「用過核子燃料最終處置計畫」（2006年7月核定版）
摘錄

（資料來源：台灣電力公司 95年8月15日提供）

用過核子燃料最終處置計畫工作推動之目的，是設法安全隔離與阻絕放射性的核種，防止其隨地下水流遷移而影響人類生活圈，以確保民眾安全及環境品質，促進非核害環境的永續發展。

國際間對用過核子燃料最終處置技術之發展，曾考慮海床處置、深孔處置、冰層處置、井注處置、太空處置及深層地質處置等方案，迄今國際間公認以深層地質處置較為可行。深層地質處置採用「多重障壁」的概念，利用深部岩層的隔離阻絕特性，將用過核子燃料埋在深約300至1000公尺的地下岩層中，再配合包封容器、緩衝回填材料等工程設施－－藉由人工與天然障壁所形成的多重屏障系統，可以有效使外釋而遷移的核種受到隔離與阻絕的效果，以換取足夠的時間，讓放射性核種在進入生物圈之前已衰減至可忽略的程度。

目前，我國用過核子燃料最終處置係採行乾式貯存，同時積極尋求境外處置的機會，在境外處置未具體可行前，需依「放射性物料管理法」第49條規定，規劃國內放射性廢棄物最終處置設施之籌建。因此，為持續進行境內最終處置所需「深層地質處置」之技術發展，依「放射性物料管理法施行細則」第37條要求台電公司，提出「用過核子燃料最終處置計畫書」。

用過核子燃料最終處置設施的籌建，參考美國、瑞典、日本等國之規劃，均須費時長達數十年，以周詳的場址調查、評選、安全評估流程，持續發展處置技術，而後進行處置場之建造及運轉。有鑑於此，我國「用過核子燃料最終處置計畫書」擬訂階段性發展計畫，長期推動以提昇國內處置技術，依序分為：(1)「潛在處置母岩特性調查與評估」，(2)「候選場址評選與核定」，(3)「場址詳細調查與試驗」，

(4)「處置場設計與安全分析評估」，及(5)「處置場建造」等五個階段。而為達成各階段目標，所需下列進行之技術發展， (1)地質環境調查技術，(2)工程障壁與處置設施技術，(3)功能/安全評估技術，(4)地下試驗技術驗證，及(5)國際合作等五項。

「用過核子燃料最終處置計畫」的近程目標為：彙整研發成果與蒐集國內外相關資料，提出我國「用過核子燃料最終處置初步技術可行性評估報告」，其內容涵蓋「處置環境條件的調查研究」、「處置技術的研究發展」、「用過核子燃料處置的功能安全評估」等技術發展成果。以此為基礎，後續之工作規劃則針對我國處置環境調查與處置技術發展，展開潛在處置母岩特性調查與技術發展工作。因此近程工作乃針對國內現有可能潛在處置地質環境，進行區域調查與地質長期穩定性研究，並進行潛在處置母岩深層地質特性調查、現地深井孔內調查與技術發展，以及核種傳輸實驗等工作，取得地質構造、地下水文、地球化學及岩石力學等深層地質特性之調查成果，並提出建立功能/安全評估初步能力之案例說明。預期於「潛在處置母岩特性調查與評估階段」完成時，根據本土處置環境特性、處置條件、處置技術研究發展及安全評估技術建立等綜合研究成果，提出「我國用過核子燃料最終處置技術可行性評估報告」。

Program Plan for Final Disposal of Spent Nuclear Fuel (July 2006)

The goal of the ‘Spent Nuclear Fuel Final Disposal Program’ is to isolate the spent nuclear fuel in an underground space permanently for preventing radiation influence on human life via nuclide migration with groundwater, and to preserve a sustainable environment for our next generations.

Potential final disposal concepts include seabed disposal, deep borehole disposal, ice sheet disposal, deep-well injection disposal, extraterrestrial disposal and deep geological disposal. To date, the disposal method widely considered by international community is the deep geological disposal. Spent nuclear fuel would be encapsulated in a combination of engineered facilities and materials, such as metal canisters, buffer and backfill materials, and then buried at a depth of 300-1000 meters deep in the bedrock. Such a multiple barrier system, comprising both artificial and natural barriers, could efficiently retard the migration speed of nuclides to retain sufficient time for radiation to decay to a safe level before reaching to biosphere.

Currently, our management strategies for final disposal of spent nuclear fuel have adopted interim storage lasting for decades while seeking international repository. Before feasible proposition for repository by international cooperation, producers of radwaste should have a program to understand the feasibility for constructing the domestic facilities for the final disposal of radwaste based on the ‘Nuclear Materials and Radioactive Materials Management Act’ (Article

49). Furthermore, according to the ‘Enforcement Rules for Nuclear Materials and Radioactive Waste Management Act’ (Article 37), this ‘Spent Nuclear Fuel Final Disposal Program’ should be a guideline of extended research and development to understand the feasibility for constructing the domestic facilities for the final disposal of spent nuclear fuel.

Many countries, such as United States, Sweden, Japan, etc., have planned long-term programs for building a spent nuclear fuel final disposal facility, based on a process including site investigation, evaluation, safety assessment, and development of technologies to construct and operate the repository. Accordingly, the ‘Spent Nuclear Fuel Final Disposal Program’ will be carried out in five phases: (1) Potential Host Rock Characterization and Evaluation; (2) Candidate Site Investigation and Confirmation; (3) Detailed Site Investigation and Testing; (4) Repository Design and License Application; and (5) Repository Construction. In order to achieve the goal of this program, research and development efforts would focus on: (1) Characterization and Evaluation of Geological Environment; (2) Utilization of Engineered Barriers and Operation of Repository Facilities; (3) Performance and Safety Assessment of Repository Facilities; (4) Testing and Verification in Underground Research Facilities; and (5) International Cooperation.

The short-term goal of the ‘Spent Nuclear Fuel Final Disposal Program’ is to review and integrate available and updated results of technology development conducted over the years, which will in turn be compiled into a ‘Preliminary Technical Feasibility Report for Final Disposal of Spent Nuclear Fuel.’ Subjects of this report would include

achievements in ‘characteristic study of geological environment,’ ‘development status of disposal technology,’ and ‘performance and safety assessment on spent fuel repository.’ The follow-on studies on potential host rocks will include regional geological survey, and geological long-term stability. Meanwhile, technologies for deep geological characterization, in-situ downhole measurements, and radionuclide transport experiment would be developed, improved and used to understand the geological structure, hydrogeology, geochemistry, and rock mechanics of deep geological properties. In-situ data gathered in these short-term projects will be used in case studies to demonstrate the capability of conducting performance and safety assessment. At the end of the ‘Potential Host Rock Characterization and Assessment’ phase, the ‘Technical Feasibility Report for the Spent Nuclear Fuel Final Disposal’ will be provided.