THE DUTIES, THE RESPONSIBILITIES AND THE JURISDICTIONS OF TURKISH ATOMIC ENERGY AUTHORITY (TAEK) AND THE NEW PROJECTS THAT TAEK IS PRESENTLY INVOLVED

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Abstract

The TAEK, reporting to the Prime Minister, has the duty to determine the national policy and the related plans and programs for the peaceful use of nuclear energy for the benefit of Turkey. The TAEK consist of a President, three Vice Presidents, an Atomic Energy Commission, an Advisory Council, Specialized Departments and Divisions and Research and Training Centers.

At present TAEK is dealing with the following new projects:

1. The seismic safety and upgrading of TR-1 and TR-2 research reactors in the Cekmece Nuclear Research and Training Center in Istanbul.
2. The construction of a 500 kev linear electron accelerator in Saraykoy, Ankara.
3. The construction of a 30 Mev proton and 15 Mev deuteron accelerator (cyclotron type) in Saraykoy, Ankara.

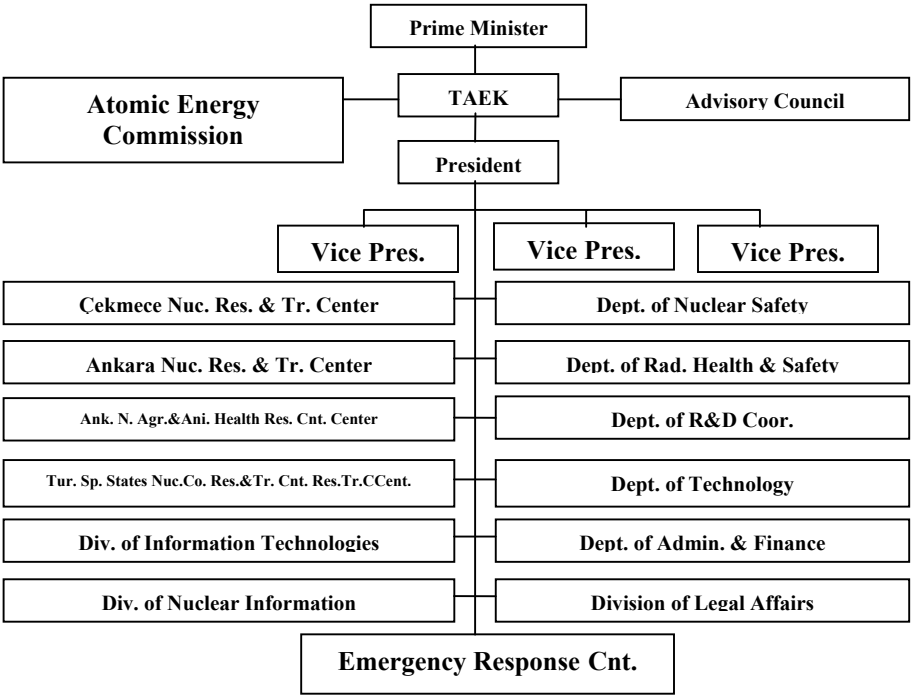
1. Historical Information about TAEK

Following the first Geneva conference in 1955 for expanding peaceful uses of nuclear energy, Turkey was one of the first countries to commence activities in the nuclear field. Turkish Atomic Energy Authority (TAEK) was established in 1956. Turkey was one of the founding member of the International Atomic Energy Agency (IAEA) when it is established in 1957. Turkey has signed the non-proliferation treaty and the comprehensive nuclear test ban treaty.

2. The Duties, the Responsibilities and the Jurisdictions of TAEK

- Act as a nuclear regulatory body,
- Carry out research and development in nuclear field,
- Support, promote and coordinate all nuclear activities in Turkey,
- Develop and implement regulations for physical protection, safeguards and illicit trafficking of nuclear materials,
- Establish cooperation with other countries and international organizations.

3. The General Administrative Structure of TAEK



3.1. The President's Office

President of TAEK: The President of TAEK assigned by and reported to the Prime Minister of Turkey. His assignment has to be approved by the President of Turkey. The President of TAEK ensures that the duties given to the TAEK by the Atomic Energy Authority Act are carried out within the principles and programs determined by the Atomic Energy Commission (AEC). The President represents and governs the TAEK and is his executive officer and the chairman of the AEC.
Vice Presidents of TAEK: There are three Vice Presidents assigned by the Prime Minister and approved by the President of Turkey. Their duties are to assist the president in his work. The Vice Presidents are the member of AEC.

3.2. Atomic Energy Commission

Structure: Chaired by the President of TAEK, consist of three Vice Presidents, one member each from Ministries of National Defense, Foreign Affairs, Energy and Natural Resources, and four faculty member active in education and research in the nuclear field. The members other than President and Vice Presidents of TAEK are assigned by the Prime Minister for four years term.

Duties:

- Determines the working principles and programs of TAEK,
- Prepares the draft acts and statutes related to the nuclear field,
- Follows and evaluates the work of TAEK,
- Prepares and submits the budget of TAEK to Prime Minister for approval.

3.3. Advisory Council

Structure: The Advisory Council consist of the faculty members teaching in the nuclear field, and the experts from other related institutions and organizations. The council members are appointed by the Prime Minister among the individuals proposed by the AEC. Local and foreign experts may be invited to the Council meetings for consultation.

Duties: The Advisory Council investigates the topics specified by the AEC and submit his conclusions and recommendations to the Chairman of the Commission.

3.4. Research Centers

3.4.1. Cekmece Nuclear Research and Training Center (CNAEM):

CNAEM was found in 1961 on the Coast of Kucukcekmece Lake near City of Istanbul and covers an area of 3200 acres. CNAEM mainly involved in various aspects of nuclear research, development and applications as well as the training activities. The first Turkish nuclear reactor TR-1 (1MW) was built at CNAEM in 1961. Later in 1981, due to the increasing demand in research and radioisotope production 5 MW TR-2 nuclear reactor was built.

These reactors were used for research and training and for the production of radioisotopes for medicine, agriculture and industry and for neutron activation analyses.

3.4.2. Ankara Nuclear Research and Training Center (ANAEM):

ANAEM was found in the Campus of University of Ankara in 1961. The main activities of this center are to carry out research in basic and applied fields using nuclear techniques and provide training in nuclear field. A linear electron accelerator and a proton and deuteron cyclotron will soon be built for this center for research, training and radioisotope production.

3.4.3. Ankara Nuclear Agriculture and Animal Health Research Center (ANTHAM):

Lalahan Animal Health Nuclear Research Institute was found in Ankara in 1981. This Institute was combined with the Agriculture Research Section of ANAEM to establish ANTHAM at Saraykoy near City of Ankara in 1999. The main activities of this Center is to carry out research in the field of agriculture, animal science, food preservation and sterilization using nuclear techniques and train the researchers working in other relevant institutes in Turkey.

3.4.4. Turkish Speaking States Nuclear Cooperation, Research and Training Center (TUDNAEM):

TAEK has started cooperating with nuclear institutes in Turkish Speaking Countries and signed protocols for cooperation in peaceful uses of nuclear energy in the late 1990's. As a result of this, a new Research and Training Center was found at TAEK Headquarters in Ankara for organizing the nuclear cooperation among Turkish Speaking Countries in 1999.

3.5. Departments

3.5.1. Nuclear Safety Department (NGD):

- Licensing and inspection of nuclear installations and other nuclear fuel cycle facilities,
- Provide measures for environmental safety of nuclear installations and other nuclear fuel cycle facilities,
- Provide measures for physical protection, safeguards and illicit trafficking of nuclear material,
- Provide measures for disposing of radioactive waste and spent fuel coming from nuclear installations and other nuclear fuel cycle facilities.

3.5.2. Radiological Health And Safety Department (RGD):

- Licensing and inspection of persons or organizations keeping, using, importing, exporting, transporting, storing and trading radioactive materials and radiation producing devices,
- Enforce insurance obligation for permitting above activities,
- Provide measures for disposing of radioactive waste coming from the use of radioactive material and radiation producing devices.

3.5.3. Research, Development & Coordination Department (AGK):

- In nuclear field, conduct or assist conducting training courses within the country and support students and TAEK personnel for training abroad,
- Distribute grants obtained from domestic or foreign sources for all kinds of studies in the nuclear field,
- International and public relations and translations.

3.5.4. Technology Department (TD):

- Investigate R&D on nuclear fuel, raw nuclear material and nuclear reactor systems not intended for power production,
- Perform duties related to quality assurance, economic analyses and industrial relations in the nuclear field.

3.5.5. Department of Administrative and Financial Affairs (IMID):

Perform the services related to personnel, general services, archives, construction, supply, budget, and accounting.

3.6. Divisions

3.6.1. Division of Information Technologies (BET)

Carries out and coordinates the following,

- Infrastructure development,
- System analysis and software development,
- e-Turkey integration,
- Internal and external WEB sites development

3.6.2. Division of Nuclear Information (NE)

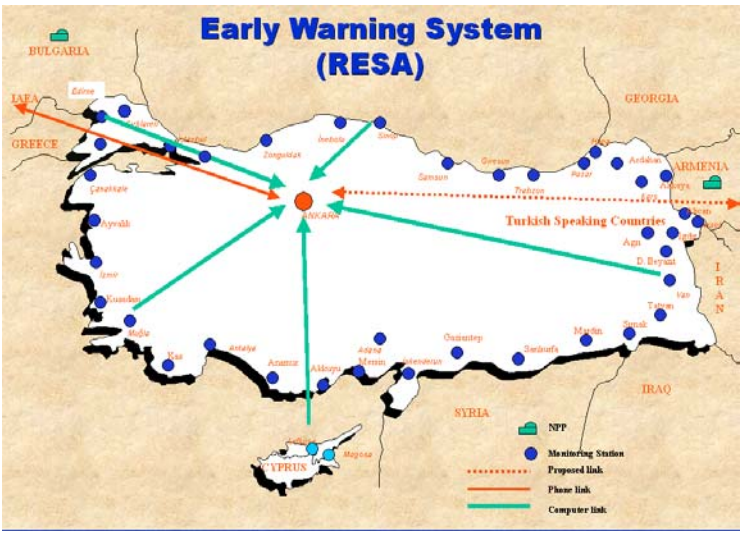
Provides nuclear data and publication to researchers through the INIS system of International Atomic Energy Agency.

3.6.3. Legal Affairs (HM)

- Deals with the ordinary legal problems of TAEK,
- Deals with the Nuclear Law related problems of TAEK,
- Deals with nuclear agreements and treaties.

3.7. Emergency Response Center

Turkey is initiated his own Environmental Radiation Monitoring System for early warning of nuclear emergencies (RESA). Over 60 radiation-monitoring stations have been installed at various locations through out Turkey and Cyprus. The monitoring locations have been selected by taking into account topographic and climatic characteristic of the region as well as the distance and locations of nuclear power plants in neighboring countries. The Emergency Response Center is located in TAEK headquarters in Ankara and has the computer links to monitoring stations and phone link to IAEA as shown in the following map.



4. New Projects

4.1. TR-1 and TR-2 Nuclear Research Reactors and their Seismic Safety Assessment and Upgrading

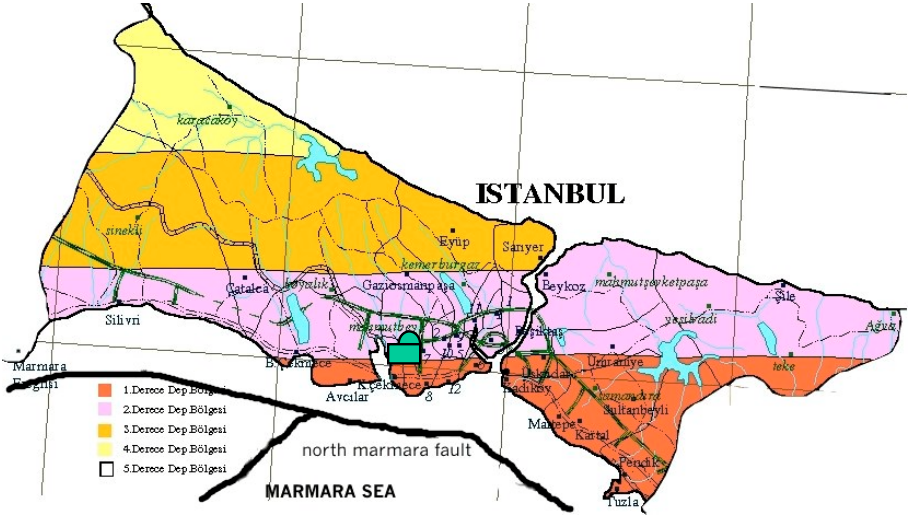
TR-1 Research Reactor: TR-1 is an open pool type of reactor with a nominal power of 1 MW. It was design and erected by American Machine and Foundry Company of USA between 1959 and 1961 in CNAEM in the Coast of Kucukcekmece Lake, 20 miles west of Istanbul City. The TR-1 reached its first criticality in January 1962. The reactor fuel is 93 % enriched uranium and it is light water moderated, cooled and reflected. The reactor is equipped with 6 radial beam tubes, one through tube and a thermal column. The TR-1 is located in the smaller part of the pool. It was used for radioisotope production, neutron beam experiments, in-core irradiation for neutron activation analysis and training. It was shut down in 1977 due to the installation of TR-2 reactor components.

TR-2 Research Reactor: During early 1970's, a power increase in TR-1 reactor was considered but later decided to build 5 MW TR-2 reactor in the larger part of the TR-1 pool. The TR-2 reactor is also open pool type with MTR fuel elements of 93 % and 19.9 % enriched uranium, reflected by beryllium blocks and moderated and cooled by light water. It was designed in 1974 jointly by engineers from CNAEM and from the Centre d'Etudes Nucléaries de Grenoble, France. The Belgonuclearie from Belgium was the main contractor for the supply of equipment and installation of reactor components. During the installation of TR-2, the pool is lined with a 3 mm stainless steel sheet for water tightness and building construction modified to maintain a certain level of air tightness. The TR-2 reactor reached its first criticality in December 1981. It is used for radioisotope production (mainly Tc-99 and Ir-192), in-core irradiation for neutron activation analysis and training. The TR-2 is shut down in 1995 for an extended period for the seismic evaluation and the necessary upgrading of TR-1 and TR-2 reactors' building and components.

The Assessment of the Seismic Safety: TR-1 and TR-2 reactors' common building was built between 1959 and 1961. At that time, a site-specific design bases earthquake was not considered in the design of the building. A devastating earthquake (magnitude of 7.4) occurred in Turkey at Eastern Marmara Sea on August 17, 1999. A few buildings were collapsed in Avcılar a district of City of Istanbul, where about 5 km away from TR-1 & TR-2 research reactors. The seismic instruments at the reactor-building basement and at the ground floor of another building at CNAEM site were recorded the peak acceleration values during this earthquake. They were 0.12 g and 0.18 g respectively. An inspection of the reactor building by experts after the earthquake showed that there was no damage on the reactor building, systems and components.

Considering the occurrence of a Review Level Earthquake (RLE) of similar magnitude as the one mentioned above in the north Marmara Sea fault line, where

is about 20 km south of the reactor site, a maximum ground level acceleration at the TR-1 & TR-2 reactors' building was calculated as 0.4g. Following is the earthquake-zoning map for Istanbul Province, also showing the north Marmara Sea fault line. The location of Reactors shown as green domed building.



Using this 0.4 g value, a finite element structural model of the reactor building was developed and a dynamic soil-structure interaction analysis was performed. The generic time histories, obtained from Turkish Seismic Design Response Spectra, were used to check the seismic capacity of the structure. The soil degradation that occurs during an earthquake was also considered in the analysis. A static analysis of a fixed–base model of the reactor building was also performed. The seismic safety of TR-1 and TR-2 reactors' building was evaluated using the results of both analyses.

Upgrading: The critical structural elements checked in the building against earthquake loads were reinforced concrete shear walls surrounding the building at the basement, the reinforced concrete frames in the superstructure and the infill brick walls,

The safe shutdown equipments and components and their anchorages or attachments are also analyzed under the effect of the RLE,

As a result of these analyses, an extensive upgrading on civil structures found necessary,

The upgrading needs for the equipment and components will be minimal,

The design work for upgrading of the civil structures and upgrading work for the equipment and components will soon be started.

4.2. The Construction of 500 kev and 20 mA Linear Electron Accelerator

The Accelerator: A 500 kev DC power linear electron accelerator has been purchased from Vivirad company in France through a grand obtained from an IAEA's technical cooperation program. We are waiting the design specification of the building, which will house the accelerator from Vivirad Company. As soon as the specification received, the building will be design and constructed in Saraykoy near city of Ankara. Following the completion of the building construction, the Company will install the accelerator.

Specifications:

- Maximum beam energy is 500 kev and changeable between 300-500kev.
- Maximum beam current is 20 mA and changeable between 1-20 mA.
- Maximum electron dose rate is 10^6 Gy/sec,
- Scans the electrons in a 61 cm path.

Proposed Use of the Accelerator:

- The electron radiation treatment of films and plastics produce cross-linking and polymerization in these organic materials, resulting improvement in their physical properties. For example, the molecular weight of bulk polymers can be tailored by depolymerization with electron beam,
- The treatment of coatings and adhesives on woods, metals and polymers with electron beam eliminates the need for chemical catalysts or solvent and therefore eliminates the pollution and occupational safety problems associated with corrosive or toxic agents. In addition, it also eliminate the need of heat treatment to save energy,
- The radiation treatment of rubber increases its strength,
- When an energetic electron beam pass through the water it produces very active chemical agents called free radicals. Then, these free radicals decompose the toxic organic compounds in wastewater and contaminated surface and groundwater to disinfect them,
- The free radicals are also produced from water vapor in flue gases coming out from coal and oil fired power plants when the effluent exposed by an electron beam. These free radicals, converted the SO_x and NO_x pollutants into sulfuric and nitric acid respectively. At this phase, if we inject ammonia to the effluent, these acids are neutralized by ammonia to form ammonium salts. These salts are solid materials and can easily be removed from the effluent. They can be used as fertilizer,
- The electron radiation treatment of surgical tool from top and bottom can sterilize the tools killing the bacteria, virus and other germs.

4.3. The Construction of a 30 Mev Proton & 15 Mev Deuteron Cyclotron

The Cyclotron: A bidding was called in July this year for the manufacturing, installation and testing of a cyclotron to accelerate protons to 30 Mev and deuterons to 15 Mev. The tender will include the construction of the buildings, which will house the cyclotron and its associated laboratories, and the supply of the laboratory equipments. It is expected that the civil construction will start next summer. The manufacturing, installation and testing of systems and components including civil construction will last 30 months.

The Proposed Use: The cyclotron will be used for the production of I-123, In-111, Ga-67, Tl-201, F-18, Rb-81 and Pd-103 radioisotopes. From these radioisotopes radio-pharmaceuticals will be produced in hot laboratories for medical applications. The cyclotron will also be used for the training and the scientific research.

Specifications:

- The cyclotron will be capable of accelerating both protons and deuterons,
- The beam energy will be variable and the maximum for protons will be 30 Mev and for deuterons 15 Mev,
- The total beam current for the protons will be 350 μA and deuterons 30μA,
- There will be two main beam port, each with switching magnet,
- Two beam line from each port will be obtained, having a total of four beam line,
- Three beam line will be used for radioisotopes production and one for training and research,
- There will be two hot laboratories for the production of radio-pharmaceuticals from Tl-201, In-111, Pd-103, Ga-67 and F-18,
- There will be two separate hot laboratories for the production of radio-pharmaceuticals from I-123 and Rb-81,
- There will be other labs for quality control and other activities.

References

1. Altınyollar, A. ,et al., Re-assessment of the seismic safety of TR-2 research reactor and dose calculations.60