

## The Analysis of the World's Most Dangerous Nuclear Plant from the Standpoint of the Most Air-Polluted City in Europe

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### Abstract

As a prominent item on the agenda of Turkish-Armenian relations from time to time, the Metsamor Nuclear Power Plant, located in the town of Metsamor in Armenia, has become an even more critical issue after the earthquakes in and around the region. The closest settlement to this nuclear power plant in the region is Iğdır. The people of Iğdır, who have severe concerns about the power plant, evaluates the nuclear plant from a different point of view. This research used "qualitative research method," which provided an in-depth examination of the subject. In order to clarify the uncertainties in the study, interviews were held with the relevant public personnel, parliamentary questions of the deputies, who were the opinion leaders of the people, and the answers of the relevant institutions and organizations to these proposals were examined. In addition, to correct the misconceptions, the working principles of nuclear power plants, the risks they carried, and why they were called clean energy, were examined. According to the 2021 World Air Quality Report, Iğdır was the city with the most polluted air in Europe. This situation has also caused the local people to establish a relationship between air pollution and the Metsamor Nuclear Power Plant. In particular, cancer cases caused by air pollution have been attributed to Metsamor, which does not contribute to air pollution; and this power plant has been seen as a cause of air pollution. This study explains primary reason for this misconception is the relevant public institutions' insufficient information to society despite the deputies' parliamentary questions submitted to the Grand National Assembly of Turkey.

**Keywords:** Turkey, Armenia, Metsamor Nuclear Power Plant, Iğdir, Cancer.

### Dünya'nın En Tehlikeli Nükleer Santralinin Avrupa'nın Havası En Kirli Şehri Açısından Analizi

#### Öz

Metsamor Nükleer Santrali, Türk-Ermeni ilişkilerinde ara ara gündeme gelen, özellikle santralin bulunduğu bölge ve civarında yaşanan depremler sonrasında dikkatleri çeken bir konu olarak yerini korumaktadır. Ancak santral konusunda endişeli olan bir topluluk var ki hem endişeleri güncel hem de santrale karşı bakış açıları farklıdır: Iğdır halkı. Bu çalışmada, bilgi edinmek için araştırılan konunun derinlemesine incelenmesini sağlayan nitel araştırma yönetimi kullanılmıştır. Özellikle çalışmada belirsizlik taşıyan hususların aydınlatılmasına yönelik konuyla alakalı kamu personeliyle görüşme yapılmış, halkın aydınlatılmasında yol gösterici olan milletvekillerinin soru önergeleri incelenmiş ve ilgili kurum ve kuruluşların açıklamaları çalışmaya yansıtılmıştır. Ayrıca nükleer santrallerin çalışma prensipleri, taşıdığı riskler veya temiz enerji olarak adlandırılmasındaki hususlar incelenmiştir ve yanlış algılanan hususların daha anlaşılır olmasına katkı sağlanmıştır. Iğdır 2021 yılı Dünya Hava Kalitesi Raporu'na göre Avrupa'nın en kirli havasına sahip şehri olmuştur. Bu husus halkın hava kirliliği ve Metsamor Nükleer Santrali arasında bir bağ kurmasına da neden olmuştur. Özellikle hava kirliliğinden kaynaklanan kanser vakaları, Metsamor'dan kaynaklanıyormuş gibi algılanmakta ve hava kirliliğinin nedenlerinden biri olarak görülmektedir. Oysa hava kirliliğine katkısı olmamasına rağmen gerek kamu kurumları tarafından şeffaf bilgilendirmenin yapılmaması gerekse milletvekilleri tarafından Türkiye Büyük Millet Meclisi'ne sunulan soru önergelerinin ilgili kurumlar tarafından gerekli düzeyde cevaplanmaması bu yanlış anlaşılmanın temel nedenleri olarak çalışmada yer bulmuştur.

**Anahtar Kelimeler:** Türkiye, Ermenistan, Metsamor Nükleer Santrali, Iğdır, Kanser.

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## Introduction

The problems between Turkey and Armenia are generally based on the so-called genocide allegations vehemently denied by Turkey (Çelikkol, 2015, p. 20), the Nagorno-Karabakh conflict, which had a general solution after the 2020 war (Çelikkol, 2015, p. 21; Kodaman, 2013, p. 115), the attacks of the Armenian Terrorist Organization Asala between 1973 and 1995 (Abdurrahmanlı, 2019, p. 69), and the lobbying activities of the Armenian diaspora against Turkey (Özocak, 2015, p. 11).

Although not discussed much, another significant issue in Turkey-Armenia relations is the Metsamor Nuclear Power Plant, whose harmful consequences will be grave and permanent in case of an accident or technical malfunction. This old Soviet technology power plant next to the Turkish border poses a risk for Turkey since it is in an earthquake-sensitive region.

The first experiments on the peaceful use of nuclear energy were in the USA in the 1930s. The first atomic reactor was built in 1942 by Enrico Fermi at the Chicago University's garden. Meanwhile, the studies on the military use of nuclear energy were also continuing. Nuclear power turned into a weapon with the invention of atomic bombs and was first used in Hiroshima of Japan on 6 August 1945 and Nagasaki on 9 August 1945. After this date, a race to acquire nuclear weapons came up between the east-west blocks, and over time, it became a decisive strategic power factor of the cold war period between the two poles (Temurçin & Aliağaoğlu, 2003; Yüksel, 2020).

The Metsamor nuclear power plant is only 16 km away from the province of Iğdır, the most air-polluted city in Europe, located at the eastern end of Turkey (IQAir, 2021). Iğdır Province deputies in the Grand National Assembly of Turkey have accused this power plant of the increasing rate of cancer cases and air pollution after the earthquakes occurred in the region. This old technology Soviet-made 1979-model power plant, currently deemed the world's most dangerous nuclear power plant (Puiu, 2017), causes security concerns today. The current study investigates the Metsamor plant's importance for Armenia, whether it threatens Turkish-Armenian relations, the local people's opinions about the power plant, and the public institutions' approach from an impartial and comparative perspective.

## 1. Literature Review

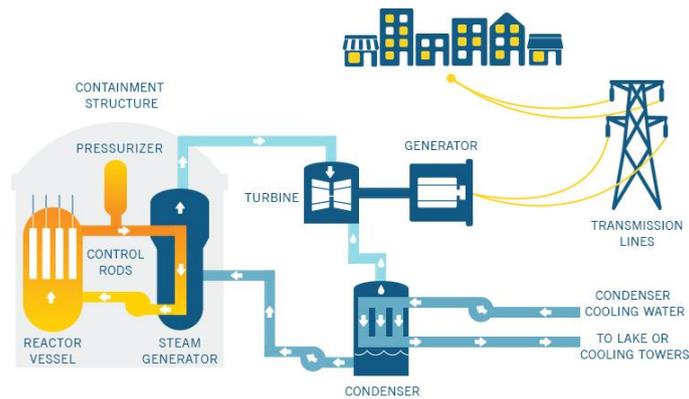
### 1.1. Features and Functioning of Nuclear Plants

Although some academic circles present nuclear power plants as a clean energy source, others claim they are dangerous and harmful to the environment because of examples such as Chernobyl. In brief, nuclear power plants obtain energy from low-enriched uranium through the nuclear fission reaction. Then using this energy, they heat water and produce steam. This obtained steam rotates the turbine blades connected to generators and enables electricity production. The water can come from a pond, river, or sea, or the hot steam is re-converted into the water in the Cooling Tower of the nuclear power plant (Duke Energy, 2020; EIA, 2021). So, the water continuously circulates in the power plant.

Uranium, used as a fuel in nuclear power plants, consists of small and hard ceramic pellets packaged in long and vertical tubes. By placing these uranium pellets in the reactor, a fission reaction occurs. A little larger than the average pencil eraser, a uranium pellet contains an energy equivalent of approximately one ton of coal, 149 gallons of oil, or 17,000 cubic feet of natural gas. Each uranium pellet lasts almost five years in power generation (GE Hitachi Nuclear Energy, 2022; Nuclear Energy Institute, 2022).

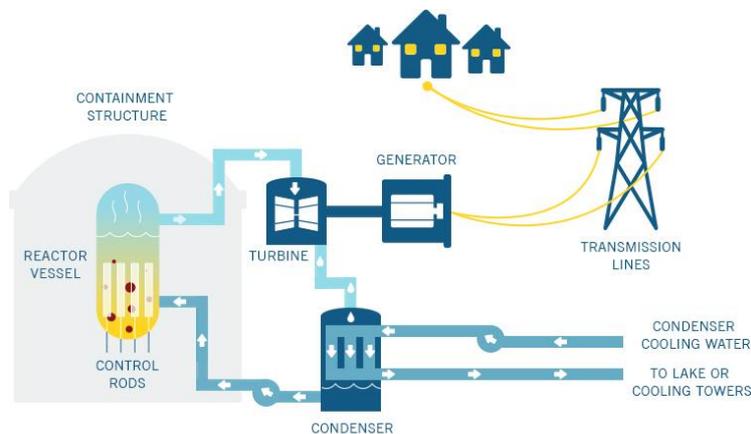
Most countries, especially the USA and France, benefit from nuclear energy. Nuclear power plants meet about 11% of the world's electricity production. On average, 20% of the electricity produced in the USA is provided by nuclear energy plants. Some states get more than half of their electricity from nuclear power (Duke Energy, 2020; GE Hitachi Nuclear Energy, 2022).

Light water reactors are the most common among nuclear power plants. There are two types of light water reactors: pressurized water reactors (PWR) and boiling water reactors (BWR) (Britannica, 2022). In the pressurized water reactors, the core inside the reactor vessel generates heat. Pressurized water in the primary refrigerant loop carries the heat to the steam generator. Inside the steam generator, heat from the primary coolant loop produces steam by evaporating the water in a secondary process. The steam line directs the vapor to the main turbine to rotate the turbine generator and thus generate electricity (Breeze, 2019; Portal on Nuclear Safety, 2022; Suppes & Storvick, 2016; U.S. Nuclear Regulatory Commission, 2015b).



**Figure 1:** Pressurized water reactor  
*Source:* Duke Energy (2020)

In boiling water reactors, the core inside the reactor vessel generates heat. Ultra-pure water (reactor coolant) absorbing heat moves upwards from the core and produces a steam-water mixture. This steam-water blend leaves the top of the core and reaches the two steps of moisture separation, where water droplets are taken out before the steam is allowed to enter the steam line. The steam line directs the steam to the main turbine, enabling it to turn the turbine generator and thus produce electricity (Silvi et al., 2021; U.S. Nuclear Regulatory Commission, 2015a).



**Figure 2:** Boiling water reactor  
*Source:* Duke Energy (2020)

## 1.2. Overview of Nuclear Power Plants

From the public's point of view, nuclear power plants may cause more problems than crimes, unemployment, or health. However, people living in nuclear-power-plant-operating

countries can support this type of energy without worrying because they know, use, and are familiar with it (Kovacs & Gordelier, 2009). For this reason, it will be more instructive to analyze the general viewpoints of the people living in Iğdir towards nuclear power plants to understand the perspectives of the Metsamor Nuclear Power Plant and atomic energy, which are placed in the main frame of the study.

### **1.2.1. Negative Perspective**

Critics with negative views traditionally state that nuclear energy is not so innocent. They argue that the power plant wastes are toxic, that there is no safe, permanent way to store or dispose of them, and that their transportation is also dangerous. No matter how safe they have been designed, a risk always exists that a nuclear disaster similar to Chernobyl in 1986 could happen again, as in Fukushima in 2011 (Spring Power and Gas, 2018). Nuclear energy production also yields many radioactive materials, including tritium, cesium, krypton, and neptunium. In other words, nuclear energy also produces many radioactive substances. Accidents may occur during normal operations at nuclear power plants, or the radioactive emissions may contact people during waste transportation. At the same time, water vapor, which is a crucial greenhouse gas in terms of the climate crisis, is released from nuclear power plant towers (Altıkat et al., 2015, p. 2059; Kabasakal & Albayrak, 2011, p. 3435).

The chief concern about the effect of nuclear energy on human health is radiation. Namely, since radioactive subatomic particles moving at an average speed of 186,000 miles per second penetrate deeply, harm living things' biology, and even cause cancer (Altıkat et al., 2015, p. 2059; Kabasakal & Albayrak, 2011, p. 3435; U.S. Environmental Protection Agency, 2022).

### **1.2.2. Positive Perspective**

Nuclear power plants are incomparably more innocent than thermal power plants in terms of the emission of greenhouse gases -chiefly carbon dioxide (CO<sub>2</sub>)- which is the most significant factor in the climate crisis. Since no material burns in nuclear power plants, no pollution or gas emission occurs due to combustion. This situation is a significant advantage of atomic energy in terms of the climate crisis and a clean future (Altıkat et al., 2015, p. 2059; GE Hitachi Nuclear Energy, 2022).

Another positive feature of nuclear power plants is efficiency. Because no other electricity generation source can compete with an atomic power plant in terms of efficiency. A nuclear power plant can uninterruptedly produce electricity 24 hours a day for years. Today, in

30 countries globally, 440 atomic power plants operate for electricity generation (GE Hitachi Nuclear Energy, 2022).

### **1.3. Features and Risks of Metsamor Nuclear Power Plant**

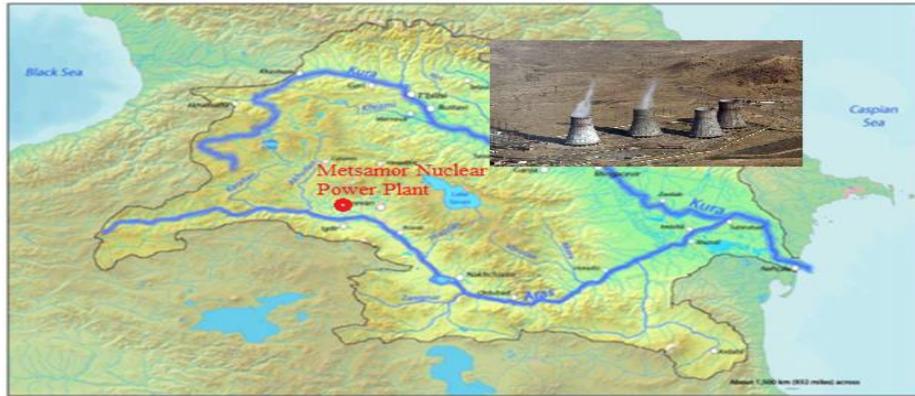
The first-generation Soviet technology Metsamor nuclear power plant was built in the 1970s as two separate units to meet the increasing energy needs of the copper and aluminum industry operating in Armenia (Yüksel, 2014, p. 4, 2020, p. 16). The power plant consists of two separate units called Metsamor-1 and Metsamor-2. The construction of the Metsamor-1 unit started in 1973 and became operational in 1976. The WWER 440/V230 type Metsamor-1 unit has a power of 240 MWe and is today riskier than the Chernobyl Nuclear Power Plant as one of the most primitive reactors. The WWER 440/V270 type Metsamor-2 unit, which started electricity generation in 1979, has a power of 400 MWe (Baghirova, 2018, p. 221; Cabbarlı, 2003, p. 241; Nadirov & Rzayev, 2017, p. 47; Oğan, 2007; Özdaşlı, 2016, p. 49; Yüksel, 2014, p. 4, 2020, pp. 16–17).

Metsamor Nuclear Power Plant, which has a pressurized water reactor operating principle, does not have the protection dome system found in modern nuclear power plants in the west to prevent possible radioactive leakage. Apart from this, its insufficient cooling water and old-unsafe technology pose a risk for the countries in the region (Ornarlı, 2011; Yüksel, 2014, p. 4, 2020, p. 17). The power plant is only 16 km from the eastern border of Turkey, 80 km from Iran, 110 km from Georgia, and 120 km from Azerbaijan (Altıkat et al., 2015, p. 2062; Kabasakal & Albayrak, 2011, p. 3435). Like the first unit of the power plant, the WWER-440/270 type second unit, which is far from western standards, does not have the technological capacity to prevent a disaster in case of a nuclear accident (Yüksel, 2014, p. 4, 2020, p. 17). Besides its old technology, its location on the Ağrı Mount's fault line also makes the power plant highly dangerous (Baghirova, 2018, p. 222; Yüksel, 2014, p. 5). The first reactor built with old technology was not an earthquake-resistant structure. Even if the second reactor is claimed to be resistant to an earthquake of magnitude 8, damage to the reactor or a leak in an earthquake may cause great destruction (Mehdiyev, 2021; Nadirov & Rzayev, 2017, pp. 47–48; Ögütçü, 2015; Özdaşlı, 2016, p. 50). The Soviet Bureaucracy built this power plant by ignoring international standards for not constructing nuclear power plants in the regions with a risk of a magnitude five or greater earthquake (Oğan, 2007; Özdaşlı, 2016, p. 50). At that time, despite the warnings by Soviet scientists that the area had high earthquake risks and there was

a risk of radioactive substances mixing with the water resources in the region, the power plant was built (Cabbarlı, 2003, p. 241; Oğan, 2007; Özdaşlı, 2016, p. 50).

Another dangerous feature of the Metsamor Nuclear Power Plant is the absence of a nuclear fuel protective basin in this power plant also, just like the Chernobyl Nuclear Power Plant, which suffered a disaster in the nuclear accident on 26 April 1986. This situation poses a significant danger for the region's countries (Eletek, 2021). Another threat regarding the power plant is its poor architectural structure, as reported by the Atomic Energy Agency Deputy General Manager Morris Rosen in his review in 1995. Morris Rosen has declared that the plant is unsuitable for operation (Özdaşlı, 2016, p. 50). This chain of shortcomings manifested itself with the 6.9 magnitude earthquake in Spitak, 75 km away from the power plant, in 1988. The reactor hit by the earthquake was closed due to seismic safety reasons. Although the damaged reactor was shut down for safety reasons, prominent intellectuals of the Armenian people pointed out the danger posed by the unprotected radioactive material inside the reactor and showed reaction (Kabasakal & Albayrak, 2011; Oğan, 2007; Ornarlı, 2011; Özdaşlı, 2016, pp. 50–51). Hakob Sanasaryan, President of the Green Union of Armenia, said that the location of the Metsamor Nuclear Power Plant and the old technology of the plant are inconvenient in terms of security (Lavelle & Garthwaite, 2011).

Despite all reactions, Armenia, negotiating with Russia, has decided to operate the reactor until 2026 instead of closing it in 2016. This attitude of Armenia may cause possible environmental problems in the region. The Metsamor Nuclear Power Plant, which discharges the reactor-coolant wastewater into the Aras River, will not affect only its near surroundings but also all the countries that the river reaches. Aras River, where radioactive wastes are poured, merges with the Kura River within the borders of Azerbaijan (Figure 3) and spills into the Caspian Sea (Özdaşlı, 2016, pp. 51–52).



**Figure 3:** Location of Aras and Kura rivers.

*Source:* Created using Zeeb (2010, p. 9)

#### **1.4. Energy Indicators of Armenia**

The Republic of Armenia is a southern Caucasus country bordered by Turkey in the west, Azerbaijan in the east, Iran in the south, and Georgia in the north (Miholjic, 2018, p. 45). According to the World Bank data for 2020, its population is 2.963 million (World Bank, 2022). The capital city, Yerevan, has a population of 1.082 million. Various reforms have been made in the Armenian economy from the economic crisis in the 1990s to the present. The country abandoned the centralized structure of the Soviet period, privatized most state enterprises, and transitioned to a free market economy as much as possible. From 2002 to 2018, it realized a steady economic growth (5.72% increase), both with the flow of foreign capital and the help of funds provided by donors. In 2018, the Gross Domestic Product (GDP) increased by two and a half times compared to 2002 and reached 9,178 USD. Diaspora aid, which makes up about 12% of Armenia's GDP, and the country's dependence on imported products cause price fluctuations in the country's economy. Unemployment, which was 27% in 2008, increased to 35% in 2011 (International Energy Agency, 2021).

The country, which is foreign-dependent on energy resources, imported 78% of its total energy needs (oil and natural gas) from Russia in 2018. While natural gas is imported from Russia via pipeline over Georgia (International Trade Administration, 2022), there is also a swap agreement with Iran in exchange for electricity export (Miholjic, 2018, pp. 45–48). Also, there is a low-level energy trade with Georgia. The energy exchange is not active with Turkey and Azerbaijan due to the insufficient level of political relations (International Trade Administration, 2022).

The country has started some betterments in the energy sector after the problems experienced in electricity supply in the 1990s. While privatizations increased in the energy sector, company structures were also modernized. Almost every household in the country has access to natural gas at cost. Diaspora has contributed massively to this energy transformation in Armenia. The current energy policy in the country is aimed at increasing the share of renewable energy resources, developing domestic resources and prolonging the life of the Metsamor Nuclear Power Plant, which meets approximately one-third of the country's energy needs. The government, paying particular attention to energy efficiency, developed the 2nd National Energy Efficiency Action Plan (NEEAP-2) in 2020. The average energy demand of Armenia was 3.40 Mtoe in 2019. This amount was comparable to Moldova and Tajikistan. Natural gas accounted for 63% of the primary energy supply in 2019. The country has no fossil fuel resources and meets 24% of its energy demand from nuclear and hydropower. In the 2019 total electricity production, the share of natural gas was 40%, hydroelectricity was 31%, and nuclear energy was 29%. Armenia is the only country producing atomic energy in the Caucasus region. Besides, Armenia is an electricity exporter, heavily under a swap agreement with Iran (International Energy Agency, 2021; World Nuclear Association, 2022).

Energy consumption in Armenia more than doubled between 2000 and 2019. Whereas natural gas and electricity consumption was more concentrated in residences, natural gas and petroleum products come to the fore in transportation. In 2019, renewable energy generation, including hydropower, accounted for about one-third of total energy production. In the country, which is resource-dependent on natural gas and oil, the government attaches importance to energy security and evaluating domestic resources to avoid supply problems. In terms of domestic energy sources, renewable energy sources and efficiency measures are of primary importance. Hence, while increasing the capacity to meet the rising demand, investment and incentives in renewable energy sources are developing. The Armenian government approved a long-term development plan from 2015 to 2036. These development program objectives also include the development of nuclear energy for electricity supply. Therefore, the continuity of atomic energy, which meets one-third of the country's energy needs, is indispensable. Although the existing reactors of the nuclear power plant, which have strategic importance, are old, their service life has been extended until 2026. At the same time, the government continues to seek financing for a new 1000 MW Nuclear power reactor construction (International Energy Agency, 2021; Miholjic, 2018, pp. 42–43).

## 2. Results

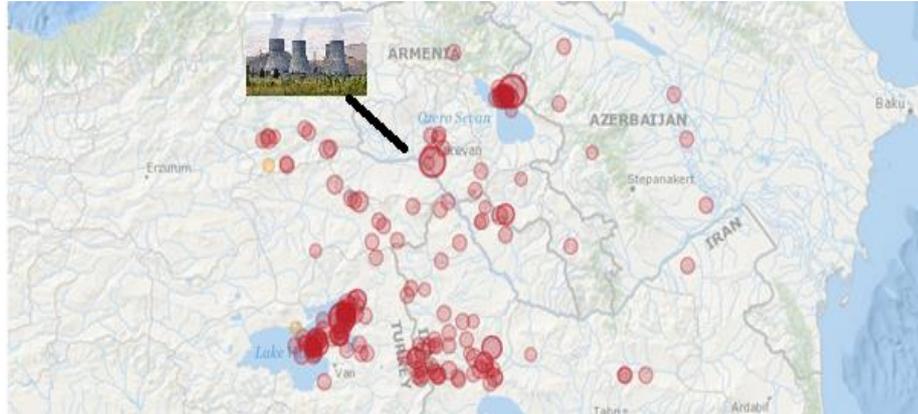
### 2.1. Metsamor Nuclear Power Plant From Iğdir Perspective

In terms of the integrity of the study, it would be more appropriate to talk about the air pollution of Iğdir before assessing the risks of the Metsamor Nuclear Power Plant. Iğdir Province, located on the eastern border of the Republic of Turkey, is bordered by Azerbaijan Nakhchivan Autonomous Administration in the east, Iran in the south, and Armenia in the north. The pot-shaped location of the province surrounded by mountains prevents air circulation, while low wind speed and precipitation contribute to air pollution in the city (Gürçam et al., 2021). Especially the consumption of poor quality coal and excessive building construction are the most important causes of air pollution (İklim Haber, 2022). Iğdir has become the most polluted city in Europe, according to the World Air Quality Report 2021 (IQAir, 2021).

Old Soviet technology Metsamor nuclear power plant is 40 km away from Armenia's capital Yerevan and 16 km away from Turkey's Iğdir Province border (Oğan, 2007; Yüksel, 2014, p. 3). A possible radioactive leak in the power plant located in the earthquake zone will affect Armenia, Nakhchivan, Iran, Azerbaijan, Georgia, and especially the Eastern Anatolia region of Turkey (Figure 4). The effects caused by radiation cover an extended period. For example, the nuclear bombs dropped on the Japanese cities of Nagasaki and Hiroshima by the USA in 1945 maintained their harmful influence on people even 30 years later. Chernobyl Nuclear Power Plant disaster in 1986 is another example. After the nuclear disaster, its effects were felt on the people of the Eastern Black Sea Region, even 18 years later (Oğan, 2007). For this reason, the destructive impacts of a potential nuclear disaster in the Metsamor plant -so close that it is visible from Iğdir- will possibly manifest themselves even after a long time.

Oğan (2007), states that no definitive research has been conducted on the environmental effects of the Metsamor Nuclear Power Plant, but that the regional investigations have detected increasing cancer cases, defective births, and child deaths in humans as well as diseased vegetation and animals. Similarly, Habip Eksik, Peoples' Democratic Party (HDP) Iğdir Deputy, attributed the increasing cancer diseases and cancer-related deaths in Iğdir to the Metsamor Nuclear Power Plant. A citizen named Serhat Hun from Iğdir has said that he lost three of his relatives, aged 48, 60, and 72, because of cancer, whereas a citizen named Halil Töre, who lives in the Tuzluca district near the nuclear power plant, lost three of his relatives

because of cancer between 2007 and 2018. Hun and Töre families attribute cancer-related deaths to the nuclear power plant (Öksüz, 2020).



**Figure 4:** Earthquakes around the Metsamor Nuclear Power Plant in 2021.

*Source:* Created using Volcano Discovery (2022)

Some deputies have submitted questions to the Grand National Assembly of Turkey (TBMM) to know the risks posed by the Metsamor Nuclear Power Plant for Turkey and its border city, Iğdır, and the measures taken. For example, in 2019, Deniz Yavuzyılmaz, Republican People's Party (CHP) Zonguldak Deputy, submitted parliamentary questions about whether there were up-to-date data on the Metsamor Nuclear Power Plant's endurance against earthquakes and accidents, whether there were any government's efforts on the plant shutting down, whether there was any insurance for the compensation of the damage that Turkey might suffer, whether there was a bilateral agreement for the information exchange and notification in case of an accident, and measures and preparations conducted in Turkey. The Ministry of Foreign Affairs replied to the questions as follows: International organizations such as the European Union and the International Atomic Energy Agency (IAEA) have declared that the current technical standards of Metsamor Nuclear Power Plant do not meet nuclear safety conditions. The IAEA, monitoring the situation closely, has been continuing efforts to eliminate the security vulnerabilities of the facility since the power plant operated again. The closure of a nuclear power plant is under the exclusive jurisdiction of that country. In the review meetings of the Convention on Nuclear Safety (to which Armenia is also a party), in the Nuclear Safety Conference, and on other relevant platforms, our country has repeatedly underlined that this old technology power plant, built on an earthquake zone, creates a real danger for all regional countries. Besides, Turkey announced these threats in the national statement at the 60th General Conference of the IAEA on 26-30 September 2016. Armenia is a party at the 1963 Vienna

Convention on Civil Liability for Nuclear Damage. Therefore, in case of a possible accident, this contract will apply for nuclear damage compensations (Cumhuriyet, 2019; TBMM, 2019).

Osman Çetin Budak, CHP Antalya Deputy, asked the following parliamentary questions in 2020: What are the attempts to shut down the Metsamor Nuclear Power Plant, which has turned into a strategic threat during the Karabakh War? Were any action plans created against the potential dangers of accidents and attacks? The Ministry of Foreign Affairs gave the same answers to this parliamentary question as those given to Yavuzylmaz and stated that the issue was being followed (TBMM, 2020).

In his parliamentary question in 2021, Habip Eksik, HDP Iğdır Deputy, asked questions about the followings: the earthquake resistance of the Metsamor Nuclear Power Plant; the diplomatic initiatives of the government in Russia, Armenia, the EU, and other international platforms to shut down this power plant dangerous for Turkey; the radiation measurement in Iğdır Province (by which institutions, in which periods, the results); the measures to prevent the Metsamor Nuclear Power Plant's the environmental damages for the human and living beings health protection; the possible effect of the Metsamor Nuclear Power Plant on the increasing cancer cases in the city, Metsamor Nuclear Power Plant's possible influences on animals and vegetables, whether necessary precautions have been taken to prevent a Chernobyl-like disaster in Turkey, and lastly, how Turkey collect possible damage compensations in case of an accident at this nuclear power plant. However, to all these questions, the "Ministry of Environment, Urbanisation, and Climate Change" replied that the "Ionizing radiation activities" were outside their authority according to the "3-1-b exception in the 2 March 2019 dated Regulation on the Preventing Major Industrial Accidents and Reducing Their Effects". On the other hand, the Ministry of Foreign Affairs gave the same answers to the Iğdır MP Habip Eksik as given to MPs Yavuzylmaz and Budak (TBMM, 2021).

Zeynep Balamir Ateş, a member of the Eastern Environment Platform (Doğu-Çep), states that the Metsamor Nuclear Power Plant significantly increase air pollution and cancer cases in Iğdır Province, which has turned into a chronic problem (Gürçam & Konuralp, 2022). She also points out high cancer cases in border villages. Similar to Ateş, Tamer Yikit, the defender of the Right to Life, claims that the city was left unkept and that one-third of the loss of life here is related to air pollution and radiation. He states that the high radiation and air pollution produced by the Metsamor Nuclear Power Plant provokes prevalent cancer and respiratory diseases, such as COPD and asthma. Yikit points out that this situation affects animals and vegetables as much as human life. He also emphasizes that there should be an

Emergency Action Plan, and the public's attention should be drawn to this issue (İklim Haber, 2022).

In his press statement, Yaşar Karadağ, Nationalist Movement Party (MHP) Iğdır Deputy, called for the Metsamor Nuclear Power Plant to be shut down immediately to avoid a Chernobyl-like disaster that occurred in 1986 (Cumhuriyet, 2022).

In 2019, Chemical, Biological, Radiological, and Nuclear (CBRN) exercises were conducted in Iğdır, Turkey's closest settlement to the Metsamor Nuclear Power Plant, in case an emergency occurred (Yıldız & Mavzer, 2019). The emergency action plan for the City of Iğdır in the event of a possible accident at the Metsamor Nuclear Power Plant is as follows: There is no mutual agreement between Turkey and Armenia regarding an emergency warning. Therefore, Armenia notifies the International Atomic Energy Agency (IAEA) according to the Early Notification Agreement between IAEA and Armenia. Under the EPR-IEComm-2012 document, the IAEA communicates with the Turkish Nuclear Regulatory Authority (NDK). After receiving notification, the NDK immediately forwards it to the Iğdır Provincial Disaster and Emergency Management Center (IAADYM) and the Disaster and Emergency Management Presidency (AFAD). AFAD sends notifications about "beginning food restrictions" to the IAADYM of the provinces remaining within the Extended Planning Distance (EPD) and Foodstuff and Commodity Restriction Distance (FCRD) of the Metsamor Nuclear Power Plant. Within 1 hour of receiving the notification from the NDK, IAADYM becomes fully operational in Iğdır (Besides IAADYM personnel, the Emergency Response Manager and the representatives of the facility, who will take part in the emergency management, reach IAADYM and begin their duties) (AFAD, 2021, p. 53).

In his briefing on the Metsamor Nuclear Power Plant, Iğdır AFAD director Yahya Duman stated that the Turkish Atomic Energy Agency (TAEK) installed six radiation measurement devices in nearby regions of the Metsamor Nuclear Power Plant to detect radiation; and state institutions -TAEK, Iğdır Provincial Agriculture Directorate, and the Directorate of Iğdır Environment, Urbanisation and Climate Change- performed tests to find radiation in the region's water, soil, and plants but found no radiation trace; however, as an extra precaution, iodine tablets were distributed to the people in the villages near the power plant. Duman also added that the precautions according to the Emergency Action Plan were taken to evacuate people without suffering from radiation.

### 3. Discussion

The economic bottleneck in Armenia, which gained independence in 1991, has caused the country, despite various criticisms, to re-operate the old technology Metsamor nuclear power plant, which had closed after the 1988 Spitak earthquake. At those times, the Metsamor power plant was producing approximately 40% of the energy needed in the country (Eletek, 2021). Today, Armenia's current electricity production, including Russian natural gas, barter agreement with Iran, and its own resources, meets its own needs, and even it exports the surplus. Even if the Metsamor Nuclear Power Plant stops, no energy problem will arise in the country because the energy consumption in the country is mostly by private houses and the transportation sector. In the country that does not have an enormous trade, the energy allocated to the industry is around 15%. The electricity consumption per capita is even less than half of Europe. These factors show that no solid obstacles exist to the closure of the severely criticized Metsamor Nuclear Power Plant (Shaffer, 2021). In the post-Karabakh War period, Armenia should take the essential steps and improve its relations with Turkey, which is its gateway to Europe. Considering that commercial activities will increase with establishing a direct roadway and railway transportation connection between Turkey and Azerbaijan via the Zangezur Corridor, an energy trading -alternative to Metsamor- between Armenia and Turkey may be possible. However, the country being energy-dependent on Russia (especially Russian gas and fuel for the nuclear power plant), cannot act on its own in terms of energy. Especially considering the energy management of Russia over Metsamor, it would not be wrong to say that Russia is perhaps the biggest obstacle to closing the power plant. For this reason, Metsamor can be considered a strategic threat from Russia, not Armenia.

BBC News Turkish (2022) has evaluated the issue from the perspective of Turkey. The BBC broadcast, "*Iğdır: The city that does not like its place,*" points out a great misconception or misguidance of the people of Iğdır. The interviews show that the people of Iğdır blame the Metsamor Nuclear Power Plant for the air pollution and the increasing number of cancer cases in the city. However, the energy obtained from nuclear power plants is deemed "clean energy" today. When evaluating the views of people, it can be suggested that the people of Iğdır have probably been perceiving the Metsamor facility as a thermal power plant and discern steam thrown out of Metsamor chimneys as an air-polluting gas (Öksüz, 2020). However, the Nuclear Regulatory Authority has stated that no unusual radioactive activity originating from the Metsamor Nuclear Power Plant has been observed in and around Iğdır until today (BBC News Türkçe, 2022). Supporting this view, Karahan et al. (2020, p. 872) have argued that using the

soil and water of Iğdır Province poses no health risks. This situation confuses the local people, essentially guided by deputies and public institutions about Metsamor. The fact that public institutions do not transparently answer parliamentary questions that express the power plant-related public concerns causes untrue theories and claims to disseminate among the public. The public's opinion clearly reflects this ambiguous situation. However, public institutions' sufficient and transparent approaches to the public's concerns manifesting itself in the deputy questions may prevent this ambiguity, and Iğdır people may know that the Metsamor Nuclear Power Plant did not affect air pollution in Iğdır. In this context, information request applications made to Iğdır Provincial Health Directorate on 09.03.2021 and 26.04.2021 in order to obtain accurate information about the rising cancer cases in Iğdır Province were rejected by the institution. Of course, such a case will inevitably cause people to show interest in hearsay information.

#### **4. Conclusion**

As stated by official institutions, Metsamor Nuclear Power Plant does not pose any danger to Turkey except in extraordinary situations. Over 400 nuclear power plants are operating worldwide, and unusual accidents pose threats to these power plants as well. The Fukushima Nuclear Power Plant accident in 2011 is the best example of this situation. Metsamor Nuclear Power Plant poses more security risks than other nuclear power plants with its older technology, location in the earthquake zone, and lack of preventive concrete domes. However, it has had no adverse effect in terms of air or soil quality in Turkey so far. For this reason, the relevant institutions and organizations should explain to the people of Iğdır that the power plant does not affect Turkey in its routine process and thus prevent information pollution. In addition, more transparent information provided by the relevant institutions to the deputies, who have close relations with the public, will ensure that the public can get more accurate information.

From the Armenia perspective, there is no plan for closing the power plant; conversely, steps have been taken in the development plans for the power plant to serve for a lengthier period. For this reason, if Turkey perceives the power plant as an urgent problem, it should take strategic steps to solve this problem in Turkish-Armenian relations nowadays when dialogue is gradually increasing. Taking steps both to break the influence of Russia, whose domination in the Armenian energy systems is paramount and to alleviate the local people's concerns will carry Turkey to a significant position in developing relations. Turkey should take advantage of

its geographic location on the energy route and take positive initiatives for this risky and old technology power plant shutting down.

## 5. Limitations

Showing the personal data confidentiality as a reason, Iğdır Provincial Health Directorate gave negative answers to the 09.03.2021 and 26.04.2021 dated petitions of the researcher who requested nonpersonal residential information of cancer patients treated in Iğdır State Hospital in order to better understand the effects of the Metsamor Nuclear Power Plant on the people of Iğdır. The rejection of these applications aiming to determine cancer patients living in villages near the power plant has limited the investigation of the effects of the Metsamor power plant claimed by the deputies and local people.

## References

- Abdurrahmanlı, E. (2019). Asala Terör Örgütü Nasıl Ortaya Çıktı ve Terör Faaliyetlerinin Amacı. *International Journal of Social Science*, 2(1), 60–73.
- AFAD. (2021). *Ulusal Radyasyon Acil Durum Planı (URAP)*. [https://www.afad.gov.tr/kurumlar/afad.gov.tr/e\\_Kutuphane/Planlar/ULUSAL\\_RADYASYON\\_A\\_CIL\\_DURUM\\_PLANI\\_\\_URAP\\_\\_2019-2\\_.pdf](https://www.afad.gov.tr/kurumlar/afad.gov.tr/e_Kutuphane/Planlar/ULUSAL_RADYASYON_A_CIL_DURUM_PLANI__URAP__2019-2_.pdf)
- Altıkat, A., Doğru, S., Argun, Y., & Bayram, T. (2015). New Chernobyl? Metsamor Nuclear Power Plant. In Ş.Şahinkaya & E.Kalıpçı (Eds.), *Digital Proceeding of ICOCEE – CAPPADOCIA2015* (pp. 2057–2066).
- Baghirova, A. (2018). Enerji Kaynaklarında Güvenlik Sorunu ve Nükleer Santraller: Metsamor Nükleer Santrali Örneği. *Türk Dünyası Araştırmaları*, 120(236), 215–232.
- BBC News Türkçe. (2022). *Iğdır: Yerini sevmeyen kent*. <https://www.youtube.com/watch?v=TOSXnoYhmMk>
- Breeze, P. (2019). Nuclear Power. In *Power Generation Technologies* (pp. 399–429). Elsevier. <https://doi.org/10.1016/B978-0-08-102631-1.00017-1>
- Britannica. (2022). *Nuclear reactor - Types of reactors*. <https://www.britannica.com/technology/nuclear-reactor/Types-of-reactors#ref155186>
- Cabbarlı, H. (2003). Bağımsızlık Sonrası Ermenistan'ın Enerji Politikası. *ASAM Kafkasya Araştırmaları Masası*, 3(1), 236–258.
- Çelikkol, A. O. (2015). Ermeni “Soykırım” İddiaları, Amerikan Kongresi ve Türkiye. *Bilge Strateji*, 7(13), 17–30.

- Cumhuriyet. (2019). *CHP, Metsamor Nükleer Santrali için araştırma önergesi verdi*. <https://www.cumhuriyet.com.tr/haber/chp-metsamor-nukleer-santrali-icin-arastirma-onergesi-verdi-1707877>
- Cumhuriyet. (2022). *MHP'li Karadağ'dan "Metsamor" tepkisi: Iğdır, Kars, Van, Ağrı ve Erzurum illerimizi yaşanmaz hale getirecek*. <https://www.cumhuriyet.com.tr/siyaset/mhpli-karadagdan-metsamor-tepkisi-igdir-kars-van-agri-ve-erzurum-illerimizi-yasanmaz-hale-getirecek-1907930>
- Duke Energy. (2020). *A clean energy resource*. Duke Energy Corporation. <https://www.duke-energy.com/energy-education/how-energy-works/nuclear-power>
- EIA. (2021). *Nuclear explained Nuclear power plants*. U.S. Energy Information Administration. <https://www.eia.gov/energyexplained/nuclear/nuclear-power-plants.php>
- Eletek, Ö. (2021). *Exclusive Interview: Major Threat from Armenia: Metsamor Nuclear Power Plant*. Ankara Center for Crisis and Policy Studies. <https://www.ankasam.org/exclusive-interview-major-threat-from-armenia-metsamor-nuclear-power-plant/?lang=en>
- G. Karahan, E. Kapdan, N. Bingoldag, H. Taskin, A. Bassari, A. T. A. (2020). Environmental health risk assessment due to radionuclides and metal(loid)s for Iğdir province in Anatolia, near the Metsamor nuclear power plant. *International Journal of Radiation Research*, 18(4), 863–874.
- GE Hitachi Nuclear Energy. (2022). *Nuclear Power Basics*. <https://nuclear.gepower.com/company-info/nuclear-power-basics>
- Gürçam, S., & Konuralp, E. (2022). Küreselden Yerele Çevresel Politika Yapımı: Iğdır İl Özel İdaresi Üzerine Bir Memorandum. *Iğdır Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 6, 65–84.
- Gürçam, S., Konuralp, E., & Ekici, S. (2021). Determining the effect of air transportation on air pollution in the most polluted city in Turkey. *Aircraft Engineering and Aerospace Technology*, 93(2), 354–362. <https://doi.org/10.1108/AEAT-08-2020-0176>
- İklim Haber. (2022). *Iğdır Neden Avrupa'nın En Kirli Havaşına Sahip?* <https://www.iklimhaber.org/igdir-neden-avrupanin-en-kirli-havasina-sahip/>
- International Energy Agency. (2021). *Armenia energy profile*. [https://iea.blob.core.windows.net/assets/89a4a24d-fe2b-4e04-9ec7-25d3c02dbefd/CountryPages\\_Armenia\\_FINAL.pdf](https://iea.blob.core.windows.net/assets/89a4a24d-fe2b-4e04-9ec7-25d3c02dbefd/CountryPages_Armenia_FINAL.pdf)
- International Trade Administration. (2022). *Armenia - Energy Sector*. U.S. Department of Commerce. <https://www.privacyshield.gov/article?id=Armenia-energy-sector>
- IQAir. (2021). *World Air Quality Report 2021*. file:///C:/Users/istan/Downloads/world-air-quality-

report-2021-en.pdf

- Kabasakal, B., & Albayrak, T. (2011). Effects of Nuclear Power Plant Accidents on Biodiversity and Awareness of Potential Nuclear Accident Risk Near the Eastern Border of Turkey. VI. *International Symposium on Ecology and Environmental Problems*, 3434–3436.
- Kodaman, T. (2013). Ermeni Açılımı ve Türk Dünyası. *Süleyman Demirel Üniversitesi Fen-Edebiyat Fakültesi Sosyal Bilimler Dergisi*, 2013(30), 111–122.
- Kovacs, P., & Gordelier, S. (2009). Nuclear power and the public. *NEA News*, 27(1), 4-7.
- Lavelle, M., & Garthwaite, J. (2011). *Is Armenia's Nuclear Plant the World's Most Dangerous?* National Geographic News. <https://www.nationalgeographic.com/science/article/110412-most-dangerous-nuclear-plant-armenia>
- Mehdiyev, M. (2021). *Armenia's Outdated Nuclear Plant Is Extremely Dangerous, International Expert Warns*. CASPIANNEWS. <https://caspiannews.com/news-detail/armenias-outdated-nuclear-plant-is-extremely-dangerous-international-expert-warns-2021-3-9-0/>
- Miholjic, N. (2018). Russia-Armenia Nuclear Energy Cooperation and the Metsamor Power Plant. *Caucasus Internationa*, 8(1), 41–52.
- Nadirov, R., & Rzayev, O. (2017). The Metsamor Nuclear Power Plant in the Active Tectonic Zone of Armenia is a Potential Caucasian Fukushima. *Journal of Geoscience and Environment Protection*, 05(04), 46–55. <https://doi.org/10.4236/gep.2017.54005>
- Nuclear Energy Institute. (2022). *Nuclear Fuel*. <https://www.nei.org/fundamentals/nuclear-fuel>
- Oğan, S. (2007). *Ermenistan, Türkiye'yi Metsamor Nükleer Santrali ile Tehdit Ediyor*. TÜRKSAM. <https://www.turksam.org/detay/54848-ermenistan,-turkiyeyi-metsamor-nukleer-santrali-ile-tehdit-ediyor>
- Öğütçü, Ö. N. (2015). *A Regional Threat: Metsamor*. AVİM. <https://avim.org.tr/en/Analiz/A-REGIONAL-THREAT-METSAMOR>
- Öksüz, E. (2020). *Iğdır'da kanser vakalarında artış: Nedeni Ermenistan'daki Metsamor Nükleer Santrali mi?* Media Arabia. <https://www.indyurk.com/node/281281/haber/iğdırda-kanser-vakalarında-artış-nedeni-ermenistandaki-metsamor-nükleer-santrali>
- Ornarlı, B. (2011). *Türkiye Sınırındaki Nükleer Tehdit: Metsamor*. Amerika'nın Sesi. <https://www.amerikaninsesi.com/a/turkiye-snrndaki-nukleer-tehdit-metsamor-118675894/894377.html>
- Özdaşlı, E. (2016). Kafkasya'nın Çernobil'i Metsamor Nükleer Santrali. *Karadeniz Araştırmaları*

*Dergisi*, 50, 45–64.

Özocak, Ö. (2015). *Diaspora Kavramı ve Ermeni Diasporası*. <https://docplayer.biz.tr/8736749-Diaspora-kavrami-ve-ermeni-diasporasi.html>

Portal on Nuclear Safety. (2022). *Pressurised water reactor (PWR)*. Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV). <https://www.nuklearesicherheit.de/en/science/nuclear-reactors-how-they-work/pressurised-water-reactor-pwr/>

Puiu, T. (2017). *Home Environment Environmental Issues Armenia's Metsamor nuclear power station – most dangerous in the world?* ZME Science LLC. <https://www.zmescience.com/ecology/environmental-issues/amernia-metsamor-nuclear-power-plant-hazard-to-world-14354523/>

Shaffer, B. (2021). *Armenia's nuclear power plant is dangerous. Time to close it*. Bulletin of the Atomic Scientists. <https://thebulletin.org/2021/03/armenias-nuclear-power-plant-is-dangerous-time-to-close-it/>

Silvi, L. D., Chandraker, D. K., Ghosh, S., & Das, A. K. (2021). Understanding dry-out mechanism in rod bundles of boiling water reactor. *International Journal of Heat and Mass Transfer*, 177, 121534. <https://doi.org/10.1016/j.ijheatmasstransfer.2021.121534>

Spring Power and Gas. (2018). *The Pros & Cons of Nuclear Energy: Is it safe?* <https://springpowerandgas.us/the-pros-cons-of-nuclear-energy-is-it-safe/>

Suppes, G. J., & Storvick, T. S. (2016). The Future in Nuclear Power. In *Sustainable Power Technologies and Infrastructure* (pp. 247–343). Elsevier. <https://doi.org/10.1016/B978-0-12-803909-0.00008-7>

TBMM. (2019). *Yazılı Soru Önergesi Bilgileri-CHP Zonguldak Milletvekili Deniz Yavuzylmaz*. [https://www5.tbmm.gov.tr/develop/owa/yazili\\_sozlu\\_soru\\_sd.onerge\\_bilgileri?kanunlar\\_sira\\_no=260214](https://www5.tbmm.gov.tr/develop/owa/yazili_sozlu_soru_sd.onerge_bilgileri?kanunlar_sira_no=260214)

TBMM. (2020). *Yazılı Soru Önergesi Bilgileri-CHP Antalya Milletvekili Çetin Osman Budak*. <https://www.tbmm.gov.tr/Denetim/YaziliSoruOnergesi/281797>

TBMM. (2021). *Yazılı Soru Önergesi Bilgileri-HDP Iğdır Milletvekili Habip Eksik*. [https://www5.tbmm.gov.tr/develop/owa/yazili\\_sozlu\\_soru\\_sd.sorgu\\_yonlendirme](https://www5.tbmm.gov.tr/develop/owa/yazili_sozlu_soru_sd.sorgu_yonlendirme)

Temurçin, K., & Aliğaoglu, A. (2003). Nükleer Enerji ve Tartışmalar Işığında Türkiye'de Nükleer Enerji Gerçeği. *Coğrafi Bilimler Dergisi*, 1(2), 25–39. [https://doi.org/10.1501/Cogbil\\_0000000034](https://doi.org/10.1501/Cogbil_0000000034)

- U.S. Environmental Protection Agency. (2022). *Radiation Health Effects*.  
<https://www.epa.gov/radiation/radiation-health-effects>
- U.S. Nuclear Regulatory Commission. (2015a). *Boiling Water Reactors*. NRC.Gov.  
<https://www.nrc.gov/reactors/bwrs.html>
- U.S. Nuclear Regulatory Commission. (2015b). *Pressurized Water Reactors*. NRC.Gov.  
<https://www.nrc.gov/reactors/pwrs.html>
- Volcano Discovery. (2022). *Past earthquakes in Armenia: 2021 - list, stats and map*.  
<https://www.volcanodiscovery.com/earthquakes/armenia/archive/2021.html>
- World Bank. (2022). *Population, total - Armenia*.  
<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=AM>
- World Nuclear Association. (2022). *Nuclear Power in Armenia*. <https://world-nuclear.org/information-library/country-profiles/countries-a-f/armenia.aspx>
- Yıldız, H., & Mavzer, B. (2019). “*Metsamor*” tehlikesine karşı tatbikat yapıldı. Anadolu Ajansı.  
<https://www.aa.com.tr/tr/turkiye/metsamor-tehlikesine-karsi-tatbikat-yapildi/1508872#>
- Yüksel, M. (2014). Türk-Ermeni İlişkilerinde Başka Bir Sorun: Metsamor Nükleer Santrali ve Türkiye’ye Etkileri. *Yeni Türkiye*, 60, 1–18.
- Yüksel, M. (2020). Uluslararası Politikalar Ekseninde Dünden Bugüne Metsamor Nükleer Santrali ve Türkiye. *Uluslararası Tarih ve Sosyal Araştırmalar Dergisi*, 23, 263–303.
- Zeeb, S. (2010). *Adaptation to Climate Change in the Kura-Aras River Basin*.  
<https://iwlearn.net/resolveuid/166c61b7bbfc4def7dffa12d5102d4b3>