "openness and transparency." We must continue to demonstrate meaningful governance, expand public participation and trust, and build on the groundwork we have already laid for the Atomic Energy Council to become the Atomic Energy Council of all people.

Minister and Chairman



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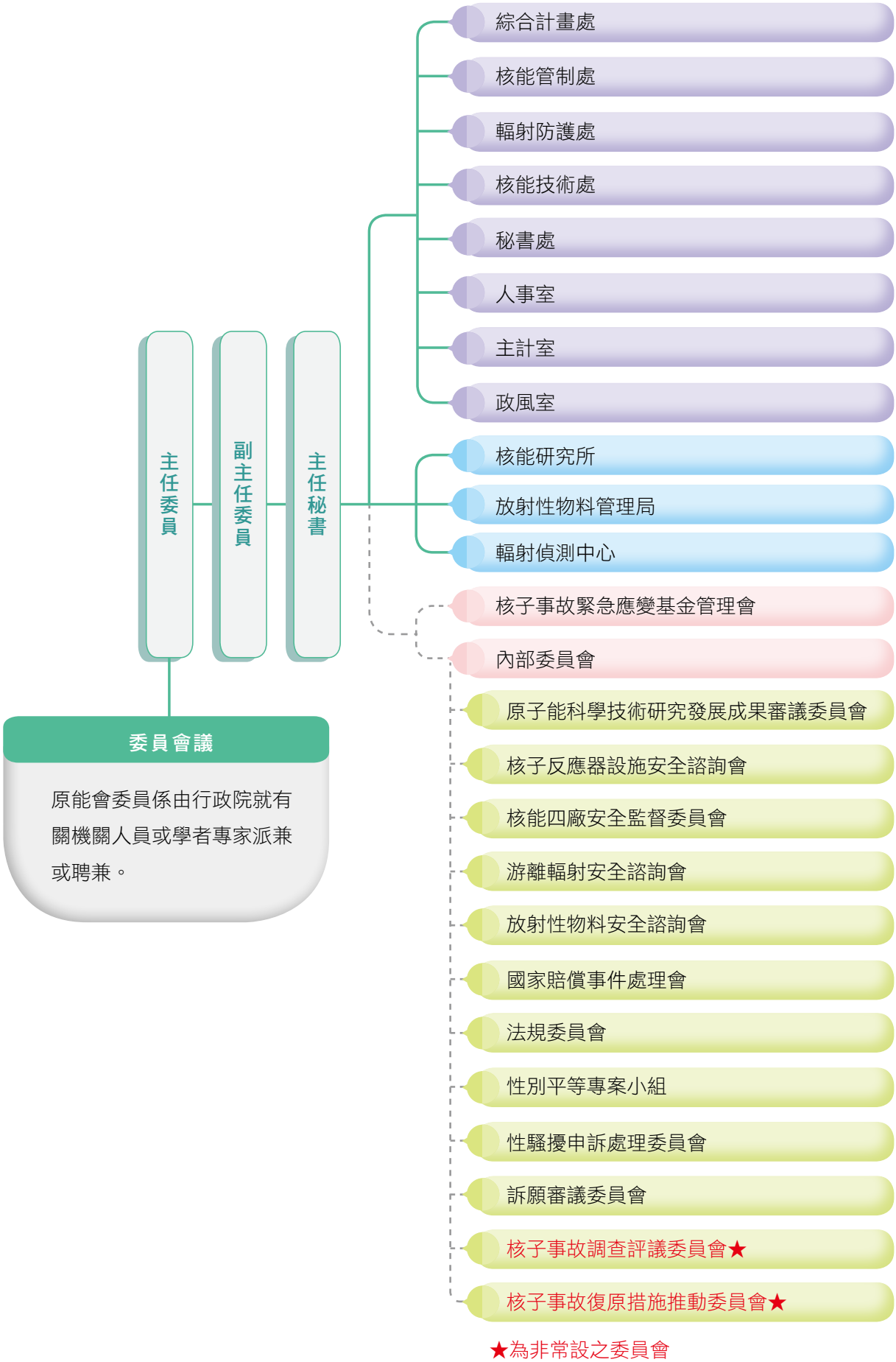
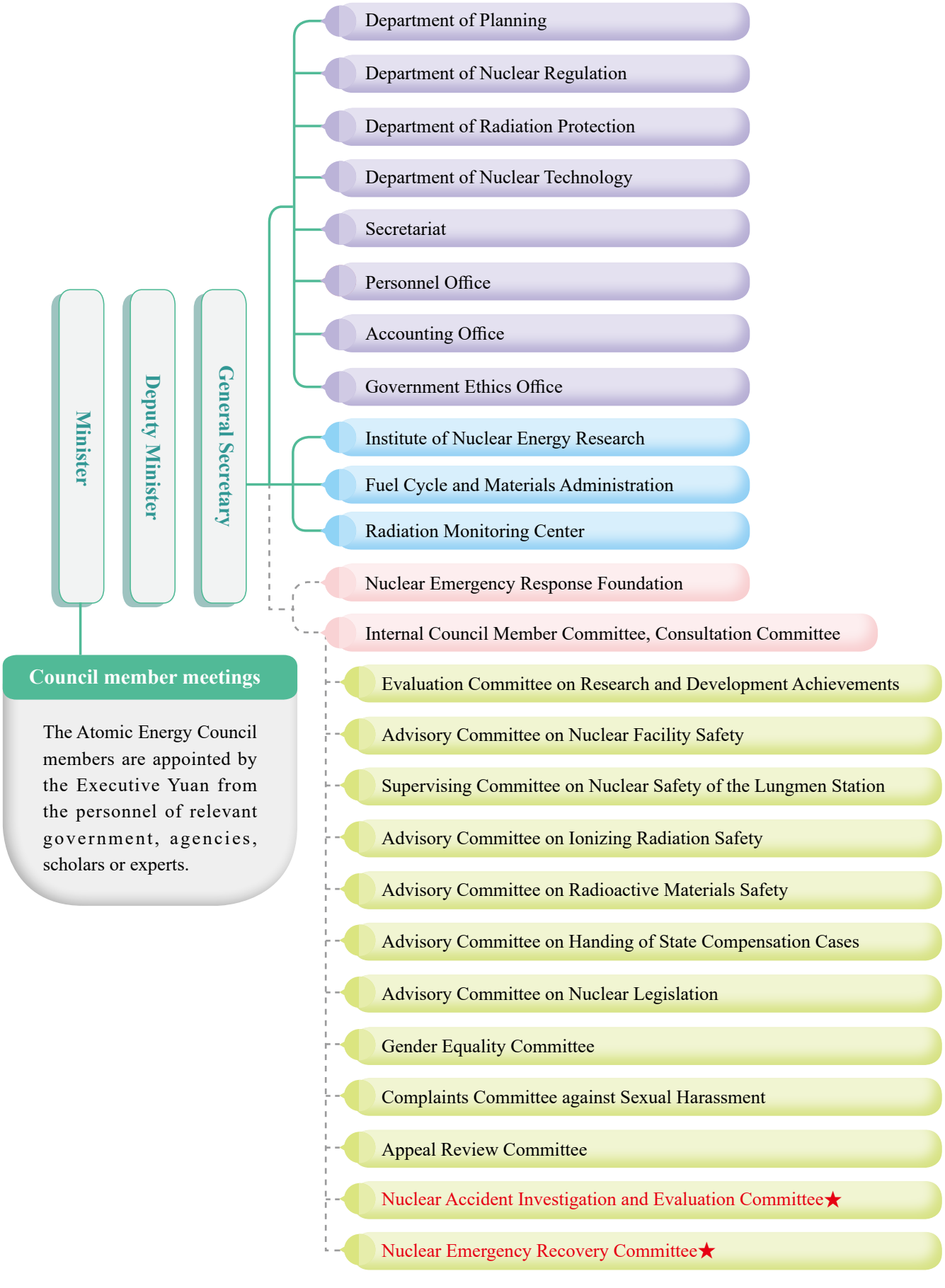
貳. 組織架構 Organizational Structure


主任委員
副主任委員
主任秘書
綜合計畫處
核能管制處
輻射防護處
核能技術處
秘書處
人事室
主計室
政風室
核能研究所
放射性物料管理局
輻射偵測中心
核子事故緊急應變基金管理會
內部委員會
原子能科學技術研究發展成果審議委員會
核子反應器設施安全諮詢會
核能四廠安全監督委員會
游離輻射安全諮詢會
放射性物料安全諮詢會
國家賠償事件處理會
法規委員會
性別平等專案小組
性騷擾申訴處理委員會
訴願審議委員會
核子事故調查評議委員會★
核子事故復原措施推動委員會★
委員會議
原能會委員係由行政院就有關機關人員或學者專家派兼或聘兼。
★為非常設之委員會

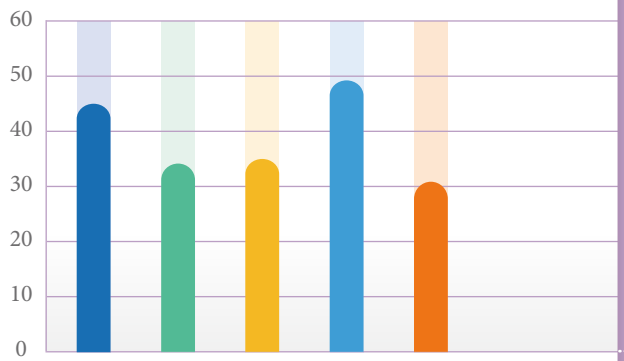

Minister
Deputy Minister
General Secretary
Department of Planning
Department of Nuclear Regulation
Department of Radiation Protection
Department of Nuclear Technology
Secretariat
Personnel Office
Accounting Office
Government Ethics Office
Institute of Nuclear Energy Research
Fuel Cycle and Materials Administration
Radiation Monitoring Center
Nuclear Emergency Response Foundation
Internal Council Member Committee, Consultation Committee
Evaluation Committee on Research and Development Achievements
Advisory Committee on Nuclear Facility Safety
Supervising Committee on Nuclear Safety of the Lungmen Station
Advisory Committee on Ionizing Radiation Safety
Advisory Committee on Radioactive Materials Safety
Advisory Committee on Handing of State Compensation Cases
Advisory Committee on Nuclear Legislation
Gender Equality Committee
Complaints Committee against Sexual Harassment
Appeal Review Committee
Nuclear Accident Investigation and Evaluation Committee★
Nuclear Emergency Recovery Committee★
Council member meetings
The Atomic Energy Council members are appointed by the Executive Yuan from the personnel of relevant government, agencies, scholars or experts.
★non-standing committee

參. 人力與經費 Manpower and Budget

AEC

行政院原子能委員會

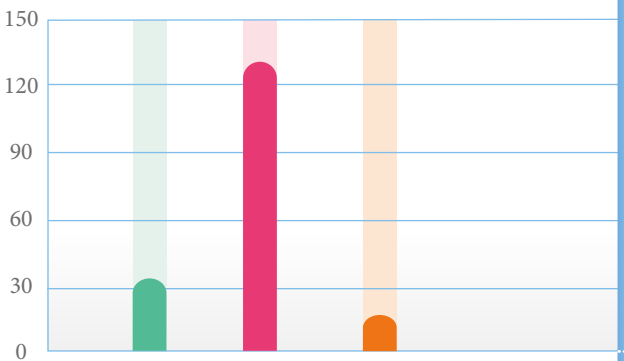
（一）110年度職員（含聘用人員7人）業務性質分配



一般行政	45 人（23.2%）
原子能科學發展	34 人（17.5%）
游離輻射安全	35 人（18.0%）
核能設施安全管制	49 人（25.3%）
原子能技術應用	31 人（16.0%）

合計：194 人

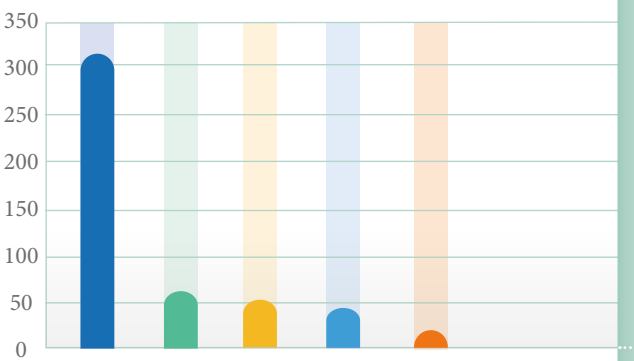
（二）110年度職員官等分配



簡任人員	32 人（17.1%）
薦任人員	138 人（73.8%）
委任人員	17 人 （9.1%）

合計：187 人

（三）110年度經費支用概況

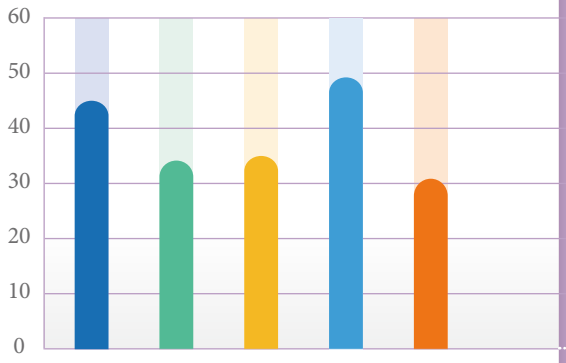


一般行政	314,657 千元（64.28%）
原子能科學發展	61,299 千元（12.52%）
游離輻射安全防護	53,331 千元（10.90%）
核能設施安全管制	45,902 千元（9.38%）
核子保安與應變	14,291 千元 （2.92%）

合計：489,480 千元

The Atomic Energy Council

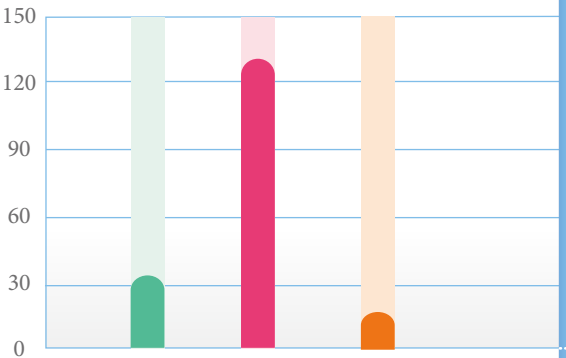
A. 2021 Human Resources Breakdown (Including seven hiring staffs)



- General administration 45（23.2%）
- Atomic energy science development 34（17.5%）
- Ionizing radiation protection 35（18.0%）
- Nuclear installation safety control 49（25.3%）
- Nuclear technology applications 31（16.0%）

total：194 人

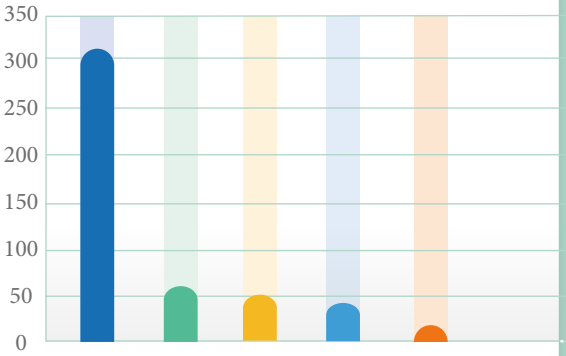
B. 2021 Employee Ranking Breakdown



- Senior Rank Personnel 32（17.1%）
- Junior Rank Personnel 138（73.8%）
- Elementary Rank Personnel 17（9.1%）

total：187 人

C. 2021 Budget/Expenditure Allocation



- General administration 314,657 K NTD（64.28%）
- Atomic energy science development 61,299 K NTD（12.52%）
- Ionizing radiation protection 53,331 K NTD（10.90%）
- Nuclear installation safety control 45,902 K NTD（9.38%）
- Nuclear technology applications 14,291 K NTD（2.92%）

total：489,480
(Unit：Thousand NTD)

肆. 重要施政成果 Important Governance Outcomes

AEC

一、民眾參與多元化，管制資訊透明化

（一）開放監督，強化公眾參與除役乾貯安全管制

為提升民眾對於核一廠除役及乾貯安全管制的了解，落實公眾參與及資訊公開，原能會於 110 年 10 月 27 日辦理核一廠除役暨乾式貯存設施第 18 次訪查活動。該活動邀請新北市政府、石門區公所與里長、地方代表及環保團體等約 20 餘人參加。

針對核一廠除役現況部分，原能會於 108 年 7 月核發核一廠除役許可，核一廠已進入除役階段。台電公司於 109 年底完成核一廠 92 束未照射核子燃料外運作業，目前廠內核子燃料倉庫已無新燃料。台電公司規劃將核子燃料貯存設施除役並轉作一般倉庫使用，俾使核一廠除役作業安排更具彈性。核子燃料貯存設施除役計畫於 110 年 1 月獲原能會審查核定，台電公司於 110 年 3 月完成除役，其除役完成報告目前由原能會審查中。

針對核一廠乾式貯存設施現況部分，核一廠用過核子燃料目前仍置於反應器與用過燃料池，乾式貯存設施為核一廠除役必要設施，第二期乾式貯存設施台電公司已採具社會共識之室內貯存型式，興建計畫已於 108 年 8 月獲行政院核定。原能會持續督促台電公司積極推動室內乾式貯存設施興建作業，並於本次訪查活動，安排訪查代表實地參訪室內乾式貯存設施預定地的地上建築物拆除及整地現況，以利訪查代表瞭解興建進度。

核一廠除役及乾式貯存訪查活動會議
Site visit meeting on the Chinshan NPP's decommissioning and dry storage facilities.

參訪核一廠二期乾貯設施預定地的地上建築物拆除及整地現況
Visit to the designated site of the phase two indoor dry storage facilities in the Chinshan NPP for the demolition of the on-ground buildings and grading.

(I) Enhancing Regulatory Information Transparency to Diversify Public Engagement

A. Openness for scrutiny: facilitating public participation in dry storage safety regulation during the decommissioning period

To improve communities' understanding for the progression of decommissioning and safety of dry storage facility in the Chinshan Nuclear Power Plant (NPP), as well as implement public participation and information disclosure, the Atomic Energy Council (AEC) initialized the 18th Public Observation Program for the Decommissioning and Dry Storage Facilities in Chinshan Nuclear Power Plant on October 27, 2021. Officials from New Taipei City Government and Shimen District Office, village chiefs and regional representatives of Shimen District, and representatives from environmental groups, totaling over 20 people, were invited to participate.

參訪核一廠核子燃料貯存設施除役辦理現況
Visit to the Chinshan NPP for the current status of the decommissioning of the nuclear fuel storage facility.

For the decommissioning of the Chinshan NPP, since AEC issued the decommissioning permit in July 2019, the NPP has been in the decommissioning process. Taipower compamy (TPC) completed the outbound shipment of 92 bundles of unirradiated nuclear fuel from the Chinshan NPP at the end of 2020. There is no new fuel in the nuclear fuel depot of the NPP. To improve the flexibility of the decommissioning schedule for the Chinshan NPP, TPC planned to decommission the nuclear fuel storage facility and turn to a warehouse for general use. The decommissioning plan for the nuclear fuel storage facility was reviewed and approved by AEC in January 2021. TPC completed the decommissioning in March 2021, and the review of AEC for Taipower's decommissioning completion report has been in progress.

Regarding the current status of the dry storage facility at the Chinshan NPP, the spent fuels are still stored in the reactor and spent fuel pool. Dry storage facility is essential in the decommissioning of the Chinshan NPP. TPC introduced indoor storage facility for which a consensus has been reached in society for the phase two dry storage facility. The construction project was approved by the Executive Yuan in August 2019. AEC contineously urges TPC to actively promote the construction plan of the indoor dry storage facility. In the public observation program, the invited representatives visited the designated site of the indoor dry storage facility for the demolition of the on-ground buildings as well as grading to understand the construction progress.

原能會是全民的原能會，將持續推動公眾參與及資訊公開。訪查活動有關訊息及訪查活動代表所提核廢料管理議題、乾貯設施安全、強化公眾溝通等議題之辦理情形，亦會登載於原能會網站，以落實資訊公開透明，讓民眾充分瞭解、安心、放心。

（二）民眾參與，推動蘭嶼地區環境平行監測活動

為積極強化公眾參與，原能會於 110 年 8 月 3 日至 4 日連續第 11 年辦理蘭嶼地區環境平行監測作業，目的為落實資訊公開、強化民眾參與及第三者驗證取樣偵測分析，於活動前邀請原住民族委員會、臺東縣政府、蘭嶼鄉公所、鄉代會、各村村長、當地環保團體及鄉民一同參加本次蘭嶼環境平行監測活動。

鑒於現場採樣期間 COVID-19 疫情全國三級警戒，避免室內人群聚集，本年度蘭嶼環境平行監測活動取消作業前說明會，改採用寄送作業說明簡報的方式，讓參與人員瞭解現場採樣之作業流程及方式。採樣期間，依照往例由參與民眾指定地點進行採樣，分別採集蘭嶼六個部落的農產品、土壤、水樣及草樣等環境試樣。各試樣檢測分析工作委由通過全國認證基金會（TAF）認證之國立清華大學原科中心執行，另同時分送樣品至原能會輻射偵測中心及台電公司放射試驗室進行計測分析，俾利比對驗證。

試樣完成分析後，由清華大學原科中心直接寄送分析結果報告至所有邀請參與單位，包含原民會、臺東縣政府、蘭嶼鄉公所、鄉代會、各村辦公室及當地環保團體，原能會亦將本年度蘭嶼平行監測分析結果報告公開於網站，供民眾閱覽。自 100 年起歷年的蘭嶼環境試樣分析結果，均在背景劑量變動範圍內，沒有發現輻射異常。

蘭嶼地區環境平行監測活動－採集水樣
Parallel Monitoring Activity on Environmental Radiation in Lanyu Area: collecting water samples.

蘭嶼地區環境平行監測活動－採集土樣
Parallel Monitoring Activity on Environmental Radiation in Lanyu Area: collecting soil samples.

In the spirit of people's AEC, it will persist in promoting public participation and information disclosure. All the information of the public observation program and the responses to the concerns related to nuclear waste management, the safety of the dry storage facilities, and public communication improvement brought up by the invited representatives were published on AEC website, whereby the public could gain a clear understanding.

B. Public participation: promoting local involvement in the parallel monitoring activity on environmental radiation in Lanyu Area

To meet the objectives of information disclosure, public participation, and environmental radiation sampling and analyzing by a third party, AEC organized the Parallel Monitoring Activity on Environmental Radiation in Lanyu Area for the 11th consecutive year from August 3 to 4, 2021. Officials from the Council of Indigenous Peoples, Taitung County Government, Lanyu Township Office, and representatives from Lanyu Township Representative Council, village chiefs, representatives from local environmental groups, and residents were invited to take part in the environmental radiation sampling process in Lanyu.

In view of the national level 3 alert due to the COVID-19 pandemic and the need to avoid indoor gathering, this year's briefing session for the parallel monitoring activity on environmental radiation in Lanyu was cancelled. Instead, a briefing on procedures was mailed to participants in advance to enhance their understanding on sampling procedures and methods. During the sampling stage, sampling locations were designated by the participants as was the case in previous years, and sets of samples comprising agricultural products, soil, water, and grass were taken in each of the six Lanyu tribes. The sample analysis was conducted by the Nuclear Science and Technology Development Center (NSTDC) of the National Tsing Hua University (NTHU), which has been accredited by the Taiwan Accreditation Foundation (TAF). Other sets of samples were also sent to AEC's Radiation Monitoring Center and Taipower's Radiation Laboratory, respectively, for analysis, comparison and validation.

Once the analysis was completed, the results were sent directly by the NTHU-NSTDC to all the groups participated, including the Council of Indigenous Peoples, Taitung County Government, Lanyu Township Office, Lanyu Township Representative Council, village offices, and local environmental groups. The analysis results of 2021 Lanyu parallel sampling monitoring activity were also published on AEC website for public access. Since 2011, no abnormal radiation has been detected in the environmental samples collected in Lanyu area. All the data and derived radiation doses are within the variation range of background radiation.

「i 上原子能 綠能 e 世界」屏東場科普活動開跑了
Pingtung session of the "I Love Atomic Energy, Green Energy of the World" science fair.

運用模型解說讓民眾了解核電廠除役
Deploying physical models to let participants understand the decommissioning of nuclear power plants

（三）玩轉科學，創新推廣線上科普

原能會近年努力推廣原子能科普活動，除與國立臺灣科學教育館合作，參加臺東縣與宜蘭縣的縣市科學巡迴教育活動、第二屆臺灣科學節及防災科普市集外，另為鼓勵女學生多參與科普活動，亦於 110 年 3 月 14 日接受國立清華大學跨領域科學教育中心邀請，參與「2021 國際女性科學日」科學市集活動，透過新竹在地國中及高中女學生擔任攤位解說員，提供女學生深度科普學習之機會，並讓參觀者看見科學女力。

此外，考量 COVID-19 疫情，在符合防疫規範下，原能會也分別在 4 月及 12 月於臺中老虎城購物中心及屏東千禧公園籌辦 2 場「i 上原子能 綠能 e 世界」科普展，其中屏東的策展是原能會首次與地方政府合辦，讓南臺灣的學生與在地鄉親也能接觸到「輻射應用」、「除役核廢」及「綠能科技」等科普資訊，兩場次共吸引 6,103 人次到場參加。

由於線上活動已然成為疫情時代下的趨勢，為能兼顧推廣原子能科普並配合政府維持安全社交距離的防疫措施下，原能會選取部份實體科普展內容，透過拍攝教學影片、手作課程，以及學習單與線上測驗型式，運用網路無距離之限制，提供給國小、國中及高中生參與線上科普活動之機會，計有北中南東的國中小及高中生共 5,433 位學生參與，其中不乏有花蓮縣、屏東縣原住民學生為主的學校參加，使原子能科普之推廣可擴及過往未曾策展之地區及偏鄉，大幅增加傳播效能。

C. Having fun in science: promoting science online in an innovative way

In recent years, the AEC has been dedicated to promoting atomic science. In addition to working with the National Taiwan Science Education Center to participate in science education tours held in Taitung County and Yilan County, the 2nd Taiwan Science Festival and disaster prevention bazaar activities, the AEC took part in the science bazaar activity with the theme of the "International Day of Women and Girls in Science" at the invitation of the NTHU Interdisciplinary Science Education Center on March 14, 2021, to encourage more female students to engage in science. Female students from junior and senior high schools in Hsinchu were given the opportunity to gain a deeper knowledge of science by explaining relevant knowledge to participants at each stall, so as to demonstrate how important the role of women is in science.

The AEC also organized two sessions of the "I Love Atomic Energy, Green Energy of the World" science fair in Tiger City shopping mall of Taichung City and Millennium Park in Pingtung County in compliance with the COVID-19 prevention regulations in April and December. It collaborated with the local government for the first time to hold one of the sessions in Pingtung County to allow students and people in Southern Taiwan to grasp the information about "radiation applications," "nuclear decommissioning and radioactive waste" and "green energy technology." The two sessions of the science fair attracted a total of 6,103 visitors.

In this pandemic era, it has become a trend to organize activities online. To promote atomic science while complying with the government's social distancing policy, the AEC made tutorial videos, arranged DIY courses and provided learning sheets and online tests for certain contents in physical science fairs to provide opportunities for elementary school, junior high, and senior high school students to learn science online without distance limitation. There was a total of 5,433 participating students from elementary, junior high, and senior high schools around Taiwan, including schools where most of the students are indigenous peoples in Hualien County and Pingtung County. This enabled the promotion of atomic science to areas and remote regions where science fairs have never been held, and also facilitated its promotion significantly.

兼顧防疫下，以 VR 遊戲介紹食品輻射檢測流程
Introducing the food radioactivity testing procedure in the form of VR while ensuring epidemic prevention.

讓參觀者以雲霧室看見「輻射的蹤跡」
Visitors actually seeing "radiation" in a cloud chamber.

「迷你風力發電機製作」手作教學課程
DIY course: "mini wind turbines."

原子能線上科普互動教學課程
Online interactive atomic science course.

（四）以全民參與委員會提升溝通效能

為提供原能會有關民眾溝通事務的建言，109 年邀請專家學者、社會公正人士或民間團體擔任「全民參與委員會」的委員。在 110 年共辦理 3 次委員會會議，分別針對「核二廠除役計畫審查公眾參與作業」、「核三廠除役計畫送審前作業規劃」、「蘭嶼地區環境平行監測活動與核一廠除役及乾式貯存訪查活動」、「優化原能會官網龍門電廠專區」、「原子能科技科普展辦理情形」及「金山地方說明會辦理說明」等活動的民眾參與，於會議中進行討論並聽取委員建議，以持續滾動與優化辦理方式，並精進原能會辦理公眾參與及溝通工作之效能。

D. Committee on Public Participation: improving communication efficiency

To receive advice on public communication affairs, the AEC invited experts, scholars, impartial social representatives, and civil society organizations to serve as the members of the "Committee on Public Participation" in 2020. Three committee meetings were held in 2021 to discuss the public participation in the "review of the Kuosheng NPP decommissioning plan," "planning prior to the review of the Maanshan NPP decommissioning plan," "Parallel Monitoring Activity on Environmental Radiation in Lanyu Area and Public Observation Program for the Decommissioning and Dry Storage Facilities in the Chinshan Nuclear Power Plant," "optimization of the designated section for the Lungmen Nuclear Power Plant on the AEC website," "organization of atomic science fairs" and "public meeting in Jinshan District" and seek the advice of the members. In this way, the AEC could make continuous adjustments and improvements and enhance the performance of public participation and communication.

官網「龍門電廠管制專區」之優化
Optimized designated section for the "Lungmen Nuclear Power Plant" on the official website.

110 年第 3 次全民參與委員會
3rd meeting of the Committee on Public Participation in 2021.

原能會於 110 年 5 月 6 日假金山區美田市民活動中心辦理核一、二廠除役管制地方說明會

AEC organized a public meeting for the regulation of decommissioning of the Chinshan and Kuosheng NPPs at the Meitian Community Center in Chinshan District on May 6, 2021.

新北市金山區廖區長於 110 年 5 月 6 日核一、二廠除役管制地方說明會表達意見

District chief of Chinshan District in New Taipei City, Mr. Liao, expressing his opinions at the public meeting for the regulation of decommissioning of the Chinshan and Kuosheng NPPs held on May 6, 2021.

（五）積極辦理除役安全管制地方說明會

核電廠除役為各界關切之議題，原能會作為除役安全主管機關，除嚴格執行各項除役安全管制作業外，並本於強化公眾參與及地方溝通的施政原則，於 110 年 5 月 6 日及 11 月 3 日分別舉辦「核一、二廠除役管制地方說明會」與「核三廠除役計畫審查地方說明會」，藉由溝通說明，讓民眾瞭解原能會除役安全管制立場及台電公司除役作業規劃，並聽取地方鄉親、民意代表及公民團體之多元意見，納入原能會除役計畫審查及相關安全管制作業之參考，使除役安全管制作業更為完備。

綜合兩次地方說明會之公眾意見，最關切事項為放射性廢棄物處理與處置、乾式貯存、環境監測、在地工作權與回饋、公眾參與及地方溝通等事項。針對地方公眾所提意見，均於會後整理紀錄，並逐項提出書面回應。針對除役安全管制相關部分，原能會參採納入管制作業之參考；對於涉及其他主管機關權責之事項，則轉請相關單位參考辦理。說明會會議紀錄及相關資料，均公布於對外網頁，供各界參閱，落實資訊公開。

與會人員於 110 年 11 月 3 日核三廠除役計畫審查地方說明會表達意見
Participants giving their opinions at the public meeting on the review of the Maanshan NPP decommissioning plan held on November 3, 2021.

原能會於 110 年 11 月 3 日假恆春鎮公所辦理核三廠除役計畫審查地方說明會
AEC organized a public meeting on the review of the Maanshan NPP decommissioning plan at the convention hall of Hengchuen Township Office on November 3, 2021.

E. Holding public meetings on the safety regulation during decommissioning

Decommissioning of nuclear power plants has been a topic of public concern in recent years. As the competent authority on the safety of decommissioning, in addition to the safety regulation of decommissioning , the AEC, based on the principle of strengthening public participation and local communication, held public meetings on "the regulation of decommissioning of the Chinshan and Kuosheng NPPs" and "the review of the Maanshan NPP decommissioning plan", on May 6 and November 3, 2021, respectively. Through the public meetings, the public could realize the AEC's safety regulation measures on decommissioning and Taipower's decommissioning planning of NPPs. The opinions from the public raised in these meetings were taken into account in the review on decommissioning plan and regulatory activities to improve the safety regulatory process.

According to the public opinions at the two local public meetings, the most mentioned concerns included the treatment and disposal of radioactive waste, dry storage, environmental monitoring, the right of work and feedback fund for local residents, public participation and communication, etc. The opinions expressed by the local participants were recorded after the meetings, and written responses to the concerns were provided item by item. The AEC took those concerns related to safety regulation of decommissioning into account. For concerns involving responsibility of other competent authorities, were forwarded to these authorities for their consideration. The meeting minutes and relevant information of the local public meetings were also posted on the AEC's website for the general public to enhance information disclosure.

（六）執行新北市四區 38 里家庭訪問，瞭解需求並傳遞核安防護知識

為瞭解核電廠緊急應變計畫區（EPZ）民眾應變需求並提供相關防護資訊，原能會定期執行緊急應變計畫區內逐戶家庭訪問，僱用核電廠附近在地民眾擔任家訪員（包括東南亞籍新住民），除協助蒐集瞭解核子事故發生時之民眾需求外，亦供民眾緊急應變整備相關資訊，讓民眾熟悉災害時之應變措施及防護知識。110 年執行新北市萬里、金山、石門、三芝四區 38 里家庭訪問作業，成功訪問 14,000 餘戶住戶，訪查過程亦會依住戶需求提供「核子事故發生時怎麼辦？」宣導單（版本包括國語、英語、泰語、印尼語、越南語），並發送 111 年防護月曆，藉由月曆長期保存之特性，讓防護資訊唾手可得。

訪員逐戶訪問（一）
Home visit 1

訪員逐戶訪問（二）
Home visit 2

F. Home visit in 4 districts of New Taipei City in order to investigate the needs of residents and convey nuclear safety knowledge

To understand the needs of residents in nuclear power plant emergency planning zones (EPZs) during an emergency and to provide relevant information on protective actions, the AEC engaged local people (including new immigrants from Southeast Asia) to visit households in the EPZs regularly. They helped to investigate the residents' needs in case of a nuclear accident and provide information regarding responses to such emergencies to enhance their familiarity with emergency response measures and protection knowledge. In 2021, the home visit program was implemented in 38 villages of Wanli, Jinshan, Shimen and Sanzhi Districts in New Taipei City, and over 14,000 households were visited. During each visit, a flyer (5 languages available: Chinese, English, Thai, Indonesian and Vietnamese) with the headline "what to do in case of a nuclear accident" was provided. The AEC also provided the 2022 calendar with features of long-term use and easy access to the information on protective actions while implementing the program.

新北大城小事
New Taipei edition

漫遊屏東之旅
Pingtung edition

咱的基隆好景
Keelung edition

原能會 111 年防護月曆
The AEC 2022 calendar provides information on protective actions with 3 editions

二、切實監督核電廠安全

（一）持續嚴格監督運轉中核電廠安全

1. 核二廠 1 號機及核三廠 1、2 號機機組大修專案視察與管制作業

110 年間共有核二廠 1 號機及核三廠 1、2 號機分別進行機組大修作業，原能會於機組大修前，先就台電公司所提大修計畫進行審查，確認已妥善規劃各項作業；大修期間由視察團隊，並考量防疫期間人員分流，加派視察人力，查證電廠大修維護與安全管理各項作業執行情形，確認作業符合品質要求。

核二廠 1 號機係受限用過燃料池貯存容量，用過核子燃料暫時無法退出爐心，機組於 110 年 7 月 2 日停機，台電公司規劃至 12 月 27 日運轉執照屆期前，進行必要之大修維護測試作業，以維持安全重要相關設備可用性。12 月 27 日完成大修作業後，核二廠 1 號機即進入除役期間，原能會仍持續比照運轉中電廠管制標準，監督電廠對核燃料安全重要設備之監控與維護測試作業。

核三廠 1、2 號機於完成大修相關工作後，提出機組起動申請，原能會於接獲台電公司申請，即依既定程序進行申請文件審查，並派員加強查證。於確認送審文件內容及機組現場狀態可符合起動要求後，原能會分別於 110 年 5 月 15 日及 12 月 6 日同意核三廠 1、2 號機起動運轉。原能會亦經審查及現場查證符合併聯要求後，同意機組併聯申請。後續於機組併聯及升載期間，原能會也持續加強監督，確認電廠依規定執行。

原能會執行核二廠 1 號機第 28 次大修專案視察
The AEC conducted the 28th refueling outage inspection of Kuosheng NPP Unit 1

原能會執行核三廠 2 號機第 26 次大修視察
The AEC conducted the 26th refueling outage inspection of Maanshan NPP Unit 2

(II) Effective Oversight of Nuclear Power Plant Safety

A. Overseeing the safety of operating nuclear power plants

a. Inspections and regulations for the safety of Kuosheng Nuclear Power Plant Unit 1 and Maanshan Nuclear Power Plant Units 1 and 2 during the refueling outage

The AEC conducted the refueling outage inspections for Kuosheng NPP Unit 1 and Maanshan NPP Units 1 and 2 in 2021, respectively. The AEC reviewed the outage plan submitted by the TPC prior to implementing the refueling outage to make sure that TPC has preperly planned all the required work items. The AEC conducted inspections to verify all the maintenance and safety management measures during the refueling outage and ensured that they met the quality requirements. Also, additional resident inspectors were organized in consideration of the separation of the refueling taskforce inspectors during COVID-19 pandemic.

Since the storage capacity of the spent fuel pool was limited, the spent fuel of Kuosheng NPP Unit 1 could not be removed from the core temporarily. Unit 1 was shut down on July 2, 2021 after coast-down operation starting from February 25, 2021. The TPC planned to implement required refueling outage maintenance and surveillance test process prior to the expiration date of the operating license, i.e. December 27, 2021, to ensure the operability of the important-to- safety equipment. Kuosheng NPP Unit 1 entered decommissioning period after the refueling outage was completed on December 27 thereafter. Before all the spent fuel are defueled from reactor and spent fuel pool, the AEC will continuously oversee the plant to implement necessary monitoring, maintenance and test on those equipment related to the safety of spent fuel in accordance with the regulatory requirements during the operational stage of the NPP.

The TPC submitted an application for the restart of Maanshan NPP Units 1 and 2 after the refueling outage was completed. After receiving the TPC's application, the AEC reviewed the documents and dispatched staffs to conduct enhanced inspection accordingly. After confirming that the submitted documents and the status of the Units comply with the restart requirements, the AEC approved the restart of Maanshan NPP Units 1 and 2 on May 15 and December 6, 2021 respectively. The AEC also reviewed the synchronizing to power grid application of the units and approved it after conducting on-site inspections to ensure the TPC's compliance with the requirements. The AEC continuously oversee the activities of synchronizing to power grid and power ascension to ensure that they are performed in compliance with the regulations and the NPP's procedure.

2. 核二廠 2 號機急停事件管制作業

核二廠 2 號機於 110 年 7 月 27 日發生因主蒸汽隔離閥關閉，造成反應爐急停事件。原能會接獲電廠通報後，第一時間即確認機組安全停機且未有造成輻射外釋情形，並由駐廠視察員掌握現場狀況，另再增派視察員赴現場就系統運作情形、事件處理過程及肇因調查進行查證。經查證相關數據、電廠模擬驗證結果及當值人員之說明，確認確實有可能因控制室值班人員行為紀律與管理上疏失而造成主蒸汽隔離閥關閉，引發反應器急停。

於台電公司提出該機組再起動申請時，原能會綜整確認台電公司已進行完整之事件檢討、查明肇因並提出改善措施，方同意再起動申請。原能會針對本次缺失開立違規，並依「核子反應器設施管制法」第 11 條規定，處以當事人吊扣執照 6 個月之處分，以為警惕。原能會也要求台電公司記取教訓，就人員紀律管理與硬體確實檢討改善，以及平行展開至其他核電廠。原能會亦查證各核電廠已完成設置盤面保護桿及紅外線侵入感應儀及新增盤面操作區域之監視器錄影功能，並提出控制室人員行為規範等強化改善措施，以杜絕此類事件再發生。原能會也利用駐廠視察與不預警視察時，查證控制室人員行為及管理情形，確認落實執行。

核二廠 2 號機 110 年 7 月 27 日急停事件控制室盤面查證
AEC inspector verified the MSIV control switch on control panel in the control room of Kuosheng NPP Unit 2.

b. Regulatory measures for the automatic scram of Kuosheng NPP Unit 2

Kuosheng NPP Unit 2 scrammed automatically on July 27, 2021 when the MSIVs closed. After receiving prompt notification from the NPP, the AEC confirmed that the unit was shut down safely and no abnormal radiation release to environment occurred. Aside from the onsite resident inspector, the AEC dispatched additional inspectors to the site to verify the sequence of the system response, the handling process of plant staff and the root cause investigation. The TPC's report showed that the root cause of this event was resulted from negligence of operator on duty in the main control room, which led to one MSIV closure and subsequent reactor automatic scram. After checking relevant data, results of simulation test for possible cause, and the reports from the crew on duty, the AEC found that the root cause investigated by TPC is reasonably acceptible.

After the TPC submitted the restart application of the Kuosheng Unit 2, the AEC made a intensive review . The AEC approved the restart application after confirming that the TPC had carried out a comprehensive review of the accident, identified the root cause and presented corrective measures to prevent reoccurrence, including crew discipline management improvement and installing protection features on control panel to avoiding misoperation. The AEC issued a violation notice and the license of the operator was suspended for 6 month according to the Nuclear Reactor Facilities Regulation Act. The AEC also required TPC to feedback the lessons learned to other two NPPs, to added recording feature on CCTV for overseeing near control panel area of all three NPPs and established enhanced guidelines for discipline management of main control room shift crews to avoid recurrence. In addition, the AEC conducted inspection on crew behavior and management in the control room during unannounced inspections, to verify that the enhanced corrective measures for crew behavior in the control room have been well implemented.

110 年 8 月 7 日查證核二廠 2 號機急停事件改善措施－控制室設置盤面保護桿改善作業

AEC inspector checked the setup of panel guard bars in the control room.

3. 各項專案團隊視察

原能會除派遣視察員赴核電廠執行現場駐廠視察（含颱風期間）外，並持續依規劃執行核安管制紅綠燈視察、核安總體檢視察、以及核電廠 COVID-19 防疫措施，以及不預警視察等各類專案團隊視察，其中核安管制紅綠燈視察部分，依視察計畫分別就系統狀態、異常天候與水災防護、火災防護、人員訓練、作業管理等進行查證，並針對視察發現請電廠檢討改善。亦利用不預警視察時，就核一、二、三廠因應核二廠 2 號機 7 月 27 日急停事件之經驗檢討，針對控制室人員行為紀律管理強化措施進行查證，查證結果均能確實執行。

原能會於 110 年 3 月 8 日至 12 日執行 110 年第 1 季核三廠核安管制紅綠燈視察（火災防護）
The AEC inspected the fire drill exercise during the 2021 Q1 reactor oversight process inspection on fire protection at the Maanshan NPP on March 8 ~12, 2021.

（二）嚴格執行核電廠除役安全管制作業

1. 核一廠除役拆除計畫審查與現場拆除作業視察

原能會持續就除役中之核一廠之周邊廠房設備拆除作業計畫執行審查及現場作業進行視察。

針對審核通過之「核一廠氣渦輪機設備及廠房與第一抽水站設備拆除作業方案」，原能會除由駐廠視察員進行查證外，並於每季由視察團隊，就拆除前先備作業，以及現場拆除作業安全及品保管理情形進行專案視察，以查證確認核一廠確實依拆除作業方案，落實執行各項作業。

c. AEC team inspections

In addition to dispatching inspectors to the NPPs to carry out on-site inspections by resident inspectors (including on typhoon days), the AEC also conducted team inspections with regard to the reactor oversight process, post-Fukushima safety enhancement measures, the NPP COVID-19 pandemic prevention enhancement measures and unannounced inspections. In the aspects of reactor oversight process inspections, the AEC verified equipment alignment, adverse weather and flood protection, fire protection, personnel training, and operational management according to inspection program. The AEC requested the TPC to take necessary corrective actions to all the inspection findings. During unannounced inspections, the inspection team also checked the discipline management improvement measure on shift crew of main control room in response to the automatic scram event of Kuosheng NPP Unit 2 happened on July 27. The results of inspections showed that the measures were implemented thoroughly for all three NPPs.

原能會於 110 年 9 月 17 日執行核二廠不預警視察
The AEC conducted the unannounced inspection at the Kuosheng NPP on September 17, 2021.

B. Strict implementing safety regulation on NPP decommissioning

a. Review the Chinshan NPP dismantling plan and conduct on-site inspection on dismantling work

The AEC continuedly reviewed the dismantling plan for the subsidiary buildings and equipment and conducted on-site inspection on dismantling work at the Chinshan NPP.

For the approved "Dismantling Plan for the Gas Turbine Equipment and Building, and the First Pumping Station Equipment at the Chinshan NPP", in addition to carrying out daily inspections by resident inspectors, the AEC dispatched teams to conduct quarterly inspections on the preparation prior to the dismantling and the safety and QA management of the dismantling work to make sure that the Chinshan NPP implemented the dismantling plan properly.

原能會於 110 年 10 月 18 日現場視察核一廠氣渦輪機設備拆除作業情形
The AEC conducted an on-site inspection of the dismantling work of the Chinshan NPP's gas turbine equipment on October 18, 2021

原能會於 110 年 3 月 12 日辦理核一廠汽機廠房等設備拆除作業計畫現場訪查
The AEC project team toured the gas turbine building of Chinshan NPP to inspect the dismantling planning on March 12, 2021

原能會對於「核一廠主發電機等相關設備拆除作業計畫」，此項國內首次規劃執行受輻射影響設備之除役拆除作業，邀請會外學者專家與原能會同仁組成專案審查小組進行審查，審查期間共提出 311 項審查意見，並於 110 年 3 月 12 日赴核一廠實地了解作業規劃狀況。於確認台電公司已就本案拆除作業及安全管理等妥適規劃，符合核一廠除役計畫及相關法規要求，於同年 9 月 30 日同意拆除計畫，後續台電公司應落實計畫具體施行。

2. 核一廠除役期間維護測試作業暨核安管制紅綠燈視察

核一廠已進入除役，因用過核子燃料仍暫存於反應爐及用過燃料池，原能會比照運轉期間管制作法，持續執行電廠各項與用過核子燃料貯存安全相關作業之視察。其中針對核一廠與用過核子燃料安全相關之系統、設備所執行大修維護測試作業，原能會要求電廠事先陳報作業計畫，並由專案視察團隊，針對各項維護測試作業進行視察。

原能會亦參照運轉期間作法，建制適用於除役期間之核安管制紅綠燈制度，依擬訂視察計畫，由駐廠視察員於駐廠期間，及每季由視察團隊，就與用過燃料貯存安全相關之作業項目進行查證，確認電廠依規定執行各項作業，以確保用過核子燃料貯存安全。

"Dismantling Plan for the Chinshan NPP Main Generator and Other Related Equipment," is the first dismantling work of the radiation-affected equipment at NPPs in Taiwan. The AEC invited external experts, along with AEC staff to organize a review team. The team put forward 311 review comments and visited the Chinshan NPP to evaluate on-site condition and status of planning on March 12, 2021. After confirming that the TPC had planned the dismantling work and safety management adequately, which complied with the regulation requirements and Chinshan NPP decommissioning plan, the AEC approved the dismantling plan on September 30, 2021.

b. Implementing the maintenance surveillance activities and the reactor oversight process inspections on the decommissioning Chinshan NPP

The Chinshan NPP has entered its decommissioning period and, for the time being, the spent fuel is still in the reactor and spent fuel pool. The AEC requested the TPC to continuously implement maintenance and surveillance related to spent fuel storage safety in accordance with the regulatory measures of the operation period. The AEC also conducted inspections on those work items. For the maintenance and testing on systems and equipment related to spent fuel safety during the refueling outage, the AEC requested TPC to submit the plan in advance and organized a task force to inspect the each work item.

Regulatory measures for the operation period have also been adopted to establish the reactor oversight process for the decommissioning period. According to the inspection plan, the AEC dispatched resident inspectors to carry out daily inspections and organized taskfore to conduct quarterly inspections of the work items related to spent fuel storage safety, to verify Chinshan NPP has implemented the work in compliance with the regulations.

原能會視察員於 110 年第四季執行核安紅綠燈現場設備配置查證情形

AEC inspectors conducted the 2021 Q4 reactor oversight process inspection of the on-site equipment configuration

原能會於 110 年第四季執行核一廠核安紅綠燈火災防護視察情形

The AEC conducted the 2021 Q4 reactor oversight process inspection (fire prevention)

3. 核三廠除役計畫審查

原能會於台電公司提送核三廠除役許可申請前，即先多次執行除役計畫先期整備作業查訪，以了解除役計畫撰寫及準備情形。

原能會於 110 年 3 月 5 日辦理核三廠除役計畫先期整備作業專案查訪
The AEC conducted the inspection of the preparatory work with respect to the Maanshan NPP decommissioning plan on March 5, 2021

台電公司於 110 年 7 月 26 日依「核子反應器設施管制法」規定向原能會提出核三廠除役許可申請，並檢附核三廠除役計畫等相關文件。原能會於 110 年 8 月完成核三廠除役計畫程序審查，確認申請文件符合應備要件，並聘請會外學者專家組成專案審查團隊，規劃辦理 3 回合實質審查作業，於 110 年 11 月 25 日已完成第 1 回合審查，總計提出審查意見 345 項，函請台電公司提出答覆。在審查期間，並依審查進度，陸續將除役計畫、審查意見結案情形、安全審查報告、公眾關切事項之回應等，公布於網站，以供各界參閱。

4. 核二廠除役過渡階段前期技術規範及安全分析報告審查

原能會於審查通過核二廠除役計畫時，要求台電公司應於 1 號機運轉執照屆期一年前（即 109 年 12 月 27 日），將核二廠除役過渡段前期技術規範及安全分析報告，提送原能會審查。原能會於 109 年 12 月 8 日接獲台電公司提出之申請文件報告後，即聘請會外學者專家與原能會同仁組成專案小組，嚴格執行審查。歷經三回合嚴格審查後，經確認台電公司已澄清相關審查意見，於 110 年 9 月 29 日審查同意。

（三）強化核安管制效能，精進管制技術

原能會為強化安全管制效能，對於所開立違規及注意改進事項，除要求台電公司確實檢討及提出有效改善措施，以避免類似狀況重複發生外，亦依所訂定相關改善作業應於 2 年內完成之時限原則，進行追蹤管控。針對 108 年所開立之違規及注意改進事項，均能依限完成改善。此外，原能會亦持續滾動檢討增修訂管制作業程序書，並於 110 年共完成 8 項作業程序書之增修訂，以完善相關管制作業程序。

c. Review of the Maanshan NPP decommissioning plan

In accordance with the "Nuclear Reactor Facilities Regulation Act", the TPC submitted the application for the decommissioning permit, together with the decommissioning plan and relevant documents, to the AEC on July 26, 2021.

原能會於 110 年 11 月 15 日舉辦核三廠除役計畫第一回合綜合審查聯席會議
The First Joint Review Meeting for the Maanshan NPP Decommissioning Plan was held on November 15, 2021

The AEC completed the acceptance review process of the Maanshan NPP decommissioning plan in August 2021 and confirmed that the documents met the requirements for subsequent technical review. Then the AEC invited external experts, along with AEC staff, to organize a task forece to perform a three-round technical review. The first round of the review was completed on November 25, 2021 with putting forward 345 review comments. The AEC then sent those comments to the TPC and requested its responses. During the review period, the decommissioning plan, the status of the review comments, the safety review report, and the matters of public concern were all published on the AEC's website.

d. Review of the pre-defueled technical specification and safety analysis report for the transition stage of the Kuosheng NPP decommissioning

After approving the Kuosheng NPP decommissioning plan, the AEC requested that the TPC submit the pre-defueled technical specification and safety analysis report for the transition stage of the Kuosheng NPP decommissioning one year prior to the expiration of the operating license for Unit 1 (i.e. December 27, 2020). After receiving the two reports for the application from the TPC on December 8, 2020, the AEC invited external experts, along with AEC staff, to organize a task force to carry out a comprehensive review. After three rounds of strict review, the AEC confirmed that the TPC had adequately responded to the relevant comments and approved the application on September 29, 2021.

C. Enhancement of nuclear safety regulation effectiveness and improvement of regulatory techniques

In addition to requesting the TPC to adopt lessons learned from the identified violations and issues, and to take effective corrective measures to avoid recurrence, the AEC also took regulatoryactions to ensure that all corrective measures are put in place in less than two years' time. Violations and issues of 2019 have all been resolved so far. In addition, the AEC contineously reviews the regulatory procedures in a rolling manner and completed the review of eight procedures in 2021 in order to make relevant procedures more complete.

原能會持續召開各項管制會議，其中核子反應器設施安全諮詢會議，主要就核一廠拆除作業計畫及核二廠 2 部機組現況進行報告，請委員提供諮詢意見；核能管制會議則就運轉安全議題，例如國內外運轉事件經驗回饋、核二廠 1 號機進入除役及 2 號機運轉之運作管理、設備可用性管制等議題，與台電公司進行討論，並傳達原能會安全管制立場；在除役管制會議部分，則針對台電公司對核一廠除役之廢料管理、作業排程規劃檢討、除役作業承包商現場施工管理、輻射特性調查執行進度等議題進行溝通討論。

110 年度第 1 次核子反應器設施安全諮詢會議
The first meeting of the Advisory Committee on Nuclear Safety in 2021

原能會亦透過參與國際交流及自辦方式，精進安全管制技術知能。110 年雖因國際 COVID-19 疫情，而暫停派員至國外參加訓練及國際核安管制技術交流活動，惟仍藉由專題演講方式，邀請專家學者針對技術議題，進行深入介紹與討論。原能會並舉辦核二廠除役計畫審查與核電廠除役視察員等線上訓練課程，以加強同仁除役安全審查與視察專業能力。

原能會辦理 110 年度第 2 次核電廠除役管制會議
The second Regulatory Meeting on Nuclear Power Plant Decommissioning in 2021

（四）2021 國際核安交流紀要

原能會配合中央流行疫情指揮中心防疫策略，積極協調將安全技術交流會議以視訊會議方式辦理，3 月 24 及 25 日舉行臺美民用核能合作視訊會議，雙方就「反應器管制與法規相關研究」、「廢棄物管理與環境復原」、「先進核能科技」及「緊急應變管理」等四分組工作項目執行結果並未來規劃進行交流。7 月 20 日以視訊方式辦理第 7 屆臺日核安管制資訊交流會議，議題包含臺日雙方引入 ROP（Reactor Oversight Process）制度經驗，以及放射性廢棄物管制技術研發等；日方亦分享福島事故十年之調查分析結果，並簡要說明目前東京電力公司就 ALPS 處理水後續相關工事之概念設計。

The AEC holds regulatory meetings on a regular basis. At the meeting of Advisory Committee on Nuclear Safety, the current status of the Chinshan NPP dismantling plan and the two Kuosheng NPP Units were reported, and then the committee members presented their comments. At the regulatory meeting on safety issues of operating nuclear power plants were discussed with the TPC, such as feedback of experiences acquired from domestic and overseas operation events, management of Kuosheng NPP Unit 1 (permanent shutdown) and Unit 2 (in operation), the regulation of equipment availability, and the position of the AEC regarding safety regulation was communicated to the TPC. At the regulatory meeting on nuclear power plant decommissioning, the AEC communicated with the TPC on issues regarding the Chinshan NPP decommissioning, including waste management, the decommissioning plan schedule, decommissioning contractor management regarding on-site work items, and the progress of radiation characteristics survey.

The AEC has also improved its safety regulation techniques and knowledge by participating in international exchange activities and holding training courses. Though international exchange activities on nuclear safety regulation techniques were largely suspended due to the COVID-19 pandemic in 2021, the AEC still invited scholars and experts to give keynote speeches and to have in-depth discussions on different topics. In addition, the AEC also held online training courses on the review of the Kuosheng NPP decommissioning plan and the decommissioning of NPPs in order to enhance the inspectors' proficiency in safety review and inspection on NPP decommissioning.

D. 2021 Summary of international exchange on Nuclear Safety Regulation

AEC complied with the pandemic prevention strategies of the Central Epidemic Command Center and held technical exchange meetings on nuclear safety via video conferencing. The AIT-TECRO Joint Standing Committee on Civil Nuclear Cooperation Meeting was held virtually on March 24 and 25. Both parties exchanged opinions on the implementation outcomes and planned activities of working items from four working groups: "Reactor Regulation and Regulatory Research," "Waste Management and Environmental Restoration," "Advanced Nuclear Technology," and "Emergency Management". AEC held the 7th AEC-NRA nuclear safety information exchange meeting via video conference on July 20. The issues included the experience of both parties in the implementation of the ROP (Reactor Oversight Process) and the R&D for Safety Regulatory Technique on Radioactive Waste Management. The Japanese participants also shared the result of the investigation and analysis of the nuclear accident in Fukushima over the past ten years, and briefed TEPCO's conceptual design of the subsequent facilities for the Advanced Liquid Processing System (ALPS) treated water.

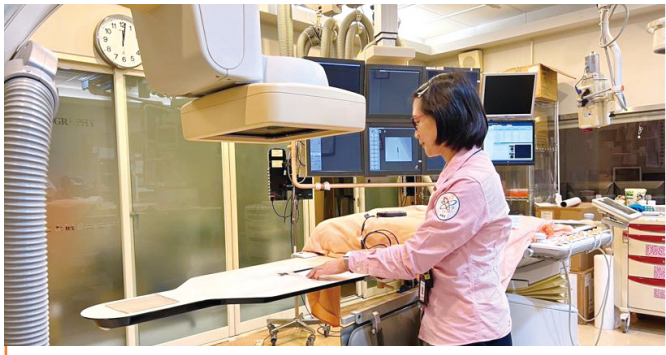
三、精進輻射防護安全管理

（一）心導管與血管攝影醫療曝露品保即將上路，提升醫療曝露品質

心臟及腦部血管病變是近十年國人常見的疾病，其影響民眾健康甚鉅。醫界為此配置高階心導管或血管攝影 X 光機，以供患者診療需求。原能會為提昇病患醫療曝露品質與操作人員之輻射安全，近年積極推動心導管或血管攝影 X 光機之醫療曝露品質保證作業（簡稱醫療曝露品保作業），以確實做好品質的管控，使病患在獲得最佳醫療照護下，亦合理抑低所接受的輻射劑量。這也正是原能會推動醫療曝露品保作業的核心價值。

原能會推動心導管或血管攝影 X 光機醫療曝露品保，110 年度已全面完成納法先期準備作業，其中包括：1. 訂定適用於心導管或血管攝影 X 光機醫療曝露品保項目，內容包含輻射安全、影像品質及輻射劑量等三大範疇共 10 項品保項目。2. 制定醫療曝露品保作業操作程序書。3. 錄製教學影片及製作紀錄表格。4. 完成全國共 359 台心導管或血管攝影 X 光機醫療曝露品保訪視實測作業及問卷調查，並進行數據分析，確保國內推行品保作業的可行性。5. 針對國內所有設置心導管或血管攝影 X 光機之 135 家醫療院所，協助培訓各院執行品保作業之專業人員已達 500 名。6. 舉辦階段性成果宣導說明會共 4 場。以上藉由人員培訓教學、訪視過程及宣導說明會，加深醫界對醫療曝露品保的瞭解及重視。

心導管與血管攝影 X 光機
Cardiac catheter and angiography X-ray machine



醫療曝露品保作業實務操作訓練（一）
Practical training on medical exposure quality assurance 1

醫療曝露品保作業實務操作訓練（二）
Practical training on medical exposure quality assurance2

(III) Enhancing Radiation Protection and Safety Management

A. The upcoming launch of the program for medical exposure quality assurance for cardiac catheter and angiography: improving medical exposure quality

Cardiovascular and cerebrovascular diseases, which can cause a huge impact on people's health, are two of the most common diseases for people in Taiwan over the past ten years. Therefore, high-end cardiac catheter and angiography X-ray machines were introduced to the medical profession to meet the treatment needs of patients. To improve medical exposure quality for patients and ensure the radiation safety of operators, the AEC has actively promoted the program for medical exposure quality assurance for cardiac catheter and angiography X-ray machines (hereinafter referred to as the medical exposure quality assurance program) in recent years to fully regulate the quality of healthcare and reduce the radiation dose to patients as low as reasonably achievable while offering them the best medical service. This is also the core value behind the AEC's promotion of the medical exposure quality assurance program.

For assurance of the medical exposure quality for cardiac catheter and angiography X-ray machines, the AEC has completed all the preliminary preparation for legislation, including (1) developing a total of 10 items with respect to the assurance of the medical exposure quality for cardiac catheter and angiography X-ray machines, covering radiation safety, image quality, and radiation dose; (2) establishing medical exposure quality assurance procedures; (3) making tutorial videos as well as records and tables; (4) finishing the on-site testing and questionnaire survey for 359 cardiac catheter and angiography X-ray machines around the country and conducting data analysis to ensure the feasibility of implementing the quality assurance program in the country; (5) assisting 135 medical institutions installed with the cardiac catheter or angiography X-ray machines in Taiwan in training up to 500 professionals for carrying out quality assurance tasks in the institutions; (6) holding 4 meetings for reporting the results of each phase. The above-mentioned measures related to personnel training, on-site visit, and meetings have helped the medical profession better understand and value the medical exposure quality assurance.

醫療曝露品保作業小班制專業課程
Professional courses on medical exposure quality assurance offered in small class sizes

心導管或血管攝影 X 光機醫療品保納法前期作業，無論項目、程序、品保人員、品保儀器及訊息推廣等，原能會皆全面準備妥適，並規劃 112 年正式納法實施。原能會隨時保持與時俱進之精神，配合醫療科技發展，並考量社會期待，落實輻射安全管制同時積極推動醫療曝露品保作業，確保輻射診療設備品質穩定與安全。

（二）為邊境管制人員輻射安全把關——辦理海關及海巡署輻射作業年度重點工作檢查

為維護公共安全，我國多年來陸續在機場、港口等地建置 X 光貨櫃檢查儀及行李（貨物）檢查 X 光機等設備，輔助儀檢或巡防人員執行查驗，有鑑於邊境管制及海岸巡防權責單位散佈全國各地，且人員異動較為頻繁，增加輻射防護安全管制之困難，為強化上述單位輻射源自主管理能力，並建立正確輻射防護觀念，原能會特辦理「110 年度海關及海巡署輻射作業年度重點工作檢查」，期藉此檢查瞭解各單位輻射作業實務管理方式，並建立良好溝通管道，進而提升自主管理效能。

本案檢查對象含括基隆關、臺北關、臺中關、高雄關與海巡署北、中、南及金馬澎各分署，除抽檢 33 台行李（貨物）檢查 X 光機及 6 顆儀檢用密封放射性物質證照外，考量使用百萬電子伏特（M eV）等級之高能量 X 光貨櫃檢查儀，來幫助儀檢人員研判櫃內貨物裝載情形及辨別可疑貨物存放位置，已是國際共通的趨勢，然而，高能量的輻射雖然可增加對貨物之穿透力，提供較佳的影像對比及鑑別度，但同時也具有較高的意外曝露風險，故原能會亦將全國各港口 11 台貨櫃檢查儀全數納檢，務求人員作業安全。

書面文件核對及審查
Checking and reviewing documents

執行高能量 X 光貨櫃檢查儀輻射偵檢
Performing radiation detection for high-energy X-ray container scanners

The preliminary works, with respect to items, procedures, quality assurance personnel and instruments, and information promotion, for introducing legislation to assure the medical exposure quality for cardiac catheter and angiography X-ray machines have been done thoroughly by the AEC. The legislation is planned to be officially introduced and implemented in 2023. The AEC always keeps pace with the times, pays attention to the development of medical technology, and takes into account social expectations to implement radiation safety regulatory measures while actively facilitating medical exposure quality assurance, therefore ensuring the stable quality and safety of radiation therapy equipment.

B. Radiation safety of border control officers: performing the annual inspection for the radiation practices of the Customs and Coast Guard Administration

To maintain public safety, Taiwan has continued to establish X-ray container scanners and X-ray baggage (cargo) scanners in airports and ports for years to assist customs and coast guards in performing inspections. Considering the scattering of border control and coast guard units and frequent staffing changes have increased the difficulty in ensuring radiation safety and regulation, the AEC hence carried out the "2021 Annual Inspection for the Radiation Practices of the Customs and Coast Guard Administration" to enhance the capability of the said units to manage radiation sources and help them building correct radiation protection practices, in hopes to understand the respective units' practical management of radiation practices and establish effective communication channels, thereby improve management efficiency.

The units that underwent inspections included Keelung Customs, Taipei Customs, Taichung Customs, Kaohsiung Customs, and the Northern, Central, Southern, and Kinmen-Matsu-Penghu Branches of the Coast Guard Administration (CGA). In addition to the examination of 33 X-ray baggage (cargo) scanners and the 6 sealed radioactive materials, the AEC also inspected 11 container scanners at all ports in the country to ensure personnel safety. It has become a global trend to use MeV high-energy X-ray container scanners for better image contrast and resolution when checking the loading of containers and identifying suspicious cargos. However, the operators of the scanners are subject to higher risks of accidental exposure.

本次年度重點工作檢查，除要求各單位詳實建立輻射源料帳及輻射工作人員清冊，並藉由作業現場輻射偵檢，實際量測各單位輻射源曝露現況，確保管制區劃定合宜、安全連鎖裝置運作正常、人員曝露劑量符合法令規範，檢查後亦與受檢者進行雙向溝通討論，釐清受檢單位法規見解上的疑義，深入瞭解其實務執行面的困難後，據以提出具體可行作法，有效促使各單位強化輻射安全管理，確保人員及環境輻射安全。

（三）提升食品輻射檢測量能與檢驗品質，守護民眾食品輻安

自日本福島核電廠事故發生後，為加強日本輸臺食品的輻射安全檢驗，原能會核能研究所及輻射偵測中心即接受衛生福利部食品藥物管理署委託，依衛福部「食品中放射性核種之檢驗方法」執行其邊境採樣的檢驗，並於檢驗完成後，即時將結果送交食品藥物管理署核判。統計至 110 年，原能會核能研究所及輻射偵測中心每年約檢驗 13,000~18,000 件，目前每年共可提供約 3 萬件檢測量能，量能尚有 40% 以上餘裕。

為持續充實輻射檢測量能，確保食品安全，原能會 110 年 10 月 13 日邀集農委會、衛福部與財政部等部會及國內 7 間分析實驗室開會研議成立檢測小組聯盟，除將調查相關部會未來對於檢測數量的需求，提供實驗室擴充的考量依據，此外，目前食品藥物管理署之邊境採樣檢驗均交由原能會核能研究所及輻射偵測中心，檢測小組聯盟亦將協調檢測量能調度機制，研議將國內分析實驗室納入檢驗體系，以進一步提升國內食品輻射檢測量能。

In the annual inspection, all the units were required to establish detailed and reliable radiation source inventory records and radiation worker lists. Through on-site radiation detection, the current radiation exposure to the personnel of each unit was measured to ensure the appropriate designation of restricted areas, normal operation of safety interlock systems, and compliance with statutory requirements for radiation dose to personnel. After the inspection, the AEC and the inspected units communicated and discussed with each other to clarify the units' doubts about the regulations. The AEC provided specific and feasible solutions after gaining a deeper understanding of difficulties in actual practice to encourage the units to reinforce the management of radiation safety and ensure personnel and environmental radiation safety.

C. Boosting food radiation testing capacity and inspection quality to assure the radiation safety of food for the public

Ever since the Fukushima Nuclear Power Plant accident, the AEC's Institute of Nuclear Energy Research and Radiation Monitoring Center have carried out sampling inspection at the border based on the "Method of Test of Radionuclides in Foods" developed by the Ministry of Health and Welfare (MOHW) at the behest of the Food and Drug Administration (TFDA), MOHW, to further inspect food products imported from Japan to Taiwan for radiation safety. Once an inspection is completed, the result is immediately delivered to the TFDA for review and interpretation. Up to 2021, the AEC's Institute of Nuclear Energy Research and Radiation Monitoring Center inspected about 13,000–18,000 samples every year. With a maximum testing capacity of 30,000 samples per year, there is still more than 40% of the capacity remaining.

To continue expanding the radiation testing capacity and ensure food safety, the AEC invited the Council of Agriculture, MOHW, Ministry of Finance, and seven domestic analysis laboratories to a meeting held on October 13, 2021, to discuss forming a testing alliance to understand the relevant ministries' future requirements for the testing capacity and use these as a reference for expanding the capacity of the laboratories. In addition, the TFDA delegated the sampling inspection at the border to the AEC's Institute of Nuclear Energy Research and Radiation Monitoring Center. The testing alliance will also coordinate the allocation of the testing capacity and plan to include domestic analysis laboratories in the inspection system in order to further enhance the food radiation testing capacity in Taiwan.

為確保食品輻射檢測品質保證與分析能力要求，原能會規定執行單位應通過全國認證基金會（TAF）認證，並且要求通過認證之實驗室每 3 年均需執行一次能力試驗。目前原能會核能研究所及輻射偵測中心均率先通過並取得全國認證基金會及衛生福利部食品藥物管理署（TFDA）的雙認證，亦已輔導國內南北國立屏東科技大學、國立陽明交通大學取得雙認證，原能會也透過檢測小組聯盟的機制，敦促其他分析實驗室取得雙認證。在確保檢驗品質的前提下，提供國內充裕的食品輻射檢測量能，守護民眾食品輻安。

（四）密切關注大陸台山核電廠輻射異常事件，嚴密監控臺灣環境輻射變動

境外輻射事件對我國之影響，主要在於放射性氣體及液體之外釋，並透過大氣或海域擴散污染環境。因大陸沿海地區之核能電廠距離我國較近，是我國境外輻射事件之首要關注對象，目前大陸運轉中核電機組共 51 個，興建中機組有 14 個，原能會已掌握其運轉情形，嚴密監控相關異常事件，評估影響範圍，並採取相關民眾防護因應作為。

原能會為守護我國輻射安全，除全時監控國際訊息外，亦於全臺及離島已建置 63 座完整的環境輻射即時監測站，其範圍包括金門、馬祖、澎湖、彭佳嶼等離島地區，可提供即時及完整之輻射監測數據。此外，原能會與中央氣象局長期合作，將放射性物質大氣擴散模式與氣象預報系統結合，完成建置「國際核災輻射塵劑量評估系統」，可進行放射性物質大氣擴散路徑模擬與民眾劑量評估，另針對放射性液體對海域之影響，著手進行海域輻射背景調查作業，對沿岸海水、離岸海水、岸沙、海產品、沉積物等皆有進行計畫性取樣分析，建立臺灣海域輻射背景數據，透過加強取樣分析及比對工作，可了解事故之影響範圍及程度，並採取所需之應變措施。

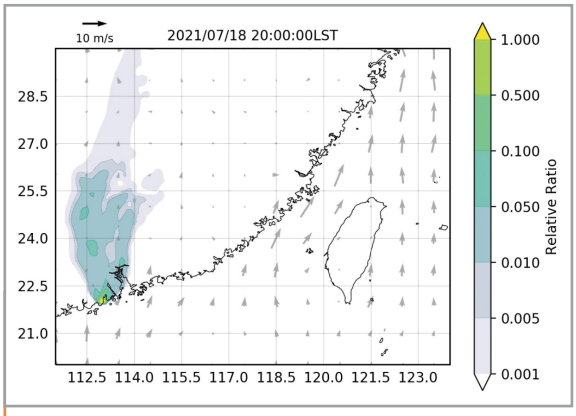
To ensure food radiation testing quality assurance and analytical competence, the AEC required the testing laboratories to receive accreditation from Taiwan Accreditation Foundation (TAF) and to take proficiency testing once every 3 years. The AEC's Institute of Nuclear Energy Research and Radiation Monitoring Center took the lead in getting accredited by the TAF and TFDA and assisted National Pingtung University of Science and Technology and National Yang Ming Chiao Tung University in acquiring the same accreditations. The AEC also encouraged other analysis laboratories to gain accreditations through the testing alliance. The AEC provides, with inspection quality ensured, sufficient food radiation testing capacity in Taiwan to assure the radiation safety of food for the public.

D. Paying close attention to radiation-related abnormalities in the Taishan NPP in China and closely monitoring changes in environmental radiation levels in Taiwan

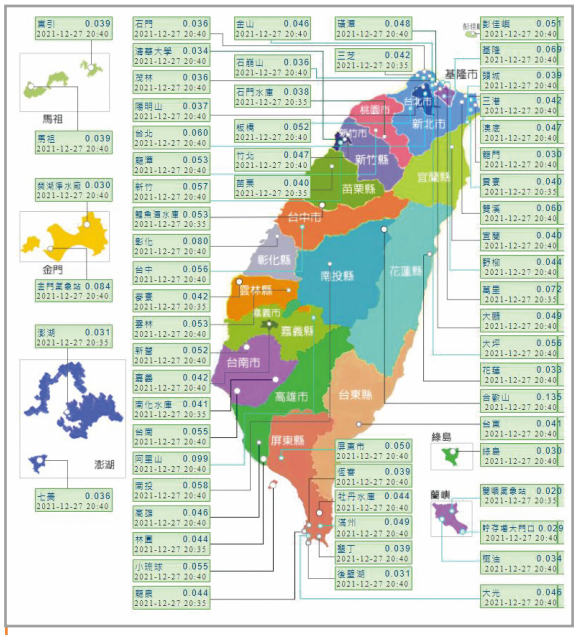
The main effect of overseas radiation accidents on Taiwan is the radioactive gaseous and liquid effluents would be dispersed via the atmosphere or sea areas and cause environmental pollution. For overseas radiation accidents, Taiwan primarily focuses on the coastal nuclear power plants in Mainland China as they are close to Taiwan. There are currently 51 nuclear power units in service and 14 units under construction in China. The AEC has fully acknowledged the operation of the units to closely monitor relevant abnormalities, assess their effects, and take actions to protect the public.

To ensure radiation safety in Taiwan, apart from keeping an eye on international news at all times, the AEC has established 63 complete real-time environmental radiation monitoring stations in place in the main island of Taiwan and outlying islands, including Kinmen, Matsu, Penghu, and Pengjia Islet, which offer real-time complete radiation monitoring data. Moreover, the AEC has collaborated with the Central Weather Bureau for a long time to integrate the diffusion behavior of radioactive materials in the atmosphere into the weather observation and forecasting system and built a "dose assessment system for radioactive fallout from nuclear disasters" to simulate the diffusion path of radioactive materials in the atmosphere and assess the radiation dose to people in Taiwan. For the impact of radioactive effluents on Taiwan's sea area, the AEC has undertaken a radiation background survey for the sea area by collecting the samples of coastal and offshore seawater, beach sand, marine products and sediments for analysis to establish radiation background data of Taiwan's sea area. Through enhanced sampling/analysis and comparison, the area subject to the impact caused by accidents and its severity can be comprehended, and the required countermeasures can be taken.

以 110 年大陸台山核電廠異常事件為例，原能會於第一時間立即加強我國環境輻射之監測作業，自事件發生迄今，已加強空氣輻射監測 157 件次、落塵水 44 件次，飲用水 554 件次，海水氚分析 27 件，並協助農委會完成海水樣本與魚體輻射檢測，目前結果均為正常。另原能會就所掌握之國際資訊，研判本事件屬燃料棒破損導致惰性氣體累積，可能造成放射性氣體之外釋，故為立即啟動「國際核災輻射塵劑量評估系統」，分析結果顯示，影響區域以大陸廣東及廣西省內陸為主，不致影響我國。未來原能會將持續掌握大陸沿海地區核電廠運行狀況，並執行海陸域環境輻射監測，一旦發現輻射異常，將第一時間對外界說明，以全民的原能會為己任，提供全民即時及正確之資訊，並啟動相關應變作為，守護國家、國民及產業之安全。



台山核電廠外釋放射性氣體之模擬，不致影響我國
Simulation of the release of radioactive gas from the Taishan NPP showed no impact on Taiwan



我國 63 座環境輻射監測
63 environmental radiation monitoring stations in Taiwan

（五）因應未來日本福島核災含氚廢水排放之監測措施及跨部會合作

原能會自 106 年起邀集相關部會研商推動「臺灣海域環境輻射監測調查計畫」，對臺灣附近海域進行輻射監測工作，故因應日本政府於 110 年 4 月 13 日宣布 2 年後將福島核災含氚廢水海洋排放之政策方針，原能會做為我國核能安全主管機關，即陸續邀集外交部、海洋委員會、農業委員會、衛生福利部、科技部等部會每季召開「日本福島第一核電廠含氚廢水排放跨部會因應會議」，以協調相關部會運用現有監測資源，強化臺灣海域輻射狀況調查工作。原能會持續以專業立場密切關注日本福島核災含氚廢水處置動態，以維護我國公眾健康及安全。

Take the incident that occurred in China's Taishan NPP in 2021 for example. The AEC immediately reinforced the monitoring of environmental radiation levels in Taiwan right after the occurrence of the incident. Ever since the incident, the AEC has completed 157 tests for monitoring the level of radiation in the air, 44 tests for water containing airborne particulates, 554 tests for drinking water, and 27 tests for analysis of tritium in seawater, and assisted the Council of Agriculture in testing seawater and fish samples for radiation levels. All the results showed no abnormality. The international information that the AEC obtained indicated that the incident resulting from inert gas accumulated due to broken fuel rods could cause the release of radioactive gas. Therefore, the AEC instantly used the "dose assessment system for radioactive fallout from nuclear disasters" for analysis and the result showed that the incident mainly affected inland Guangdong and Guangxi in China and had no impact on Taiwan. The AEC will keep monitoring the operation of the coastal nuclear power plants in China and performing environmental radiation monitoring for Taiwan's sea and land areas. Whenever a radiation abnormality is detected, the AEC will give an immediate explanation to the public. In the spirit of people's AEC, we will offer the public real-time correct information and take relevant countermeasures to protect the country, people, and industries.

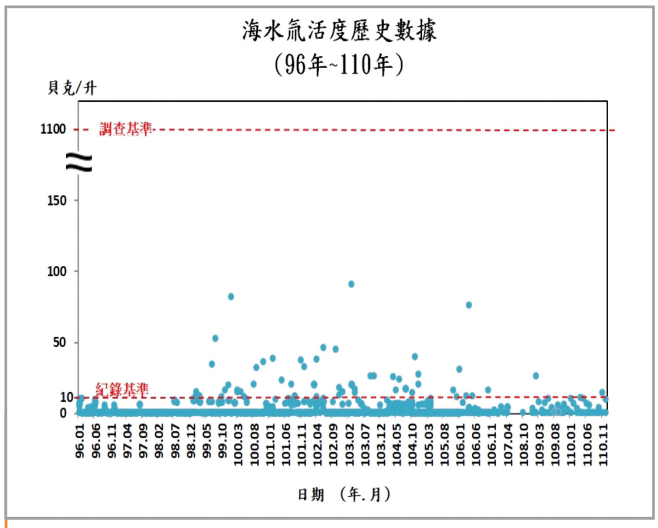
E. Monitoring measures and inter-ministerial cooperation for the future discharge of tritium-containing wastewater from the Fukushima nuclear disaster in Japan

Since 2017, the AEC has promoted the "program for environmental radiation monitoring and survey for Taiwan's sea area" with relevant ministries to monitor radiation levels in the sea area near Taiwan. In response to the Government of Japan's policy announced on April 13, 2021, for discharging the tritium-containing wastewater from the Fukushima nuclear disaster into the ocean 2 years thereafter, the AEC, as the competent authority for nuclear safety in Taiwan, further invited the Ministry of Foreign Affairs, Ocean Affairs Council, Council of Agriculture, MOHW, and Ministry of Science and Technology to the "inter-ministerial response meeting for the discharge of tritium-containing wastewater from the Fukushima Daiichi Nuclear Power Plant in Japan" convened quarterly to coordinate with relevant ministries to use existing monitoring resources and facilitate the survey on the radiation levels of Taiwan's sea area. The AEC continues to pay close attention to the disposal of the tritium-containing wastewater from the Fukushima nuclear disaster as a professional to maintain the health and safety of the public in Taiwan.

另一方面，由原能會協調相關政府及學術單位共同執行我國周圍海域之海水氚輻射取樣分析，於 110 年底已完成日本排放前之臺灣海域海水氚輻射背景值的建立，海水取樣位置計 99 個點位，總計分析海水氚 229 件，分析結果顯示，臺灣周邊海域海水樣品氚含量檢測結果皆小於最低可測值（MDA 為每公升 2.03 貝克），無輻射異常現象。

111 年原能會將持續執行「臺灣海域海水氚輻射監測計畫」，考量臺灣地理位置、洋流流向、海域分布、沿岸近海遠洋與深層分布之監測資料及實驗室分析量能等相關因素，擇定具代表性 106 個建議監測點位，預計執行 319 件海水樣品之氚分析。

第六次日本福島第一核電廠含氚廢水排放跨部會因應會議
6th inter-ministerial response meeting for the discharge of tritium-containing wastewater from the Fukushima Daiichi Nuclear Power Plant in Japan



臺灣周邊海域海水氚輻射背景
Background levels of tritium in seawater from the sea area around Taiwan

四、強化輻災應變與整備能量及資通安全防護

（一）核安演習兼顧防疫措施，確保災害應變量能

110 年核安 27 號演習以除役中之核能一廠為模擬事故電廠，雖事故風險相較為低，但仍務實參照電廠現況可能衝擊事故危害程度，積極整備演練，以儲備應變量能，演習區分兵棋推演與實兵演練二階段，並實施廠內無預警動員及廠外臨時抽演科目等。

Besides, the AEC, as the coordinator, worked with relevant government units and academic institutions on the sampling and analysis of tritium radioactivity in seawater from the sea area around Taiwan. At the end of 2021, the background levels of tritium in seawater from Taiwan's sea area before the discharge of Japan's radioactive wastewater were developed. The samples of the seawater were collected from 99 sampling locations, and a total of 229 tests were performed for analysis of tritium in the seawater. The analysis result showed that the concentration of tritium in the samples of the seawater from the sea area around Taiwan was lower than the minimum detectable activity (2.03 Bq/L), indicating no abnormal level of radiation was detected.

In 2022, the AEC will continue the implementation of the "program for monitoring the levels of tritium radioactivity in the seawater from Taiwan's sea area" and select 106 suggested representative monitoring locations for analysis of tritium in about 319 seawater samples while taking into account the geographical location of Taiwan, movement of ocean currents, distribution of waters, monitoring data of coastal and offshore seawater, ocean water and deep sea water, analytical capacity of laboratories, and other relevant factors.

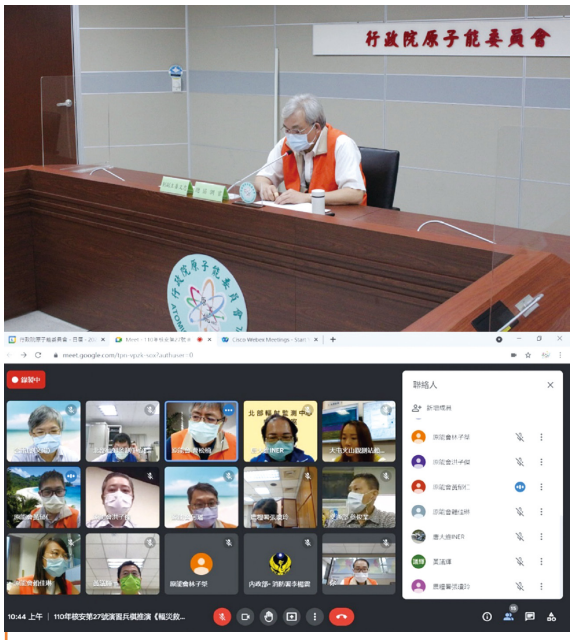
(IV) Enhancing Radiological Emergency Preparedness and Cyber Security

A. Nuclear Emergency Exercises along with the COVID-19 pandemic prevention measures to ensure adequate emergency response capabilities

AEC organized the 2021 Nuclear Emergency Exercise (No. 27) in the Chinshan Nuclear Power Plant under decommissioning, where a simulated accident occurred. Although the accident posed a relatively low level of risk, preparedness were performed in an active and practical manner according to the impact and damage that might be caused by the incident based on the current status of the NPP in order to increase response capabilities. The exercise was carried out in two stages: a table-top exercise and a full-scale exercise. In addition, an unannounced mobilization drill was performed on-site and randomly selected drill scenarios were conducted off-site.

1. 兵棋推演

考量國內疫情嚴峻，為兼顧國內防疫政策，首度採全視訊線上作業方式進行，整合中央與地方等 7 個應變中心透過使用視訊軟體及網路視訊會議平台，讓 256 位應變人員在彼此無法面對面狀況下，仍能各依職掌針對疫情、地震、火山併同核子事故發生的複合式災害想定，盤整全國救災資源、超前部署防救策略、研討核子事故解除時機，以及因應無預警狀況下達疫情更趨嚴峻下之作為等，在各參演單位妥善應變作為及相互協調合作下，順利以全視訊兵棋推演完成演練。



核子事故中央災害應變中心前進協調所演練
Table-top exercise at the Forward Coordination Post, National Nuclear Emergency Response Center

台電公司（含核一廠）演練
Table-top exercise at the TPC (including the Chinshan NPP)

2. 實兵演練

分別於 9 月 4 日及 9 月 9 日至 10 日辦理，參與人數計 4,014 人，說明如下：

（1）運用網路資通訊科技

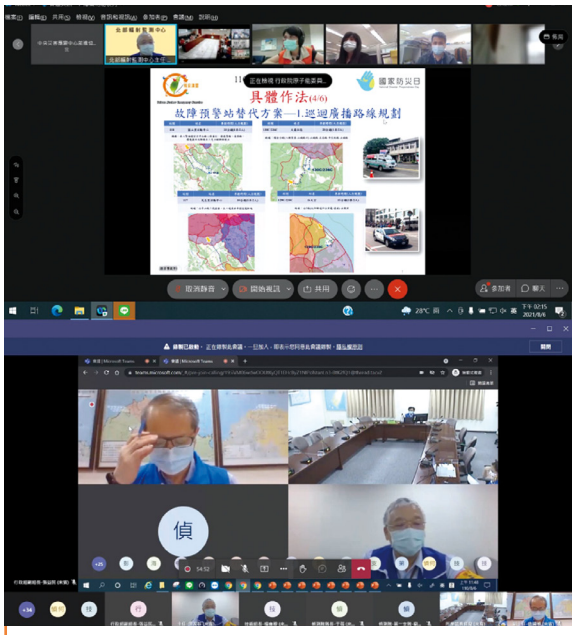
為落實各項演練及防疫措施，廠內演練採遠距視訊視察與評核作業方式進行，廠外演練亦以網路直播方式，讓更多民眾可以上線收視，瞭解政府應變作為。

a. Table-top exercise

Due to the severe pandemic, it was the first time that AEC conducted an exercise through video conferencing to follow the pandemic prevention policy of the government. Seven response centers worked concurrently using video conferencing software and online video conferencing platforms to allow a total of 256 response personnel, in a non face-to-face manner, to coordinate disaster relief resources, to draw up disaster reduction strategies in advance, to discuss the timing of lifting the warning for nuclear emergency, and to develop counter measures in an unexpected scenario that a complex disaster which the pandemic, earthquakes or volcanic eruptions and nuclear accidents occur at the same time. The table-top exercise through video conferencing was successfully completed due to the appropriate coordination and cooperation of all the participating units.

新北市災害應變中心演練

Table-top exercise at the New Taipei City Emergency Response Center



輻射監測中心演練

Table-top exercise at the Radiation Monitoring Center

b. Full-scale exercise

The exercise took place on September 4 and September 9th to 10th with 4,014 participants. It is described as follows:

(a) Use of information network and communication technology

To thoroughly carry out drills and pandemic prevention measures, the on-site drills were inspected and reviewed remotely through video conferencing, and the off-site drills were broadcasted live on internet to bring in more people to comprehend the government's nuclear emergency response measures.

陸海空域環境輻射偵測及漁獲偵檢演練
Land, sea, and airborne radiation monitoring and detection drill

三軍總醫院輻傷患者污染偵測演練
Contamination detection drill for patients with radiation injuries at Tri-Service General Hospital

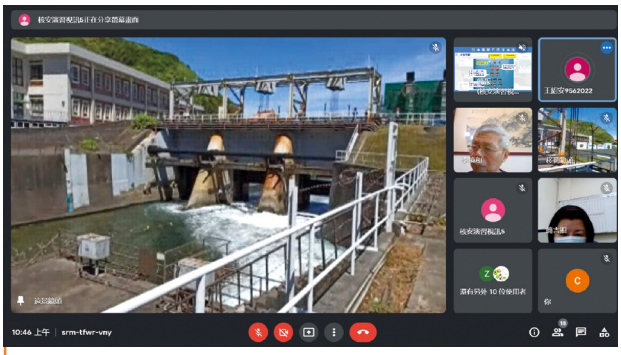
（２）疫情下維持核災應變能量

① 從嚴想定除役中核能一廠喪失所有廠內、外交流電源，並藉由無預警狀況發布，檢驗電廠人員在疫情期間對事故處理的應變能力；演練的內容包括確保廠內水源及電源的多重性與多樣性、斷然處置措施及移動式電源車列置等，另外也首度增列火山灰防護演練。

② 為能符合最新防疫要求及仍能達成演習目的，廠外演練以分區分時段及分流方式進行，執行陸海空域之環境輻射偵測整合及運作演練，以達應變人員專業技能之驗證。

（３）拓展訊息發布管道方面

發布訊息管道包括核子事故民眾預警警報系統、災防告警細胞廣播服務訊息 (CBS)、手機簡訊 (LBS)、民防廣播系統、警察廣播電台及國家災害防救科技中心民生示警公開資料平台等。此外，原能會另於演練前廣宣預告核子事故預警警報系統廣播時間，以及透過社群媒體向當地民眾傳遞演習訊息。



核能一廠海嘯閘門開啟演練（遠端視訊）
Tsunami gate operation drill at the Chinshan NPP (through video conferencing)

國軍人車輻射偵檢及除污作業演練
Military personnel and vehicle radiation detection and decontamination drill

(b) Maintenance sufficient nuclear emergency response capabilities during the pandemic

i. The exercise scenarios included: the Chinshan Nuclear Power Plant is under decommissioning and loss of both offsite and onsite AC electrical power. During the pandemic, the nuclear power plant operators exercised their response after unannounced scenarios issued. The drills covered the assurance of multiple water sources and power supplies, verifying the Ultimate Response Guidelines (URG), and use of power supply vehicle. It was also the first time that a volcanic ash drill was included in the exercise.

ii. To complete the exercise while complying with the latest pandemic prevention requirements, the off-site drills were conducted in different areas, times, and groups. A drill of integrated operation of land, sea and airborne environmental radiation monitoring were performed to verify the responders had the required professional skills.

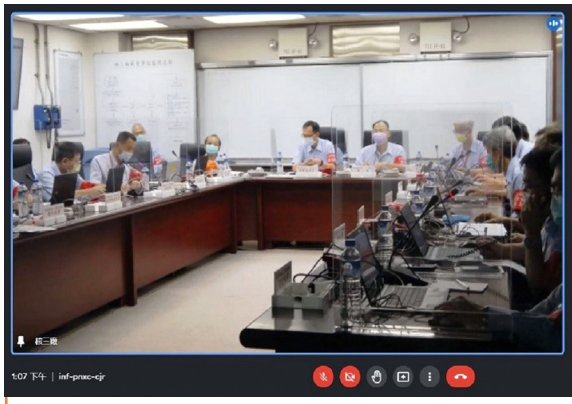
(c) Expanding message distribution channels

Message distribution channels include the Public Alert System for nuclear emergency, Cell Broadcast Service (CBS), Cellphone Alert System (LBS), Civil Defense Broadcasting System, Police Broadcasting Service, and the Public Alert Open Data Platform of the National Science & Technology Center for Disaster Reduction. AEC also informed, in advanced, the residents the nuclear alert broadcasting schedule, and disseminated the exercise information through social media.

（二）精進整備視察方法，確保電廠應變量能

1. 藉由遠端動態視訊視察，突破疫情限制，確保管制視察有效性

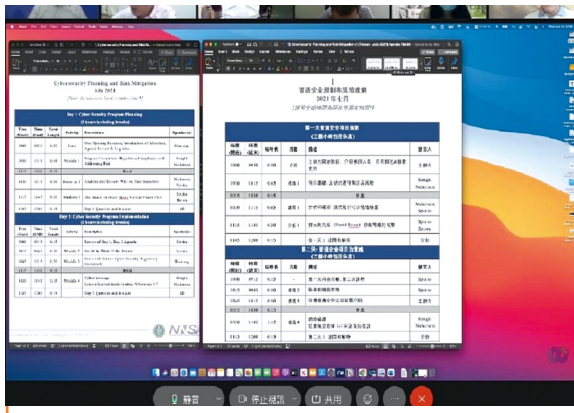
110 年 5 月進入疫情三級警戒後，在疫情限制下，以視訊方式有效如期執行各核電廠核子保安與緊急應變整備視察。在各核電廠年度緊急應變計畫演習的視察上，以創新做法執行遠端動態視訊視察，並逐次精進。此外，為惕勵緊急應變人員之警覺性與機動性，以視訊方式監控執行核一廠無預警動員測試，成效良好。為檢視核電廠對於保安事件的應變程序與量能，以視訊視察督導核一廠執行軍警海巡聯合實兵演練，核二、三廠實施保安應變桌上兵推演練，檢討精進保安防護效能與應變量能。



核三廠演習視訊視察畫面
Remote Inspection and video conference at the Maanshan NPP

2. 以視訊會議方式，克服時差限制，執行國際核設施資安訓練與技術交流

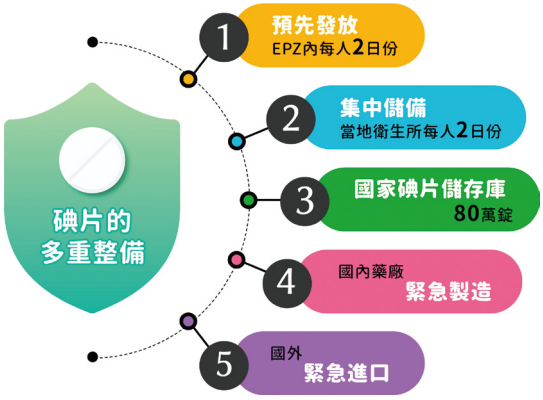
為強化核設施資安防護與應變效能，並兼顧 COVID-19 防疫措施及克服時差問題，於 7 月首次與美國能源部國家核子保安局（NNSA/DOE）辦理 3 天「核設施資通安全計畫與執行實務」全視訊訓練，研習核設施資安計畫與實施程序實務。疫情期間也持續以視訊會議方式進行國際技術交流，12 月以視訊方式與 NNSA 交流「核設施資通安全訓練用測試設備（Cyber-in-a-Case）」設計理念與使用方法，精進專業知能，維持與國際資安趨勢同步。



NNSA 核設施資通安全視訊訓練畫面
Video conferencing training for cybersecurity at nuclear facilities with NNSA

（三）核災應變能量盤點與防疫措施精進

為使核災應變與支援調度能有條不紊，原能會與相關部會及地方政府共同合作，以全國範圍進行核子事故應變相關人力物力、水資源、民生物資、碘片等備援調度機制之專案盤整，盤點成果並落實於核安演習演練精進，使我國核災應變更迅速有效。



碘片的多重整備機制
Multiple mechanisms for potassium iodine pills preparedness and delivery

B. Enhance inspection methodology to ensure sufficient response capabilities in nuclear power plants

a. Conducting remote inspections with a dynamic video conferencing system to overcome difficulties from the pandemic while assuring inspection and control effectiveness

In spite of the level 3 Alert due to the COVID-19 pandemic in May 2021, inspections on nuclear security and emergency preparedness in nuclear power plants were smoothly performed as scheduled through video conferencing. AEC inspected each nuclear power plant's annual nuclear emergency exercise remotely using an innovative approach: a dynamic video conferencing system. Also, in an effort to keep emergency response personnel stay vigilant and always be ready, an unannounced mobilization at the Chinshan NPP was implemented through video conferencing. In order to audit the response procedures and capabilities for security incidents at nuclear power plants, an joint exercise with the military, police and coast guard was conducted at the Chinshan NPP, and table-top exercises were carried out in the Kuosheng NPP and Maanshan NPP. All of the exercise were inspected and overseed through video conferencing.

b. Using video conferencing for international training course on nuclear facility cybersecurity

With the aim of improving cybersecurity as well as response cyber incidents capacities at nuclear facilities, and the COVID-19 prevention measures was implemented, AEC conducted a 3-day video conferencing training on "Nuclear Facility Cybersecurity Programs and Implementation Practices" by the National Nuclear Security Administration, Department of Energy (NNSA/DOE) of United States in July to look into cybersecurity programs and procedures for nuclear facility. During the pandemic, the international technical exchange has kept ongoing with the help of video conferencing tools. In December, a video conference was held for the technical exchange of the design concepts and use of " NPP cybersecurity training tool (Cyber-in-a-Case)" between AEC and the NNSA, in order to enhance AEC's expertise and knowledge as well as keep pace with the international cybersecurity trend.

C. Inventory survey on nuclear emergency response capability and enhancement on pandemic prevention measures

A nationwide inventory survey was conducted by AEC cooperated with relevant ministries and local governments on the manpower, water resources, daily necessities, potassium iodide pills and other spare parts for nuclear emergency. The survey results were introduced to the nuclear emergency exercises and drills, enabling a more rapid and effective emergency response.

另外，考量近年 COVID-19 疫情影響甚鉅，為確保疫情期間核災應變順利進行，原能會邀集核災相關應變單位共同討論，及納入中央流行疫情指揮中心意見，訂定「核子事故各應變中心因應嚴重特殊傳染性肺炎疫情之防疫措施及運作機制」及「嚴重特殊傳染性肺炎疫情期間實施核子事故民眾防護行動注意事項」，供各應變單位依循，以維災害應變能量，有效保護民眾安全。

（四）協助地方政府提升輻射災害防救能量

地方政府為各類災害第一線應變不可或缺的重要角色，輻射災害的整備應變，也需要中央及地方攜手合作。為充實我國輻射災害整體應變量能，原能會持續協助地方政府提升輻射災害防救能量。110 年著重協助地方政府提升第一線應變知能、掌握應變所需資訊，說明如下：

1. 辦理北中南東 4 場次「地方政府輻射災害防救講習」，透過輻射事件第一線應變注意事項與案例分享等課堂講授，輻射偵檢儀器操作與放射性物質意外事件模擬推演等實作訓練，使學員更了解輻射防護要領，強化學員輻災辨識、第一線應變能力。

2. 完成供地方政府應變使用之「放射性物質使用場所查詢系統」及「輻射災害第一線應變人員手冊」改版更新，更新內容以地方政府第一線應變需求為出發點，增加放射性物質防災處理方式等第一線應變所需資料，並利用圖像化方式，提高資訊使用友善性，有助地方政府進行輻射災害應變時，能更正確快速採取救援措施，確保人員安全。

地方政府輻射災害防救講習之模擬推演與儀器操作課程
Accident Simulation and Radiation Survey Meter courses in the Radiological Emergency Response Workshop for Local Governments

Meanwhile, considering the COVID-19 pandemic has caused a considerable impact recently, to ensure smooth nuclear emergency response during the pandemic, AEC invited the units responsible for nuclear emergency to formulate the "Pandemic Prevention Measures and Operation Mechanism for the Nuclear Emergency Response Centers in Response to the COVID-19 pandemic" and "Directions of Implementing Nuclear Emergency Public Protective Action During the COVID-19 pandemic" followed comments by the Central Epidemic Command Center, and then issued to the response units to implement. In this way, the emergency response capabilities could be remained effectively to protect the public safety.

D. Assisting local governments in improving radiation disaster prevention and response capabilities for radiation accidents

Local governments play critical roles in frontline responses to disasters. The preparedness and response for radiation accidents also involve the collaboration among central and local governments. AEC continues assisting the local governments in increasing prevention and protection capabilities for radiation accidents in order to extend Taiwan's overall capacity on radiological emergency response. In 2021, the focus was on helping the local governments' first responders to enhance their abilities on response and information collected for the emergency. The description is as follows:

a. AEC held four times of the "Radiation Disaster Prevention and Protection Workshops for Local Governments" in northern, central, southern and eastern regions. Through courses on emergency response guides in radiation accident and case studies, as well as using of radiation detectors and simulation of emergency involving radioactive materials, the participants could learn more about the principles of radiation protection and ability to identify and respond to a radiological emergency.

b. The "Search Platform for Locations Using Radioactive Materials" and "Handbook for First Responders to a Radiological Emergency" for responders were revised and updated. The update was based on the needs of the local governments first responders to provide treatment on radioactive material and other information for response. The user-friendliness of the data interface was also improved by using graphical design to display, so the responsers could respond more correctly and quickly to ensure people safety.

放射性物質使用場所查詢系統
Search Platform for Locations Using Radioactive Materials

輻射災害第一線應變人員手冊
Handbook for First Responders to a Radiological Emergency

（五）因應遠端連線需求，強化原能會資通安全防護

1. 建置遠端連線環境

因應 COVID-19 疫情，部份同仁採用居家辦公方式上班，原能會建置遠端連線環境，利用安全加密傳輸管道的 VPN 連線技術，使同仁於居家辦公期間亦能如常辦理公務，維持業務順利運作。

2. 管制連線設備，加強資通安全監控

為防範居家辦公遠端連線的資安風險，原能會針對連線設備進行管制，公務用筆記型電腦皆經過相關設定及檢查後配發，並要求同仁隨時執行作業系統及應用程式更新。另外亦調整資安設備設定，加強相關監控，積極處理可能之威脅，維護原能會資通安全。

強化遠端連線資安防護
Securing remote access for information security protection

3. 辦理資安健診及滲透測試

為能早期發現資訊系統弱點以儘速修補，避免被有心人士利用該弱點進行入侵行為，原能會依據資安法規定，進行資安健診、資訊系統弱點掃描及滲透測試，並積極完成修補作業，以強化資通安全防護。

E. Meeting the need for remote access, AEC strengthen the Cyber Security

a. Building a remote access environment

In response to the COVID-19 pandemic, AEC's staff were required to work from home. AEC thus built a remote access environment where virtual private network (VPN) connection with secured and encrypted transmission channels was used to allow the staff to do their jobs while working from home to ensure AEC's continued operations.

b. Controlling connected devices and enhancing cybersecurity monitoring

AEC has completed relevant settings and checks for the controlled connected devices and notebooks for working from home, and asked the staff to update operating systems and applications so that cybersecurity risks from remote access for work from home could be avoided. To maintain the cybersecurity, AEC have also adjusted the setting of cyber security devices, actively enhanced monitoring and dealing with possible external cyber threats.

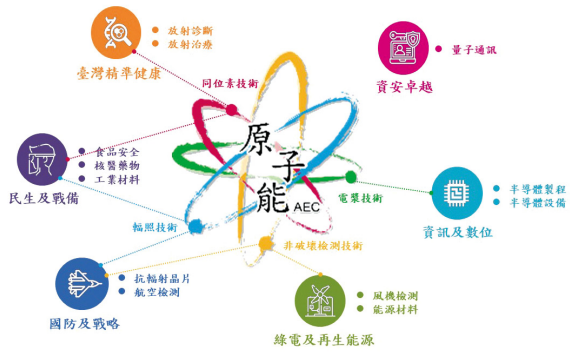
c. Conducting cyber security diagnostic assessment and penetration testing

Early detection and repair of vulnerabilities in an information and communication system can prevent people with bad intentions from using the vulnerabilities for invasion. In view of that, AEC has performed cyber security diagnostic assessment, vulnerability assessment and penetration testing pursuant to the Cyber Security Management Act, and actively fixed vulnerabilities to boost cybersecurity.

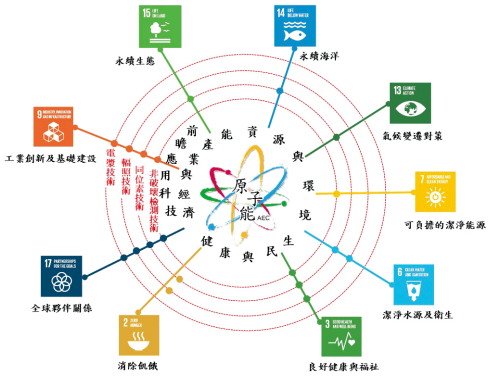
五、精進原子能科技研發

（一）推動科研轉型

因應非核家園能源政策，為推動原子能科研轉型，並拓展原子能民生應用，於 110 年已擬訂 111 ～ 114 年「原子能科技民生應用發展策略藍圖」草案，以「善用原子能技術，提升產業價值，促進永續發展」為目標，區分「健康與民生」、「能資源與環境」、「前瞻應用科技」與「產業經濟」4 大面向，共 45 項技術項目發展優先順序，以布局政府六大核心戰略產業政策所需原子能關鍵技術，實踐聯合國永續發展目標。



運用原子能技術提升六大核心戰略產業價值



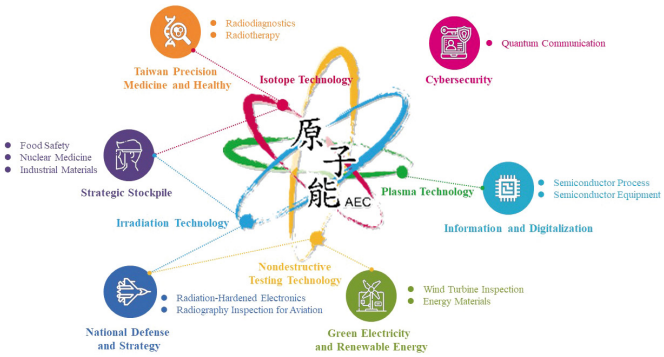
善用原子能技術實踐聯合國永續發展目標（參考國際原子能總署網站資訊）

為厚實國家原子能科技基礎研究能量，推動原子能跨域合作與創新，持續與科技部合作推動補助學術專題研究，佈局政府資訊及數位（半導體及 AI）、國防及戰略（太空產業）、精準健康（核醫藥物）、民生及戰備（糧食及物資）等核心戰略產業之原子能關鍵技術研究，另強化量子束基礎科學人才以及原子能相關議題之人文社會人才培育，俾相關研究成果及人才培育合於科技發展趨勢及產業需求。

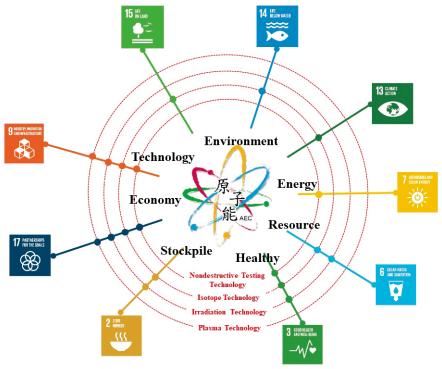
(V) Advancing the Research and Development of Atomic Energy Technology

A. Promotion of research transformation

In order to promote the research transformation of atomic technology and expand the civil uses of atomic energy to be in line with the Nuclear-Free Homeland Policy, AEC has developed the draft of "Development Strategy Blueprint for Civil Uses of Atomic Technology" for 2022–2025 in 2021. With "making use of the atomic energy technology to boost the industry value and facilitate sustainable development" as the objective, four main aspects are covered, comprising "health and livelihood," "energy, resource and environment," "forward-looking application technology" and "industry and economy." Then 45 technical characteristics are included in order of priority for development. This blueprint is aimed to help AEC develop the key technologies of atomic energy needed for the government's policy of six core strategic industries and achieve the United Nations Sustainable Development Goals (SDGs).



Application of atomic technology to boost the value of the six core strategic industries



Utilization of atomic technology to achieve the United Nations SDGs (with reference to the IAEA website)

To reinforce the basic research capability of atomic technology in Taiwan, interdisciplinary collaboration and innovation for atomic energy is promoted. AEC has been collaborating with the Ministry of Science and Technology, granting subsidies for related academic studies to facilitate the research in the key technologies of atomic energy for the government's core strategic industries, such as information and digital industries (semiconductor and AI), national defense and strategic industries (space industry), precision health industry (nuclear medicine and radiology), and strategic stockpile industries (food and supplies). In addition, strengthening the cultivation of talents of quantum beam science and education for humanistic quality focusing on atomic energy issues will be a priority. Through these actions, related research results and talent cultivation could meet to international trend of technology and domestic industry demands.

（二）含再生能源之智慧配（微）電網研發技術

總統頒發 110 年公務人員傑出貢獻團體獎合影
The President awarded the 2021 Civil Service Outstanding Contribution Award.

核研所於 91 年配合國家能源政策之推動，投入能源科技研發，以開發能源技術多樣化及推廣能源技術產業化為目標。自 98 年起參與政府能源國家型科技計畫與前瞻基礎建設計畫，深耕技術研發多年，其中能源領域已達到國際水準，技術深具競爭力。近年來，政府提升再生能源與推動淨零排放的政策目標，為因應大量再生能源併入電網，急需開發有別於傳統電網的控制技術，透過微電網與配電系統的關鍵技術發展，管理再生能源的間歇性發電特性，強化電網韌性與效能。行政院於 101 年核定「智慧電網總體規劃方案」，核研所為智慧電網推動小組成員之一，研究團隊便即致力於發展自主式區域（微）電網技術，奠定我國微電網關鍵技術基礎。配合行政院於 109 年 2 月修訂版之滾動式檢討，研發團隊朝電網管理構面發展本土化配電網路管理系統，協助台電於饋線發生事故時，達成快速復電的目標。其研發成果榮獲 110 年公務人員傑出貢獻獎團體獎殊榮，可概述以下三個面向。

1. 開發國內首座微電網系統

建置國內首座與台電高壓饋線併接的百瓩級微型電網示範系統，開發太陽光電、風機、儲能、及微渦輪機等分散式再生能源系統整合與能源管理協調控制技術，並提供產、學、研之實證試驗場域，可接受 20 公里外之台電桃園區處調度指令，執行微電網市電同步併聯、解聯與獨立運轉、需量卸載、及電力輸出輔助服務等運轉，並完成穩定輸出 100kW 與維持 4 小時的電力輸出輔助服務功能實測，驗證其技術可行性，具提升再生能源利用與抑低尖峰用電等效益，以提供政府修訂電業法的參考依據，奠定國內微電網之電力系統、電力電子、能源管理與智慧控制、及資通訊整合等關鍵技術發展基礎。研究團隊以「用於微電網之電壓控制系統及方法」專利技術，榮獲 110 年臺灣創新技術博覽會（TIE）發明競賽鉑金獎，並協助提升國內產業技術能量，進軍國際市場；開發「具平滑微電網功率之能源管理控制策略技術」，並技術移轉廠商，協助執行屏東縣政府「林邊光采溼地微型電網示範園區建置案」，獲得行政院科技會報主辦的智慧城市創新應用獎優勝；以「18kW 防災型微電網之能源管理控制策略技術」技術移轉廠商，協助執行新北市烏來區公所再生能源微電網建置案；以「防災型微電網之能源管

B. R&D of the technology of intelligent distribution network and microgrid incorporating renewable energy

INER started devoting to the Research and Development (R&D) of energy technology in 2002 to conform with the implementation of the national energy policy, aiming to develop diversified energy technologies and encourage the industrialization of energy technologies. Since 2009, INER has been taking part in the government's National Energy Program and Forward-looking Infrastructure Development Program, and has been dedicating to the technology R&D for years. Cultivating the highly competitive technology, its technical level in the energy field has reached the international standards. With the government's policy goals of renewable energy enhancement and net zero emission in recent years, a great deal of renewable energy is going to be integrated into the power grids. There is thus an urgent need for the development of a control technology, which is different from that for conventional grids, so that the instability of renewable energy can be managed, and the resilience as well as performance of grids can be strengthened through the key technology development of microgrid and distribution system. The Executive Yuan approved the "Smart Grid Master Plan" in 2012, and INER is one of the members of the Smart Grid Task Force. The research team, devoted to the technology development of autonomous regional microgrids, has laid the foundation for the key technologies of microgrid in Taiwan. Conforming with the Executive Yuan's adjustment made through rolling planning in February 2020, the research team has developed the domestic distribution network management system for the grid management aspect to assist Taiwan Power Company (TPC) with rapid power restoration when an accident happens to the feeder. The R&D results thereof, won the Civil Service Outstanding Contribution Award for teams in 2021, can be summarized based on the following three aspects.

a. Development of the first microgrid system in Taiwan

The team has set up the first domestic 100kW microgrid demonstrate site connected to TPC's high-voltage feeders, and developed the technology of distributed renewable energy system integration as well as energy management, coordination and control for solar photovoltaic energy, wind turbine, energy storage and micro-turbine, etc. Also, there are areas provided for the evidence-based experiments of the industries, schools, and research institutes. Coordination commands from the TPC Taoyuan Branch located 20 km away can be received to execute the synchronization operation with utility grids, disconnection, island-mode operation, demand load shedding, power output ancillary service, etc., of the microgrids. In addition, the team has completed the experiment of stable 100kW output and 4-hour operation of the power output ancillary service, providing the government with a

理控制」技術移轉廠商，協助台電於新北市烏來區福山國小建置防災型微電網系統，該系統在災害停電時，仍可自主運轉長達 14 天，讓福山揮別颱風孤島、走向綠能部落，為國內首座偏鄉防災型微電網。

核研所百 kW 級微電網系統

榮獲 110 年 TIE 發明競賽鉑金獎
Recognition with the Platinum Award of the 2021 TIE Invention Awards

2. 離島微電網系統實例應用

研究團隊開發高占比再生能源離島微電網系統關鍵技術，於核研所微型電網場域中，透過再生能源、儲能系統、及柴油發電機的實測驗證，完成再生能源發電與負載用電預測、最佳化機組排程、及整合分散式能源協調等智慧控制功能開發，並應用於核研所實際館舍用電，進行高占比再生能源微電網 100 小時連續孤島運轉測試，期間再生能源發電量占比 54%，瞬間滲透率最高 135%，系統仍能穩定運轉。相關技術在核研所微電網試驗場測試成功後，研究團隊開始進行實際場域應用之規劃，著手協助澎湖縣政府於澎湖東吉嶼完成國內首座離島再生能源微電網系統建置，有效降低離島發電成本，並商轉成功，其中再生能源發電量占全島用電量之最高瞬間占比 92.8%，系統仍能穩定運轉。因此，研究團隊與技轉廠商進一步共同以「澎湖東吉嶼微電網供電系統」參加 106 年亞太經濟合作會議（APEC）智慧電網最佳案例競賽（Best Practice Award），並榮獲銀質獎，為國爭光，後續將相關技術移轉廠商，提升國內產業技術能力，配合南向政策，進軍東南亞離島電力市場。

澎湖東吉嶼微電網建置
Microgrid setup on the Dongji Islet, Penghu

reference for the amendment to the Electricity Act by verifying that the technology applied is feasible and offers the benefits such as increasing the renewable energy penetration and reducing the peak net load. These achievements have laid the groundwork for Taiwan's development of key technologies including the power system, power electronics, energy management and smart control, and Information and Communication Integration (ICT) with microgrids. With the patented technology "Voltage Control System and Method for Microgrid," the research team was honored with the Platinum Award of the 2021Taiwan Innotech Expo (TIE) Invention Awards, and has enhanced the domestic industrial technology capability to push Taiwan forward to the international market. Moreover, the team has developed the "Strategic Technology of Energy Management and Control with Smoothing Microgrid Power" and made technology transfer to manufacturers to support Pingtung County Government's "Establishment Plan of Microgrid Demonstration Park in Guangtsai Wetland, Linbian," further winning the first prize of the Smart City Innovation Award hosted by the Board of Science and Technology, Executive Yuan. With the "Strategic Technology of Energy Management and Control with 18 kW Disaster-Preventing Microgrid" transferred to manufacturers, the team assisted in the implementation of the renewable energy microgrid setup plan of Wulai District Office, New Taipei City. Also, with the "Strategic Technology of Energy Management and Control with Disaster-Preventing Microgrid" transferred to manufacturers, the team has assisted TPC with the setup of the disaster-preventing microgrid system in Fushan Elementary School, Wulai District, New Taipei City; the system, which is the first disaster-preventing microgrid system in remote areas in Taiwan, can autonomously run for up to 14 days when power failure occurs due to any disasters, allowing Fushan Tribe to have support when isolated by Typhoon and become a green energy tribe.

100 kW microgrid system in INER

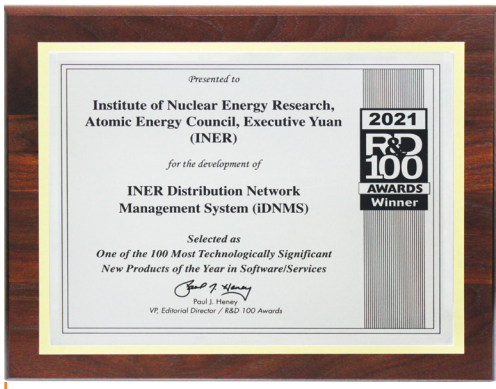
b. Practical application of microgrid system on the outlying island

The research team has developed the key technology of outlying island microgrid system with high penetration of renewable energy, and has, through the practical testing and verification of renewable energy, storage system and diesel generator, completed the generation of renewable energy and load forecasting, optimized the unit commitment, and integrated the development of smart control functions such as distributed energy coordination in the microgrid field of INER. This technology was applied to the power use in the buildings of INER for uninterrupted 100-hour islanding operation test of the microgrid system with high penetration of renewable

3. 本土化配電網路管理系統應用

研究團隊與台電合作，開發本土化配電網路管理系統，跨域整合國內電力監控與地理空間資訊產業，創造新合作領域，並實際於台電雲林區處配電調度中心上線運轉，即時管理雲林縣全縣配電系統 300 多條饋線、700 多 MW 再生能源發電與 58 萬用戶用電狀況，並整合配電饋線監控、地理空間資訊、及電力潮流程式運算等配電管理應用功能開發，提供台電配電調度人員進行配電管理及調度參考，協助台電於饋線事故發生時，達成 5 分鐘內快速復電，提升再生能源與配電系統的管理能力，其應用亦將陸續推廣至國內其他縣市，有效管理全臺 4,000 多條配電饋線，協助政府推動再生能源與智慧電網的政策目標。此外，研究團隊以「含綠能之先進配電管理系統」技術移轉產業，扶植國內系統廠商，強化其配電轉供決策及地理空間資訊整合應用技術基礎，進軍東南亞之配電饋線自動化市場；以「含綠能之配電饋線轉供方法」專利技術，榮獲 109 年臺灣創新技術博覽會（TIE）發明競賽鉑金獎，並以「區域（配）電網強韌性研究與技術發展」參與科技部 110 年舉辦之「Taiwan GET ！國際論壇暨成果發表會」展示計畫研發成果，在共計 64 項研究計畫中，獲選為 17 項亮點計畫之一，並於研發成果競賽評比榮獲第一名；110 年更以「智慧配電網路管理系統（iDNMS）」技術，奪得素有科技產業奧斯卡之稱的全球百大科技研發獎（R&D 100 Awards），科技研發實力受到國際肯定。

本土化配電網路管理系統於台電雲林區處上線運轉
Domestic distribution network management system running in TPC Yunlin Branch



R&D 100 Awards 獎牌
R&D 100 Awards

（三）核研多蕾克鎵肝功能造影劑技術開發——從實驗室邁入臨床試驗

1. 開發背景

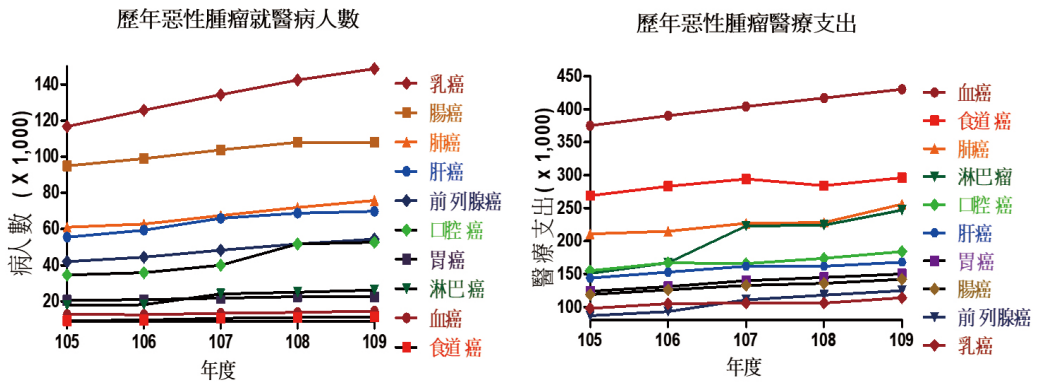
依據衛生福利部過去五年數據統計，因為肝臟疾病就診人數由每年 55,000 人增加到 69,000 人，而醫療健保支出也從平均每人 14 萬元增加為每人 16.8 萬元，在癌症十大健保醫療支出中排名第六位；但從癌症死亡率來看，109 年肝和肝內膽管癌排行第 2 位，其中又以肝癌為主因，可見肝癌早期診斷仍是重要的公共衛生課題。

energy; during the period, the percentage of renewable energy generation was 54% while the instantaneous penetration reached 135% at most, and the system continued running stably. After the relevant technology passed the test at INER's microgrid testing site, the research team started the planning of practical application, supporting the Penghu County Government to set up Taiwan's first renewable energy outlying-island microgrid system on Dongji Islet to effectively reduce the island's power generation cost. The system, successfully turned into commercial operation, showed an instantaneous penetration of renewable energy generation up to 92.8% on the islet while the operation remained steady. The research team, together with the technology transfer manufacturer, further won the silver award of the 2017 Best Practice Award of Asia-Pacific Economic Cooperation (APEC) under the category of smart grid with the "Penghu Dongji Islet Microgrid Power Supply System". After winning such an honor for the country, the research team transferred the technology to manufactures to enhance the industrial technology capacity in Taiwan, and marched towards the outlying island electricity market of Southeast Asia to fit the Southbound Policy.

c. Application of domestic distribution network management system

The research team has worked with TPC to develop the domestic distribution network management system, achieved interdisciplinary integration of the power supervision and the geospatial information industries in Taiwan, and created new possibilities of collaboration. The system has been applied to the Power Distribution Center of Yunlin Branch, TPC, and delivers real-time management of more than 300 feeders, renewable energy generation of more than 700MW, and the power use of 580,000 households for the distribution system of the whole Yunlin County. It integrates the development of distribution management application functions such as Supervisory Control and Data Acquisition (SCADA), Geographic Information System (GIS) and power flow program operation to assist the dispatchers of TPC with the distribution management and coordination, so that rapid power restoration by TPC within 5 minutes is possible when an accident happens to the feeder. The system will be further introduced to other cities and counties in Taiwan to support the government's implementation of the policy goals regarding the renewable energy and smart grid by effectively managing a total of more than 4,000 feeders in Taiwan. In addition, the research team has transferred the technology of "Advanced Distribution Management System with Green Energy" to different industries, enhancing the technical level of the system manufacturers in Taiwan, strengthening their decision-making ability for power load transfer and their basic technology of geospatial information integration application, and pushes them towards the distribution feeder automation market of Southeast Asia. The team won the Platinum Award of the TIE Invention Awards in

肝臟疾病依疾病進程包含慢性肝炎、肝硬化及肝癌，在發現肝臟疾病後一定要積極治療，並且定期追蹤。只要早期發現肝癌，就有機會做手術進行根除治療。臨床上進行手術前必須評估病患肝功能，避免術後發生肝衰竭的情形。國際上現階段並沒有準確的肝功能定量分級技術，因此核研所開發核研多蕾克鎵肝功能造影劑，期望可輔助醫師對肝功能進行更準確的評估與測定。

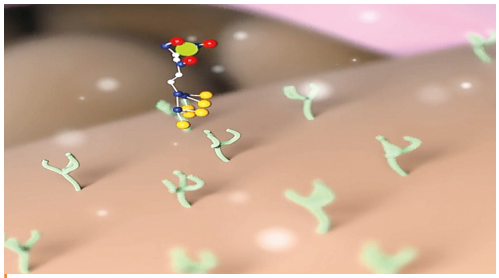


全民健保惡性腫瘤就醫病人數與醫療支出歷年統計（資料來源：衛福部　製圖：核研所）

2. 核研多蕾克鎵肝功能造影劑的概念設計

正常肝細胞表面有一特殊受體——去唾液酸醣蛋白受體（Asialoglycoprotein Receptor, ASGPR），透過與醣蛋白上的半乳醣基結合並攝入細胞內，來代謝血液中老化的醣蛋白，隨著肝病惡化，肝實質細胞死亡，此受體會逐漸減少，故評估受體的數量可反應肝臟的功能。研究顯示去唾液酸醣蛋白受體會與具乳糖（Lactose）基的醣胜肽結合，核研所透過具乳糖基的醣胜肽鍵結 NOTA 螯合基，發展成能夠進一步螯合放射性同位素鎵 -68 的肝受體正子造影劑。

核研所開發的核研多蕾克鎵肝功能造影劑具有良好的標靶特性，能夠特異標靶到肝細胞表面的去唾液酸醣蛋白受體，僅須極低的劑量（微克級），結合放射性同位素鎵 -68 後，透過正子造影可區分病人體內肝癌細胞與正常肝細胞，因此能夠進一步定量肝癌病人的肝臟功能，供醫師評估切肝手術時的切除範圍。



藥物的高特異性可將放射性同位素導引到肝臟受體，因而可以顯影出肝受體的數量
The drug leads the radionuclides to the liver receptors with its high specificity, so the number of liver receptors can be shown through imaging

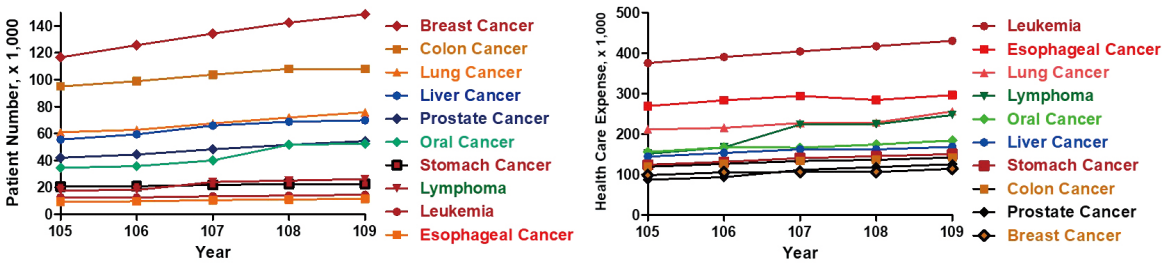
2020 with the patented technology "Load Transfer Method for Distribution Feeder with Green Energy." Also, they participated in the "Taiwan GET! International Forum and Result Presentation Conference" hosted by the Ministry of Science and Technology in 2021 to present the R&D results of the "Research and Technology Development for Resiliency Enhancement of Regional Distribution Power Network," which was selected as one of the 17 highlights among the 64 research plans, and won the first prize in the R&D result competition. The research team even won the best honor in the technology industry, R&D 100 Awards in 2021 with the technology of "Intelligent Distribution Network Management System (iDNMS)," which implies that the technology R&D capacity is internationally recognized.

C. From Benchtop to Bedside- INER Dolacga Liver Reserve Imaging Agent

a. Background of development

According to the statistics over the past five years by the Ministry of Health and Welfare, the number of people seeking medical treatment due to liver diseases has grown from 55,000 to 69,000 per year, and the relevant average national health expenditure has increased from NT$140 thousand to NT$168 thousand per person, which ranked sixth in the top-ten health expenditures for cancers. However, the liver cancer and cholangiocarcinoma ranked second in 2020 when it comes to the mortality rate of cancers, and most of them are liver cancer cases, showing that early diagnosis of liver cancer is still a critical public health issue.

Liver disease progression includes chronic hepatitis, liver cirrhosis and liver cancer; when any liver diseases are discovered, curative care and regular follow-up are necessary. As long as the liver cancer is discovered early, it is possible to receive curative surgical treatments. According to the clinical procedure, an assessment of the patient's liver reserve is required before the surgery to avoid post-operative liver failure. As there has not been any international technology to give accurate quantitative rating of liver reserve, the INER Dolacga Liver Reserve Imaging Agent has been developed in the hope of supporting doctors to assess and measure the liver reserve with higher accuracy.



Statistics on the number of patients seeking medical care for malignant tumors and the national health expenditures thereof over the past few years (source: MOHW; chart: INER)

3. 創新與應用

透過多聚醣肝受體正子造影凍晶藥劑之技術開發，核研所自行研發之核研多蕾克鎵肝功能造影劑具有高專一性、低背景值、高靈敏度、凍晶即溶、標誌快速（15 分鐘）、穩定性佳等優勢，至今已獲得全球專利超過 20 件，並且於國內外獲獎，分別為 102 年國家新創獎、103 年紐倫堡發明獎、104 年臺北國際發明鉑金獎、108 年新創精進獎、109 年國家發明創作獎銀牌以及 110 年臺灣創新技術博覽會發明競賽鉑金獎。

核研多蕾克鎵肝功能造影劑於民國 108 年於臺大醫院完成第一期臨床試驗，受試者接受理學檢查、監控生命徵兆與尿液、血清生化等檢驗，以上檢驗數值皆正常且無任何不良反應通報。今年於林口長庚醫院啟動第二期臨床試驗，針對切肝換肝病人族群，預計於 111 年完成臨床試驗。未來將成立一個穩定供藥平台，期望與各大醫院合作，使用核研多蕾克鎵肝功能造影劑於肝癌確診以及實際肝功能診斷。希望在核研所研究團隊的努力下，能夠提供給全國醫院一個更準確、更方便的肝功能評估工具，輔助醫師做出最合適的治療決策。

核研多蕾克鎵肝功能造影劑
INER Dolacga Liver Reserve Imaging agent

（四）核研所除役用低放射性廢棄物盛裝容器開發與應用

1. 背景說明

因應核研所擁有的臺灣研究用反應器（Taiwan Research Reactor）爐體廢棄物拆除需求，另鑒於我國當時沒有針對核設施除役產生的低放射性廢棄物所開發設計之盛裝容器，核研所於民國 105 年責成該所的工程技術與設施運轉組，成立容器的開發與應用技術團隊，著手開發適用於臺灣研究用反應器爐體廢棄物拆除作業所需的容器。由於臺灣研究用反應器爐體拆除產生之廢棄物具有不同的輻射強度，在符合安全要求的前提下，核研所規劃開發二款不同的低放射性廢棄物盛裝容器（以下簡稱低放容器），以經濟有效地盛裝不同輻射強度的低放射性廢棄物（以下簡稱低放廢棄物）。於 105 至 109 年度間，核研所開發出 INER-LRW-C1 與 INER-LRW-C2 兩款容器（以下簡稱 C1 與 C2 容器），而相關之容器使用申請書已分別於 109 年 1 月與同年 11 月獲得行政院原子能委員會放射性物料管理局的同意核備，為我國為核設施除役所開發的低放容器之首二例。C1 與 C2 容器目前已取代原先臺灣研究用反應器爐體廢棄物拆除所規劃使用的 55 加侖鋼桶，改用 C1 與 C2 容器除可節約爐體切割所需的資源外，另可提升作業的安全性，有助於臺灣研究用反應器爐體廢棄物拆除任務的達成。

b. Concept design of the INER Dolacga Liver Reserve Imaging Agent

Asialoglycoprotein receptors (ASGPRs), the special receptors residing on the surface of normal liver cells, bind the terminal galactose residues on glycoproteins and enter the cells to remove the aged glycoproteins in the blood. When the liver disease deterioration leads to hepatocyte death, these receptors gradually decrease as well. Thus, the liver reserve can be reflected through the number of the receptors. INER has successfully developed an ASGPR positron emission tomography (PET) imaging agent with the terminal lactose residues of glycopeptide and chelating ligand NOTA conjugated that can chelate the radionuclide gallium-68, and the research showed it binds with ASGPRs efficiently.

INER Dolacga Liver Reserve Imaging Agent has excellent targeting ability and can specifically target to the ASGPRs on the liver cell surface. With just an extremely low dose (mcg) chelating the radionuclide gallium-68, the positron imaging can differentiate the liver cancer cells and normal liver cells in a patient's liver and therefore give quantitative rating for the liver reserve, which is beneficial for doctors to assess the resection range of liver resection surgery for the liver cancer patient.

c. Innovation and application

With the technology development of a lyophilized multivalent glycoside product for liver receptor PET imaging, the Dolacga Liver Reserve Imaging Agent developed by INER has the advantages of high specificity, low background levels, high sensitivity, lyophilization with rapid dissolvability, fast radio-isotope labeling (15 mins), great stability, etc. This imaging agent has received more than 20 patents around the world and earned awards in Taiwan and abroad, including the 2013 National Innovation Award, 2014 iENA Award, Platinum Medal at the 2015 Taipei International Invention Show, 2019 Excelsior Award of the National Innovation Award, Silver Medal of the 2020 National Invention and Creation Award, and Platinum Award in the invention competition of the 2021 Taiwan Innotech Expo.

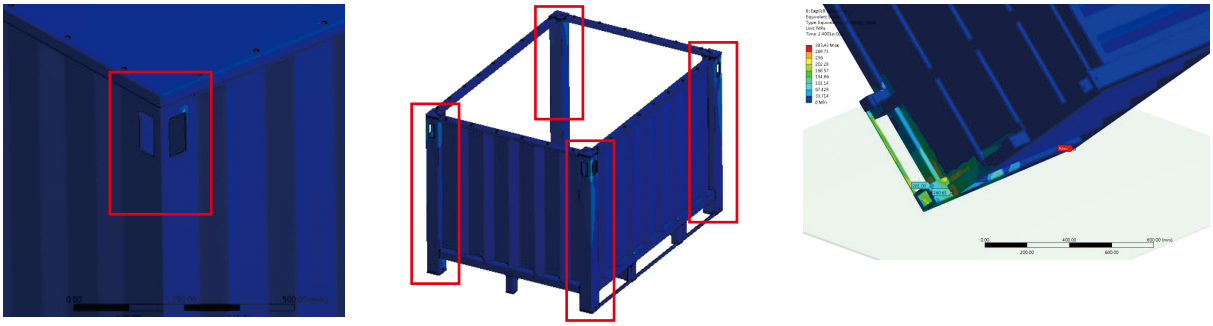
The Phase I clinical trial of the INER Dolacga Liver Reserve Imaging Agent was completed in the National Taiwan University Hospital in 2019. The subjects received physical examination, vital sign monitoring, urine, and serum biochemical tests, etc.; the test results thereof were all normal, and no adverse effect was reported. The Phase II clinical trial has started in Chang Gung Memorial Hospital, Linkou this year, with the patients of liver resection and liver transplantation as the target group. The clinical trial is planned to be completed in 2022. A platform for stable drug provision will be established in the future in hope of working with different hospitals to use the INER Dolacga Liver Reserve Imaging Agent for the diagnoses of liver cancer and actual liver reserve. It is hoped that with the INER research team's effort, all the hospitals in Taiwan can be provided with a more accurate and convenient liver reserve assessment tool that supports doctors to figure out the best treatment.

（a）　（b）

容器原型：（a）C1 容器 （b）C2 容器
Container prototypes: (a) C1 container (b) C2 container

2. 開發概述

為滿足未來臺灣研究用反應器爐體拆除廢棄物盛裝需求，C1 與 C2 容器除須具有貯存功能外，另須具備符合第二型工業包件的運輸能力。依據法規要求，於申請容器使用許可前，容器設計須通過靜態與動態的結構分析，並對容器的熱傳與屏蔽能力作相關評估，確定相關能力後續對容器耐久度與使用性的影響。此外，當容器的設計通過分析驗證後，據此設計所製造的容器原型，另須通過噴灑試驗、振動試驗、吊掛試驗、貫穿試驗、堆積試驗與自由墜落試驗，其中自由墜落試驗包含了正向墜落試驗與傾角墜落試驗。待相關的分析與試驗完成並通過後，分析與試驗結果須彙整，並節錄於容器的使用申請書中。



（a）　（b）　（c）

C1 容器分析：（a）吊掛孔分析 （b）堆積分析 （c）自由墜落分析
Analyses of C1 container: (a) hanging hole analysis (b) stacking analysis (c) free drop analysis

D. Development and application of the INER low-level radioactive waste containers for decommissioning

a. Introduction of background

As the dismantling of wastes in the core barrel of the Taiwan Research Reactor (TRR) owned by INER was needed, and that there was no container developed and designed in Taiwan for the low-level radioactive wastes resulting from the nuclear facility decommissioning, INER assigned the Engineering Section in 2016 to organize a technical team for the development and application of containers to develop the containers applicable to the dismantling of wastes in the core barrel of TRR. Since the wastes resulting from the dismantling of TRR core barrel have different radiation intensity, INER has, with the safety requirements satisfied, planned to develop two different low-level radioactive waste containers (hereinafter "LLRW containers") to cost-effectively contain the low-level radioactive wastes (hereinafter "LLRW") with different radiation intensity. During 2016 to 2020, INER developed two containers: INER-LRW-C1 and INER-LRW-C2 (hereinafter referred to as C1 and C2 containers), and the applications for the use of the containers has been reviewed and approved by the Fuel Cycle and Materials Administration, Atomic Energy Council, Executive Yuan in January and November respectively in 2020, making them the first two LLRW containers developed for the nuclear facility decommissioning in Taiwan. The C1 and C2 containers have currently replaced the 55-gallon steel drums initially planned to be used for the dismantling of wastes in the core barrel of TRR. The replacement with the C1 and C2 containers can not only save the resources needed for the core barrel cutting but also enhance the safety of the procedure, which is helpful for the dismantling of wastes in the TRR core barrel.

b. Overview of development

To meet the future requirements for containing the wastes resulting from the dismantling of TRR core barrel, the C1 and C2 containers must also have the transport capacity corresponding to the Type 2 industrial packages in addition to the storage function. According to the laws and regulations, before applying for the use permit of a container, the container design shall pass the static and dynamic structural analyses, and the heat transfer capability as well as shielding ability of the container shall be assessed to make sure the further impacts of relevant capacities on the durability and usability of the container. Moreover, after the container design is verified through the analyses, the container prototype produced based on the design is required to pass the water spray test, vibration test, hanging test, penetration test, stacking test and free drop test; the free drop test includes straight drop test and angle drop test. After completing and passing the related analyses and tests, the analysis and test results must be compiled and attached to the container use application.


（a）


（b）


（c）


（d）

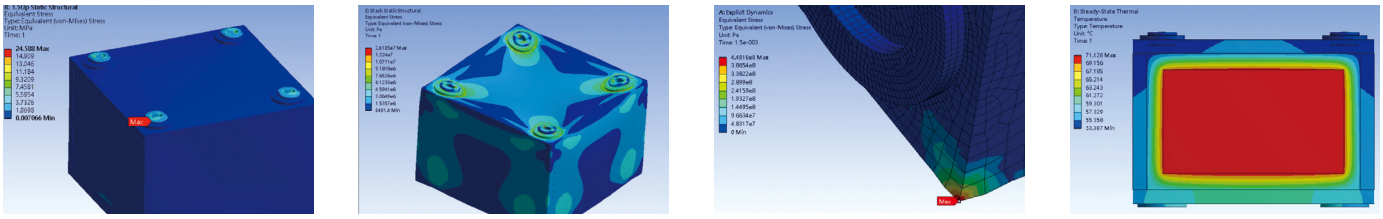

（e）


（f）

C1 容器試驗：（a）噴灑 （b）吊掛 （c）振動 （d）堆積 （e）正向墜落 （f）傾角墜落
Tests on C1 container: (a) water spray (b) hanging (c) vibration (d) stacking (e) straight drop (f) angle drop

3. 應用規劃與貢獻

核研所開發的 C1 與 C2 容器已開始用於盛裝臺灣研究用反應器爐體拆除廢棄物，依據臺灣研究用反應器爐體拆除廢棄物盛裝規劃，爐體拆除工作預計將使用 550 只的 C1 容器與 24 只的 C2 容器，而盛裝相關拆除廢棄物的 C1 與 C2 容器，將暫時貯存在核研所內核可的貯存設施中。



（a） （b） （c） （d）

C2 容器分析：（a）吊掛孔分析 （b）堆積分析 （c）自由墜落分析 （d）熱傳分析
Analyses of C2 container: (a) hanging hole analysis (b) stacking analysis (c) free drop analysis (d) heat transfer analysis

（a） （b） （c）

（d） （e） （f）

C2 容器試驗：（a）噴灑 （b）吊掛 （c）振動 （d）堆積 （e）正向墜落 （f）傾角墜落
Tests on C2 container: (a) water spray (b) hanging (c) vibration (d) stacking (e) straight drop (f) angle drop

c. Application planning and contribution

The C1 and C2 containers developed by INER have started to be used to contain the wastes resulting from the dismantling of TRR core barrel. According to the plan of containing such wastes, 550 C1 containers and 24 C2 containers are expected to be used for the dismantling of core barrel, and the C1 and C2 containers with the dismantled wastes will be temporarily stored in the storage facilities approved by INER.

使用 C1 與 C2 容器取代原先規劃使用的 55 加侖鋼桶，除可節約數千萬元的容器購置經費外，也可以減少 50% 以上的切割長度，有效地節省臺灣研究用反應器爐體廢棄物拆除所需的經費，並增進相關工作的安全性與效率。此外，C1 與 C2 容器除可滿足臺灣研究用反應器爐體拆除廢棄物的盛裝需求外，也可應用到其它核設施除役的工作上。目前 C1 容器已採用非專屬授權方式技轉予國內廠商，未來將推廣應用至國內外核設施除役工作。

	年度	109	110	111	112	113	114	115	總計
規劃採購數量	C1	25	25	20	80	100	150	150	550
	C2	-	-	8	4	8	4	-	24

C1 與 C2 容器用於臺灣研究用反應器爐體廢棄物拆除的採購規劃

（a）　　（b）

C1 容器：(a) 盛裝臺灣研究用反應器上生物屏蔽切割廢棄物 (b) 盛裝完成並封蓋
C1 container: (a) containing the waste cut from the biological shield of TRR (b) covering the container after containing the waste

（五）我國 70MeV 中型迴旋加速器建置規劃

自 108 年底迄今，COVID-19 新冠肺炎疫情風暴破壞了世界各國原有的經濟體活動與全球供應鏈次序，而目前仍因變種病毒株肆虐，世界各國仍必須嚴整以待。核研所在新冠肺炎疫情期間，國際航班無法正常運作，導致國內進口核醫藥物供應鏈中斷，醫院用藥出現缺口，核研所緊急將核醫藥物的產能提高，順利解決國內核醫藥物供應短缺的問題，貢獻足夠地防疫能量。見微知著，自主供應與研發能力將是國家的關鍵軟實力。

Replacing the 55-gallon steel drums initially planned to be used with the C1 and C2 containers can save tens of millions of NT dollars of the container purchase budget as well as reducing the cutting length by more than 50%. The replacement helps effectively save the budget required for the dismantling of wastes in the core barrel of TRR, and enhance the safety and efficiency of the related procedures. Furthermore, the C1 and C2 containers can not only satisfy the requirements of containing the wastes resulting from the dismantling of TRR core barrel, but can also be applied to the other nuclear facility decommissioning tasks. The technology of C1 container has now been transferred to the domestic manufacturers by non-exclusive license, and will be applied more widely to the nuclear facility decommissioning tasks in Taiwan and abroad.

	Year	2020	2021	2022	2023	2024	2025	2026	Total
Number planned to be purchased	C1	25	25	20	80	100	150	150	550
	C2	-	-	8	4	8	4	-	24

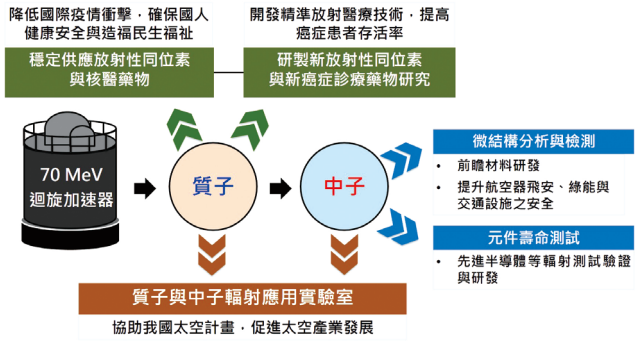
Purchase plan of C1 and C2 containers for the dismantling of wastes in the core barrel of TRR

E. Establishment plan of 70MeV medium-sized cyclotron in Taiwan

Since the end of 2019, the COVID-19 pandemic has disrupted the original economic activities all over the world and the order of the global supply chain so far. Currently, all the countries still have to stay cautious because of the coronavirus variants. During the COVID-19 pandemic, the impacted international flights have resulted in the supply chain disruptions of the imported radiopharmaceuticals in Taiwan and further led to drug shortages in hospitals. INER thus urgently increased the radiopharmaceutical production capacity to solve the radiopharmaceutical shortages in Taiwan and contributed to the pandemic prevention capability. A straw shows which way the wind blows. Apparently, the autonomous supply and R&D capabilities are going to be the key soft powers of a country.

數量	12台	1台	無	2台
能量	9.6~18 MeV	15~30 MeV	30~70 MeV	70~230 MeV
電流	<300 μA	500 μA	1000 μA	<0.3 μA
應用與需求	核醫藥物 腫瘤造影用 ・生產氟-18核醫藥物為主	核醫藥物 診斷用 同位素 ・可生產鉈-201等5種診斷用同位素	核醫藥物 診斷用、治療用 同位素 ・可生產鉈-201等同位素，以及3種治療用與1種新診斷用同位素 質子、中子源應用	質子治療

國內迴旋加速器能量缺口
Demand for cyclotron in Taiwan



70MeV 迴旋加速器應用領域涵蓋醫學、半導體與太空科技
The application fields of 70 MeV cyclotron include medical science, semiconductor and space technology

我國已運轉的迴旋加速器依其功率及用途可分為小型（9.6~18 MeV）（MeV: 百萬電子伏特）、中型（15~30 MeV）與大型（70~230 MeV），應用於診斷用核醫藥物與質子治療等用途。其中，核研所現行生產放射性同位素的 15~30MeV 迴旋加速器，自民國 82 年運轉迄今已 28 年，加速器部分關鍵元件近趨老化，難以維持長時間運轉的穩定性。現今隨著社會與民生進步及國家科學發展需要，已呈現對 30~70MeV 迴旋加速器之科學研究與應用的功能需求。例如癌症治療與精準醫療之核醫藥物研發與供應以及中子與質子之科技應用與研發，而此功率範圍正是我國科學研發上亟待補上之缺口，這也是世界強國在中子與質子科學研究上重要的競爭焦點。

核研所研提「國家中子與質子科學應用研究：70MeV 中型迴旋加速器建置計畫」精準掌握與扣合六大核心戰略產業之國家發展目標，結合基礎科學研究、醫療科學、太空科技、軍事國防、半導體等產業，發揮極大的加乘綜效，也勢必帶動全面性的產業發展與提升臺灣的全球競爭力。

鑑於國內核醫藥物穩定供藥的重要性與未來發展性以及立法院的支持，核研所提出「國家中子與質子科學應用研究：70MeV 中型迴旋加速器建置計畫」的構想，建置期並由原訂的 7 年縮短為 4 年，本建置計畫分為概念設計與設施 / 設備建置二階段來推動。

概念設計部份，核研所擬訂「建置我國中子與質子科學研究 70MeV 迴旋加速器之概念設計」計畫，已於 110 年 04 月 28 日獲行政院國家科學技術發展基金管理會核定與執行（自 110 年 05 月至 111 年 12 月，總經費 820 萬），主要工作為完成概念設計與新建工程先期規劃，用以展開 70MeV 迴旋加速器建置準備與主管機關審查作業。另，設施 / 設備建置部份，本案歷經 12 個月的腦力激盪與擬定研究方向、

In Taiwan, the operating cyclotron can be divided into small-sized (9.6–18 MeV) (MeV: million electron volts), medium-sized (15–30 MeV) and large-sized (70–230 MeV) based on their power and purpose of use that are used for the diagnostic radiopharmaceutical and proton therapy, etc., The 15–30 MeV cyclotron producing radionuclides of INER have been used for 28 years since 1993, however, it started to have difficulty maintaining the stability of long-term operation due to some aged key components. Now, it has been rendered for the scientific research and functional requirement application of the 30–70 MeV cyclotron to correspond with the social and civil progress and the requirement of national science development, for examples, including the radiopharmaceutical R&D and supply for cancer treatments and precision healthcare, and the technology application and R&D of neutron and proton. The corresponding power range of cyclotron is just really required for scientific R&D in Taiwan, and also an important focus of competition for the competitive countries around the world in terms of the scientific research of neutron and proton.

INER has prepared and submitted the "National Research on the Scientific Application of Neutron and Proton: Establishment Plan of 70 MeV Medium-Sized Cyclotron" to precisely grasp and be in line with the national development goals of six core strategic industries. The plan, in combination with the industries such as basic scientific research, medical science, space technology, military and defense, semiconductor, etc., will surely bring about a powerful synergistic effect, and will facilitate the comprehensive industrial development as well as elevating Taiwan's global competitiveness.

In view of the importance and future development potential of the stable domestic radiopharmaceutical supply and the support of the Legislative Yuan, INER has proposed the concept of "National Research on the Scientific Application of Neutron and Proton: Establishment Plan of 70 MeV Medium-Sized Cyclotron." The period of establishment has been shortened from 7 years to 4 years, and the establishment plan is going to be implemented in two phases, one is the concept design and the other is facility/equipment establishment.

For the concept design phase, INER has prepared the "Conceptual design of 70 MeV cyclotron for neutron and proton research," which has been approved by the National Science and Technology Development Fund, Executive Yuan on April 28, 2021 and carried out (from May 2021 to December 2022, with a total budget of NT$8.2 million). The main task is to complete the concept design and the advance planning of new construction, so that the preparation for the establishment of 70 MeV cyclotron and the review process of the competent authority. As for the facility/equipment establishment phase, the plan has, after 12 months of brainstorming and processes of developing the direction of research, planning the preparation and replying for review, been approved by the Executive Yuan on October 21, 2021 to be implemented as planned. The plan

規劃準備與回覆答辯，已於 110 年 10 月 21 日獲行政院函「准予照辦」，計畫期程於 112 至 115 年共 4 年，總預算約 15 億 4 千 4 百萬元。

70MeV 中型迴旋加速器建置後，長遠發展目標為研製與生產醫用（診斷與治療）重要放射性同位素與核醫藥物、中子與質子應用研究及衍生於國防、半導體的耐輻射檢證 / 驗證及前瞻材料的非破壞性檢測研究，將發揮最大的功能與效益，以確保我國原子能科技研發的全球競爭力。

六、落實放射性物料管理

（一）嚴密管制除役廢棄物，確保公眾安全

原能會為強化精進安全管制，參酌國際發展經驗，與時俱進檢討修訂核廢料管制法令，以完善法規體系，嚴密管制做好安全管制。國內各核電廠已逐步進入除役階段，為強化放射性廢棄物盛裝容器安全管制，原能會於 110 年完成修訂「放射性廢棄物處理貯存及其設施安全管理規則」，要求放射性廢棄物管理應考量各階段作業及其安全之相互依存性，並於使用申請書載明容器與放射性廢棄物管理各階段作業具備技術可行性，以符合國際原子能總署安全要求，具體展現我國放射性廢棄物的安全管制要求與國際同步。

核一廠廢棄物貯存壕溝除役專案檢查
Taskforce Inspection for the decommissioning of waste storage trenches in the Chinshan NPP

為配合國內核電廠除役計畫之推展，台電公司已於 110 年完成核一廠核子燃料貯存設施及核一廠貯存壕溝之清除作業，並提報除役完成報告送原能會審查，原能會續執行兩次專案檢查，現正嚴密審查其報告，以順遂銜接第二期乾式貯存設施之開發，及有效活化電廠空間利用，提升除役作業效能。

台電公司為龍門電廠核子燃料資產最大價值化之經營策略，自 107 年 7 月起分 9 批次執行該廠 1,744 束核子燃料外運作業，至 110 年 3 月核子燃料已全數運出。原能會於每批次燃料外運期間，皆成立檢查專案小組及應變小組，全程監督運送作業，順利安全完成外運。

龍門電廠核子燃料外運檢查專案小組及應變小組
Taskforce Inspection team and response team for the outbound shipment of nuclear fuel in Lungmen NPP

is expected to take four years from 2023 to 2026, with a total budget of NT$1.544 billion.

The long-term development goals after the establishment of the 70MeV medium-sized cyclotron are the development and production of important radionuclides and radiopharmaceuticals for medical use (diagnosis and treatment), research on the application of neutron and proton and further inspection/verification of radiation resistance in the fields of national defense and semiconductor, and non-destructive testing of foresight materials. The cyclotron will, with its greatest functions and benefits, help ensuring the global competitiveness of the research and development of atomic energy technology in Taiwan.

(VI) Achieving Effective Radioactive Material Management

A. Regulating the decommissioning waste rigorously to ensure public safety

To strengthen and improve the safety regulation, AEC has reviewed and amended the regulations regarding radioactive waste management with the international development experience as reference to keep abreast of the times, so that safety can be achieved through the strict and complete regulatory system. The nuclear power plants in Taiwan have gradually moved to the decommissioning phase. To reinforce the safety regulation of radioactive waste containers, AEC has amended the "Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities" in 2021, requesting that the interdependency between the operation and safety of each phase be considered for the radioactive waste management. AEC has also specified that it should have technical feasibility in the applications for the use that the containers and the operations during all radioactive waste management phases, so as to meet the safety requirements of the IAEA and clearly show that Taiwan's safety regulatory requirements regarding radioactive waste are in line with the international requirements.

To conform with the implementation of the NPP decommissioning plans in Taiwan, the TPC has completed the cleanup programs of the nuclear fuel storage facility and the LRW storage trenches at the Chinshan NPP in 2021, and submitted two decommissioning completion reports to AEC for review. After conducting two inspection tasks, AEC currently has been reviewing of the reports to ensure a smooth transition to the installation of the secondary dry storage facility, to activate use of NPP site land, and to enhance the performance of the decommissioning effectively.

With the business strategy of maximizing the value of Lungmen NPP's nuclear fuel assets, the TPC has performed the outbound shipment of 1,744 bundles of nuclear fuel

為因應核電廠除役廢棄物之處理與貯存管制議題，原能會已辦理 8 次「除役放射性廢棄物管制技術議題討論會」，對除役廢棄物管理、除役期間規劃增建廢棄物設施、廢棄物容器開發等重要議題，進行先期前瞻管制的探討，藉以提升除役廢棄物的安全管制。原能會將持續掌握國際上除役電廠放射性廢棄物相關技術、管制資訊與經驗回饋，以提升管制技術與能量。

（二）督促蘭嶼遷場，持續強化蘭嶼貯存場營運安全

蘭嶼貯存場之核廢料遷出是政府長期既定的政策，原能會已審定「蘭嶼貯存場遷場規劃報告」，要求台電公司依規劃報告內容，儘速將存放於蘭嶼的核廢料送至集中式貯存設施貯放管理。原能會依循總統府原住民族歷史正義與轉型正義委員會第 5 次委員會議之決定，連續 4 年定期邀集經濟部及原住民族委員會召開跨部會討論會議，共同督促台電公司辦理遷場事宜。原能會已要求台電提出中期暫時貯存之替代方案，並經行政院非核家園推動專案小組決議，要求台電積極推動，並展開社會溝通，以儘早遷出蘭嶼核廢料。

蘭嶼貯存場重裝作業
Repackaging work in the Orchid Island Storage Site

原能會為精進蘭嶼貯存場核廢料桶之貯存安全，要求台電公司將現有的 55 加侖廢棄物桶，全數以厚實的熱浸鍍鋅容器進行重裝，以提升貯存安全，並作為蘭嶼貯存場遷場前的包裝準備作業。原能會審查核可重裝作業計畫，並督促台電公司於 110 年 2 月完成蘭嶼貯存場全數核廢料桶之重裝作業。重裝作業期間未發生工安或輻安事件，原能會派員駐場安全檢查達 230 人 / 日。

原能會持續要求台電公司強化蘭嶼貯存場安全措施，執行蘭嶼貯存場壕溝結構安全檢測及老化管理評估，以確保貯存安全；每年執行蘭嶼貯存場意外事故演練，以提升作業人員之危機意識與事故應變能力，並要求規劃蘭嶼貯存場專用龍門碼頭運送作業之適用性及執行運送船舶設計等前置準備作業。原能會除加強環境輻射即時監測外，亦與蘭嶼居民、地方政府及公民團體，共同執行平行監測，以確保蘭嶼環境品質及居民健康。

蘭嶼貯存場意外事故演練
Emergency drill in the Orchid Island Storage Site

from the NPP in 9 batches since July 2018. In March 2021, all the nuclear fuel has been moved out. During each batch of fuel outbound shipment, AEC organized the taskforce inspection team and response team to oversee the whole shipment process until the outbound shipment was completed successfully and safely.

To deal with the issues about the treatment and storage regulation of the NPP decommissioning waste, AEC has held the "Seminar on Issues of Regulatory Technologies Concerning Radioactive Waste during Decommissioning" eight times. Important issues, such as the decommissioning waste management, the planning of additional waste facilities during decommissioning, and the waste container development, have been discussed in advance proactive regulation to enhance the safety regulation related to the decommissioning waste. AEC will continue to keep track of the technologies, regulatory information and feedback of experiences regarding the radioactive waste of NPP decommissioning in the world to promote the regulatory technologies and capabilities.

B. Overseeing the Orchid Island Storage Site relocation and continuously strengthening the operational safety of the Orchid Island Storage Site

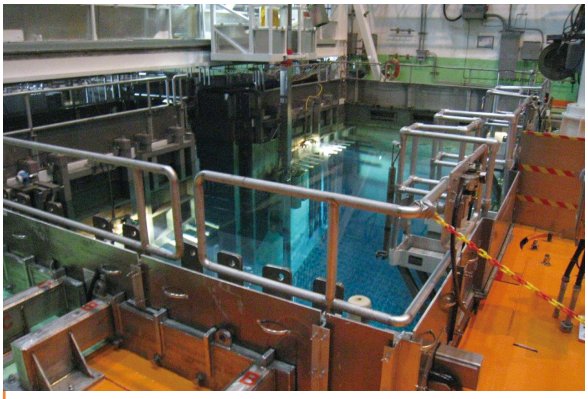
The relocation of the radioactive waste in the Orchid Island Storage Site has long been a determined policy of the government. AEC has reviewed and approved the "Planning Report on the Orchid Island Storage Site Relocation", and required the TPC to ship the nuclear waste stored in Lanyu out to a centralized storage facility as planned in the report as soon as possible. In accordance with the decision of the Fifth Meeting of the Presidential Office Indigenous Historical Justice and Transitional Justice Committee, AEC has, for four consecutive years, regularly invited the Ministry of Economic Affairs and the Council of Indigenous Peoples to hold inter-ministerial discussion meetings and jointly oversee the TPC's relocation process. AEC has also requested the TPC to provide an alternative plan for the mid-term interim storage and, upon the resolution of the Executive Yuan's Nuclear-Free Homeland Task Force, required the TPC to take action proactively as well as engaging in social communication to move out the radioactive waste from Lanyu as soon as possible.

To enhance the storage safety of the nuclear waste drums in the Orchid Island Storage Site, AEC asked the TPC to repack all the existing 55-gallon waste drums with thick hot-dip galvanized containers to increase the storage safety, which is also regarded as a preparation for the Orchid Island Storage Site relocation. AEC has reviewed and approved the repackaging work plan, and urged that TPC should complete the repackaging work of all the nuclear waste drums in the Orchid Island Storage Site in February 2021. During the repackaging process, there were no accidents related to industrial safety or radioactive safety; and AEC assigned personnel for on-site safety inspection up to 230 man-days in total.

（三）督促積極推動用過核子燃料乾式貯存計畫，順遂核電廠除役作業

乾式貯存設施為核電廠除役的必要設施，為增進民眾對乾式貯存設施接受度，台電公司已參採社會共識，規劃各核電廠室內乾式貯存設施興建計畫，並皆獲行政院核定。為順遂推展室內乾式貯存興建計畫，俾利核電廠除役作業推動，原能會要求台電公司以核電廠除役計畫停機過渡階段，完工啟用室內乾式貯存設施為目標積極推動，並透過每月乾式貯存設施管制討論會議，就相關安全技術議題先期管制。為確認核一、二廠乾式貯存設施待貯用過核燃料完整性，原能會已啟動先期管制作業，要求台電公司提報「用過核燃料完整性評估與啜吸抽樣檢驗計畫」，經邀集學者專家審查後同意核備。於檢驗作業期間，原能會派員進行專案檢查，以確保未來用過核燃料運貯作業及設施營運安全。

核一廠第一期乾式貯存設施已完成興建，原能會亦持續要求台電公司維持熱測試作業量能，定期辦理設備組件維護保養及年度統合演練作業，確保熱測試作業人力及技術能量。作業期間，原能會派員執行專案檢查，查核台電公司執行成效，以確保未來乾式貯存設施營運安全。此外，原能會針對核二廠乾式貯存設施密封鋼筒及其組件製造期間，原能會組成檢查小組每季辦理專案檢查作業，追蹤管控製造進度及品質。



核二廠用過核子燃料啜吸檢驗作業專案檢查
Taksforce Inspection for the Sipping Test of the Spent Fuel in the Kuosheng NPP

110 年核一廠乾貯設施統合演練作業專案檢查
Taksforce Inspection for the 2021 integrated drill of the dry storage facility in the Chinshan NPP

核二廠乾式貯存設施密封鋼筒燃料方管製程作業檢查
Taksforce Inspection for the square tube manufacturing process for the fuel in the dry storage facility's sealed drums in the Kuosheng NPP

AEC has continuously requested TPC to reinforce the safety measures in the Orchid Island Storage Site, conducting safety inspection for the trench structure and the management assessment of aging trenches in the site to ensure the storage safety. Emergency drills in the Orchid Island Storage Site have been implemented yearly to increase the crisis awareness and response ability of the operating personnel. Moreover, AEC has required the planning for the applicability of shipment operation in Lungmen Port dedicated for the Orchid Island Storage Site, as well as the implementation of pre-processing such as designing the vessels for shipment. In addition to the enhancement of the real-time environmental radiation monitoring, AEC has also performed parallel monitoring with the Lanyu residents, local government and civic groups to ensure the environmental quality and people's health in Lanyu.

C. Urging the active implementation of the plan for dry storage of spent fuel to ensure smooth NPP decommissioning

Dry storage facility are essential for the NPP decommissioning. With a view to increasing people's acceptance of the dry storage facility, TPC has reached a consensus with the society and developed the construction plans of indoor dry storage facility for different NPPs; all the plans have been approved by the Executive Yuan. In order to carry out the construction plans of indoor dry storage facility successfully and further guarantee the smooth NPP decommissioning, AEC has requested the TPC to actively set up the indoor dry storage facility and put them into operation during the shutdown and transitional phase of the NPP decommissioning plan. Also, preliminary regulation on the relevant safety technical issues has been provided through the monthly meetings about the dry storage facility regulation. To ensure the integrity of the spent fuel to be stored in the dry storage of Chinshan and Kuosheng NPPs, AEC has initiated the preliminary regulation, asking the TPC to submit an "Integrity Assessment and Sampling Sipping Test Plan for the Spent Fuel," which was then reviewed by a group of invited scholars and experts and later approved. During the testing, AEC dispatched personnel to conduct the taskforce inspection so as to ensure the future shipment and storage of the spent fuel and the facility operational safety.

The construction of the first-phase dry storage facility of the Chinshan NPP has been completed. In addition, AEC has kept on requesting the TPC to maintain the capability for hot tests; the equipment component maintenance and the yearly integrated drills have been carried out on a regular basis to make sure the manpower and the technology capability for hot test operation are sufficient. In the period, AEC dispatched personnel to execute the taskforce inspection; the implementation effectiveness of the TPC was inspected to ensure the operational safety of dry storage facility for the future. Furthermore, for the manufacturing process of the sealed steel drums and components of the Kuosheng NPP's dry storage facility, AEC formed an inspection team to follow up and monitor the manufacturing progress and quality through quarterly taskforce inspection.

（四）督促臺灣研究用反應器設施除役作業，嚴密管制小產源廢棄物

原能會於 93 年 4 月核發核研所臺灣研究用反應器（TRR）設施除役許可，要求於 118 年 3 月完成除役工作。原能會監督核研所執行臺灣研究用反應器除役作業，已完成濕貯槽及緊急冷卻水塔拆除、破損燃料套管清理、鈾粉收集及安定化後安全貯存、污染燃料池池水、池壁及附屬設備等除污及清理工作，110 年完成附屬設施乏燃料套管地下貯存庫除役完成報告審查，依法同意並解除設施管制。

原能會依法要求核研所每年 3 月底前提出年度執行報告及除役計畫書修正版，報請原能會審核，定期檢討執行進度並強化除役作業之品質。於 TRR 除役作業期間，原能會組成跨局處專案小組執行專案檢查，以確保除役作業安全。

考量除役過程產生的除役廢棄物特性與運轉廢棄物不同，原能會審核核研所自主開發適用於臺灣研究用反應器（TRR）除役廢棄物的盛裝容器，核發許可。原能會於製造過程中派員檢查，確認盛裝容器製造三級品保符合申請書之規定。

核研所肩負接收國內小產源廢棄物的任務，原能會為嚴格管制核研所的廢棄物管理，要求定期提報放射性廢棄物設施運轉報告及放射性廢棄物處理量、產生量或貯存量之資訊，並公布於原能會網站，以落實資訊公開。原能會將持續嚴密監督核研所的環境輻射監測，切實保障輻射安全及環境品質。

TRR 除役作業例行檢查
Regular inspection for TRR decommissioning

TRR 除役作業專案檢查
Inspection project for TRR decommissioning

D.Supervising the TRR facility decommissioning and carefully controlling the small producers' waste

AEC has issued the decommissioning permit of INER's Taiwan Research Reactor (TRR) facility in April 2004, requesting that the decommissioning task be completed by March 2029. So far, with AEC's oversight over INER's implementation of the TRR decommissioning, the wet storage tank and emergency cooling tower have been dismantled, the damaged fuel tubes have been cleaned, the uranium powder has been collected, stabilized and stored safely, and the decontamination and cleanup work for contaminated fuel pool water, pool wall and other ancillary facilities has been conducted. In 2021, the Report on the Completed Decommissioning of the Underground Storage Facilities for Spent Fuel Tubes of the ancillary facilities was reviewed, and the facility regulatory restriction was lifted accordingly as per the regulations.

In accordance with the regulations, AEC has required INER to submit the annual implementation report and the amended decommissioning plan by the end of March every year to AEC for review, so that the implementation status can be reviewed regularly and the quality of decommissioning can be enhanced. During the TRR decommissioning, AEC organized an interdepartmental taskforce team to execute the inspection and ensure decommissioning safety.

Considering that the radioactive waste produced during the decommissioning has different characteristics compared with the operational waste, AEC reviewed the containers developed by INER for the TRR decommissioning waste, and further issued the permit. In the manufacturing process, AEC dispatched personnel to check if the three-level quality assurance of the container manufacturing complies with the regulations specified in the applications.

INER is responsible for receiving the small producers' waste in Taiwan. To carefully regulate the waste management of INER, AEC has requested INER to regularly provide reports on the operation of radioactive waste facilities and the information about the amount of radioactive waste disposed of, produced or stored, and publish them on AEC website to achieve transparency of information. In the future, AEC will continue to oversee INER's environmental radiation monitoring strictly to ensure the radiation safety and the environmental quality.

七、強化環境輻射監測

（一）國民輻射劑量調查研究計畫

為了瞭解臺灣民眾在生活環境中所接受到天然與人造游離輻射曝露的輻射劑量，輻射偵測中心自 108 年起，展開為期 4 年的國民輻射劑量調查計畫；環境中的游離輻射包含天然輻射及人造輻射，計畫調查範圍包含 1. 天然背景輻射、2. 消費性產品、3. 醫療輻射、4. 工業、安全檢查、醫療、教學、研究等活動所導致的輻射曝露與 5. 職業曝露等 5 大類。110 年以醫療輻射、消費性產品、職業曝露與消費食品釙 210 攝入之劑量評估為主。

醫療輻射是目前國際間普遍判定提高國民輻射劑量最主要的輻射來源。輻射偵測中心自 108 年開始著手調查國內的醫療輻射劑量，在經衛福部人體試驗委員會的同意後，進行健保資料庫資料之分析，以及陸續建立介入性透視攝影（心臟類）、介入性透視攝影（非心臟類）、傳統透視攝影、牙科攝影等 8 種類別之劑量評估模型，並陸續運用在醫療輻射劑量調查及醫療院所之現場實測中。110 年已完成健保資料庫的人數趨勢再評估、統整各類檢查項目年頻次等資料、完成 32 個類次之取樣醫院檢查序列調查，以及精進與微調 51 個檢查項目合計 138 個檢查序列之劑量評估模型，以目前之 64 個類次分別以 ICRP60 號與 ICRP103 號報告所述方法評估國民平均年劑量，醫療輻射曝露之階段性結果如下表，待所餘之 32 個類次調查結果整理完成後，會再進一步更新評估結果。

方法 / 類別	ICRP60 號報告	ICRP103 號報告
電腦斷層	1.03 毫西弗	1.05 毫西弗
核子醫學	0.15 毫西弗	無
心臟類介入性透視攝影	0.28 毫西弗	0.30 毫西弗
非心臟類介入透視攝影	0.05 毫西弗	0.05 毫西弗
傳統透視攝影	0.02 毫西弗	0.02 毫西弗
一般傳統 X 光	0.09 毫西弗	0.08 毫西弗
乳房攝影	1.4 微西弗	3.3 微西弗
牙科攝影	1.2 微西弗	3.4 微西弗

目前 8 類醫療診斷檢查之國民輻射劑量階段性結果

(VII) Strengthening Environmental Radiation Monitoring

A. Survey project on the population radiation dose

For the purpose of understanding the natural and artificial ionizing radiation dose to people living in Taiwan, the Radiation Monitoring Center initiated a 4-year survey project on the population radiation dose since 2019. Radiation in the environment includes natural and artificial ionizing radiation. The project covers: (1) natural background radiation, (2) consumer products, (3) medical radiation, (4) radiation exposure resulting from industrial, safety inspection, medical, teaching, research or other activities, and (5) occupational exposure. In 2021, the project focused on medical radiation, consumer products, occupational exposure and the assessment of the polonium-210 dose received from consumer food products.

Generally speaking, medical radiation is the main source that increases the population radiation dose. The Radiation Monitoring Center (RMC) has surveyed the medical radiation dose in Taiwan since 2019. Upon the consent of the Institutional Review Board, MOHW, the RMC analyzed the data in the National Health Insurance Research Database and established radiation dose dosimetry assessment models for eight types of medical examinations, including interventional fluoroscopy (cardiac) and interventional fluoroscopy (non-cardiac), conventional fluoroscopy, and dental radiography. The models have been used in the survey on medical radiation dose and tests at hospitals. In 2021, the RMC completed the re-assessment of the population trend based on the data in the National Health Insurance Research Database, organized the data on the annual frequency of respective medical examinations, finished 32 surveys on the sequences in the medical examinations of sampled hospitals, and improved and slightly adjusted the radiation dose assessment models for a total of 138 sequences in 51 medical examinations. In the existing 64 surveys, the annual average population radiation dose was assessed based on the methods in the ICRP Report 60 and ICRP Report 103. The result on medical radiation exposure is shown in the following table. The assessment result will be further updated when the results of the remaining 32 surveys are completed and organized.

在天然背景輻射部分，持續彙整歷年實測之環境輻射結果，目前已有 497 處戶外地表輻射（110 年新增 50 處）、50 戶室內地表輻射、27 處中子宇宙射線及加馬宇宙射線之偵測結果；在主要消費食品攝入部份，110 年進一步針對國人主要消費食品中的魚、豬、牛、雞肉及其內臟進行釙 -210 放射性核種含量分析，共完成 63 件，其中有 8 件（花腹鯖魚肝臟等）活度濃度超過 100Bq/kg- 鮮重，11 件（三線櫛鱸魚肝臟等）活度濃度介於 10～100Bq/kg- 鮮重，13 件（秋刀魚魚肉等）活度濃度介於 1 ～ 10Bq/kg- 鮮重，14 件小於儀器最低可測活度濃度；依據衛福部食藥署國家攝食資料庫 106 年 19 至 65 歲之平均攝食量資料，經計算評估，因攝食魚豬牛雞等內臟及肉品中所含釙 -210 造成之國民輻射年劑量為 0.598 毫西弗 / 年。

產業活動部分，完成國內農業用肥料對農民造成輻射劑量的調查評估，年有效劑量平均值為 0.606 微西弗；針對雲林麥寮、高雄興達與臺中火力發電廠等三個電廠進行燃煤電廠周圍環境土壤輻射強度調查，經調查其周圍土壤輻射劑量量測結果為一般地表加馬輻射，故居住於該地區的居民並不會因此獲得較高的輻射劑量。

消費性產品部份，完成國人飛航行為調查與劑量初步評估，在考量飛航時間、緯度、太陽活動等影響因素下，以法國 SIEVERT 模式進行主要航線之劑量計算，評估高雄來回澳門、桃園來回美國紐約、兩岸線、松山來回上海虹橋、桃園來回北京等國際線之總劑量，綜合各項評估結果推估商用飛航宇宙輻射所造成之國民輻射年劑量約為 0.012 毫西弗 / 年；此外，也完成陶瓷耳環、貓砂、藍玉髓等所含微量天然放射性物質之活度濃度分析。

110 年進行職業曝露的評估，劑量監測數據引用 104 年至 109 年之「全國輻射從業人員劑量資料統計年報」，近六年職業輻射曝露之國民輻射年劑量落在 0.234 ～ 0.366 微西弗 / 年之間，平均值為 0.281 微西弗 / 年；整體而言，我國的職業輻射從業人數雖增加，但年集體有效劑量則逐年下降，故職業曝露之國民輻射年劑量呈現長期下降趨勢。惟因「全國輻射從業人員劑量資料統計年報」並無民用航空職業曝露相關監測數據，以 UNSCEAR1993 報告之飛航從業人員之個人年有效劑量 (3 毫西弗 / 年) 及國籍航空飛航工作人數進行估算，104 年至 109 年民用航空職業曝露之平均年集體有效劑量為 32.34 人 - 西弗，換算成國民輻射劑量為職業輻射曝露為 1.373 微西弗 / 年，與劑量監測所得之國民輻射年劑量 (0.281 微西弗 / 年) 加總，職業曝露之國民輻射劑量為 1.654 微西弗 / 年。

國民輻射劑量調查研究計畫

Type \ Method	ICRP Report 60	ICRP Report 103
Computed tomography	1.03 mSv	1.05 mSv
Nuclear medicine	0.15 mSv	None
Interventional cardiac fluoroscopy	0.28 mSv	0.30 mSv
Interventional non-cardiac fluoroscopy	0.05 mSv	0.05 mSv
Conventional fluoroscopy	0.02 mSv	0.02 mSv
Conventional radiography	0.09 mSv	0.08 mSv
Breast radiography	1.4 μSv	3.3 μSv
Dental radiography	1.2 μSv	3.4 μSv

Result on the population radiation dose in eight types of medical examinations

For natural background radiation, the historical environmental radiation data have been compiled on a continuous basis. There were currently radiation detection data for outdoor terrestrial radiation at 497 locations (of which 50 locations were added in 2021), indoor terrestrial radiation in 50 buildings, and neutron cosmic rays and gamma cosmic rays at 27 locations. As for polonium-210 absorbed from main consumer food products, a further analysis of polonium-210 radionuclides in fish, pork, beef, chicken and their offal, which are the main consumer food products for people in Taiwan, was conducted in 2021. A total of 63 tests were performed, of which eight tests (for blue mackerel liver, etc.) showed the activity concentration were over 100 Bq/kg fresh weight; 11 tests (for chicken grunt liver, etc.) showed the activity concentration ranging from 10–100 Bq/kg fresh weight; 13 tests (for the flesh of Pacific saury, etc.) indicated an activity concentration ranging from 1–10 Bq/kg fresh weight; and 14 tests were lower than the minimum detectable activity concentration of the instrument. According to the assessment results calculated based on the 2017 data on the average food consumption of people aged 19 to 65 from the Food Consumption Database of the FDA, MOHW, the annual population radiation dose from polonium-210 contained in fish, pork, beef, chicken or their offal was 0.598 mSv.

Regarding industrial activities, the domestic survey and assessment of the radiation dose from agricultural fertilizers to farmers were completed and the annual average effective dose was 0.606 μSv. The survey on the radiation of soils around the Mailiao Power Plant in Yunlin, Hsinta Power Plant in Kaohsiung, and Taichung Power Plant, all of which are fossile power plants, showed that the terrestrial gamma radiation measured in the soils was at a normal level, and thus residents living in these areas were not exposed to a high radiation dose.

輻射偵測中心預計在 111 年度完成後續評估，未來也會延續醫療輻射、天然背景輻射及消費性產品部份的調查結果，持續更新國民輻射劑量評估數據。

（二）建立南部放射分析備援實驗室環境試樣分析能力

為提升並強化南部地區輻射檢測人力及放射性分析能量，輻射偵測中心協助國立屏東科技大學，於該校「災害防救科技研究中心」轄下建置『放射性分析備援實驗室』（以下簡稱南部備援實驗室），迄今已通過財團法人全國認證基金會（TAF）游離輻射領域測試實驗室及衛生福利部食品藥物管理署（TFDA）的放射性食品核種分析認證，成為具專業性及公信力的輻射檢測實驗室。

110 年南部備援實驗室為擴展實驗室放射性分析技術並積極推廣輻射安全宣導，在輻射偵測中心的協助下，完成下列事項：

1. 提升環境放射性分析備援技術，建立水樣總貝他分析技術並通過 TAF 增項認證。
2. 與輻射偵測中心共同進行第 1 ～ 4 季核能三廠環境試樣放射性分析比較實驗，確保實驗室符合環境樣品分析技術品質要求，可擔任第三方公正實驗室角色。


TAF
財團法人全國認證基金會
Taiwan Accreditation Foundation
認 證 證 書
國立屏東科技大學
災害防救科技研究中心放射性分析備援實驗室
為本會認證之實驗室
連錦漳

TAF 實驗室認證證書
TAF laboratory accreditation certificate

3. 走進群眾，執行核能三廠周遭鄉鎮里及學校核安講習，以現場輻射偵檢器實作方式，偵測分析民眾關注之在地食材放射性。

核安講習及現場輻射偵檢器實作展示
Nuclear safety-themed lectures and on-site radiation detector demonstration

In terms of consumer products, the initial assessment on the air travel of the radiation dose were carried out. The radiation dose during air travel on the main airline routes were calculated by using the SIEVERT system developed in France, with the flight time, latitude, solar activity and other factors taken into account. The total radiation dose on the international flight routes from Kaohsiung to Macao, from Taoyuan to New York, from Taiwan to China, from Taipei Songshan Airport to Shanghai Hongqiao International Airport, and from Taoyuan to Beijing were assessed. Based on the assessment results, it was estimated that the annual population radiation dose from cosmic rays during commercial flights was about 0.012 mSv. In addition, the analysis of the activity concentration of a trace of natural radioactive materials in ceramic earrings, cat litter and blue chalcedony was also conducted.

In 2021, the radiation monitoring data in the "Occupational Radiation Exposure in Taiwan, Republic of China" from 2015 to 2020 were used for the assessment of occupational exposure. In the last six years, the annual occupational radiation exposure dose ranged from 0.234–0.366 μSv and was 0.281 μSv on average. Overall, despite the increasing radiation workers in the country, the annual collective effective dose decreased year by year, indicating a long-term decreasing trend in the annual occupational radiation exposure dose. However, as there were no occupational exposure data for civil aviation in the "Occupation Radiation Exposure in Taiwan, Republic of China," the data on the annual effective dose to a crew member (3 mSv) from the UNSCEAR 1993 Report and the data about the number of the crew members of national airlines were used for estimation. The result showed that the average annual collective effective dose of occupational exposure in civil aviation from 2015 to 2020 was 32.34 person-Sv, which corresponded to an occupational radiation exposure dose of 1.373 μSv per year for Taiwanese population. The sum of the annual occupational radiation exposure dose and the annual population radiation dose (0.281 μSv) calculated based on the dose monitoring data was 1.654 μSv.

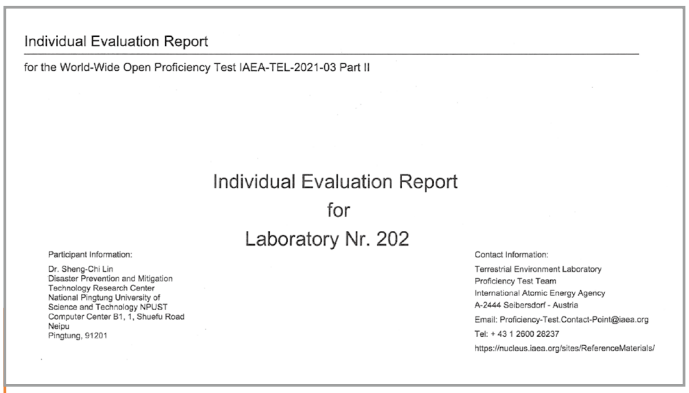
Survey project on the population radiation dose

The RMC was expected to complete subsequent assessment in 2022 and will continue to update the survey results on medical radiation, natural background radiation and consumer products to keep updating the assessed population radiation dose data.

4. 於校內開辦輻射安全及災害防救環境教育課程，以教育方式將輻射安全知識向下紮根。


開辦通識課程與實地參觀備援實驗室
Offering relevant general education courses and visiting the backup laboratory

5. 參加國內外環境試樣分析實驗室間比較實驗或能力試驗，確保分析技術品質符合國際公認標準。


Individual Evaluation Report
for the World-Wide Open Proficiency Test IAEA-TEL-2021-03 Part II

Individual Evaluation Report
for
Laboratory Nr. 202

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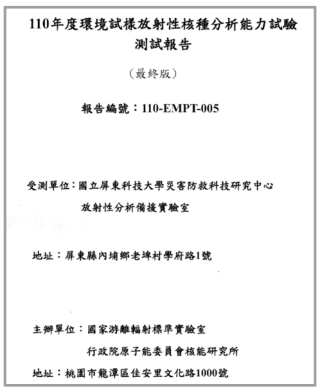
https://nucleus.iaea.org/sites/ReferenceMaterials/


110年度環境試樣放射性核種分析能力試驗
測試報告
（最終版）
報告編號：110-EMPT-005
受測單位：國立屏東科技大學災害防救科技研究中心
放射性分析備援實驗室
地址：屏東縣內埔鄉老埤村學府路1號
主辦單位：國家游離輻射標準實驗室
行政院原子能委員會核能研究所
地址：桃園市龍潭區佳安里文化路1000號

參與國際原子能總署（左）及國內環境試樣（右）放射性分析能力試驗
Participation in the International Atomic Energy Agency's radioactivity analysis proficiency test (left) and the domestic proficiency test for environmental sample radioactivity analysis (right)

展望未來，南部備援實驗室仍秉持加強環境樣品放射性分析技術能力，確實扮演第三方公正實驗室之角色，平時亦可協助食品之放射性含量分析，增進民眾對環境輻射及食品輻射之認知。

B. Building a radioactivity analysis backup laboratory in Southern Taiwan to develop the analytical capabilities for environmental samples

To enhance and facilitate the capacities in radioactivity analysis and manpower of Southern Taiwan, the RMC assisted National Pingtung University of Science and Technology in building the "Radioactivity Analysis Backup Laboratory" (hereinafter referred to as the Southern Backup Laboratory) administered by the "Disaster Prevention and Mitigation Technology Research Center" of the university. The Southern Backup Laboratory is the accredited ionizing radiation testing laboratory of Taiwan Accreditation Foundation (TAF) and also accredited by TFDA, MOHW, for the radionuclides analysis in food, and thus has become a professional and reliable radioactivity analysis laboratory.

In 2021, to expand its radioactivity analysis techniques and propagate radiation safety, the Southern Backup Laboratory obtained the following achievements with the assistances from the RMC:

a. The laboratory improved its environmental radioactivity analysis capabilities in gross beta of water samples and is successfully accredited by TAF.

b. To ensure that the laboratory met the technique and quality requirements for environmental sample analysis and prove that it could serve as an impartial third-party laboratory, it conducted an intercomparison exercise for the analysis of the radioactivity in environmental samples at the Maanshan NPP from Q1 to Q4 in collaboration with the RMC.

c. In order to propagate topics about the radiation safety, the task force organized by the laboratory conducted some face to face communications among local residents living around Maanshan NPP, provided real-time radioactive analysis of indigenous agricultural products, and expounded the analytical result on site.

d. The courses titled as environmental education relating to radiation safety and disaster reduction were offered at the school to cultivate the sense of radiation safety among students.

e. The laboratory participated in inter-comparison exercises or proficiency tests in domestic and overseas interlaboratory for environmental sample analysis to ensure that its analytical techniques and quality meet internationally recognized standards.

In the future, the Southern Backup Laboratory will remain dedicated to reinforcing its radioactivity analysis capabilities for environmental samples, serving as an impartial third-party laboratory, assisting in food radioactivity analysis, and enhancing the public's knowledge about environmental radiation and food radiation.

伍. 大事紀 Chronicle of Events

AEC

January

01.02、01.04

同意核二廠 2 號機第 26 次大修後再起動臨界申請。
AEC approved the restart and criticality application of the Kuosheng NPP Unit 2 after the 26th refueling outage.
同意核二廠 2 號機第 26 次大修後併聯申請。
AEC approved the synchronizing to power grid application of the Kuosheng NPP Unit 2 after the 26th refueling outage.

01.04-03.12、02.22-03.03、08.30-10.18、11.12-11.22、12.13-12.17

執行核一廠 2 號機第 1 次維護測試週期作業專案視察。
AEC conducted the inspection of the operation for the 1st maintenance surveillance cycle (MSC) of the Chinshan NPP Unit 2.
執行核一廠 110 年除役計畫暨核安管制紅綠燈專案視察（電力系統）。
AEC conducted the inspection of the 2021 decommissioning plan implementation and reactor oversight process (electrical system) at the Chinshan NPP.
執行核一廠 110 年除役計畫（含核一廠防疫強化措施）暨核安管制紅綠燈專案視察（設備組件設計基準）。
AEC conducted the inspection of the 2021 decommissioning plan implementation (incl. pandemic prevention enhancement measures) and reactor oversight process (component design bases) at the Chinshan NPP.
執行核一廠 110 年除役計畫暨核安總體檢專案視察（含火山灰因應措施）。
AEC conducted the inspection of the 2021 decommissioning plan implementation and post-Fukushima safety enhancement measures (incl. volcanic ash response measures) at the Chinshan NPP.
執行核一廠 110 年除役計畫暨核安管制紅綠燈專案視察（火災防護）。
AEC conducted the inspection of the 2021 decommissioning plan implementation and reactor oversight process (fire protection) at the Chinshan NPP.

01.05、03.12、09.30

召開「核一廠主發電機等相關設備拆除作業計畫」第 1 次聯席審查會議。
AEC held the 1st joint review meeting about the “Dismantling Plan for the Chinshan NPP Main Generator and Other Related Equipment”.
辦理「核一廠主發電機等相關設備拆除作業計畫」現場查訪。
AEC conducted the on-site inspection for the “Dismantling Plan for the Chinshan NPP Main Generator and Other Related Equipment.”
同意備查台電公司「核一廠主發電機等相關設備拆除作業計畫」。
AEC approved the TPC’s “Dismantling Plan for the Chinshan NPP Main Generator and Other Related Equipment.”

01.06

召開「研商放射性污染建築物居民健檢項目調整及健檢資料庫整合規劃事宜會議」。
AEC held the “Meeting for the Adjustment of Health Examination Items for the Residents of Radioactively Contaminated Buildings and the Integration Planning of the Health Examination Database.”

01.07、01.19-20、03.08-10、04.14-16、5.03-06

1 月執行臺南地區之地表環境輻射偵測；3 月執行臺中彰化地區之地表環境輻射偵測；4 月執行屏東臺東地區之地表環境輻射偵測；5 月執行花蓮地區之地表環境輻射偵測，偵測結果均已上載「臺灣環境輻射地圖」。
The terrestrial radiation detection in Tainan, Taichung and Changhua, Pingtung and Taitung, and Hualien areas were carried out in January, March, April and May, respectively. The results of the detection have been uploaded to the "Taiwan Environmental Radiation Map."

01.07、04.08、07.01

發函台電公司，說明龍門（核四）電廠建廠執照已於 109 年 12 月 31 日屆期失效，依法不得再繼續興建作業。
AEC issued TPC a letter to notify that the construction license of Lungmen NPP had expired on December 31, 2020 and no further construction work was allowed as per the regulations.

完成龍門（核四）電廠地質再調查小組建議事項案總結報告，於原能會網站公告。
The final report regarding the recommendations of the Lungmen NPP geology re-survey team was completed and published on AEC's website.

完成原龍門電廠管制專區整體網頁地圖改版，並新增焦點關注議題專區。
The sitemap of the overall webpage for the regulation on Lungmen NPP was updated, and a section for concerned issues was added to the webpage."

01.11、03.22

召開 2 場「游離輻射防護法修正研析」法學專家諮詢會議。
AEC convened two expert advisory panel meetings of the "Study of the Revision of Ionizing Radiation Protection Act.

01.12、02.05、02.05

赴核三廠、核一廠、核二廠進行年初查訪。
AEC conducted annual dialogue with the TPC and inspections at the Maanshan, Chinshan, and Kuosheng nuclear power plants.

01.21-01.22

完成「109 年加強進口食品輻射監測評估報告」，作為 110 年監測取樣參考；並派員至消費市場及年貨大街購買進口核桃糕、開心果、髮菜、海蔘、杏仁、核桃、丁香、蝦米、木耳、南瓜子、蔓越莓、水果乾、鮑魚、干貝、香菇、腰果等 38 件，進行放射性含量檢測，檢測結果皆符合國家法規標準，相關結果於原能會網站發佈最新消息。
AEC finished the "2020 Report on the Enhanced Radiation Monitoring and Assessment of Imported Food" as a reference for the sampling and monitoring operations in 2021. AEC also dispatched personnel to regular consumer markets and New Year markets to buy 38 kinds of imported products including walnut cakes, pistachios, hair weeds, sea cucumbers, almonds, walnuts, clove fishes, dried shrimps, tree mushrooms, pumpkin seeds, cranberries, dried fruits, abalones, scallops, mushrooms, and cashew nuts. They were used for radiation content analysis and the results met the requirements of the national standards. The latest survey results were publsihed on the AEC website.

01.22

彙整各應變單位及地方政府資料，完成「核子事故應變專案盤整報告」。
AEC collected the information from response units and local governments to present the "Consolidated Report on Nuclear Accident Response Projects."

01.22、03.24、07.27

辦理「全民參與委員會」委員會議，共召開 3 次，就核電廠除役及科普展辦理情形等民眾關心議題進行報告及討論。
AEC held the meeting of the “Committee on Public Participation” for three times in total for the briefing and discussion on the issues that people were concerned about, including the nuclear power plant decommissioning and the performance of the science fairs.

01.26

研提原能會 111 年度施政方針並提報行政院。
AEC prepared the 2022 administrative policies and submitted it to the Executive Yuan.

01.29

原能會依放射性物料管理法第 14 條規定，核發核一廠核子燃料貯存設施除役許可。
AEC issued the decommissioning permit of nuclear material storage facilities to Chinshan Nuclear Power Plant pursuant to Article 14 of the Nuclear Materials and Radioactive Waste Management Act.

1月-10月

執行全國 44 家放射線照相檢驗業者之輻射作業現場不預警安全稽查，強化輻射管制。
AEC implemented unannounced radiation work site inspections for 44 radiographic inspection operators across Taiwan to improve the quality of radiation protection regulation.

1月-12月

執行醫療院所、高風險及放射性物質使用業者、海巡及海關輻射源輻射安全作業年度重點檢查。
AEC implemented key examinations on the radiation safety operation for the radiation sources at medical institutions, operators with a high risk of exposure and using radioactive materials, coast guard units and customs.

1月-12月

辦理輻射屋居民健康檢查及到府健康關懷訪視。
AEC provided health examinations for the residents of radioactively contaminated buildings and made home visits to assess their health conditions.

01.01-12.31

核研所因應疫情期間國內進口核醫藥物短缺問題，緊急投入生產「氯化亞鉈（鉈 -201）注射劑」及「檸檬酸鎵（鎵 -67）注射劑」核醫藥物，110 年全年供應約 65,500 人次病患造影使用。
INER produced “INER THALLOUS CHLORIDE (T1-201) INJECTION” and “INER GALLIUM CITRATE (GA-67) INJECTION” in emergency to make up the deficiency of imported radiopharmaceuticals during the pandemic. It supplied the radiopharmaceuticals for about 65,500 patients in 2021.

February

02.03

執行蘭嶼貯存場檢查，並監督台電公司完成蘭嶼貯存場所有低放射性廢棄物桶重裝作業。
ACE conducted taskforrce inspection on Lanyu Storage Site to supervise Taipower to complete the low level waste repackage project.

02.20

完成「臺灣地區 110 年環境輻射監測計畫」，並上網公開。
The "2021 Environmental Radiation Monitoring Plan in Taiwan" was completed and published on the website.

02.20

完成「110 年上半年翡翠水庫集水區域水樣放射性含量分析結果」，並函文臺北翡翠水庫管理局。
"The Radiation Content Analysis Result of the Water Samplet in the Catchment Area of the Feitsui Reservoir in the First Half of 2021" was available and a related letter was set to Taipei Feitsui Reservoir Administration.

02.24、03.18、03.19

執行 110 年度第 1 次核三廠、核二廠及核一廠不預警視察。
AEC conducted the 1st unannounced inspection at the Maanshan, Kuosheng, and Chinshan nuclear power plants in 2021.

02.25-07.01、07.02-12.27

核二廠 1 號機進入功率遞減運轉，持續執行運轉安全監督作業。
AEC conducted the inspection of safety operation while the Kuosheng NPP Unit 1 entered coastdown operation.
執行核二廠 1 號機第 28 次大修作業（含核二廠防疫強化措施）專案視察。
AEC conducted the inspection of the 28th refueling outage (incl. pandemic prevention enhancement measures) for the Kuosheng NPP Unit 1.

March

03.08-03.12、05.03-05.07、10.25-11.05

執行核二廠 110 年核安管制紅綠燈專案視察（修改、測試或實驗之評估及永久性修改）。
AEC conducted the inspection of the 2021 reactor oversight process (evaluations and permanent changes of the revision, test or experiment) at the Kuosheng NPP.
執行核二廠 110 年核安管制紅綠燈專案視察（問題確認與解決）。
AEC conducted the inspection of the 2021 reactor oversight process (problem identification and resolution) at the Kuosheng NPP.
執行核二廠 110 年核安管制紅綠燈專案視察（火災防護）及核安總體檢專案視察（含火山灰因應措施）暨 110 年動力驅動閥設計基準能力專案視察。
AEC conducted the inspection of the 2021 reactor oversight process (fire prevention), post-Fukushima safety enhancement measures (incl. volcanic ash response measures)and the design basis capacity for power-driven valve at the Kuosheng NPP.

03.08-03.12、09.17-10.19、10.12-10.15

執行核三廠 110 年核安管制紅綠燈專案視察（火災防護）。
AEC conducted the inspection of the 2021 reactor oversight process (fire prevention) at the Maanshan NPP.
執行核三廠 110 年核安總體檢專案視察。
AEC conducted the inspection of the 2021 post-Fukushima safety enhancement measures at the Maanshan NPP.
執行核三廠 110 年動力驅動閥設計基準能力專案視察。
AEC conducted the inspection of the 2021 capacity for the design criteria of power-driven valve at the Maanshan NPP.

03.10-03.11

國際原子能總署（IAEA）保防官員至核研所進行 TWL （036 館）查驗，檢查結果核物料料帳查驗相符。
IAEA safeguards officers came to INER for TWL (Hall 036) inspection. The result showed a compliance in the nuclear materials accounting.

03.12

核研所 5 項綠能科技聯合研發計畫參加科技部於沙崙智慧綠能科學城舉辦之「Taiwan GET ！國際論壇暨成果發表會」，其中核研所「區域配電網強韌性研究與技術發展」獲選為 17 項亮點計畫之一，並在簡報比賽中榮獲第一名。
With five Green Energy Technology Joint Research and Development Program, INER participated in the “Taiwan GET! International Forum and Result Presentation Conference” hosted by the Ministry of Science and Technology in Shalun Smart Green Energy Science City. INER’s “Research and Technology Development for Resiliency Enhancement of Regional Distribution Power Network” was selected as one of the 17 highlights and won the first prize in the presentation contest.

03.12、04.01、05.31、08.10、11.30

完成 109 年第 4 季「臺灣地區核設施環境輻射監測季報」，並寄送各單位及政府出版品展售門市及上網公開。
AEC prepared the “Quarterly Report on the Environmental Radiation Monitoring of Nuclear Facilities in Taiwan” for Q4, 2020. In addition to being published on the website, the report has been sent to each relevant unit and the stores displaying and selling government publications.
完成「臺灣地區核設施 109 年環境輻射監測年報」，並寄送各單位及政府出版品展售門市及上網公開。
AEC prepared the “2020 Annual Report on the Environmental Radiation Monitoring of Nuclear Facilities in Taiwan.” In addition to being published on the website, the report has been sent to each relevant unit and the stores displaying and selling government publications.
完成 110 年第 1 至 3 季「臺灣地區核設施環境輻射監測季報」，並寄送各單位及政府出版品展售門市及上網公開。
AEC prepared the “Quarterly Report on the Environmental Radiation Monitoring of Nuclear Facilities in Taiwan” for Q1 to Q3, 2021. In addition to being published on the website, the report has been sent to each relevant unit and the stores displaying and selling government publications.

03.14、04.24、11.6

受邀參與國立清華大學辦理之「2021 國際女性科學日」科學市集活動；受邀參與國立臺灣科學教育館辦理之「110 年行動科教館臺東縣及宜蘭縣科學巡迴教育活動」。
AEC was invited to participate the science fair for “2021 International Day of Women and Girls in Science” hosted by the National Tsing Hua University, and the “2021 Mobile Science Education Taitung County and Yilan County Tours” organized by the National Taiwan Science Education Center.

03.22、08.18

完成 109 年下半年「臺灣地區放射性落塵與食品調查半年報」，並上網公開。
”The Semi-Annual report of Radioactive Fallout and Food Investigation in Taiwan” for the second half of 2020 was completed and published online.
完成 110 年上半年「臺灣地區放射性落塵與食品調查半年報」，並上網公開。
”The Semi-Annual report of Radioactive Fallout and Food Investigation in Taiwan” for the first half of 2021 was completed and published online.

03.22-03.23

辦理「氚分析計測技術訓練課程」，協助陽明交通大學北部備援實驗室以實作方式學習氚樣品前處理、計測及數據誤差分析等。

AEC provided the "Training Course on Tritium Analysis and Measurement Technique" to assist the north backup lab of National Yang Ming Chiao Tung University in pre-treatment, measurement and data error analysis of tritium samples through practical training.

03.24-03.25

舉行臺美民用核能合作視訊會議。

The TECRO-AIT Joint Standing Committee Meeting on Civil Nuclear Cooperation took place through video conferencing.

03.26、06.25、09.24、12.24

召開第 16 屆核子反應器設施安全諮詢會。

AEC held four meetings for the 16th Advisory Committee on Nuclear Safety.

03.29、06.17、10.08、12.15

完成 110 年第 1 至 4 季「臺灣地區自來水試樣放射性分析結果」函送臺灣自來水公司，各季檢測 124、110、121 及 101 件皆符合「商品輻射限量標準」之規定。

Analysis Result of the Tap Water Sample Radiation Content in Taiwan Area" for Q1 to Q4 of 2021 was available and the related report was sent to Taiwan Water Corporation. The quarterly analytical results of 124, 110, 121 and 101 met the requirements of the "Standards for Limiting Radioactivity in Commodities".

03.30

執行核一廠廢棄物壕溝清除作業專案檢查。

ACE conducted taskforce inspection on the cleanup project of waste storage trenches at Chinshan NPP.

April

04.01

核（換）發清華大學水池式反應器（THOR）運轉執照。

AEC renewed the operating license of the Tsing Hua Open Pool Reactor (THOR).

04.01、04.29

原能會官網版面改版上線；偵測中心及物管局網站版面改版上線。

The new layouts of the AEC's, RMC's and FCMA's official websites were launched.

04.06-05.20、10.29-12.09

分別執行核三廠 1 號機、2 號機第 26 次大修作業（含核三廠防疫強化措施）專案視察、大修後再起動臨界申請審查與加強查核視察以及併聯申請審查。

AEC conducted the inspections of the 26th refueling outage (incl. pandemic prevention enhancement measures) for the Maanshan NPP Units 1 and 2, reinforced inspection before restart and criticality, and reviewed on the application for restart and criticality, synchronizing to power grid.

04.09

因應核研所與臺灣翰〇公司簽訂執行之「紐西蘭木片轉化乳酸之噸級測試」技術服務，紐西蘭貿易發展中心商務代表 -Miss Tina Wilson 處長（Director, New Zealand Trade Development Centre）等至核研所參訪。
Director Miss Tina Wilson, a business representative of the New Zealand Trade Development Center, and others visited INER for the matters concerning the technique service agreement on the "Ton-scale testing for the conversion of New Zealand wood chips into lactic acid" between INER and X Company in Taiwan.

04.09

核研所與國內最大的電致變色車用後視鏡產銷公司簽署「高密度電漿鍍製大面積變色薄膜技術」授權案，總簽約金達新臺幣 1,600 萬元。
INER cooperated with the largest electrochromic rearview mirror production and sales company in Taiwan. INER signed the "Technologies of large-area electrochromic film deposited by high-density plasma" licensing agreement, with a contract value of NT$16 million.

04.14

召開 110 年核子設施類輻射防護管制臨時會議。
AEC convened an extraordinary meeting of "2021 Radiation Protection and Regulation for nuclear facilities."

04.17-18、12.04

於臺中及屏東辦理原子能科技科普展，透過動手體驗及互動溝通，讓原子能安全管制工作和科技研發成果更貼近民眾，兩場次共吸引 6,103 參觀人次。
AEC organized atomic science fairs in Taichung and Pingtung to let people know more about the safety regulation and the R&D achievements of the atomic energy through actual experience and interactive communication. A total of 6,103 visitors were attracted by the two science fairs.

04.21、08.11、12.01

召開第七屆第一次至第三次放射性物料安全諮詢會。
AEC held the 1st to 3rd meetings of the 7th Advisory Committee on Radioactive Materials Safety.

04.23、07.15

參加日本一般社團法人「日本環境測定分析協會」舉辦之環境水樣放射性能力試驗，輻射偵測中心參與之海水及淡水銫 -137 分析結果皆通過比較實驗允收標準，顯示環境水樣放射性銫分析技術能力符合國際水平。完成「2020 年參加日本一般社團法人環境測定分析協會之環境水樣銫放射性分析比較實驗結果報告」，並將報告上載原能會官網。
AEC participated in the radiation analytical laboratory proficiency testing of environmental water samples. This activity was organized by Japan Environmental Measurement & Chemical Analysis Association (JEMCA). The analysis results of the sea and freshwater cesium-137 test in which the RMC participated passed the acceptance criteria of the comparison experiment, indicating that the technique and capability needed for analyzing the radiative cesium in the environmental water samples reach up to the international level.
The "Comparison Experiment Result Report for the 2020 Cesium Radiation Analysis of Environmental Water Samples Organized by JEMCA" was completed and uploaded to the official website of AEC.

04.23、08.27、12.17

召開第 17 屆第 4 次至第 6 次「游離輻射安全諮詢會」。
AEC convened the 4th to 6th sessions of the 17th "Ionizing Radiation Safety Advisory Board."

04.27

召開第 6 次日本福島核災含氚廢水跨部會因應會議。
AEC held the 6th inter-ministerial response meeting for the tritium-containing wastewater from the Fukushima nuclear accident in Japan.

04.28-04.29

辦理 110 年低放處置計畫專案視察作業及用過核子燃料最終處置計畫專案視察作業。
AEC conducted taskforce inspection project on the 2021 low-level radioactive waste final disposal program and the spent nuclear fuel final disposal program.

May

05.02

舉辦 110 年度第 1 次「輻射防護專業測驗及操作人員輻射安全證書測驗」。
AEC held the 1st exam of "2021 Certification Examination for Radiation Protection Personnel and Radiation Operators on Radiation Safety."

05.03-05.04

核研所辦理員工健康檢查，執行健檢單位為臺北醫學大學附設醫院，健檢對象除原能會、核研所及物管局同仁外，並由鄰近地區里長安排里民計 82 人參加。
INER commissioned Taipei Medical University Hospital to provide physical examinations for employees. In addition to the employees of the AEC, INER and FCMA, the head of the neighborhood arranged 82 residents for the physical examination as well.

05.03、05.06、10.12-10.13及10.18-10.20、11.03

拜訪金山區里長與地方人士。
AEC visited the district chiefs of Chinshan and other local representatives.
辦理「核一、二廠除役管制地方說明會」。
AEC held a "Local Public Meeting for the Regulation of the Decommissioning of Chinshan and Kuosheng NPPs."
拜訪恆春鎮鎮長、滿州鄉長代表、恆春鎮民代表會主席、滿州鄉民代表會主席、村（里）長暨地方意見領袖。
AEC visited the mayor of Hengchun Township, the representative of the mayor of Manzhou Township, the chairmen of Hengchun Township Representative Council and Manzhou Township Representative Council, and the village chiefs and local opinion leaders.
辦理「核三廠除役計畫審查地方說明會」。
AEC held a "Local Public Meeting for the Review of the Maanshan NPP Decommissioning Plan."

05.07、11.04

國立中山大學海洋科學系師生 26 人至輻射偵測中心參訪。
屏東縣教育處防災輔導團參訪輻射偵測中心，來訪人員計有 29 位。
"26 participants of Department of Oceanography of National Sun Yat-sen University visited the RMC.
29 members of the disaster prevention guidance group of Education Department of Pingtung County Government visited the RMC."

05.12、11.24

召開 110 年度核電廠除役管制會議。
AEC held the 2021 Regulatory Meeting on Nuclear Power Plant Decommissioning.

05.17

核定公告新北市核子事故區域民眾防護應變計畫。
AEC approved and published the "Public Protection Plan within the EPZ in New Taipei City".

05.25

修正發布「放射性廢棄物處理貯存及其設施安全管理規則」第八條、第九條。
Article 8 and 9 of the "Regulations on Treatment and Storage of Radioactive Waste and Safety Management of the Facilities" were amended and announced.

05.25

完成 2020 年版用過核子燃料與放射性廢棄物管理安全聯合公約國家報告書。
AEC finished the 2020 National Report as referred to by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

June

06.04

核定 110 年臺灣海域海水氚輻射調查計畫初版，並函送行政院農業委員會水產試驗所、海洋委員會海洋保育署、海洋委員會海巡署艦隊分署及國立中山大學。
AEC approved the first edition of the 2021 Tritium Radiation Investigation Plan in Taiwan Area and sent related letters to the Fisheries Research Institute of the Council of Agriculture; Ocean Conservation Administration of the Ocean Affairs Council; Fleet Branch of the Coast Guard Administration, Ocean Affairs Council; and National Sun Yat-sen University.

06.21

國際原子能總署（IAEA）公布「2020 年全球核子保防實施總結報告」（The Safeguards Statement for 2020），我國連續第 15 年被宣告為「所有核物料均用於核能和平用途」國家之列。
The International Atomic Energy Agency (IAEA) published "The Safeguards Statement for 2020," declaring Taiwan a country where "all the nuclear materials are used for peaceful purposes" for 15 consecutive years.

06.28

完成辦理 109 年度放射性廢棄物最終處置計畫執行成效評核作業。
AEC completed the evaluation of the 2020 annual implementation effectiveness of the low-level radioacive waste final disposal plan.

06.28-07.01

辦理核子事故應變階段輻射數據圖像化系統核一廠陸域輻射偵測相關功能及操作訓練。
AEC provided the training on the Chinshan NPP on-land radiation monitoring function and operation of the radiation data visualization system needed at the nuclear accident response stage.

06.30

發布我國「109 年度全國輻射工作人員劑量統計年報」。
AEC published the "2020 Annual Statistical Report on Occupational Radiation Exposure in Taiwan, Republic of China."

06.30、12.29

召開 110 年度核能管制會議。
AEC held the 2021 Nulcear Regulatory Meeting.

06月-12月

密切關注大陸台山核電廠輻射異常事件，嚴密監控臺灣環境輻射變化量。
AEC paid careful attention to the radiation abnormal occurrences of the Taishan NPP in China, and closely monitored the changes in environmental radiation in Taiwan.

July

07.08

召開嚴重疫情期間核子事故應變防疫措施討論會。
AEC held a meeting on discussing the COVID-19 pandemic countermeasures during the nuclear emergency.

07.12-08.31

辦理核能電廠除役視察員轉換訓練課程。
AEC held the NPP decommissioning inspector training course.

07.13-07.14

完成翡翠水庫集水區域及臺北自來水事業處所屬淨水場水樣放射性含量分析結果 2 及 10 件，分析結果函送臺北翡翠水庫管理局及臺北自來水事業處。
Two and ten analysis cases of radiation content in the water sampled from the catchment area of the Feitsui Reservoir and the water treatment plants of Taipei Water Department were completely respectively. The analysis results were sent to Taipei Feitsui Reservoir Administration and Taipei Water Department.

07.13-07.15

辦理美國能源部國家核子保安局（NNSA/DOE）「核設施資通安全計畫與執行實務」全視訊訓練。
AEC conducted a virtual training on the"Cyber Security Plan for Nuclear Facilities and its Implementation Practices" with National Nuclear Security Adminstration, US Department of Enegty (NNSA/USDOE).

07.14、11.23

召開蘭嶼核廢料貯存場設置真相調查後續應辦有關遷場及補償事項第七次及第八次討論會議。
AEC held the 7th and 8th meetings on the Review Meeting for Site Relocation and Compensation following the Truth Investigation on the Setup of the Lanyu Storage Site.

07.19-07.23、07.26-07.30、08.09-08.13

執行核二廠、核一廠、核三廠人員訓練與資格鑑定專案視察。
AEC conducted the inspections on personnel training and qualification for the Kuosheng, Chinshan and Maanshan NPPs.

07.20

辦理第 7 屆臺日核安管制資訊交流視訊會議。
AEC held the "7th AEC-NRA Nuclear Regulatory Information Exchange Meeting" through video conferencing.

07.22-07.23、09.30

執行核三廠緊急應變計畫演習與核子保安及反恐演練視察。
AEC conducted a variety of inspections including the emergency response exercise, nuclear security, and counter-terrorism drill at Maanshan NPP.

07.26、08.18、08.23、11.15、11.25

接獲台電公司提送之「核三廠除役許可申請案」，開始程序審查作業。
AEC received the "Application for the Maanshan NPP Decommissioning Permit" submitted by TPC and started acceptance review process.
召開「核三廠除役計畫實質審查準備會議」。
AEC convened the "Pre-review preparation Meeting for the Maanshan NPP Decommissioning Plan."
完成「核三廠除役許可申請案」程序審查並開始實質審查。
The acceptance review of the "Application for the Maanshan NPP Decommissioning Permit" was completed, and the technical review was commenced.
召開「核三廠除役計畫第一回綜合審查聯席會議」。
AEC held the "First Joint Review Meeting for the Maanshan NPP Decommissioning Plan."
函送台電公司核三廠除役計畫第一回合審查意見。
AEC sent the review comments from the first meeting on the Maanshan NPP decommissioning plan to TPC."

07.27、08.26

同意核備「核二廠第一期乾式貯存設施用過核燃料完整性評估及檢驗計畫書」、「核一廠第二期乾式貯存設施用過核燃料完整性評估與啜吸抽樣檢驗計畫」。
AEC approved the "Assessment and Inspection Plan for the Integrity of the Spent Fuel of the First-Phase Dry Storage Facilities of Kuosheng NPP" and the "Integrity Assessment and Sampling of Sipping Test Plan for the Spent Fuel of the Second-Phase Dry Storage Facilities of the Chinshan NPP".

07.27、08.07-08.08、08.16

原能會審查後同意台電公司核二廠 2 號機急停後再起動申請。
AEC approved TPC's application for the restart of Kuosheng NPP Unit 2 after automatic shutdown.
執行核二廠主控制室操作盤面區域實體防護措施施作現場視察。
AEC conducted the on-site inspection of the physical protection measures for the operation panel in the main control room at the Kuosheng NPP.
召開「台電公司核能電廠控制室管理強化措施」討論會議。
AEC held the meeting on the "Enhancement Measures for the Administrative Controls on Main Control Room Management of the TPC's Nuclear Power Plants".

07.29

召開第 7 次日本福島核災含氚廢水跨部會因應會議。
AEC held the 7th inter-ministerial response meeting for the tritium-containing wastewater from the Fukushima nuclear accident in Japan.

07.29

同意核備核研所「核能研究所臺灣研究用反應器（TRR）及微功率反應器（ZPRL）除役計畫之除役計畫書 110 年修正版及 109 年度執行報告」。
AEC approved the “2021 Amendments of the Decommissioning Plan for INER’s TRR and ZPRL and its 2020 Implementation Report”.

07.31

發布我國「109 年游離輻射應用與管理統計」年報。
AEC published the “2020 Annual Statistical Report on Application and Management of Ionizing Radiation in Taiwan, Republic of China.”

August

08.03-08.04

辦理 110 年蘭嶼地區環境平行監測活動。
AEC carried out the 2021 Parallel Monitoring Activity on Environmental Radiation in Lanyu Area.

08.05

訂定「核子事故各應變中心因應嚴重特殊傳染性肺炎疫情之防疫措施及運作機制」及「嚴重特殊傳染性肺炎疫情期間實施核子事故民眾防護行動注意事項」，函送各應變單位依循。
AEC has formulated the “Pandemic Prevention Measures and Operation Mechanism for the Nuclear Emergency Response Centers in response to the Severe Pneumonia with Novel Pathogens” and “Directions of Implementing Nuclear Emergency Public Protective Action During the Severe Pneumonia with Novel Pathogens”, both are officially announced to all response centers.

08.06

辦理 110 年核安第 27 號演習兵棋推演。
AEC conducted the table-top exercise of the 2021 National Nuclear Emergency Exercise.

08.10-09.11

執行「核二廠第一期乾式貯存設施熱測試用過核子燃料啜吸檢驗作業」專案檢查。
AEC executed taskforce inspection for the “Sipping Test of the Spent Fuel for the Hot Test of the Kuosheng NPP’s First-Phase Dry Storage Facilities”.

08.12、08.19

執行 110 年度核一廠用過核子燃料乾式貯存設施設備組件維護保養專案檢查。
AEC performed the 2021 taskforce inspection for the maintenance of the equipment components of the Chinshan NPP’s dry storage facilities.

08.19

核定 110 年臺灣海域海水氚輻射調查計畫修訂 1 版，8 月 24 日函送行政院農業委員會水產試驗所、海洋委員會海洋保育署、海洋委員會海巡署艦隊分署及國立中山大學據以執行。

AEC approved the first amendment edition of the 2021 Tritium Radiation Investigation Plan in Taiwan Area and sent related letters to the Fisheries Research Institute of the Council of Agriculture; Ocean Conservation Administration of the Ocean Affairs Council; Fleet Branch of the Coast Guard Administration, Ocean Affairs Council; and National Sun Yat-sen University for implementation on August 24.

08.23-25、09.16、09.22、10.05、11.10

完成 110 年南部輻射監測中心基礎及再訓練，本次以線上視訊方式辦理，基礎訓練 25 人參訓、再訓練 51 人參訓。

The basic training and retraining for the radiation monitoring center in Southern Taiwan in 2021 were completed. Both were held online this time. A total of 25 and 51 staff members participated in the basic training and retraining respectively.

南部輻射監測中心例行訓練：9 月 16 日完成恆春地區空中偵測飛行實作訓練、9 月 22 日完成 110 年南部輻射監測中心陸域輻射偵測進階訓練、10 月 5 日完成 110 年南部輻射監測中心海上輻射偵測及取樣訓練。

The routine training for the radiation monitoring center in Southern Taiwan: Completion of the practical flying training for aerial measurement in Hengchuen Area on September 16; completion of the 2021 advanced on-land radiation measurement training on September 22; completion of the 2021 radiation measurement and sampling training on sea surface on October 5.

11 月 10 日完成劑量評估系統教育訓練，計 18 名參訓，與會單位包含原能會、氣象局、核研所、輻射偵測中心。

The education training for the dosage assessment system was completed on November 10. There were 18 participants from AEC, Central Weather Bureau, INER, and RMC."

08.30-09.02

陪同監察院長訪查蘭嶼貯存場，並執行 110 年蘭嶼貯存場定期檢查。

AEC accompanies the President of the Control Yuan during her visit to the Lanyu Storage Site and conducted its 2021 regular inspection.

September

09.01-03

舉辦 3 場「2021 游離輻射防護法規精進宣導視訊說明會」。

AEC organized three sessions of the "2021 Video Briefing on the Improvement and Promotion of Ionizing Radiation Protection Regulations."

09.04、09.09-09.10

於核一廠及鄰近地區辦理 110 年核安第 27 號演習實兵演練。

AEC conducted the full-scale Nuclear Emergency Exercise for the Chinshan NPP.

09.06

辦理「110 年核安第 27 號演習實兵演練說明」記者會，向媒體說明第 27 號演習實兵演練之地點、項目、動員人力及演習特點。

The "Briefing on 2021 No. 27 Nuclear Emergency Full Exercise" press conference was held to provide the media with information, such as the locations, events, mobilized manpower, and drill features of the exercise.

09.07

辦理原能會主管 110 年度預算說明會。
The AEC 2021 annual budget briefing was held.

09.07

完成「110 年蘭嶼地區環境試樣平行監測分析」，檢測試樣包含水樣、草樣及土壤共 24 件，均在環境背景變動範圍內無異常現象。
The "2021 Parallel Monitoring Analysis of Environmental Radiation in Lanyu Area." A total of 24 samples was collected for the analysis included water, grass and soil samples. All data were within the variation range of the environmental background and no deviation was detected.

09.09

執行核一廠緊急應變計畫演習與核子保安及反恐演練視察。
AEC conducted a variety of inspections including the emergency response exercise, nuclear security, and counter-terrorism drill at Chinshan NPP.

09.11

辦理放射性廢棄物處理設施運轉人員測驗。
AEC held the Examination for Operators of Radioactive Waste Treatment Facilities.

09.13-10.15

執行 110 年度核一廠乾式貯存設施統合演練作業專案檢查。
AEC executed taksforce inspection for the "2021 integration drill of the dry storage facilities of Chinshan Nuclear Power Plant".

09.16

「輻射源進出口簽審通關系統」通過資訊安全 ISMS 管理制度（ISO27001）BSI 外部委員稽核。
The "Radiation Source Import/Export Customs Licensing System" passed the audit of the Information Security Management System (ISO 27001) by the BSI external auditor.

09.16

原能會資通安全管理制度（ISMS）通過 ISO 27001 外部稽核，證書持續有效。
AEC Information Security Management System (ISMS) passed the ISO 27001 external audit and certificate remained effective.

09.16-09.30

核研所舉辦 109 年度「行政院原子能委員會委託研究計畫」成果發表會，因應 COVID-19 疫情，首次以視訊會議方式辦理，邀請產、學、研界合作夥伴參加，人數計 171 人。
INER organized a result presentation for the "2020 Research Project under Commission of the Atomic Energy Council, Executive Yuan." It was the first presentation held via video conference in consideration of the COVID-19 pandemic and a total of 171 persons from our industry, university and institute partners were invited for the presentation.

09.17、09.24、10.30

執行 110 年度第 2 次核二廠、核三廠及核一廠不預警視察（含控制室人員行為及管理情形查證）。
AEC conducted the 2nd unannounced inspection at the Kuosheng, Maanshan, and Chinshan nuclear power plants in 2021 (incl. the behaviors of the staff and the management in the control rooms).

09.22

辦理「109 年原子能科技合作研究計畫」成果發表會。
AEC arranged " the 2020 Atomic Science and technology Cooperation Research Program" presentation.

09.23、09.27、 10.01、10.04

於北、中、南、東區辦理「地方政府輻射災害防救講習」。
AEC held four "Radiation Disaster Prevention and Protection Workshops for Local Governments" in northern, central, southern and eastern regions.

09.29

完成核能資訊公開線上申請作業，可提供民眾無紙化線上申請，除可降低個資外洩風險外，亦提升行政效率。
AEC completed the public online application for nuclear information that allowed civilian to make paperless online application, not only reducing the risk of personal information breach but also enhancing the administrative efficiency.

09月-12月

輔導推動 7 間民間實驗室通過全國認證基金會（TAF）及衛福部食品藥物管理署（TFDA）之食品輻射雙重認證。
AEC assisted 7 private labs in getting the dual accreditations regarding food irradiation from Taiwan Accreditation Foundation (TAF) and Taiwan Food and Drug Administration (TFDA).

October

10.01-10.30

執行新北市緊急應變計畫區家庭訪問作業。
AEC carried out a home-visit program in the emergency planning zone(EPZ) in New Taipei City.

10.13

辦理輻射應變技術隊年度訓練。
AEC conducted annual training for the Radiation Response Technique Team.

10.14-10.15

辦理「核能電廠警衛效能評估進階訓練」。
AEC conducted "Advanced Training on Performance Evaluation of the Security Guards of Nuclear Power Plants."

10.18-12.10

辦理 110 年原子能線上科技科普研習活動，計有國小、國中及高中 5,433 位學生參與。
AEC organized the 2021 Online Atomic Science Workshop, with a total of 5,433 elementary, junior and senior high school students participating in the event.

10.19

原能會依放射性物料管理法第 23 條規定，核發核研所低放射性廢棄物實驗型電漿焚化熔融爐除役許可。
AEC issued the decommissioning permit of lab plasma furnace for low level radioactive waste to INER pursuant to Article 23 of the Nuclear Materials and Radioactive Waste Management Act.

10.20

「2021 臺灣創新技術博覽會」發明競賽獎線上公布獲獎名單，核研所獲得 2 面鉑金、3 面金牌、2 面銀牌、3 面銅牌，獲獎率約 77%（遠高於大會平均獲獎率 58%）。
The winner list of the "2021 Taiwan Innotech Expo" competition was announced online, and INER won two platinum awards, three gold medals, two silver medals and three bronze medals in the competition with a prize winning rate of 77% (much higher than the overall average prize winning rate of 58%).

10.22

核研所主辦「110 年核設施除役技術國際研討會」，邀請台電公司、學界、產業界等專家學者與會，以組成臺灣核電廠未來除役工作所需之團隊為目標。
INER organized the "2021 International Workshop of Nuclear Facility Decommissioning Technologies" and invited the experts from Taipower, universities and industries for the workshop in order to form the teams needed for the expected decommissioning of the nuclear power plant in Taiwan.

10.22

2021 全球百大科技研發獎（R&D 100 Awards）公布獲獎名單，核研所以「智慧配電網路管理系統（iDNMS）」參賽且獲獎。
The list of the winners of the R&D 100 Awards was announced in 2021. INER took "Intelligent Distribution Network Management System (iDNMS)" to participate in this competition and won the prize.

10.24、11.12-11.14

受邀參與國立臺灣科學教育館辦理「第二屆臺灣科學節」的「新竹市科普市集」與「療癒嘉年華」活動。
AEC was invited to participate the "Hsinchu City Science Fair" and "Vivid Life in Healing Era" events hosted by the National Taiwan Science Education Center for the " 2nd Taiwan Science Festival."

10.25

財團法人生技醫療科技政策研究中心公布第 18 屆國家新創獎得獎名單，核研所榮獲 2 項「學研新創獎」及 4 項「2021 年度績獎」。
Research Center for Biotechnology and Medicine Policy announced the winner list of the 18th National Innovation Award and INER won two "research and innovation awards" and four "2021 renewal awards" in the competition.

10.25、11.11

執行核二廠緊急應變計畫演習與核子保安及反恐演練視察。
AEC conducted a variety of inspections including the emergency response exercise, nuclear security, and counter-terrorism drill at Kuosheng NPP.

10.27

召開第 8 次日本福島核災含氚廢水跨部會因應會議。
AEC held the 8th inter-ministerial response meeting for the tritium-containing wastewater from the Fukushima nuclear accident in Japan.

10.27

提出「2323 ～ 2026 國家海域放射性物質環境輻射監測及安全評估應對計畫」。
AEC presented the "2023–2026 Environmental Radiation Monitoring and Safety Assessment Countermeasure Plan for Radioactive Materials in the National Sea Areas."

10.27

辦理 110 年度核一廠除役及乾貯設施訪查活動。
AEC executed the 2021 Non-governmental participation to Chinshan Nuclear Power Plant decommissioning and dry storage facility.

10.29

核備核研所「乏燃料套管地下貯存庫除役完成報告」，並同意解除該設施之除役管制。
AEC approved the INER's "Report on the Completed Decommissioning of the Underground Storage Facilities for Spent Fuel Tubes".

10.30

舉辦 110 年度第 2 次「輻射防護專業測驗及操作人員輻射安全證書測驗」。
AEC held the 2nd exam of "2021 Certification Examination for Radiation Protection Personnel and Radiation Operators on Radiation Safety."

November

11.08

立法院續審原能會主管 111 年度預算及緊急應變基金。
The Legislative Yuan reviewed the 2022 AEC annual budget and emergency response fund.

11.08

核定公告基隆市核子事故區域民眾防護應變計畫。
AEC approved and published the " Public Protection Plan within the EPZ in Keelung City".

11.18

2021 年 IAEA 能力試驗結果公布，輻射偵測中心參與項目均通過（含水樣加馬／氚／鍶 90 ／總貝他／鈽 239、生物樣加馬、濾紙加馬／總貝他）。
The result of the"2021 WorldWide Open Proficiency Test Exercise" was announced by IAEA. RMC passes all the tests that it participated in (including water samples with gamma/tritium/strontium-90/total beta/plutonium-239; bio-samples with gamma; filter paper with gamma/total beta).

11.24-11.25

國際原子能總署（IAEA）保防官員至核研所進行 2021 年核子保防例行檢查，檢查結果發現部分館舍平面圖（Floor Plan）與早期提報時略有差異，相關缺失將於 111 年之設計資訊問卷及補充議定書更新。
IAEA safeguards officers conducted the regular 2021 nuclear safeguards inspection at the INER. The result showed a slight difference between the floor plan of some buildings and the reports submitted earlier. Update will be made in the 2022 Design Information Questionnaire and Additional Protocol for the deficiencies.

11.24、12.01

辦理南、北兩場次「110 年度核子事故緊急應變主管決策人員進階訓練」。
AEC arranged two sessions of "2021 Advanced Training for the Emergency Response Officers and Decision Makers Responsible for Nuclear Accidents" in northern and southern Taiwan.

11.27

完成原能會 112 年度科技發展計畫總體說明書並送至科技部。
The AEC 2023 General Descriptions of Technology Development Plan was completed and submitted to the Ministry of Science and Technology (MOST).

11.30

執行 110 年度輻射污染建築物居民醫療服務諮詢及後續醫療照護計畫，完成 528 位輻射屋居民健康檢查。
AEC executed the "2021 Medical Consultation and Subsequent Medical Care Program for residents of radioactively contaminated buildings" and provided health examinations for 528 residents of radioactively contaminated buildings.

11.30

「輻射防護雲化服務系統」完成優化電子化政府（MyData）繼續教育積分線上申辦服務及稽查作業線上申報服務。
AEC optimized the " Radiation Protection Registration and Control System" and provided the electronic government (MyData) online application for continuing education score accumulation and online reporting service of audit operations.

11.30-12.02

完成大港計畫輻射異常事件處置教育訓練，共計 56 人參訓（參與單位包含原能會、核研所、高雄關、航商及集散站業者等）。
AEC carried out the educational training on the handling of abnormal radiation accidents related to Taiwan Megaport Initiative. Fifty-six staff members participated in the training (from AEC, INER, Kaohsiung Customs, shipping companies and cargo entrepot service providers).

December

12.03

召開第 54 次核子設施類輻射防護管制會議。
AEC convened the 54th Session of "Radiation Protection and Regulation for nuclear facilities".

12.04、12.11、12.17

執行 110 年度第 3 次核二廠、核一廠及核三廠不預警視察（含控制室人員行為及管理情形查證）。
AEC conducted the 3rd unannounced inspection at the Kuosheng, Chinshan, and Maanshan nuclear power plants in 2021 (incl. the behaviors of the staff and the management in the control rooms).

12.06

衛福部公布 110 年「衛福部／經濟部藥物科技研究發展獎」得獎名單，核研所以「低劑量三維 X 光造影儀 -Taiwan TomoDR」技術榮獲醫療器材類銀質獎。
MOHW announced winner list of the "2021 Drug Research and Development Science and Technology Awards, jointly organized by the MOHW and the MOEA." INER won the silver medal in the medical device category with its "Low-dose 3D X-ray Imaging Scanner – Taiwan TomoDR" technology.

12.06-12.10

執行核二廠 1 號機除役前準備作業專案視察。
AEC conducted the inspections on the preparatory activities before Kuosheng NPP Unit 1 entering decommissioning period.

12.08、15、22

於北、中、南舉辦 3 場「110 年度放射線照相檢驗業輻射安全防護管制宣導暨操作實務訓練」宣導活動。
AEC held three sessions of "2021 Radiographical Testing Service Operator's Radiation Safety and Protection Control Promotion and Practical Operation Training" in Northern, Central, and Southern Taiwan.

12.14

完成「輻射災害第一線應變人員手冊（二版）」改版更新。
AEC revised the "Handbook for the Frontline Radiation Disaster Response Personnel (2nd Version)."

12.14

核研所「含再生能源之智慧配（微）電網研發團隊」榮獲 110 年全國公務人員傑出貢獻獎，得獎團隊赴銓敘部參加頒獎典禮，總統親臨致詞頒獎。
The "Research Team of Intelligent Distribution Network and Microgrid Technique Incorporating Renewable Energy" of INER won the 2021 Public Servant Outstanding Contribution Award. The awardee went to the Ministry of Civil Service to attend the awards ceremony, where President Tsai delivered a speech and awarded in person.

12.16

執行核能研究所臺灣研究用反應器專案檢查。
AEC executed taskforce inspection for the INER's Taiwan Research Reactor (TRR).

12.16

辦理「國內環境試樣比較實驗研討會」，邀請國內環境輻射偵測實驗室及地方衛生局與民間食品放射性檢驗實驗室共 10 個單位，共同討論本年度國內環境試樣比較實驗結果及 IAEA 能力試驗結果。
AEC organized the "Domestic Environmental Sample Comparison Experiment Workshop. Ten units, including the domestic environmental radiation measurement labs, local health departments, and private food radiation testing labs, were invited to discuss the results of the domestic environmental sample comparison experiment and WorldWide Open Proficiency Test Exercise host by IAEA.

12.21

舉辦「110 年度原子能安全績優獎暨放射性物料研究發展傑出貢獻及安全營運績優獎」頒獎典禮。
AEC organized the award ceremony for the "2021 Atomic Energy Safety Merit Award and Outstanding Radioactive Material Development Contribution and Safe Operation Award."

12.22

完成低放射性廢棄物最終處置技術評估報告（2020 年版）審查。
AEC finished the review of the assessment report on the final disposal technology for low-level radioactive waste (2020 Version).

12.24

核定 111 年臺灣海域海水氚輻射監測計畫，並函送行政院農業委員會水產試驗所、海洋委員會海洋保育署及海洋委員會海巡署艦隊分署。
AEC approved the 2022 Tritium Radiation Monitoring Plan in Taiwan Area and sent related letters to the Fisheries Research Institute of the Council of Agriculture; Ocean Conservation Administration of the Ocean Affairs Council; and Fleet Branch of the Coast Guard Administration, Ocean Affairs Council.

12.29

發布修正「游離輻射設備製造業個人資料檔案安全維護管理辦法」。
AEC revised and published the “Regulations Governing Personal Information File Security Maintenance and Administration for Ionizing Radiation Equipment Manufacturing Enterprise.”

12.30

辦理「110 年媒體溝通與輿情回應技巧——科普影片自製技巧攻略」訓練課程，以增進同仁自製業務有關科普影片之技巧。
AEC conducted the “2021 Media Communication and Public Opinion Response Skills: Science Video Production Techniques” workshop to enhace the AEC staff ‘s skills on making science videos related to their jobs.

12.30

完成 2020 年核能安全公約國家報告中英文版（英文版部分已送美國核管會，完成同行審查作業），於原能會網站公布。
Both the Chinese and English versions of 2020 National Report for the Convention on Nuclear Safety were completed (English version already submitted to the NRC for peer review) and disclosed on AEC’s website.

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