

# The Iranian Nuclear Project: Developments and Environmental Implications for the Middle East (1957–2010)

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## Abstract

*The Iranian nuclear project represents a central issue in the international system. Its political and security dimensions intersect with economic, strategic, and environmental concerns. While global discussions often focus on security and nuclear proliferation, the environmental dimension is no less critical. It carries the potential for catastrophic consequences affecting Iran, neighboring countries, and possibly the world. Among the most serious risks are direct environmental threats linked to nuclear reactors and the transboundary regional effects they could cause. This paper highlights the importance of integrating environmental concerns into both regional and international policy-making. Neglecting this aspect of Iran's nuclear file may not threaten a single state alone but poses a danger to the entire Middle East. Since the main aim of this article is to examine the environmental risks arising from Iran's nuclear facilities, it is essential to understand the components of the nuclear program and the key areas of international contention surrounding it. Although originally intended for peaceful purposes such as electricity generation, medical isotopes, and scientific research its strategic implications have raised widespread concerns.*

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## Introduction

Security in the Middle East is among the most pressing and volatile global concerns, particularly with the spread of weapons of mass destruction. This issue has gained increasing international relevance in the 21st century. A major turning point came after the events of September 11, 2001, when international discourse began linking terrorism with weapons of mass destruction—particularly nuclear weapons. Both were now viewed as threats requiring urgent global action.

Iran found itself in a challenging position, especially as its nuclear activities had always been shrouded in secrecy and ambiguity. This secrecy stems partly from the military doctrine of the Iranian regime, which draws on a blend of expansionist Persian heritage and the ideological goal of exporting the Shiite Islamic revolution. Iran's pursuit of nuclear capabilities appears consistent with its security doctrine, which anticipates a range of strategic threats.

Selecting research topics is never random. It is driven by both objective and subjective justifications. In this study, we were motivated by the need for an academic and historical analysis of a topic that has become central in international relations. Understanding Iran's determination to develop a nuclear weapon requires examining its strategic goals and the broader consequences for the region especially from an environmental perspective. These consequences are particularly concerning given Iran's strategic position and its ambitions for regional leadership.

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## Research Objectives

- To explore the declared and undeclared motivations behind Iran's nuclear project.
- To trace the origins and evolution of the Iranian nuclear program and its infrastructure.
- To assess the impact of the Iranian nuclear program on environmental balance in the Middle East.

The Iranian nuclear issue remains a subject of intense international debate. Western countries have repeatedly condemned Iran's nuclear ambitions and held multiple conferences on the matter. Meanwhile, regional states—especially Arab countries—view the project as a threat to the future of the entire region. As the program advances, its potential consequences become more pronounced across the Middle East. This leads us to the central research question:

To what extent does the Iranian nuclear project affect the environmental stability of the Middle East?

This study relies on the historical-analytical method. We follow the project's development over time, examine its implications on regional and global levels, and analyze the motivations behind Iran's insistence on nuclear capability. The study also sheds light on the environmental risks it may pose to the region.

### Section One: The Geographic Scope of the Middle East

The term "Middle East" dates back to 1902, when Britain divided its colonies into three zones: the Far East, the Near East, and the Middle East. Since then, the term has been widely adopted by states and international organizations. However, its geographic boundaries remain disputed, often shaped by political, strategic, and economic interests.

**Israel's Perspective:** From an Israeli viewpoint, the Middle East encompasses both immediate neighboring countries and more peripheral Arab states like Iraq and Libya. Former Israeli President Shimon Peres, commenting on the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), described Iran as a provocative regime that threatens regional stability and Israel's security. Israel, which has not signed the NPT, has tied its participation in any initiative to make the Middle East a zone free of weapons of mass destruction to one condition: that Arab states officially recognize Israel's legitimacy and existence().

**The United States of America** The United States defines the region through its proposal for political and economic reforms presented at the G8 Summit in 2003. According to this view, the region includes all countries stretching from Morocco in the west to Iran in the east. This includes all Arab states, as well as Israel and Iran, while explicitly excluding Turkey().

**The League of Arab States** In March 1993, the League of Arab States defined the Middle East region through its proposal to establish a zone free of weapons of mass destruction. It described the region as including all territories under the autonomy and control of the member states of the League, in addition to Israel and Iran().

**The United Nations** The United Nations defined the region through the United Nations Institute for Disarmament Research (UNIDIR). This definition was based on a study conducted by the institute in 2004 concerning the establishment of a zone free of weapons of mass destruction. According to this definition, the region includes 22 countries: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen ().

**The International Atomic Energy Agency (IAEA)** The IAEA defined the region in a technical study it conducted in 1989 on the application of nuclear safeguards in the context of nuclear energy in the Middle East. It described the region as extending from Iran in the east to Libya in the west, and from Syria in the

north to Yemen in the south. The definition includes 15 countries: Libya, Egypt, Syria, Jordan, Lebanon, Israel, Iraq, Qatar, Bahrain, Saudi Arabia, the United Arab Emirates, Oman, Kuwait, and Yemen ().

From the previous definitions, the Middle East region has several geographical definitions, some of which include the Arab countries, Turkey, and Iran, and some of which include... All Arab countries and Turkey are included. However, this study adopts the definition provided by the International Atomic Energy Agency (IAEA), which defines the region geographically as extending from Iran in the east to Libya in the west, and from Syria in the north to Yemen in the south. This choice is based on the following reasons:

- The IAEA is concerned with nuclear energy and nuclear armament, which aligns with the focus of this study.
- This definition includes Iran as a Middle Eastern state, which is essential, as Iran cannot be separated from the nuclear issue in the region.
- This definition excludes the Maghreb countries, except for Libya. This aligns with our research scope, as those states are not directly affected by the Iranian nuclear issue to the same degree.

## **Second: The Motivations Behind Iran's Nuclear Project**

Iran's nuclear policy is driven by a complex set of motives and intentions. Some are publicly declared, while others remain implicit. Iranian officials consistently claim that the nuclear program is aimed solely at benefiting from the peaceful uses of nuclear energy. However, at different times, some Iranian leaders have made statements suggesting a clear interest in developing nuclear weapons.

### **Political and National Motivations**

Western countries did not oppose Iran's nuclear program during the Shah's reign. However, after the success of the revolution, Western powers—particularly the United States—began to express concern and disagreement. This shift in attitude can be explained by the different goals of the two regimes. The Shah aimed to strengthen Iran's military power to serve as the “guardian” of oil fields and the security of maritime oil routes in the Gulf. In contrast, the post-revolutionary regime sought to lead the Islamic world, secure a prominent regional position, and assume multiple strategic roles, the most significant of which are():

- Participating in Gulf security arrangements and contributing to stability in the broader Northwest Asia region.
- Taking advantage of shifts in the global order, particularly the ideological vacuum that followed the collapse of the Soviet Union. This includes confronting the United States based on a value system rooted in Islam, and exploiting both Israeli intransigence and American bias toward it.
- Benefiting from American policy, which led to the removal of regional rivals such as Saddam Hussein's regime and the Taliban movement. The Iranian leadership recognized that nuclear weapons could serve as a powerful tool to strengthen Iran's political position at both the regional and international levels. This, in turn, supports its ambition to lead sectarian, ideological, and cultural movements that extend beyond its geographic borders.

From a national perspective, Iran also seeks to revive the idea of the Persian Empire, a concept that remains deeply embedded in Iranian national identity.

### **Military and Strategic Motivations**

There is near consensus that military factors are among the core drivers of Iran's nuclear program. Iranian strategic thinking has placed strong emphasis on the lessons learned from the Iran-Iraq War and on the

ongoing threats posed by the United States and Israel. One key conclusion is that Iran must be ready for any possible future scenario.

Iran has also realized that it should not rely heavily on the self-imposed limits of its rivals or their commitment to international obligations. Based on this view, Iran saw value in possessing nuclear weapons, especially in a region where nuclear arms are already present, with Israel, Pakistan, and India all having such capabilities. This grew stronger as Israeli threats toward Iran increased(). In addition, Iran seeks to secure itself against the Gulf states, which signed defense agreements with the United States and Western powers following the Second Gulf War in 1991. These agreements left Iran surrounded by American forces on multiple fronts—by Iraq to the west, Afghanistan to the east, naval presence and military bases in the Arabian Gulf to the south, and military installations in former Soviet republics to the north.

Iran also faces ongoing disputes with the United Arab Emirates over the three islands. At the same time, NATO has expanded into Central Asia in a move seen as aimed at separating the region from both Russia and China. Moreover, since 1996, an Israeli-Turkish alliance has existed. Despite current tensions between the two countries, military cooperation has continued.

All of these threats have pushed Iran to pursue deterrent power to strengthen its military and security capabilities in response to any potential aggression.

From a strategic perspective, the development of Iran's nuclear capabilities is part of a broader vision for its foreign policy, both regionally and internationally. It is also linked to a comprehensive plan to rebuild the Iranian Armed Forces.

Iran's foreign policy is based on securing a prominent position in the regional arena. Some analyzes suggest that Iranian leadership seeks to play multiple roles within this vision. These roles include participating in Gulf security arrangements and contributing to stability in the broader Northwest Asia region.

Official Iranian discourse also sees value in the global structural changes that followed the collapse of the Soviet Union. It views these changes as an opportunity to adopt a strategy aimed, first, at filling the ideological vacuum in the developing world and, second, at continuing confrontation with the United States. In this context, nuclear weapons are seen as a powerful tool to reinforce Iran's regional and international standing.

### **Economic Motivations**

There are several key economic reasons that have driven Iran to seek nuclear capability. One of the most important is the goal of generating 20% of its electricity from nuclear sources. This aim is especially relevant in light of the country's growing population and its ambitious economic plans.

Iran's economy has been growing at a rate of about 5% per year. To support this growth, the government has sought to reduce its domestic consumption of gas and oil. In addition, during the Shah's rule, Iran spent a significant portion of its national wealth on purchasing nuclear equipment ().

The Israeli nuclear threat remains a central concern, as Israel continues to be the only nuclear-armed state in the region. It still views Iran as the primary threat to its security, especially after the fall of the Iraqi regime, the shift in Libya's foreign policy, and the normalization of relations between Israel and several Arab states.

This perception is reinforced by Iran's consistent stance on the Palestinian issue. In 2001, Tehran hosted the Conference in Support of the Palestinian Intifada. Furthermore, Ayatollah Khomeini was the first to call for the observance of International Quds Day, beginning in August 1979(). On the other hand, the continued disregard for Israel's nuclear capabilities, along with the ongoing neglect of Iran's repeated calls to establish a weapons-of-mass-destruction-free zone in the region, has led Iran to lose confidence in diplomatic and political solutions.

The continued American and Western pressure on Iran since the success of the Islamic Revolution, along with the repeated crises between Iran and the United States—which has pursued a policy of dual containment, expanded its military bases in the region, invaded Iraq, and labeled Iran as part of the “Axis of Evil”—has led international efforts to isolate Iran.

All of this has convinced Iranian leaders that a military threat from the United States is not distant, and that the country must be prepared for such a possibility .

Whatever Iran's nuclear motivations may be—whether peaceful or military—it is scientifically and technically established that its success in enriching uranium at low levels (3.5%, then 20%) confirms that Iran possesses a nuclear infrastructure, scientific knowledge, and technological expertise. These capabilities have been developed over the past thirty years and are used for peaceful and civilian purposes, such as building power reactors for electricity generation and water desalination.

It can be said that while Iran's declared nuclear goals appear peaceful so far, they at least follow the principle of “dual-use.” In this, Iran is not an exception. Countries like India and even North Korea have taken similar paths. This is evident in the parallel development of nuclear capabilities and advanced missile systems, along with a strongly advancing space program. Technically, both tracks allow for civilian and military applications.

### **Third: Stages of the Iranian Nuclear Project**

#### **1. The Foundation Phase and Infrastructure Development**

Iran's nuclear activities began in the 1950s through close cooperation with the United States, starting in 1957. Since the time of the Shah, Iran had pursued the development of a nuclear program. This came after the CIA overthrew Prime Minister Mohammad Mossadegh in August 1953. General Fazlollah Zahedi was appointed as his replacement, tasked with reversing the nationalization of Iranian oil and redistributing foreign shares in a new way. The goal was to prevent Britain from regaining its former control over Iran's oil resources. A group of eight oil companies, known as the Consortium, was formed to manage this distribution. The agreement was set to remain in force for twenty years(). Within the framework of the "Atoms for Peace" program initiated by US President Dwight D. Eisenhower in 1953, which aimed to open the nuclear pathway to countries worldwide through the transfer of peaceful nuclear technology, the first nuclear agreement between Iran and the United States was signed in 1957 and came into effect in 1960.( ), Through this agreement, Iran obtained its first research reactor at Tehran University (TRR) in 1967, with a capacity of 5 megawatts. This cooperation was the result of strategic relations during the Cold War era. The training reactor served as a cornerstone for Iran's nuclear program, with an annual production capacity equivalent to 0.6 kilograms of plutonium.

The American-Iranian cooperation coincided with the development of relations between Iran and Israel due to regional changes at the time. These included the union between Syria and Egypt in 1958, the military coup in Iraq led by Abd al-Karim Qasim in July 1958, and the fall of the monarchy. The United States supported this relationship as it ensured American control over the region and fostered a sense of trust between Israel and its regional environment. This served as a security guarantee for Israel, especially following the security and political vacuum created by Britain's withdrawal from the Suez Canal and Gulf areas. Israel worked on arming the Iranian military and assisted the US intelligence services in establishing Iran's intelligence agency, SAVAK, in the mid-1950s. ( ). In 1977, the two countries launched “Project Flower,” a joint initiative to build missile capabilities. The focus was on developing long-range missiles with a range of 150 to 200 kilometers, as well as heavy anti-ship missiles. However, the project was not completed due to the outbreak of the Islamic Revolution.

The Shah's plans were based on establishing 23 nuclear reactors, expected to be fully operational by the mid-1990s. These reactors were intended to cover the entire Iranian territory at an estimated cost of 30 billion US dollars. The reactors had the capacity to produce plutonium, a key component in the manufacture of nuclear weapons. The Shah was highly enthusiastic about involving his country in this field. He justified

the move by claiming that Iran needed nuclear energy to generate electricity, despite its large reserves of oil and natural gas(). In July 1968, Iran signed the Treaty on the Non-Proliferation of Nuclear Weapons. The treaty came into effect on March 5, 1970. Article IV of the treaty affirmed Iran's right to develop, produce, and use nuclear energy for peaceful purposes. It also recognized Iran's right to access nuclear materials, equipment, and scientific and technological knowledge without discrimination, like any other state. These rights were later invested in Iran's nuclear program.

In 1974, the Shah established the Atomic Energy Organization to implement the national nuclear plan. Akbar Etemad was appointed as its head. In the same year, Iran signed the IAEA Safeguards Agreement, in accordance with Article III of the treaty. This agreement defined the inspection and monitoring procedures to be carried out by IAEA inspectors at all nuclear facilities and over all nuclear materials ().

The United States actively encouraged Iran to expand its non-oil energy base. American companies also expressed interest in participating in Iran's nuclear energy projects. As a result, both sides signed an agreement on November 3, 1974, under which Washington would supply enriched fuel for eight reactors in Iran. In 1975, the agreement was expanded, and its total value was estimated at 60.4 billion US dollars ( ), In addition, Iran signed a series of contracts with European nuclear suppliers. In 1974, it concluded an agreement with Kraftwerk Union (KWU), a subsidiary of the German company Siemens, to build two nuclear reactors. One reactor had a capacity of 1300 megawatts, and the other 1200 megawatts. Both were pressurized heavy-water reactors, known as the Bushehr reactors. Around 2,100 German workers and approximately 7,000 Iranian workers were involved in the nuclear program. The Shah stated that this program would provide the necessary infrastructure for the country's industrial development. ( ), About 85% of the first reactor had been completed, and the second was near completion when the 1979 Islamic Revolution took place, bringing an end to the Shah's rule.

France, Italy, Spain, and Belgium also joined the Iranian nuclear program. Akbar Etemad, Head of the Atomic Energy Organization of Iran (1974–1979), confirmed that Iran held negotiations with the French company Faramaton to establish a nuclear power plant in Darkhovin, located on the banks of the Karun River in the Ahvaz region. Iran also invested one billion dollars in the French-owned uranium enrichment plant “Eurodif.” In addition, Iran signed a contract with the French company Alstom to build four nuclear reactors. This company includes contributions from Belgium, Spain, and Italy, alongside France.

In 1975, a technology center was established in Isfahan with French support. Its purpose was to train workers who would later operate the Bushehr reactors. An agreement was also signed between the Atomic Energy Organization of Iran and the Massachusetts Institute of Technology in the United States to train specialized Iranian engineers. On July 10, 1978, a final draft of an Iranian-American nuclear agreement was signed. This agreement included provisions for facilitating and regulating the export and transfer of equipment and materials for the Iranian nuclear program ().

From the above, it becomes clear that the Shah was the one who laid the foundations of the Iranian nuclear program. The declared goal was to produce electrical energy. However, the program carried within it different intentions related to the pursuit of nuclear weapons. This is confirmed by the Shah's own words in 1974: “We are among those who do not possess nuclear weapons, and therefore, friendship with a country like the United States—with its nuclear arsenal—is a matter of vital importance”.

## **2. Suspension and Revival of the Program (1979–1990)**

Following the victory of the revolution, Iran's revolutionary leaders—foremost among them Ayatollah Khomeini—adopted a negative stance toward many national projects inherited from the previous regime. Their aim was to Islamize these initiatives, including the nuclear program. The Shah had sought to launch what he called the "Iranian Civilization Project," which shaped the new Islamic regime's skeptical view of the nuclear program. Ayatollah Khomeini went as far as to describe the Bushehr reactors as a project opposed to Islam.

In addition, the United States and Western countries refused to cooperate with the leaders of the Islamic Revolution in the nuclear field. They imposed sanctions across various sectors. As a result, the nuclear program was suspended, and arms deals and industrial projects with the United States, France, Germany, and Japan were canceled following the declaration of the Islamic regime in Iran ().

The available data indicates that, at the beginning of the Islamic Republic, Iran appeared to abandon its nuclear program. However, the existing evidence contradicts this assumption. The most significant points include the following:

- The continued operation of the reactor at Amirabad Technical College and the ongoing inspections by the International Atomic Energy Agency.
- The appointment of Ayatollah Hossein Beheshti in 1981 to oversee the nuclear program. He held a prominent political and religious position, which reflects the importance assigned to the program at that time.
- The retention of approximately 300 to 400 Iranian technicians who remained active after the departure of foreign experts, along with 13 Iranian nuclear specialists assigned to work at Bushehr ().
- A fire broke out at the Bushehr plant in 1982. This suggests that work was ongoing at the reactor despite the absence of foreign expertise. The fire led to a complete shutdown of operations at the facility.
- The removal of spent nuclear fuel from the reactors to distant locations, as a precaution against a possible Iraqi attack, indicates the importance given to this strategic material.
- The rejection of a proposal by the KWU company to replace the nuclear reactors with gas-powered turbines reflects Iran's commitment to maintaining its nuclear infrastructure.
- In 1982, a formal complaint was submitted to the International Chamber of Commerce (ICC) against the German company Siemens. The complaint demanded the delivery of stored reactor materials and components located in Iran. In 1996, Iran sought compensation after Germany failed to comply with the ruling. This demonstrates Iran's intention at the time to complete the Bushehr reactor ().

The claims that the nuclear program was halted or frozen during this period may be attributed to several factors. The new regime was unable to bear the high financial costs. Most of Iran's national nuclear experts had left the country. There were no ready plans for the program at the time. In addition, the international stance, especially the position of the United States, Germany, and other Western countries, was firmly against cooperation with Iran in the nuclear field due to American pressure ().

Whether Iran suspended its nuclear program by its own choice, due to external pressure, or as a result of both, it is certain that the program was never fully cancelled. This is confirmed by its revival in 1984, when Iran began moving quickly toward acquiring nuclear weapons. The government strengthened and supported the Atomic Energy Organization of Iran and decided to resume work at the Bushehr plants. Ali Akbar Hashemi Rafsanjani, who was then the Speaker of the Iranian Parliament, led efforts to reactivate the program (), In the same year, Iran opened the Isfahan Research Center. An agreement was reached with China to reopen the facility under the terms of the 1985 Iran–China treaty, which included restarting the reactor with a capacity of 400 megawatts. In 1986, Ayatollah Khomeini declared Iran's commitment to continue developing its nuclear capabilities. That same year, Iran signed an agreement with Pakistan for cooperation in military nuclear fields () Under this agreement, Pakistan was to train and assist Iranian personnel. In 1987, Iran signed another agreement with Argentina to obtain enriched uranium for the Tehran Research Reactor. Between 1988 and 1989, Iran reached an agreement with South Africa to acquire quantities of uranium for nuclear testing purposes ().

Iran also sought to acquire nuclear warheads from the Islamic republics of Central Asia following the collapse of the Soviet Union. Several Western intelligence agencies even confirmed that Iran had, in fact, obtained a number of them from Kazakhstan ( ).

### 3. The Rapid Advancement Phase of the Program (1991–2002)

The world experienced significant changes after the end of the Cold War. It became clear that the international system faced new conditions and entered a new era in terms of structures and relations within the emerging global order. The Second Gulf War in 1991 introduced new realities at both regional and international levels. These developments led to a series of United Nations Security Council resolutions concerning Iraq's weapons of mass destruction program.

In response, Iran sought to take advantage of these changes by intensifying its efforts and rapidly advancing its nuclear program once again. By this time, Iran had developed an infrastructure capable of conducting advanced nuclear research. It also expanded its strategic nuclear facilities over a wide area and surrounded them with extensive security measures. This was done to protect against possible military airstrikes, a precaution learned from the Iraqi nuclear experience, when one of Iraq's sites was hit by an Israeli airstrike in 1981.

The capacity of the Atomic Energy Organization of Iran was further strengthened by the establishment of affiliated facilities and centers. Among the most prominent were the Advanced Technology Center in Isfahan and the Nuclear Research Center in Bushehr. Meanwhile, the Iranian government exerted significant efforts to secure assistance from Russia, China, and North Korea. This support focused on developing the nuclear program and enhancing nuclear delivery systems, particularly missile technology, which Iran prioritized with great attention and focus( ). Iran continued its efforts without notifying the International Atomic Energy Agency. In 1991, press reports indicated that Rafsanjani concluded special negotiations during his visit to Beijing to purchase two reactors with a capacity of 300–330 megawatts from China. In 1992, Iran conducted experiments on uranium enrichment and centrifuge technology at Sharif University. At the same time, he sought to acquire equipment used in centrifuge production( ). In the same year, Russia announced that it had signed an agreement with Iran to build a light-water reactor in Bushehr, along with another agreement on cooperation in the peaceful use of nuclear energy. Under these agreements, more than 100 Russian experts arrived at the Bushehr site. That year, Iran also graduated sixteen technicians from the Nuclear Energy College in Bushehr. However, Iran's economic conditions at the time hindered the completion of the agreements.

In 1993, Iran renewed its contract with Russia to revive the Bushehr reactor and two additional reactors. Yet, ongoing economic difficulties prevented the contract's implementation. The crisis caused the Iranian currency to fall by about 7% of its real value. Despite these challenges, Iran continued to advance its nuclear program. It also contracted with the Argentine nuclear company Invap to supply peaceful nuclear equipment valued at approximately \$18 million. However, this contract was canceled under US pressure ( ).

In 1993, Iran also attempted to obtain eight nuclear models (steam condensers) from the company Ansaldo, but it failed because the Italian government confiscated this equipment. Iran's attempts to purchase an unfinished reactor from Poland also failed. The most significant development in the program came in 1995, when the Iranian government signed a Russian contract to implement the Bushehr project under the supervision of the International Atomic Energy Agency. Under this contract, the Iranians obtained two light-water nuclear reactors with a capacity of 1,000 megawatts. Under the agreement, it was decided to complete the first nuclear reactor in Bushehr to generate 30-50 megawatts within four years, and to train 15 Iranian nuclear experts in Russia.( )It is worth noting that the reactors agreed upon have a production capacity of 180 kg of plutonium per year. The United States exploited this and claimed that it would be used to produce nuclear weapons, which resulted in a US-Russian agreement to return the spent nuclear fuel from Bushehr to Russia.( ).In mid-1995, Iranian officials reported that Iran had allocated \$800-900 million to acquire two 300-megawatt heavy-water nuclear reactors from China.( )In the same year, more than three new uranium milling facilities were inaugurated, and some reports confirmed that Iran had

become capable of producing uranium hexafluoride gas on its own. In late 1995, the Chinese began work on the Kharg complex, where they installed a uranium enrichment system with the ability to gradually produce nuclear weapons. An accident at the Rasht facility, 9 km north of Gilan, in which about 50 people were exposed to radiation, also shed light on the nuclear program, especially since this new site was previously unknown .

At the beginning of 1999, Iran raised the budget for the construction of two nuclear reactors to \$850 million, to ensure the purchase of the turbines it needed from a Russian factory. It did so, as it succeeded in securing Russian cooperation despite American pressure ( ). Because of these Iranian successes in reviving its program, and following the failure of American pressure on Russia, Israel directly entered the line of pressure to thwart Iranian efforts and cooperated with Russia to take strict measures against Iran.

At this stage, it is clear that Iran has benefited to the fullest extent from international and regional developments. It has intensified its activities in all areas to support its nuclear program, whether by building a basic research infrastructure, including human resources and technological equipment, or by deploying facilities throughout Iranian territory, shrouding them in secrecy. It has also exerted tremendous efforts to sign agreements and obtain the necessary materials to operate the nuclear program from Russia, China, and North Korea. It has also been largely successful in confronting American and Israeli pressure.

#### **4- The stage of confrontation with the international community**

Following the events of September 11, 2001, the United States began to make reckless accusations against countries that were not in its orbit, calling some of them rogue states or states sponsoring terrorism. It began to classify the world on the basis of two axes: the axis of evil and the axis of good. Iran was among the countries classified as rogue and sponsoring terrorism. These changes came to shed light on Iran's nuclear program, so that the United States increased its pressure by seeking international support to deprive Iran of possessing nuclear technology, under the pretext that its possession of nuclear technology would enable it to obtain nuclear weapons, and also enable it to carry out, on its own or through terrorist organizations (according to American and Israeli statements), strikes on selected targets in various parts of the world and Israel.( )In addition to the imbalance in the Middle East, which threatens its interests and the interests of its allies, the pressure of the Zionist lobby contributed to strengthening this American pressure. In mid-August 2002, the nuclear crisis was resolved on the international scene following a press conference in which Alireza Jafarzadeh - the spokesman for the National Council of Resistance of Iran, the political arm of the Mujahedin-e Khalq Organization - spoke in Washington. During the conference, he displayed pictures of secret Iranian nuclear facilities in Natanz and Arak, far from the supervision of the International Atomic Energy Agency. Satellite images showed that part of these facilities were built underground, surrounded by a large security fence, and appeared to be designed to withstand air strikes .

Iran's announcement that it is developing a small nuclear reactor that relies on local resources and domestic capabilities has set off international alarm bells. Enrichment, heavy water production, and nuclear fuel extraction, in their view, contribute effectively to developing a domestic nuclear fuel cycle and, consequently, to manufacturing a nuclear weapon .

Iran has realized the seriousness and complexities of the current situation, and has therefore tried to preserve its nuclear achievements. This was demonstrated by its denial of its violations of international agreements, especially the Nuclear Non-Proliferation Treaty, and its insistence on the peaceful nature of its nuclear program. It also denied the existence of any secret activities in the Arak and Natanz reactors, emphasizing that the primary objective of the two facilities is to produce the nuclear fuel needed to operate the nuclear power plant in Bushehr( ). In August 2003, a new element emerged in the Iranian nuclear crisis with the discovery by the International Atomic Energy Agency (IAEA) of highly radioactive traces in samples taken from the environment in Iran. The agency considered this evidence that Iran had been refining uranium without informing the IAEA. The analysis showed high levels of uranium enrichment consistent with those found in materials used in the production of nuclear weapons( ) These two matters constituted a significant shift in the Iranian nuclear crisis, as it moved from the stage of unprovable suspicions to the stage of explicit accusations due to the availability of practical evidence of the existence

of secret activities taking place within the framework of the Iranian nuclear program, which contributed to increasing international fears of Iranian nuclear activities, which prompted Iran to announce the voluntary suspension of its activities related to uranium enrichment. This came after concluding an agreement with Britain, France, Germany and the High Representative of the European Union in October 2003, as European efforts resulted in Iran signing the Additional Protocol, as well as their signing of the Paris Agreement. In November 2004, Iran committed to a complete and comprehensive halt to all nuclear program activities throughout the period of negotiations with the European Troika. In return, the Troika pledged to provide technological support to Iran in the field of peaceful use of nuclear energy, supply it with a light-water reactor to generate electricity, and commit to supplying it with nuclear fuel. This was in addition to avoiding referring the Iranian nuclear file to the Security Council, working to end Tehran's political and economic isolation from the Western world, and, above all, supporting Iran in obtaining membership in the World Trade Organization, which the United States has been blocking since 2001. The Board of Trustees of the International Atomic Energy Agency (IAEA) also adopted a resolution welcoming Iran's voluntary decision on November 29, 2004, to continue to suspend all nuclear activities, although the resolution expressed its concern about Iran's policy of concealing nuclear activities. This concern was expressed by the Director General of the IAEA at the time, Mohamed ElBaradei, in his report submitted to the Agency's Board of Trustees on November 25, 2004. Indeed, despite the agreement, Iran continued to operate its nuclear program with such skill that it prevented IAEA inspectors in December 2004 from accessing two Iranian military sites. They are: Parchin and Lavizan, as a result of denunciation by the Iranian opposition abroad. It was discovered that the two sites were prepared for testing conventional explosives and storing equipment and materials transferred to them from other sites that had been classified as being of a nuclear nature. This increased the fears of European countries and the United States at the beginning of 2005, as the implementation of the Paris Agreement between the European Troika and Iran faltered after a round of negotiations between the two sides, and each accused the other of violating the agreement. In March 2005, Iran rejected a second visit to the Parchin site by IAEA inspectors on the grounds that it was unjustified. This prompted the IAEA to say that this refusal was obstructing the IAEA's efforts. In July, Iran announced, through its former president, Mohammad Khatami, its intention to resume nuclear activities.

Despite Iran's attempts to avoid a confrontation with the international community, especially the United States, Iranian President Ahmadinejad declared in September 2005 during the United Nations summit that Iran had the right to develop its peaceful nuclear program in accordance with the provisions of the 1970 Treaty on the Non-Proliferation of Nuclear Weapons...and offered a compromise allowing foreign companies to participate and invest in the program. In November, the Iranian government approved a plan allowing foreign investors to participate in work at the Natanz uranium enrichment facility. The Cabinet also authorized the Atomic Energy Organization of Iran to take all necessary measures to attract foreign and domestic investment in the enrichment process. In November 2005, the International Atomic Energy Agency announced that Iran had a document regarding the procedural requirements for reducing UF<sub>6</sub> to metal in small quantities, and discusses ways to manufacture machines for enriched, natural and depleted uranium metal in hemispherical shapes, and that it has information for making the "explosive core" of a nuclear bomb. In light of these developments and discoveries, the International Atomic Energy Agency adopted a resolution supported by China and Russia demanding that Iran suspend its enrichment activities and inform the Security Council of developments in the nuclear file.

Following these developments mentioned above, on March 8, 2006, the Iranian nuclear file was referred to the Security Council. The Security Council gave Iran a deadline until April 28, 2006, to suspend its enrichment activities, which Iran met with no response. On April 3, 2006, Iran conducted important military maneuvers and tested new weapons as a warning message against any attack on it. On April 9, it announced its success in enriching uranium to 3.5 percent. And its decision to accelerate the nuclear program, and it began to talk about a major development in the program, and it rejected the call of the Director General of the International Agency to suspend its nuclear activity and insisted on the continuation and continuation of the program with strength and stability.

Iran continues to announce that it has enriched uranium to 8.4 percent. Following this, France and Britain submitted a draft resolution to the Security Council, which was supported by the United States of America, referring to Chapter VII of the United Nations Charter. However, Moscow and Beijing opposed it, which prevented its approval. On June 6, 2006, the five permanent members of the United Nations, plus Germany, presented an offer of incentives to Iran if it agreed to suspend its uranium enrichment activity. However, the Security Council issued a resolution on July 31 giving Iran a month to stop and suspend uranium enrichment under penalty of sanctions. Iran considered this an impossible path, and announced that it would begin operating a heavy water plant in Arak. On December 26, 2006, the Security Council issued Resolution 1737, imposing a series of sanctions on Iran for its non-compliance with its resolutions. Iran continued to refuse, so on March 24, 2007, the Security Council, by Resolution 1747, expanded the scope of the sanctions to include a travel ban on thirteen Iranian officials, a freeze on their financial assets abroad, and the imposition of further sanctions on the export and supply of materials, goods, and technologies related to nuclear activities. It also threatened to take new measures and procedures, including further economic and diplomatic sanctions, under Article 41 of Chapter VII of the United Nations Charter.

On April 9, 2007, Iranian President Ahmadinejad announced that his country had entered the nuclear manufacturing phase. Then came advertisement Iranian Defense Minister" Mustafa Muhammad Najjar" In his speech before the mobilization forum of the Ministry of Defense personnel, The construction of the Ashura missile, which has a range of 2,000 km, is one of the It came and went R And defense, as he pointed out to the industry submarine from tRazAl-Ghadeer, and designs for the Dam Saw Mog missile launchers, and the manufacture of various Types of missiles and submarines radars It is done self-sufficiently from within the country. )And in A report by the US National Intelligence Council published at the end of 2007M Emphasis on that Iran It halted its nuclear weapons program in the fall of 2003, and It did not restart the weapons program before. Mid In 2007, it also made significant progress in installing new devices. And Centrifuge in Natanz, and will become capable Technically capable of producing a quantity of enriched uranium to manufacture a nuclear weapon in the period between 2010 and 2015. ).and In early 2008, the Security Council agreed to impose a set of new sanctions on Iran Badoptionresolution (1803) The judge ordered the application of a series of penalties against Iran In June 2009, it announced the design of plans for another reactor, and a year after the rejection, it was allowed Iran With the arrival of inspectors to the reactor, monitoring of the site was increased. Natanz, and the agency reported on a new facility, which later turned out to have been under construction since 2006, And on the 8th February 2010 The Israeli ambassador announced Rani At the International Atomic Energy Agency, "Ali Asghar bowl", that Iran The agency has been officially notified of its plans to produce 20% enriched uranium to provide Fuel for a nuclear reactor cat The allocation for medical research, as he stressed, " Ali Akbar Salehi" Head of the nuclear program The ERI, that production will start in Natanz .

On June 9, 2010, the United Nations Security Council imposed new sanctions on Iran under Resolution 1929. These sanctions prohibited Iran from making foreign investments in sensitive activities such as uranium mining, as well as in its maritime and banking sectors. The resolution also banned the purchase of heavy weapons, including tanks, armored combat vehicles, heavy artillery, fighter jets, helicopters, warships, missiles, and missile systems. In addition, it prohibited any activity related to ballistic missiles.

Iran responded through a statement by President Mahmoud Ahmadinejad, who remarked that the resolution was fit to be thrown in the trash. Ali Asghar Soltanieh, Iran's permanent representative to the International Atomic Energy Agency, also affirmed that his country would not halt its uranium enrichment activities.

On July 26, the European Union imposed unilateral sanctions targeting Iran's oil and gas sector. These included bans on investment and the transfer of technology related to oil refining. Australia also imposed restrictions, banning arms trade and the export of dual-use materials, in addition to applying financial sanctions. Likewise, Japan enacted both financial and economic sanctions. It also froze the assets of forty Iranian companies.

Despite these measures, Iran did not halt its nuclear program. On December 13, 2010, President Mahmoud Ahmadinejad dismissed Foreign Minister Manouchehr Mottaki and appointed Ali Akbar Salehi, head of the Atomic Energy Organization of Iran, as acting minister. Experts interpreted this move as a sign that the Iranian leadership intended to accelerate the development of its nuclear program and avoid making concessions in any future negotiations. This interpretation was based on Salehi's previous role and the responsibilities he assumed in his new post ( ).

The Iranian nuclear project has undergone several phases since its inception. Despite facing strict and varied sanctions imposed by the Security Council, Iran remained steadfast in pursuing it, though it has not reached the point of military intervention. Consequently, Iran developed a nuclear infrastructure that serves its objectives by establishing numerous research centers and nuclear reactors. Additionally, it built facilities dedicated to designing and producing missile technologies, resulting in possession of multiple ballistic missile models. Continuous advancements and new tests are underway to enhance nuclear weapon delivery methods and extend their range capabilities.

#### **Fourth: Environmental Impacts of the Iranian Nuclear Project on the Middle East**

Although the Iranian nuclear project is often presented as a domestic issue related to Iran's autonomy, its environmental repercussions extend beyond national borders and affect the entire region due to the transboundary nature of radioactive pollution, as illustrated by:

##### **1. Threat to Water Security in the Middle East**

The Middle East is among the most water-scarce regions globally, with the majority of its population suffering from limited water resources. Any radioactive leak from Iranian reactors, especially those located near the Arabian Gulf or transboundary rivers such as the Karun River and Shatt al-Arab, could contaminate both groundwater and surface water sources.

The Gulf countries, which depend on desalination plants for more than 70% of their water supply, would be the most severely affected. The introduction of radioactive substances into Gulf waters would render them unsafe for consumption even after desalination .

Iraq, which relies heavily on water sources originating from Iran, is also at risk of river contamination if Iranian nuclear waste is not properly managed.

##### **2. Impacts on Marine Ecosystems**

The Arabian Gulf is an extremely fragile ecological zone due to its high salinity and low water renewal rates. Any radioactive leakage would cause :

- Widespread fish mortality, undermining the food security of Gulf countries.
- Destruction of coral reefs and marine ecosystems, which require decades to recover.
- The transfer of radioactive materials through the food chain (humans ← fish ← plankton), amplifying both health and economic consequences.

##### **3. Air Pollution and the Spread of Radioactive Dust**

Iran is located in a region of high seismic activity, which increases the likelihood of its nuclear reactors being exposed to earthquakes that could cause radioactive leaks. In the event of an explosion or leakage, winds may carry radioactive dust to neighboring countries such as Iraq, Kuwait, Saudi Arabia, Turkey, and Jordan. This radioactive dust contributes to higher rates of cancer, especially thyroid and bone cancers. It also affects agriculture by depositing radiation in the soil, rendering crops unsafe for human and animal consumption

#### 4. Transboundary Health Impacts

Lessons learned from the Chernobyl disaster (1986) demonstrated that the health effects were not confined to Ukraine but extended to more than 20 European countries. By comparison, any nuclear leak in Iran would likely result in:

- Increased rates of cancer and congenital deformities across Middle Eastern countries.
- Additional strain on already fragile healthcare systems in Arab countries such as Iraq, Yemen, and Syria, further deepening humanitarian crises .

#### 5. Shared Economic and Environmental Impacts

Any nuclear incident in Iran would disrupt navigation in the Arabian Gulf, through which about 30% of the world's oil supplies pass. Environmental pollution would cost the region billions of dollars in cleanup operations and compensation, imposing a heavy burden on its economies. Moreover, ecotourism in the Gulf, Jordan, and Turkey would suffer significantly due to concerns over contamination.

An airstrike targeting Iran's nuclear facilities could trigger a nuclear nightmare due to the leakage of radioactive materials from reactors and plants. Such an event could result in severe and widespread human casualties. Moreover, the radioactive dust carried by the wind would likely spread to neighboring countries such as Iraq, Kuwait, Saudi Arabia, Jordan, and Turkey, potentially reaching as far as the Eastern Mediterranean. This contamination would increase rates of cancer, congenital disabilities, and respiratory illnesses among the affected populations (.). And Agricultural soil will be exposed to long-term pollution that will make it less fertile, threatening food security and leading to humanitarian crises linked to mass displacement from affected areas.

as A The regional economy will be paralyzed, especially if navigation in the Strait of Hormuz, which is a global artery for oil exports, is disrupted, which will lead to disruption of international markets and an increase in energy prices. And this strike It will exacerbate political tensions, deepen regional instability and hinder any move towards sustainable development for many years to come.

#### Environmental Impacts of the Iranian Nuclear Project on the Middle East

The environmental impacts of Iran's nuclear project on the Middle East are not merely hypothetical; Rather, they represent a persistent strategic risk. The environmental dimension emerges here as a key component of regional security because it directly affects water security, food security, public health, and the economic stability of countries in the region. Without transparent mechanisms to manage Iran's nuclear project in accordance with the standards of the International Atomic Energy Agency, the Middle East may face a catastrophic transboundary environmental crisis.

#### Study Findings

This study topics aimed to examine one of the most significant at both regional and international levels: the Iranian nuclear program and its environmental repercussions on the Middle East from 1957 to 2010. It explored the objectives, motivations, origins, and development of the Iranian nuclear project. It also analyzed key regional positions and inferred the expected environmental impacts on the Middle East. Based on this analysis, the study reached the following conclusions:

It is neither possible to fully confirm nor deny that the Iranian nuclear project is purely peaceful, as Iran's claims. Nor can it be definitively stated that it conceals a military nuclear program, as Western countries assert. This ambiguity is also reflected in some positions taken by the International Atomic Energy Agency, which suspects military dimensions to the program. Iran must prove its peaceful intentions by providing objective and practical justifications to the international community.

Iran's justifications appear logical and acceptable as they derive from its national will and interest. These remain sovereign rights as long as they comply with international law, particularly the Nuclear Non-Proliferation Treaty. Nevertheless, doubts about the true intentions of the Iranian nuclear program persist, rooted in the historical and ideological background of Iranian society and the nature and details of the program itself.

Iran presents itself to the regional countries as the stronghold against the Greater Middle East project. It seeks to highlight its role in restraining Israel and to persuade neighboring states, especially Arab countries, that it is capable of supporting and standing by them.

International efforts over recent years to find a resolution to the Iranian nuclear dilemma and convince Iran to abandon its uranium enrichment activities and nuclear fuel cycle have not succeeded.

Iran views possessing nuclear weapons as a new equation that can change the rules of the game in the Middle East and restore the glories of the past by building a modern empire on the ruins of the ancient Persian Empire.

Iran believes that nuclear weapons possession will serve as a deterrent against US and Israeli threats to strike its nuclear facilities. It is also concerned about the arms build-up in the Gulf Cooperation Council states, supported by the United States.

The Iranian nuclear project constitutes a regional environmental threat due to the risk of radioactive leaks that could cross borders.

It increases the risks of water pollution, particularly in the Arabian Gulf, which is a vital source of drinking water and desalination.

The project may cause deterioration of marine ecosystems, such as coral reefs and fish stocks, thus threatening food security in the region.

It increases the likelihood of radioactive dust spreading through the wind, potentially affecting Iraq, the Gulf, Jordan, and even the eastern Mediterranean.

Long-term exposure to radiation could lead to higher rates of cancer and congenital malformations.

The project poses a threat to regional water security in an area already suffering from water scarcity.

It weakens the health and environmental capacities of Middle Eastern countries due to their fragile infrastructure.

It presents a direct threat to the regional economy by potentially disrupting navigation in the Gulf and causing losses in the energy sector.

It exacerbates the already complex environmental and political crises in the region, possibly creating additional tension hotspots.

These factors underscore the urgent need for regional and international cooperation to enhance environmental monitoring and ensure compliance with nuclear safety standards.

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