

# 台電工程月刊 899 期(7 月)目錄

## 配 電 :

### DISTRIBUTION :

配電系統電桿狀態即時偵測與事故防範對策之研究 .....黃暉珩 等 .....(1)

Real-time Detection of Pole Status and Accident Prevention in Distribution

System .....Huang, Wei-Heng et al. ....(1)

供電瓶頸地區及中小學用戶之需量反應方案效益測試與技術驗證研究 .....黃秉偉 等 .....(8)

A Study on Performance Evaluation and Technology Validation of Demand Response Programs

for Power Supply Constrained Areas and Elementary and Middle Schools .....Huang, Bing-Wei et al. ....(8)

## 工程技術 :

### ENGINEERING TECHNIQUES :

輻射偵測智慧載具自走應用研究 .....林聰得 等 .....(23)

Application of Radiation Detection Automatic Navigation for Smart Vehicles .....Lin, Tsung-Te et al. ....(23)

智慧變電所 IEC 61850 監控系統 MCC IED 規劃實例 - 以楠旗 D/S 為例 .....呂世彬 等 .....(32)

Smaller Substation IEC 61850 Supervisory Control System MCC IED Planning-

Taking Nanqi D/S as an Example .....Lu, Shih-Pin et al. ....(32)

## 環境與永續 :

### ENVIRONMENT AND SUSTAINABILITY :

環保業務資訊系統應用研究發展之進程 .....溫桓正 等 .....(40)

Application and Development of Taipower's Environmental Integrated Information

System .....Wen, Huan-Cheng et al. ....(40)

燃氣電廠 SO<sub>x</sub> 排放濃度研究 .....吳政宏 等 .....(48)

Study on SO<sub>x</sub> Emission Concentration of Gas-fired Power Plants .....Wu, Cheng-Hung et al. ....(48)

## 售電與用戶 :

### ELECTRICITY RETAILING AND CUSTOMERS :

電力大數據應用人工智慧於微型區域發展預測創新試驗研究 .....張宇琦 等 .....(58)

Application of Electric Power Big Data and Artificial Intelligence in Micro Area

Potential Forecast .....Zhang, Yu-Chi et al. ....(58)

## 減 碳 :

### CARBON REDUCTION :

台電 2050 年淨零碳排關鍵技術之研究 .....林慧瑩 .....(65)

Research on Key Technologies for Taipower's 2050 Net-Zero Carbon Emissions .....Lin, Hui-Yin .....(65)

## 核 能 :

### NUCLEAR ENERGY :

核一、二、三廠緊急應變計畫區檢討修正 .....余政倫 等 .....(84)

The Review and Revision of the Emergency Planning Zones of the Nuclear Power Plants

in Taiwan .....Yu, Cheng-Lun et al. ....(84)

# 配電系統電桿狀態即時偵測與事故防範對策之研究

Real-time Detection of Pole Status and Accident Prevention in Distribution System

黃暉珩\*  
Huang, Wei-Heng

陳鳳惠\*  
Chen, Fung-Fei

柴建業\*\*  
Chai, Chien-Yeh

黃彥皓\*\*\*  
Huang, Yan-Hao

毛鈺甫\*\*\*  
Mao, Yu-Fu

鍾煜光\*\*\*  
Zhong, Yu-Guang

張瑞彥\*\*\*  
Chang, Jui-Yen

## 摘要

本研究目標在協助台電公司提升電桿狀態監測之效率，並透過開發監測資料管理平台有效管理數據與資訊。使用智慧影像辨識之試驗研究，建置電桿巡檢車來巡拍電桿狀態，利用 AI 引擎進行影像辨識，以求快速且大量進行電桿狀態判斷，提升電桿巡檢作業之效能。

AI 影像辨識處理平台開發整合影像蒐集巡檢車，於巡檢過程中擷取電桿影像後將資料匯入 AI 影像辨識處理平台，利用 AI 深度學習引擎 YOLO<sup>[1]</sup>來偵測道路順向以及對向車道電桿，結合輔助資料來分析電桿的傾斜狀態評估等級，最後將評估結果記錄在雲端資料庫作為電桿維護參考。

將資料彙整於研華物聯網平台 WISE-PaaS，提供完善的平台開發工具包含可視化顯示開發頁面、資產管理系統、AI Framework 服務、資料庫管理服務等。實際場域驗證部分，則會於桃園、新竹等二區處挑選共 250 支電桿進行影像辨識系統功能驗證。

## Abstract

The goal of this research is to assist Taiwan Power Company to improve the efficiency of pole condition monitoring, and to effectively manage data and information through the development of a monitoring data management platform. Using the experimental research of intelligent image recognition, a pole inspection vehicle is built to patrol the status of the poles, and the AI engine is used for image recognition to quickly and massively judge the status of the poles and improve the efficiency of the pole inspection operation.

The development of AI image recognition processing platform integrates image collection and inspection vehicles. During the inspection process, the pole images are captured and the data is imported into the AI image recognition processing platform. The AI deep learning engine YOLO is used to detect the direction of the road and for the poles in the opposite lane; analyze the evaluation level of the inclination state of the poles in combination with the auxiliary data; record the evaluation

\*台灣電力公司綜合研究所

\*\*台灣電力公司配售電事業部配電處

\*\*\*工業技術研究院

results in the cloud database as a reference for pole maintenance; integrate data into Advantech's IoT platform WISE-PaaS and provide comprehensive platform development tools, including visual display development pages, asset management systems, AI framework services, database management services, etc. In the actual field verification part, a total of 250 poles located within the service area of TPC's Taoyuan and Hsinchu district offices for the functional verification of the image recognition system.

**關鍵詞(Key Words)**：智慧電桿(Smart Electric Pole)、電桿感測(Electric Pole Sensing)、AI 影像辨識(AI Image Recognition)。

# 供電瓶頸地區及中小學用戶之需量反應方案效益測試與技術驗證研究

A Study on Performance Evaluation and Technology Validation of Demand Response Programs for Power Supply Constrained Areas and Elementary and Middle Schools

黃秉偉\*  
Huang, Bing-Wei

楊新全\*  
Yang, Xin-Quan

鄒玉萍\*\*  
Tsou, Yu-Ping

陳俊宇\*\*  
Chen, Chun-Yu

陳暉祁\*\*  
Chen, Wei-Chi

許品超\*\*  
Hsu, Pin-Chao

## 摘要

由於輸變電設備興建飽受民眾抗爭，以致部分區域於用電尖峰發生設備超載之現象，可能進而引起區域限電之風險。不同供電瓶頸地區的用戶組成、發生時間及頻率之特性皆不盡相同，由中央調度中心執行之需量反應方案可能無法滿足不同區域之需求，為維持供電瓶頸區域之用電安全，研議具區域穩定功能之需量反應方案。行政院推動全國中小學「班班有冷氣」，全台 10 萬間教室冷氣裝設用電需求為 30 萬瓩，可藉此導入空調即時卸載方案，透過對新裝設冷氣之負載控制，將有助於尖峰負載抑低，提升電力系統調度效益，各校亦可藉此獲得需量反應回饋，減少因冷氣使用之電費負擔。本研究針對需量反應設計特性，提出方案的方案設計要素，並擬訂未來可參考之需量反應方案草案。

## Abstract

The construction of transmission facilities has been subject to public protests. For this sake, some areas have experienced equipment overload during peak hours, which may further lead to the risk of regional power curtailment. Due to the differences of customer composition, occurrence time and frequency of curtailments of different power supply constrained areas, the demand response plan implemented by the central dispatch center may not be able to meet the needs of all areas. To maintain the safety of power supply in constrained areas, a demand response (DR) program with regional stabilization functions is discussed to provide more attractive incentive and flexibility of participation. The Executive Yuan promotes “air-conditioning in every class” of elementary and middle schools across Taiwan. The electricity demand for air-conditioning (AC) installations in 100,000 classrooms in Taiwan is around 300MW. This can be used to introduce a real-time loading shedding solution for AC. Besides, load control of newly installed A.C. may help reduce the system peak load and improve the efficiency of power system dispatching. Schools can benefit from obtaining demand response feedback and reduction of electricity bills. According to the characteristics of DR design, this study proposes some crucial elements of DR design to serve as reference in the future.

**關鍵詞(Key Words)**：需量反應(Demand Response)、供電瓶頸(Power-supply Bottleneck Areas)、能源管理系統(Energy Management System)、自動需量反應(Automated Demand Response)。

\*台灣電力公司綜合研究所

\*\*工業技術研究院綠能與環境研究所

# 輻射偵測智慧載具自走應用研究

Application of Radiation Detection Automatic Navigation for Smart Vehicles

林聰得\*  
Lin, Tsung-Te

姜欣辰\*  
Chiang, Hsin-Chen

許怡儒\*\*  
Hsu, Yi-Ru

## 摘要

本研究以開源架構機器人操作系統(ROS)為基礎，以輪組機構作為機器人載具移動方式，搭載輪型里程計、光學雷達及深度相機等感測器，進行場域實體障礙物偵測，達成同步定位與地圖建模作業。依輻射偵測等特殊場域探索需求，結合各式環境感測資訊，疊加環境偵測資訊於機器人載具建模地圖中，以規劃適合機器人載具或人員最適化之安全通行路徑。經無線網路通訊架構佈建，可經遠端遙控操作，減少人員暴露於危險作業環境中，並可推展於定點巡航環境偵測及未知場域環境探索作業需求。

## Abstract

This study is based on the open source architecture Robot Operating System (ROS), using the wheel mechanism as the moving mode of robot vehicles, equipped with sensors such as wheel odometer, LiDAR, depth camera among others, to detect physical obstacles in the field and achieve Simultaneous Localization and Mapping (SLAM) algorithm. According to the needs of specific field exploration such as radiation detection, combined with various sensing information, the environmental detection information is superimposed on the modeling map for smart vehicles to plan the most suitable and safest path for the vehicles and personnel. With the deployment of wireless network communication system, the said vehicles can be operated remotely to reduce personnel exposure to dangerous operating environments. Furthermore, it can be applied to fixed-point cruising environment detection and exploration of unknown field environments.

**關鍵詞(Key Words)**： 機器人操作系統(Robot Operating System)、載具(Vehicle)、光學雷達(LiDAR)、同步定位與地圖建模(Simultaneous Localization and Mapping)。

---

\*行政院原子能委員會核能研究所

\*\*優利資源整合股份有限公司

# 智慧變電所 IEC 61850 監控系統 MCC IED 規劃實例— 以楠旗 D/S 為例

Smaer Substation IEC 61850 Supervisory Control System MCC IED Planning - Taking Nanqi D/S  
as an Example

呂世彬\*

Lu, Shih-Pin

徐仁正\*

Syu, Ren-Jheng

林正義\*

Lin, Cheng-Yi

黃壬譽\*

Huang, Ren-Yu

廖威宇\*

Liao, Wei-Yu

陳應廣\*

Chen, Ying-Kuang

## 摘 要

本文主要介紹台電公司積極推動智慧變電所，並在新建變電所工程採用新穎技術 IEC 61850 通訊協定架構，提供變電所擁有自動化互操作性及整合性，使變電所電力設備透過 IEC 61850 通訊協定來順利交換資料，為使加強該核心技術推行，本公司開始著手導入自營規劃 IEC 61850 監控系統架構，進而設計 MCC IED 之 CID 及 SCD 檔案，並導入 SCADA 監控系統測試及除錯機制，達到有形成果為無須依賴發包於系統承攬商施作，除了提升自我規劃能力外，也憑藉技術轉移成功案例，持續推廣至其他智慧變電所新建工程，達到自營建置效益及節省工程成本。

## Abstract

Taipower actively promotes smart substations, and adopts the IEC 61850 communication protocol framework in its new substation projects to provide automation interoperability and integration of the substations, so that the power equipments of the substations can exchange data smoothly through the said IEC 61850 communication protocol. In order to strengthen the implementation of the core technology, Taipower embarks on introducing the self-operated planning IEC 61850 monitoring system architecture, designed the CID and SCD files of MCC IED, and introduced the SCADA monitoring system testing and debugging mechanism to achieve tangible results without relying on system contractors for implementation. In addition to improving self-planning capabilities, Taipower will continue to promote new projects of smart substations by virtue of successful technology transfer cases to achieve self-construction benefits and save engineering costs.

**關鍵詞(Key Words)**：監控系統(Supervisory Control and Data Acquisition, SCADA)、智慧型電子裝置(Intelligent Electronic Device, IED)、SCT 規劃工具(System Configuration Tool)、IED 規劃工具 ICT(IED Configuration Tool)。

# 環保業務資訊系統應用研究發展之進程

Application and Development of Taipower's Environmental Integrated Information System

溫桓正\*

Wen, Huan-Cheng

林景庸\*

Lin, Ching-Yung

蔡幸枝\*

Tsai, Hsing-Chih

管永愷\*\*

Kuan, Yung-Kai

沈道剛\*\*

Shen, Tao-Kang

李佩庭\*\*

Li, Pei-Ting

## 摘要

台電環保處配合台電公司整體數位化政策，歷經 10 年努力，已完成各項環保業務的 e 化管理資訊系統建置，協助業務同仁處理相關工作執行與進度追蹤，因應近年環境政策快速變動，為強化整體業務管理之效能，台電環保處持續發展各業務資訊系統的跨業務整合、分析演算與決策輔助等加值應用，提升環保業務之自主管理能力。本文將針對近年所完成的空污排放量推估系統、環境監測數據加值應用及生態調查資料地理資訊圖臺應用，詳細介紹其各自的開發原由、應用延伸成果產出、協助解決之問題。

## Abstract

To comply with the company's overall digitalization policy, after ten years of hard work, the Department of Environmental Protection (DEP) of Taiwan Power Company has completed the establishment of an online information management platform for various environmental protection businesses, assisting colleagues in handling related work execution and progress tracking. In response to the rapid changes in environmental policies and to strengthen the effectiveness of overall business management, DEP continues to develop value-added applications such as cross-business integration of business information systems, analytics and algorithms, and decision-making support system to enhance the self-management capabilities of environmental protection businesses. This paper focuses on the issues such as air pollution emission estimation, value-added application of environmental monitoring, and applications of geographic information maps of ecological survey data completed in recent years, and introduces in detail the reasons for their respective development, extended application results, and problems needed to be solved.

**關鍵詞(Key Words)**：環保業務管理系統(Environmental Integrated Information Management System)、空污排放推估(Air Pollution Emission Estimation)、生態熱區(Ecological Hot Spot)。

---

\*台灣電力公司環境保護處

\*\*環興科技股份有限公司



# 燃氣電廠 SO<sub>x</sub> 排放濃度研究

Study on SO<sub>x</sub> Emission Concentration of Gas-fired Power Plants

溫桓正\*

Wen, Huan-Cheng

吳政宏\*

Wu, Cheng-Hung

王郁惠\*

Wang, Yu-Huei

郭子豪\*\*

Kuo, Tzu-Hao

李其霈\*\*

Li, Chi-Pei

## 摘要

國內燃氣電廠使用之燃料為天然氣(NG)，其成份以甲烷為主，相較於燃煤電廠顯著減少粒狀物及硫氧化物之空氣污染物排放，因此燃氣電廠一般在空污防制上通常僅設置脫硝設備，在硫氧化物的空污排放上則可以依照含硫量依質量平衡推估。開採出來的天然氣會先經過純化處理去除不純物質(汞及硫等)，並經過檢測把關，而為了便於長途運輸再藉由超低溫液化為液化天然氣(LNG)，大幅縮小體積。由於不純物質汞及硫對於液化設備之危害，LNG 的硫及汞含量低，早期並不是重大環境議題，直到近期國內能源轉型提高燃氣機組占比，而有研究必要。

近期有燃氣電廠管道實際檢測 SO<sub>x</sub> 濃度值高於質量平衡推估值，可能來自含硫量或檢測結果誤差。本研究從天然氣的燃料特性、排放管道中二氧化硫自動檢測方法，探討國內燃氣電廠 SO<sub>x</sub> 實際排放濃度特性，提供新設燃氣機組環評及許可審查之參考。

## Abstract

The fuel used by domestic gas-fired power plants (GPPs) is natural gas (NG), which is mainly composed of methane and may significantly reduce the emission of particulate matter and sulfur oxides air pollutants, when compared with coal-fired power plants (CPPs). Therefore, GPPs only have to install denitrification equipment for air pollution control, and the emissions of sulfur oxides can be estimated according to the calculation of mass balance based on the fuel sulfur content. The extracted NG will first be purified to remove impurities, such as mercury and sulfur, and then tested and checked. In order to facilitate long-distance transportation, it will be liquefied into liquefied natural gas (LNG) by ultra-low temperature, and the volume will be greatly reduced. Due to the harmfulness of impurities to liquefaction equipment, the sulfur and mercury content of LNG is low, therefore not a major environmental issue in the early days. Nevertheless, accompanied by the policy of energy transformation to increase the proportion of gas-fired units, research relevant to LNG becomes necessary. Recently, the actual detection of SO<sub>x</sub> concentration in GPP stacks is higher than the estimated mass balance value, which may be due to the sulfur content or the error of the detection results. This study discusses the actual SO<sub>x</sub> emission concentration characteristics of domestic GPPs from the fuel characteristics of natural gas and the automatic detection method of sulfur dioxide in the discharge stack to serve as reference for the environmental impact assessment and permit review of new gas-fired units.

**關鍵詞(Key Words)**：天然氣(Natural Gas, NG)、非分散性紅外光法(Nondispersive Infrared, NDIR)、二氧化硫(Sulfur Dioxide)、甲烷(Methane)、干擾(Interference)。

\*台灣電力公司環境保護處

\*\*環興科技股份有限公司



# 電力大數據應用人工智慧於微型區域發展預測創新試驗 研究

Application of Electric Power Big Data and Artificial Intelligence in Micro Area Potential Forecast

張宇琦\*  
Zhang, Yu-Chi

蔡志祥\*  
Tsai, Chih-Hsiang

陳以彥\*  
Chen, Yi-Yen

楊雅惠\*\*  
Yang, Ya-Hwei

蔡孟君\*\*  
Tsai, Meng-Chun

曾嘉怡\*\*  
Tseng, Jia-Yi

王維屏\*\*  
Wang, Wei-Ping

## 摘要

台電公司於台灣之用戶涵蓋率近 100%，運用用戶用電行為資料，並結合逐步普及的智慧電表自動化蒐集之即時資訊，可成為產業評估區域發展趨勢、協助產業升級的關鍵資源。本研究透過質化深度訪談，蒐集國內連鎖產業業者評估區域發展潛力之關鍵因素；並以電力大數據為基礎，導入人工智慧開發「微型區域發展指標體系」，為產業提供評估區域現況及發展潛力的參考依據，提升電力大數據資料應用效益；最後規劃微型區域發展預測短、中、長期之商業應用模式及配套措施，以供台電公司相關業務推動之參考。

## Abstract

The user coverage rate of Taipower in Taiwan is nearly 100%. Using the data of users' electricity consumption behaviors, combined with real-time information collected automatically by smart meters, which are more and more popular, can become a critical resource for the industry to evaluate the regional development trends and assist industry upgrades. Through qualitative in-depth interviews, this research collects key factors for domestic chain industry operators to assess regional development potential; based on electric power big data, introduces artificial intelligence to develop a "micro-regional development index system" to serve as reference for industries to evaluate regional status and development potential, and to improve the application efficiency of electric power big data; finally, engages in the planning of short-, medium-, and long-term commercial application models and supporting measures for the development of microregion to serve as reference for Taipower's related businesses.

**關鍵詞(Key Words)**：微型區域(Microregion)、資料經濟(Data Economy)、AMI 資料應用(AMI Data Application)、商業模式(Business Model)、人工智慧 (Artificial Intelligence)。

\*台灣電力公司綜合研究所

\*\*典通股份有限公司

# 台電 2050 年淨零碳排關鍵技術之研究

Research on Key Technologies for Taipower's 2050 Net-Zero Carbon Emissions

林慧瑩\*  
Lin, Hui-Yin

## 摘要

電業位居全球淨零轉型技術價值鏈的樞紐地位，是關鍵技術創新成功的核心，將對全球能源轉型產生深刻影響。到 2050 年，電力將成為能源消費的主要形式，90% 的電力需求將由再生能源提供。2050 淨零轉型是全世界目標，成熟技術不足達成淨零排放，須仰賴創新研發與投資。全球政府與能源相關的研發約 80% 用於淨零技術，包括再生能源極大化、提高能源效率、電氣化取代化石燃料設備、發展碳捕捉再利用及封存技術(CCUS)與氫能等應用。我國 2050 年能源結構中預計 60 至 70% 為分散式再生能源，因此台電規劃強化電網韌性，也提早為 2050 淨零轉型目標做好準備。台電綜合研究所將積極研發關鍵淨零技術及布局應用，同時將持續探討國際電業有關智能電氣化及分散式電網相關技術研究，引領台電加速邁向淨零。

## Abstract

The electric industry occupies a pivotal position in the global net-zero transition technology value chain, is the core of key technology innovation success, and will have a profound impact on the global energy transition. By 2050, electricity will be the dominant form of energy consumption, and 90% of electricity demand will be provided by renewable energy. 2050 net-zero transition is the goal of the world. Nevertheless, current mature technology is not yet enough to achieve the goal. We must rely on innovative R&D and investment. Approximate 80% of global governments' energy-related R&D is devoted to net-zero technologies, including maximizing renewable energy, improving energy efficiency, replacing fossil fuel equipment with electrification, developing carbon capture, utilization and storage (CCUS) and hydrogen energy applications. It is estimated that 60 to 70% of Taiwan's energy mix will be distributed renewable energy in 2050. Therefore, Taipower plans to strengthen the resilience of its power grid to prepare for the 2050 net-zero transition goal in advance. Correspondingly, Taiwan Power Research Institute (TPRI) will actively engage in developing the key technologies and applications regarding net-zero, electrification and decentralized power grid technologies, with reference to the R&D of worldwide electric industries, so as to accelerate the net-zero path for Taipower.

**關鍵詞(Key Words)**：能源轉型 (Energy Transition)、淨零轉型 (Net-zero Transition)、關鍵技術(Key Technologies)。

# 核一、二、三廠緊急應變計畫區檢討修正

The Review and Revision of the Emergency Planning Zones of the Nuclear Power Plants in  
Taiwan

余政倫\*  
Yu, Cheng-Lun

王德全\*  
Wang, Te-Chuan

陳承賢\*  
Chen, Chen-Hsien

施聿懷\*  
Shih, Yu-Huai

夏振原\*  
Hsia, Chen-Yuan

陳青漢\*  
Chen, Ching-Han

## 摘要

本文執行民國 110 年核一、二、三廠緊急應變計畫區評估之檢討修正，評估結果揭示核二、三廠全功率運轉階段，若設計基準事故發生時，以反應器為中心，距離中心半徑分別為 1.0 與 0.5 公里處的有效劑量皆小於 50 mSv；而爐心熔損事故發生時，距離反應器中心之半徑分別為 1.0 與 0.5 公里處，超出 50 mSv 之年機率皆小於 3E-05，此外，距離反應器中心之半徑同為 2.5 公里處超出 2 Sv 之年機率皆小於 3E-06。

核一、二廠在除役過渡階段前期，若發生設計基準事故，距離反應器中心之半徑分別為 0.5 與 2.0 公里處的有效劑量皆小於 50 mSv；而若爐心與用過燃料池熔損事故發生時，距離反應器中心之半徑同為 0.5 公里處，超出 50 mSv 之年機率皆小於 3E-05，超出 2 Sv 之年機率亦皆小於 3E-06。本評估結果揭示核一、二、三廠緊急應變計畫區皆可在距反應器中心之半徑 2.5 公里範圍內符合「核子事故緊急應變法施行細則」第三條之規定。

## Abstract

In this project, we execute the review and revision of the assessment of the Year 2021 Emergency Planning Zone (EPZ) of the first, second and third nuclear power plants (NPPs) in Taiwan. As the assessment results reveal, for the second and third NPPs, when operating at rated power and a Design Basis Accident (DBA) occurs, assuming the reactor as the center, the effective doses at the radiuses of 1.0 and 0.5 kilometers from the center will be less than 50 mSv; when a core meltdown accident occurs, for the radii from the center of the reactor are 1.0 and 0.5 kilometers respectively, the annual probability of exceeding 50 mSv is less than 3E-05. In addition, the annual probability of exceeding 2 Sv at the same radius of 2.5 kilometers from the center of the reactor is less than 3E-06.

In the pre-defueled stage of the first and second NPPs, if a DBA occurs, the effective doses at the radii of 0.5 and 2.0 kilometers from the center of the reactor are less than 50 mSv. If a core or Spent Fuel Pool (SFP) meltdown accident occurs, the radius from the reactor is the same as 0.5

kilometers; the annual probability of exceeding 50 mSv is less than 3E-05; the annual probability of exceeding 2Sv is less than 3E-06. As the assessment results reveal, the first, second and third NPPs can all comply with the provisions of Article 3 of the Rules for the Implementation of the Nuclear Emergency Response Act within a radius of 2.5 kilometers from the center of the reactor.

**關鍵詞 (Key Words)**：核子事故緊急應變法施行細則(Enforcement Rules for the Implementation of the Nuclear Emergency Response Act)、核能電廠(Nuclear Power Plant, NPP)、緊急應變計畫區(Emergency Planning Zone, EPZ)。