UNITED NATIONS

A S

GENERAL ASSEMBLY SECURITY COUNCIL

Distr.
GENERAL

A/36/610
S/14732
20 October 1981

ORIGINAL: ENGLISH

GENERAL ASSEMBLY
Thirty-sixth session
Agenda items 33, 46 and 130
THE SITUATION IN THE MIDDLE EAST
ESTABLISHMENT OF A NUCLEAR-WEAPON-FREE ZONE IN THE REGION OF THE MIDDLE EAST
ARMED ISRAELI AGGRESSION AGAINST THE IRAQI NUCLEAR INSTALLATIONS AND ITS GRAVE CONSEQUENCES FOR THE ESTABLISHED INTERNATIONAL SYSTEM CONCERNING THE PEACEFUL USES OF NUCLEAR ENERGY, THE NON-PROLIFERATION OF NUCLEAR WEAPONS AND INTERNATIONAL PEACE AND SECURITY

SECURITY COUNCIL
Thirty-sixth year

Letter dated 19 October 1981 from the Permanent Representative of Israel to the United Nations addressed to the Secretary-General

On instructions from my Government, I have the honour to transmit to you the attached document which sets out in some detail the position of my Government regarding the questions arising in connexion with the Iraqi nuclear reactor and its destruction last June.

The attachment entitled "The Iraqi nuclear threat - why Israel had to act", includes documented information on Iraq's preparations for the production of nuclear bombs whose principal target would have been Israel.

The nature and purpose of the Iraqi reactor Tammuz I, as well as of the action taken by Israel to eliminate the threat posed by it, have been grossly misrepresented in the United Nations and elsewhere. This is clearly evidenced even in the formulation of item 130 which is patently designed to prejudge the outcome of the debate to be held in the General Assembly under the said item.

I have the honour to request that this letter and its attachment be circulated as an official document of the General Assembly, under agenda items 33, 46 and 130, and of the Security Council.

(Signed) Yehuda Z. BLUM
Ambassador
Permanent Representative of Israel
to the United Nations

ANNEX

Government of Israel

THE IRAQI NUCLEAR THREAT-

WHY ISRAEL HAD TO ACT

MINISTRY OF FOREIGN AFFAIRS
and
ATOMIC ENERGY COMMISSION (OFFICE OF THE PRIME MINISTER)

Jerusalem, 1981

The item on the Agenda of this Assembly dealing with the destruction of the Iraqi nuclear reactor, has been formulated in a manner clearly intended to prejudge the outcome of the debate. As has been stated by Israel, the decision to destroy that reactor was taken only when it became absolutely certain that Iraq was on the verge of producing nuclear bombs, the principal target of which would have been Israel. People in all parts of the world, including the Middle East, are sleeping more soundly today, secure in the knowledge that this particular reactor has been removed. Iraq's nuclear reactor had to be destroyed before it was to become operational in the summer of 1981, for its destruction at a later date would have brought about radioactive fallout endangering the civilian population of Baghdad.

Ever since the establishment of the State of Israel, Iraq has been conspiring against it, both politically and militarily.

Iraq set out to acquire nuclear facilities and expertise, and then proceeded to assemble all the ingredients required for the development of nuclear weapons. This indicated a calculated effort on the part of Iraq to embark on a nuclear weapons programme. Our concern about the Iraqi nuclear programme was shared also by authoritative foreign governmental and professional assessments. Nonetheless, six years of diplomatic and public efforts to bring about the cessation of the Iraqi military nuclear programme yielded little more than reference to IAEA inspections under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), to which Iraq is a signatory.

Israel has had to conclude that a country which acquired a complete fuel cycle and is openly bent on the destruction of Israel will not balk at going ahead with its programme, whether or not it is party to the NPT.

Let me take this opportunity to reiterate Israel's policy that it will not be the first country in the Middle East to introduce nuclear weapons into the region. Faced as it is with the stark realities of the Middle East, Israel must insist on distinguishing between spurious and genuine safety. As the case of Iraq has clearly demonstrated, the NPT cannot effectively prevent such a country from resorting to nuclear weapons so as to achieve what more conventional means have failed to do.

The only genuine way to remove the nuclear threat to the Middle East can be found in the establishment of a nuclear-weapon-free zone, freely and directly negotiated among the countries of the region and based on mutual assurances, on the pattern of the Tlatelolco Treaty of Latin America.

In this Assembly, we shall continue to advocate and support constructive steps genuinely advancing the prospect of a Middle East free of nuclear weapons. At the same time, we shall warn against, and oppose, steps designed to exploit this subject as a tool of anti-Israel political warfare.

(from Foreign Minister Shamir's Statement in the General Debate at the United Nations General Assembly, 1 October 1981)

/...

TABLE OF CONTENTS

/...

/...

G L O S S A R Y

Caramel - a low-enriched (7-8% ^{235}U) nuclear fuel which was developed in France to replace the original highly-enriched (93% ^{235}U) fuel in its Osiris reactor and has been tested in it since June 1979

enriched uranium - uranium having a greater abundance of ^{235}U than uranium found in nature (0.7%); can serve, at high levels of enrichment, as the fissionable material required for the manufacture of nuclear weapons

FFL - Fuel Fabrication Laboratory—such a facility was constructed by Italian experts at the Tuwaitha Nuclear Centre near Baghdad

IAEA - International Atomic Energy Agency, Vienna, Austria

INFCE - International Nuclear Fuel Cycle Evaluation - a technical and analytical study initiated at an international conference held in Washington, D.C. from 19 to 21 October 1977

INFCIRC - IAEA information circular

Isis - a low-power research reactor with a core identical to that of Osiris located at the Saclay Nuclear Institute in France; used primarily for Osiris core tests and studies

LAMA - Laboratoire d'Analyse et de Mèsure de Haute Activité - an auxiliary laboratory, such as that adjacent to the Osirak reactor at the Tuwaitha Nuclear Centre near Baghdad

London Club - a group of nuclear supplier states which, in January 1978, announced a common policy on the export of nuclear materials, equipment and technology

MTR - Materials Testing Reactor - a highly-enriched-uranium fuelled

/...

thermal reactor used to produce a neutron flux for testing material properties and other applications

MW(e) - megawatt electrical - the customary unit in which the generating capacity of an electricity-producing facility is defined

MW(th) - megawatt thermal - the customary unit in which the thermal capacity of a reactor is defined

NIRA - Nucleare Italiana Reattori Avanzati, Genova, Italy

NPT - the Treaty on the Non-Proliferation of Nuclear Weapons of 1 July 1968, which entered into force on 5 March 1970

nuclear fuel cycle - a system of nuclear installations interconnected by a stream of nuclear material; such a system may consist of the various stages of uranium mining, ore processing, conversion, enrichment, fuel fabrication, reactors, spent fuel storage, reprocessing, etc.

Osiris - a French materials testing and research reactor located at the Saclay Nuclear Institute in France

Osirak - the French designation (an acronym for the names "Osiris" and "Irak," as it is spelled in French) for the Osiris-type research reactor located at the Tuwaitha Nuclear Centre near Baghdad

Pu - plutonium - a radioactive element which is produced by irradiating uranium in a nuclear reactor; can serve as the fissionable material required for the manufacture of nuclear weapons

RPL - Radioisotope Production Laboratory - a "hot" laboratory facility, such as that constructed by Italian experts at the Tuwaitha Nuclear Centre near Baghdad

/...

Safeguards	- a system of technical measures entrusted to the IAEA aimed at the timely detection of the diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear explosive devices
Tammuz I	- the Iraqi designation for Osirak
Tammuz II	- an Isis-type reactor adjacent to Tammuz I (Osirak) located at the Tuwaitha Nuclear Centre near Baghdad
THFCER	- Technological Hall for Chemical Engineering Research - a plutonium separation, simulation and testing facility, such as that constructed by Italian experts at the Tuwaitha Nuclear Centre near Baghdad
U	- uranium - a naturally-occurring radioactive element with an atomic weight of approximately 238; comprised of 3 isotopes: minute quantities of ^{234}U, 0.7% ^{235}U and 99.3% ^{238}U
UO_2	- uranium dioxide - generally used for nuclear fuel fabrication
weapons-grade uranium	- uranium enriched to the degree required for use as fissionable material in the manufacture of nuclear weapons; usually contains more than 80% ^{235}U
weapons-grade plutonium	- plutonium containing a low concentration (usually less than 10%) of the non-fissionable isotope ^{240}Pu
yellowcake	- uranium concentrate prepared by the extraction of uranium from ores

INTRODUCTION

In deciding to disable the inactive Tammuz I reactor near Baghdad by the military operation of 7 June 1981, the Government of Israel was reacting to Iraq's declared and proven policy of seeking to eliminate the State of Israel. By 1985, a developing nuclear potential would have enabled Iraq to begin producing nuclear weapons whose principal target would have been Israel. The decision was taken after six years of intensive diplomatic efforts, which proved futile, aimed at defusing the Iraqi military nuclear programme.

Ever since the establishment of the State of Israel, Iraq has been openly committed to its elimination, actively participating in three major wars against Israel and consistently refusing to reach any form of accommodation with it

In 1974 a new dimension was added to the Iraqi enmity towards Israel, with its initiation of a series of uninhibited measures designed to provide it with a military nuclear capability. It was at that time that Iraq began to acquire the technologies, installations and nuclear materials required for the development and manufacture of nuclear weapons. Its choice of an Osiris-type reactor, coupled with an insistence on weapons-grade uranium and the acquisition of ancillary installations capable of sustaining a complete fuel cycle, left little doubt as to the military nature of the Iraqi nuclear programme. These steps clearly constituted a deliberate attempt to exploit limitations in the International Atomic Energy Agency (IAEA) safeguards on Materials Testing Reactors (MTRs) — of which Osiris is among the largest in the world — to embark on a programme of nuclear weapons development, without risking detection, within the framework of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), of which Iraq is a signatory.

Had the Iraqi nuclear programme continued, that country could have accumulated sufficient plutonium by 1985 to manufacture at least one nuclear explosive device. Iraq could have proceeded as far as possible with its nuclear weapons programme and, once ready, at any moment of its choice, it could have exercised its right to withdraw from the NPT framework on three months notice. It could also have abrogated its safeguards agreement with the IAEA — with no known back-up safeguards in force — without fear of sanctions or of incurring any other major risks. In view of Iraq's extreme hostility, the Government of Israel had no alternative but to conclude that Israel would be the principal target of this Iraqi military nuclear programme.

/...

For six years, successive Israeli governments made every possible diplomatic effort to enlist the help of the supplier countries and other states to forestall this threat. These efforts yielded no concrete results. Instead, Israel was repeatedly advised to place its trust in the NPT and in the IAEA safeguards.

Iraq's repeated hostile acts against Israel have left no doubt that such a country, which is openly bent on the destruction of Israel or its dismemberment and which acquires the means for making nuclear weapons, would not hesitate to go through with its programme, whether or not it is party to the NPT. Furthermore, although Israel has great respect for the manner in which the IAEA staff discharge their inspection duties within their mandate, it is nevertheless inconceivable that a country directly threatened would entrust its fundamental security to an inspection procedure which is contractually limited, is not unconditional and binding, and is substantially dependent in both character and duration on the discretion of the country posing that threat.

In the face of Iraq's plans to achieve a nuclear military capability, and given the state of war which Iraq has actively maintained against Israel, Israel could not simply stand by and await the realization of Iraq's plans, in the form of a "hot" reactor engaged in the production of weapons-grade plutonium. To wait passively and thereby appease the reluctance of the international community to acknowledge the reality and urgency of Israel's concerns would have constituted a breach of the primary responsibility of the Government of Israel to protect its citizens from the threat of nuclear obliteration.

The destruction of Osirak was, therefore, a necessary and legitimate act of self-defence. Its timing was dictated by the fact that the reactor was due to become critical between July and September of 1981, after which radioactive release could have entailed injury to civilians.

The Government of Israel believes that the introduction of nuclear weapons into the Middle East can be avoided. A nuclear-weapon-free zone agreement, freely negotiated among the parties concerned in the area and providing mutual assurances, can avert this mounting threat. If realized, such a treaty would make a significant contribution to the future well-being and security of the entire Middle East.

Conscious of the dangers inherent in nuclear weapons, Israel has appealed at the United Nations to all states in the region to negotiate the establishment of a nuclear-weapon-free zone modelled on the Tlatelolco Treaty of 1967 for the establishment of a nuclear-weapon-free zone in Latin America. This proposal still stands.

/...

THE IRAQI REGIME - AND ITS ATTITUDE TOWARDS ISRAEL

The supreme body which governs Iraq and possesses all executive and legislative powers is the Revolutionary Command Council, whose sixteen members all belong to the Regional Command of the Ba'ath Party. In power since 1968, the Ba'ath has stipulated by law that no representative of any other party or political body is eligible to sit in the Revolutionary Command Council. All key government and military positions are also held by members of the Ba'ath, and ultimate power is in the hands of the president who, since 1979, has been Saddam Hussein.

The Iraqi regime relies heavily on the secret police to enforce its all-encompassing control over the country. Ethnic and religious groups—including Iraq's Shi'ite Moslems, who comprise over half of the country's population; its substantial Kurdish minority; and the 2,500 or so remaining Iraqi Jews—are brutally repressed and their members subjected to routine detainment without trial, to torture and execution.

During the past few years, President Hussein has conducted a campaign to liquidate all real and suspected political opposition - both within the party and outside of it, whether in Iraq or abroad. According to a report confirmed by Amnesty International in 1980, the regime executed, in August 1979, twenty-two of its leading politicians and imprisoned several dozen others. It also jailed another 2000 people and put 70 of them to death. Iraq is in fact a totalitarian regime, with all of the characteristics of a classic police state.

IRAQ'S POLICY TOWARDS ISRAEL

Iraq is one of the leaders of the extremist forces in the Middle East which seek the destruction of Israel, even though the two countries share no common border. Its policy is motivated by historical-ideological, as well as political, considerations.

Historical-Ideological Hostility

On the historical-ideological plane, Iraq's refusal to accept the "Zionist entity" as part of the Middle East is based on a deeply-rooted pan-Arab attitude, with strong Islamic undertones, which denies the right of non-Arab groups to national existence within the bounds of what is regarded as the "Arab homeland" - stretching from the Atlantic Ocean to the Persian Gulf. Israel is viewed as an injustice and should therefore be "eradicated."

/...

As an illustration of this point, Iraqi Foreign Minister Hamadi stated in an interview with the Lebanese weekly *Al-Jumhur al-Jadid* on 31 January 1980:

> *"Iraq cannot agree to the existence of Zionism - neither as a movement nor as a state....The Arab nation cannot agree to the amputation of any part from its body...because the land of Palestine is an Arab land and we cannot conceive giving it up.... The struggle against Zionism is for us a struggle in which there can be no compromise."*

Political Considerations

The struggle against Israel is used by Iraq for political purposes on two levels: to divert public attention within Iraq from pressing internal issues; and, in its inter-Arab relations, to rally the support of other Arab forces for its extremist views and to achieve supremacy for itself in the Arab world.

On the political plane, Iraq categorically refuses to recognize Israel's existence and is unconditionally opposed to any negotiations with it. In his "National Charter" of February 1980, President Saddam Hussein explained his policy of regional non-alignment and solidarity against foreign infiltration, adding that: *"naturally, as you know, the Zionist entity is not included because the Zionist entity is not considered a state, but a deformed entity occupying an Arab territory."* (UN Document A/35/110: S/13816 of 27 February 1980)

In a speech before the "National People's Conference" in Baghdad on 27 March 1980, President Hussein declared:

> *"I do not think that there is anyone who believes that the monstrous Zionist entity conquering our land really constitutes a state. On the contrary, we disagree with some Arab regimes and organizations because of our belief that Arabs must not give their signature and agreement to the recognition of the monstrous Zionist entity, even within the borders of 5 June 1967."*
> (*Al-Jumhuriyya*, Iraq, 28 March 1980)

CONTINUED MAINTENANCE OF A STATE OF WAR

Ever since the establishment of the State of Israel, Iraq has maintained a state of war with it. Iraq participated in three major Arab-Israeli wars—in 1948, 1967 and 1973—and in various campaigns between them:

Iraqi Military Action Against Israel

a) The War of Independence (1948)—On 15 May 1948, the day after the State of Israel was established, the regular armies of Egypt, Transjordan, Syria, Lebanon and Iraq invaded the new state and other areas of Western Palestine. The war lasted for nearly eight months, during the course of which the Iraqi force fought prominently in a number of battles. Some 4500 men strong, it crossed the Jordan River and fought in the Jordan Valley region, in Samaria and in the Sharon Plain. Constantly reinforced, the Iraqi contingent numbered 18,000 by the end of the war, and it was equipped with 120 artillery pieces—more than all the other Arab artillery units combined.

b) The Six-Day War (1967)—On 31 May 1967, before the outbreak of the Six-Day War, an Iraqi regiment was dispatched to Egypt. When the war began, the 8th Iraqi Brigade entered Jordan and engaged in the battles on that front. The Iraqi air force also participated in the hostilities.

c) The War of Attrition (1967-1970)—During the War of Attrition, Iraqi forces shelled Israeli villages in the Jordan Valley on a number of occasions. Iraq became part of the joint military command of the "Eastern Front," which also included Syria, Jordan and Saudi Arabia.

d) The Yom Kippur War (1973)—During the Yom Kippur War, two Iraqi divisions, two infantry brigades and various commando units were deployed on the Syrian front on the Golan Heights. The Iraqi air force also conducted aerial activity against targets within Israel.

Since the Yom Kippur War, an immense build-up of the Iraqi armed forces has taken place, which has entailed huge arms purchases from both East and West, amounting to some $8-9 billion. In effect, the Iraqi army has virtually doubled in size, with special emphasis placed on its transport and logistics capability, which has greatly enhanced its ability rapidly to transport large combat contingents to any future "Eastern Front" battle zone against Israel.

Rejection of Any Form of Political Accommodation

Iraq has consistently refused to reach any form of accommodation with Israel. After the 1948 war, Iraq refused to conduct armistice negotiations with Israel and, in fact, has never signed such an agreement with it. Iraq also refused to agree to a cease-fire in 1967. Furthermore, it has consistently rejected United Nations Secur-

ity Council Resolutions 242 and 338, which call for negotiations between Israel and the Arab states and for secure and recognized boundaries.

Upon the initiation of peace negotiations between Israel and Egypt, Iraq became one of the leaders of the "Arab Rejection Front," which included all the remaining Arab countries and the PLO. In November 1978, following the signing of the Camp David accords, Iraq convened a summit conference of the front, which called on all Arab states to participate in the *"diplomatic, economic and military struggle against the Zionist enemy in order to restore the Palestinian rights,"* and to extend all possible assistance to the PLO. It rejected the agreements between Egypt and Israel, and called upon Egypt to abrogate them. Iraq has also been at the forefront of the Arab economic boycott against Israel.

IRAQI SUPPORT OF PALESTINIAN ARAB TERRORISM AGAINST ISRAEL

Iraq considers itself the leader of the Arab countries in the fight for the "liberation of Palestine." In an interview with the Lebanese weekly *Al-Hawadith* on 17 April 1981, President Hussein declared:

> *"As for the Iraqi, when we tell him that he is called upon to stand at the head of the liberation of Palestine, he understands what the intention is and what he must do, as this* (the 'liberation of Palestine') *is the basis of the Ba'ath Party."*

Ever since the Ba'ath Party came to power in Iraq, Iraqi aid to Palestinian Arab terrorism has become an integral part of the country's official policy. To this end, Iraq established an organizational system to foster terror against Israel, the West and other perceived enemies of its regime. This system is comprised mainly of the "Palestinian Office and the Armed Struggle" of the Ba'ath Party and the "Arab Liberation Front," an arm of the PLO which is administered directly by Iraq.

The "Palestinian Office and the Armed Struggle" has been headed since 1974 by Na'im Haddad, who is now also the head of the new Iraqi parliament, the National Council. This office is responsible for maintaining contacts with terrorist organizations. Among the beneficiaries of its military and financial assistance is the "Abu Nidal Group," which specializes in murdering "unfavourable" elements abroad.

The "Arab Liberation Front" is responsible for numerous attacks on the civilian population of Israel, including two attacks on Kibbutz Misgav Am. The front published its aims in *Ath-Thawra*, the official organ of the Iraqi Ba'ath Party, on 30 March 1980, stating its support of terrorist activities within Israel, for

/...

"Palestine is one land, despite the occupation, and it includes Hebron and the Galilee, Haifa and Nablus, Gaza and Nazareth...Palestine is one land, which cannot be divided, be the casualties what they may."

Iraq grants the PLO monetary aid under the "Baghdad Aid" programme, under which the PLO received more than $100 million from the beginning of 1979 to mid-1981. It also grants special aid to various PLO factions, including the "Popular Democratic Front for the Liberation of Palestine," a Marxist group headed by Nayif Hawatmah, and the "Popular Front - General Command" led by Ahmad Jibril. Furthermore, Iraq dispatched a variety of military hardware to the PLO terrorists in Lebanon in the course of 1980.

The above data indicate clearly that Iraq's regime is based on radical, extremist ideologies, which it pursues ruthlessly and ambitiously. Drawing strength from its enormous economic resources, Iraq is currently engaged in a struggle to attain hegemony in the Arab world and in the Persian Gulf. Its hostility towards Israel, however, has not been diminished by these goals.

THE IRAQI NUCLEAR THREAT

Iraq began its nuclear activities by concluding an agreement of nuclear cooperation with the Soviet Union in 1959. In 1969 the two countries further agreed that a reactor would be built in Iraq. The construction of this reactor, of the IRT-2000 type with a capacity of 2 megawatts thermal [MW(th)], began in 1963 at the Tuwaitha Nuclear Centre near Baghdad. Here the Soviets also built laboratories for the production of radioisotopes and for nuclear physics research, as well as various auxiliary installations. The reactor began operation in 1969 and, in 1978, its power was upgraded, by increasing the fuel enrichment, to 5 MW(th).

In 1974-75 Iraq extended its nuclear interests. After prolonged negotiations culminating in a visit by Saddam Hussein (then Vice-President) to France, a nuclear cooperation agreement was concluded between France and Iraq. During the negotiations preceding this agreement, Iraq asked France to supply it with a Gas-Graphite-type power reactor with a capacity of 500 megawatts electrical [MW(e)] and 1500 MW(th).

Graphite reactors are best suited for the production of plutonium, and most of the plutonium used for military purposes by the United States, the Soviet Union, the United Kingdom and France is indeed produced by this type of reactor. The double-purpose Gas-Graphite power reactors were designed to produce both plutonium and electricity. The power programmes based on this type of double-purpose reactor, which were carried out mainly in England and France, were discontinued in the early 1970s, when it became clear that the most efficient power reactors are those of the Pressure Water Reactor (PWR) and Boiling Water Reactor (BWR) types. The Iraqi request for the Gas-Graphite reactor in 1974-75 was therefore highly suspect, since such a reactor can produce some 400 kg of weapons-grade plutonium annually.

France stopped the production of this type of reactor in the late 1960s, and this was the reason given by the French for not supplying such a reactor to Iraq.

The Iraqis did not accept the alternative offer of a conventional PWR or BWR nuclear power reactor manufactured by a reliable and skilled manufacturer but, rather, chose a very advanced Osiris-type research reactor, which has a relatively high power rating compared to other light-water research reactors.

/...

It is a well-known fact that materials change their properties as a consequence of prolonged exposure to nuclear radiation. This is why the influence of radiation on power reactor construction materials has to be tested. Materials Testing Reactors (MTRs) such as Osiris were especially designed for this purpose. Such reactors usually exist only in countries which manufacture nuclear power reactors. No evidence suggests that Iraq has any intentions of becoming a manufacturer of such reactors.

Of all available research reactors, the Osiris-type is one of the most suitable for the production of weapons-grade plutonium in significant quantities. The Iraqi choice of an Osiris-type research reactor therefore serves as yet another indication of that country's intention to produce nuclear weapons. Other Iraqi efforts to advance its nuclear power programme are no less suspect. The major aspect of this effort has been its attempt to purchase a 350 MW(th) Cirene-type reactor from the Italian company NIRA. This reactor is still under development, and preferring it over most conventional types makes little sense from the point of view of either economics or reliability. On the other hand, its capacity to produce weapons-grade plutonium is very high (about 100 kg per year). Thus Iraq's interest in this type of reactor can be seen as a logical component of a long-range programme for the creation of a large nuclear arsenal.

The following sections will describe how Iraq was in fact using a peaceful cover in order to assemble all the ingredients necessary for acquiring a nuclear military option. The first and most important prerequisite for achieving this goal is the acquisition of sufficient fissionable material—i.e., weapons-grade enriched uranium, and/or plutonium. All available evidence indicates that Iraq has been trying to do just that.

THE PLUTONIUM OPTION

Plutonium is produced by the irradiation of uranium targets in a suitable reactor. As already mentioned, the Iraqis purchased an Osiris-type reactor(hereafter referred to as Osirak), which is suitable for that purpose. However, in order to be able to irradiate uranium targets, these must obviously be manufactured. Furthermore, the plutonium produced must be separated from the irradiated uranium and the radioactive waste must be treated and disposed of. Also, minimum research and development (R&D) support must be given to all these operations in suitable "hot" laboratories which are integral to the facility.

Plutonium Production in the Osirak Reactor

The French-supplied reactors at the Tuwaitha Nuclear Centre near Baghdad are almost identical to their prototypes at the Saclay Nuclear Institute in France:

a) The main, Osiris-type, reactor, Tammuz I (Osirak), is a light-water, tank-type reactor fuelled by highly-enriched uranium (93%), with a power output of 70 MW(th) and a core-load of fuel typically comprised of about 12 kg of Uranium-235 (^{235}U). Continuous operation of Tammuz I requires 3 to 4 core-loads per year.

b) The second, Isis-type, reactor, Tammuz II, adjacent to Tammuz I, is similar in every respect to Tammuz I, but does not have a cooling system and cannot, therefore, operate at high power. One fuel load for Tammuz II, which also typically consists of approximately 12 kg of uranium enriched to 93% (^{235}U), is sufficient for several years of operation.

Osiris (and, therefore, the very similar Tammuz I reactor) was designed to enable efficient studies of the behaviour of various nuclear and structural materials under irradiation by intense neutron flux. Such studies are an essential component of any programme for the development of nuclear power reactors. Indeed, for that purpose, a very high neutron flux (up to $4x10^{14}$ neutrons/cm^2/sec) and a large excess of reactivity are essential for the irradiation of relatively large bulks of structural materials. But the reactor can also be used for irradiating natural (or depleted) uranium for the production of plutonium.

One possible way of producing significant quantities of plutonium in the Osirak reactor is by concentrating all the regular fuel and control elements into the 5x5 central positions of the reactor's grid, while the remaining 31 sites are occupied by fertile elements composed of natural or depleted uranium. Operating the reactor at 70 MW(th) in this configuration would produce 7-10 kg of plutonium annually, depending on the particular type of fertile elements. In order to produce this quantity of weapons-grade plutonium, an annual uranium consumption of about 10 tons is required.

It is important to note that replacing the reactor's fuel with less highly-enriched uranium, such as "Caramel," would not significantly reduce the plutonium production capacity of Osirak.

/...

Supporting Facilities

In order to produce usable plutonium, a number of vitally important auxiliary facilities must be installed in addition to the reactor; and, indeed, all the necessary facilities were foreseen, contracted for and installed by Italian and French firms which are known experts in the field. Moreover, these facilities were designed to allow for the handling of up to 25 tons of natural uranium annually, rather than a nominal throughput of about 10 tons of uranium and 7-10 kg of plutonium a year, possibly with the intention of increasing plutonium production in the future.

The following is a brief description of the facilities:

a) Uranium Target Manufacturing Facility

From Italy Iraq acquired a pilot plant for the manufacture of PWR-type fuel, in which uranium dioxide pellets could be manufactured and clad to make fuel-type elements which would fit into the Osirak reactor core in target form. As mentioned, the capacity of this plant, known as a Fuel Fabrication Laboratory (FFL), is about 25 tons annually. Iraq can have no reasonable peaceful use for this product in the foreseeable future.

Iraq also purchased some 100 tons of natural uranium from Portugal, a similar amount from Niger and additional quantities from Italy, to guarantee an adequate supply of raw material for this purpose.

b) Plutonium Separation

Plutonium is separated from irradiated uranium in a chemical process which involves the dissolution of relatively large quantities of highly-radioactive material and the consequent extraction of the plutonium from the uranium and fission products. (In order for the uranium itself to be of further use, it must first be purified of fission products to allow for subsequent handling.) Once separated, the plutonium can be treated metallurgically in small-scale, glove-box installations for the manufacture of nuclear devices.

To acquire these technologies Iraq purchased, in 1978, a small-scale "hot" laboratory which is capable of separating and handling gram quantities of plutonium. This facility has enabled the Iraqi scientists and technicians to study separation procedures and to become familiar with the specialized techniques of handling highly-radioactive materials.

More recently, an Italian firm supplied Iraq with all the engineering expertise and equipment for a large-scale separation plant in which uranium targets can be processed at the rate of 25 tons a year. However, this particular facility was designed without radiation shielding, and some of its components are unsuitable in their original form for "hot" work.

For these reasons it is considered a mock-up or training facility, in which the chemical separation process can only be studied, but not operated with radioactive materials. Although it is known as a Technological Hall for Chemical Engineering Research (THFCER), it deals only with the chemical separation process and appears to be basically a copy of a similar plant in Italy.

Despite its apparent unsuitability for "hot" operation, the possibility of adding radiation shielding to the facility and modifying some of its components cannot be ruled out. In any event, the construction of a special "hot" plant is always possible at a later stage, using all the suitable processing equipment from the THFCER and adding the few required items. If the problem of adapting the existing building to "hot" operation proves too difficult, the erection of a new one is mainly a matter of conventional civil engineering, which could well be executed by Iraq without outside help.

c) Radioactive Waste Treatment

The treatment and disposal of the radioactive waste produced by chemical separation plants require substantial skill, as compared with the handling of such waste from research laboratories, where simple chemical neutralizing and storage or ground disposal are generally sufficient.

To deal with the relatively large quantities of radioactive waste that would be produced in Iraq, a French firm supplied and installed a medium-sized radioactive liquid and solid waste treatment facility. This facility, and the waste treatment equipment which is integral to Iraq's plutonium separation plant (THFCER), are of sufficient capacity to handle all of the anticipated uranium and fission product effluents.

d) R & D Support Facilities

In addition to the plutonium cycle facilities, two major installations were included in the Iraqi nuclear complex. The first, supplied by the French, is a "hot" metallurgical laboratory called Laboratoire d'Analyse et de Mesure de Haute Activité

(LAMA), in which irradiated materials such as fuels or structural metals can be tested and analyzed. The second, a Radioisotope Production Laboratory (RPL), comprises a number of large "hot" laboratories with 26 "hot cells" for isotope production, research and analytical work.

All these facilities serve as essential R&D back-up for the plutonium cycle production process.

THE URANIUM OPTION

Another option available to Iraq for acquiring fissionable material is to divert the reactor's fuel for this purpose. As already mentioned, the fuel load of each of the Tammuz reactors is about 12 kg of uranium enriched to 93% (^{235}U), which is weapons-grade material.

In normal operation, Tammuz I requires some 3 to 4 fuel loads per annum, while one load is sufficient for several years of operation of Tammuz II. Thus, a year's supply of fuel for both Tammuz reactors consists of about 50 kg of highly-enriched uranium, an amount sufficient for the manufacture of at least two nuclear explosive devices.

It is noteworthy that the original agreement between France and Iraq specified the supply of about 80 kg of this highly-enriched uranium fuel. To eliminate the danger inherent in the uranium option, a shift towards a low-enrichment fuel (Caramel), which was developed and tested in France, was suggested. According to all available evidence, the Iraqis never accepted this proposal. Unfortunately, even had they agreed, and had the uranium option thus in fact been eliminated, this could not have been considered a dissipation of the Iraqi nuclear threat, in view of the remaining plutonium option.

THE BOMB

A country in possession of sufficient fissionable material will not encounter much difficulty in manufacturing at least a crude nuclear explosive device within a relatively short time. The scientific and technical manpower already existing today in Iraq, which will be augmented in the near future by scientists (Iraqi as well as from other, "sister," countries), engineers and technicians returning from specialized training abroad, lends credence to the above scenario. Moreover, the possibility of technical cooperation in this realm between Iraq and Pakistan cannot be overlooked.

/...

DELIVERY

The MIG-23 and other Soviet aircraft in Iraq's possession can carry and deliver nuclear weapons over ranges which include targets in Israel. Moreover, Iraq has been attempting to obtain intermediate-range ballistic missiles capable of carrying nuclear warheads.

SAFEGUARDS

In 1972 Iraq concluded a safeguards agreement with the International Atomic Energy Agency (IAEA), in connection with the Non-Proliferation Treaty (NPT), which was subsequently supplemented in 1975 by a French-Iraqi exchange of letters. Ostensibly, therefore, Osirak would have been operated under IAEA supervision.

The IAEA safeguards system is especially suited for electricity-producing power reactors, and inspection is mostly focussed on the nuclear-materials-accounting system related to the reactor and its fuel cycle. It would be very difficult for such safeguards to prevent the diversion of non-irradiated or slightly irradiated fuel for the production of nuclear weapons (using highly-enriched ^{235}U). It is clear that no inspection exists of "experiments" within the reactor core itself. It would have been relatively simple for Iraq to have produced weapons-grade plutonium within the reactor "chimney" in a manner unobservable to IAEA inspectors. The fuel used in the reactor, and duly supervised, would not have been directly involved in the production of plutonium, and its materials-accounting would therefore have remained unchanged, fulfilling the safeguards requirement of the IAEA.

Since plutonium production inside the reactor "chimney" is possible without any exterior hardware modifications in the reactor itself, as the entire process is simply conducted by moving the natural uranium target rods within the core, there is no effective method for detecting violations other than round-the-clock, continuous on-the-spot control. Even surveillance equipment to back up inspections would not be effective in this type of reactor.

In addition to the IAEA safeguards system, much attention has been focussed on the deterring effect of the continuous presence of French technicians at Osirak. Israel has always had serious doubts as to the reliability of this deterrent. Events following the outbreak of the Iraqi-Iranian war, when almost all the foreign technicians and scientists hurriedly left Iraq and the remaining few were not allowed even to approach the Iraqi nuclear centre, fully justified these doubts.

/...

SUMMARY AND CONCLUSIONS

The data presented above reveal the true nature of Iraq's nuclear activity. Under the guise of the acquisition and development of nuclear energy and technology for peaceful purposes, Iraq has systematically accumulated all the ingredients required for the development of nuclear weapons:

a) The Osirak reactor is one of the largest research reactors in the world. Similar reactors exist in a number of highly-developed industrial states solely for the purpose of the development of power reactors. There is no doubt that Iraq's scientific and economic development does not justify the construction of such a reactor, since Iraq does not possess the scientific and technological infrastructure required for its utilization. It is thus clear that the reactor was purchased for the production of plutonium.

b) The fuel fabrication facility constructed in Iraq can produce some 25 tons of power-reactor-type fuel elements per annum. Iraq has no use for these elements in the conceivable future, other than as uranium targets for the production of plutonium.

c) A third essential element of this process is the means of separating plutonium from the highly-radioactive irradiated uranium. Iraq was unable to locate a supplier of a complete separation facility, and was forced to adopt a step-by-step procedure for the acquisition of this technology: ① a small-scale laboratory for the study of separation processes and for the training of technicians and operators in separation techniques; and ②, a facility for the study and "cold" simulation of a full-scale separation process, to serve as a basis for the actual implementation of this process. Here again, the only conceivable reason for the purchase of these facilities is the desire to separate weapons-grade plutonium.

The combination of all these components exposes the true purpose of the Iraqi nuclear programme, and seriously calls into question Iraq's stated justifications for the separate acquisition of each of them.

After careful evaluation of all the technical and other evidence it is clear that, by 1985, Iraq could have been in possession of sufficient weapons-grade plutonium to produce at least one nuclear explosive device, and could also have had at its disposal the means of constructing and delivering such a device.

THE INEFFECTIVENESS OF EXISTING SAFEGUARDS ON OSIRAK

The safeguards instrument is a comprehensive system of nuclear materials accountancy and containment/surveillance measures.

The shortcomings in the effective application of this system to high-power MTRs in general, and to Osirak in particular, are due to the irregularity of the implementation of technical and administrative procedures laid down in the safeguards agreement between Iraq and the IAEA, as well as to technical constraints on the IAEA safeguards system and techniques regarding Osirak. Iraq's abuse or potential abuse of conditions under which safeguards apply and of inspection procedures, along with the absence of back-up safeguards, as well as the right to withdraw from NPT and the ineffectiveness of international sanctions, in the case of Iraq, must also be borne in mind.

Most up-to-date evidence corroborates long-held doubts on the effectiveness of existing safeguards with regard to Osirak.

IRREGULARITY OF IMPLEMENTATION

On 29 October 1969 Iraq ratified the NPT in Moscow. The agreement between Iraq and the IAEA for the implementation of safeguards in connection with the NPT entered into force on 29 February 1972.[1]

According to Article 40 of this safeguards agreement, the "Subsidiary Arrangements" should have entered into force *"at the same time as, or as soon as possible after, the entry into force of this Agreement."*[2]

---

[1] IAEA, *INFCIRC*/172, Vienna, 22 February 1973

[2] *Ibid.*, p.11. The "Subsidiary Arrangements," as defined in the *IAEA Safeguards Glossary, "constitute a document containing a set of technical and administrative procedures designed primarily to implement the safeguards procedures laid down in safeguards agreements; they deal with matters such as design review, records requirements, reporting requirements and inspections....they consist of a general part applicable to all nuclear activities of the country concerned and facility attachments which contain specific procedures for each facility."* See *IAEA Safeguards Glossary*. Vienna: IAEA, 1980, IAEA/SG/INF/1, p.69

Furthermore, according to Article 42:

> *"The time limits for the provision of design information in respect of the new facilities shall be specified in the Subsidiary Arrangements and such information shall be provided as early as possible before nuclear material is introduced into a new facility."*[3]

However, according to *The Annual Report for 1980* published on 10 April 1981 by the IAEA Board of Governors,[4] the subsidiary arrangements relating to Tammuz I and Tammuz II were still not in force by 31 December 1980, although nuclear material (about 12 kg of highly-enriched uranium) had already been supplied in June-July 1980. This is in direct contradiction of Article 42 of the safeguards agreement. Thus, all inspections carried out since that time by the IAEA were *ad hoc* inspections. The lack of adequate design information concerning Osirak is clearly apparent from the uncertainty of the IAEA concerning the capacity of Tammuz I. In September 1980 the IAEA maintained that Tammuz I was a 50 MW(th) research reactor;[5] in *The Annual Report for 1980* the stated capacity of this same reactor was 40 MW(th);[6] while the power output of this reactor is 70 MW(th).

The absence of subsidiary arrangements and facility attachments regarding Tammuz I and II, and other facilities/locations containing nuclear material, could be considered at least an irregularity, if not also a violation of the obligations by Iraq.

TECHNICAL CONSTRAINTS

The technical objective of safeguards has been defined as:

> *"The timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection."*[7]

It is the official view of the IAEA[8] that the production of significant quantities of plutonium would be detected with very high probability through usual procedures. The

---

[3] *INFCIRC*/172, p.11, emphasis added

[4] IAEA, Gov/2023, Vienna, 10 April 1981, p.41

[5] IAEA, Press Release PR 80/21, Vienna, 23 September 1980

[6] IAEA, Gov/2023, p.41

[7] IAEA, "The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons." *INFCIRC*/153, June 1972, p.9

[8] IAEA Press Release PR 81/10, Vienna, 12 June 1981

experts of the Israel Atomic Energy Commission, however, as set out elsewhere in this publication,[9] are of the opinion that the clandestine production of significant quantities of plutonium in Osirak was indeed possible. These experts also share the view emphasized in the *Report of Working Group 8* of the International Nuclear Fuel Cycle Evaluation (INFCE) that:

> *"The proliferation aspect of the widely distributed highly enriched uranium and the production of fissile materials in research reactors make these reactors of concern to INFCE.... However the use of research reactors for fissile materials production is not prevented by changing fuel enrichments and, therefore, appropriate safeguarding of the reactor is still required.*
>
> *"In an overall assessment of the proliferation risks of a particular research reactor, it is necessary to consider both the enriched uranium as well as the plutonium produced, and adequate safeguards must be provided."*[10]

This statement suggests that existing safeguards procedures are less than adequately concerned with the plutonium production capacity of such reactors.

Inapplicability of Safeguards to Research Within a Facility

Substantial possibilities of diversion and concealment exist in Osirak-type reactors due to existing safeguards methods. These do not apply to nuclear research within the facility itself: with respect to research reactors, no clarification need be given to the inspector for any experiment conducted within the reactor, and accounts need be given only regarding the inventory of the declared fuel. With respect to a large MTR such as Osirak, this limitation permits the insertion of various targets, including, for instance, undeclared natural uranium for which the reactor operator is not accountable to the inspector.

Moreover, were inspectors to try to determine whether research was being conducted for peaceful purposes only, this would prove ineffective in particular cases of reactors such as Osirak.[11] Indeed, it is definitely possible to remove any suspicious equipment from the inspected area, due to the convenient accessibility of Osirak's nuclear core.

---

[9] See Chapter "The Iraqi Nuclear Threat" and Appendix A: "The Plutonium Production Potential of Osirak"

[10] INFCE, *Advanced Fuel Cycle and Reactor Concepts. Report of Working Group 8.* INFCE/PC/2/8, Vienna: IAEA, January 1980, pp. 137-138

[11] Testimony by Roger Richter before the Senate Foreign Relations Committee. Hearing on Nuclear Non-Proliferation, Washington, D.C., 19 June 1981

/...

Inadequacy of Non-Diversion Verification Measures

The difficulties faced by the IAEA in detecting diversions and concealments are due to the following limitations:

a) Inspection is intermittent and advance notice is given prior to the arrival of inspectors. This would have permitted Iraq to load Osirak with natural uranium following each inspection and to unload it before the next. In this way, Iraq could have produced plutonium without the fear of being detected by IAEA inspectors.

b) Inspection procedures permit the use of television or photographic surveillance for monitoring between inspection visits. However, no such measures are foreseen under the present safeguards approach for MTRs such as Osirak. As a result, no means are available to provide any indication of diversion between inspections.

MTRs do not readily lend themselves to unambiguous interpretation of surveillance results because, in research reactors, the planned mode of operation may include frequent insertion into, and removal from, the core of irradiation elements and experimental systems. In the case of Osirak there were no standard experimental systems, elements, containers, etc., and, therefore, no movement of nuclear material could have been ascertained even if such equipment movement was recorded. Consequently, containment/surveillance measures would have been ineffective with regard to Osirak. Moreover, even if accumulated data were to have indicated unreasonably numerous movements, inspectors could not have taken remedial action.

c) The NPT does not provide for the possibility of carrying out special inspections on the basis of accusations.[12]

The issue of the clandestine production of plutonium in Osirak-type reactors was dealt with recently within the IAEA. According to US Senator Alan Cranston, an extraordinary meeting of nine senior IAEA technical specialists was convened to consider the dangers presented by the Iraqi nuclear programme. They reported their unanimous conclusion to Mr. Hans Gruemm - IAEA Deputy Director-General, Department of Safeguards - on 10 March 1981, stating that such *"(plutonium) diversion paths are technically practicable."*[13]

---

[12] Paul Szasz, *The Law and Practices of the International Atomic Energy Agency*. Vienna: IAEA, September 1970, p.549

[13] Statement by Senator Alan Cranston Before the Senate Foreign Relations Committee, Washington, D.C., 18 June 1981

Since the present safeguards approach to MTRs such as Osirak is inadequate and its effectiveness questionable, these IAEA senior technical specialists suggested that strengthened safeguards would be required. This, they claimed, would *"represent a fundamental change in the scope of agency responsibility"* and could come only by negotiation with the host country. However, they continued, such inspection would *"introduce an entirely new dimension in the safeguard policy whereby we go looking for clandestine installations instead of verifying statements."* The suggestion that host countries would agree to such strengthened safeguards was dismissed with the comment that, *"if we were to negotiate on the basis of this policy, the states involved would laugh their heads off."*[14]

ABUSE AND POTENTIAL ABUSE

Conditions Under Which Safeguards Apply

a) Nuclear Materials

According to Article 33 of *INFCIRC* 153, NPT-type safeguards agreements *"shall not apply thereunder to materials in mining or ore processing activities."* Furthermore, according to Article 34c, the starting point of NPT safeguards is with uranium hexafloride (UF_6), taken to be of a composition and purity suitable for fuel fabrication.[15] This applies to the Iraq-IAEA safeguards agreement as well, since it is an NPT-type agreement and, therefore, does not provide for the application of safeguards to natural uranium in the form of concentrates. Indeed, Portugal notified the IAEA of its shipment of some 100 tons of yellowcake to Iraq, but this was only a formality, since yellowcake is not subject to safeguards. Iraq has also been reported to have purchased large quantities of yellowcake elsewhere, without providing any notification to the IAEA.

The conversion of concentrates to target quality UO_2, or uranium metal, does not require any sophisticated equipment or complex technology. Iraq is capable of carrying out this procedure by utilizing the supporting facilities supplied by Italy,[16] and of preparing the appropriate targets from uranium concentrates for irradiation within Osirak in order to produce plutonium.

---

[14] *Ibid.*

[15] This issue was also dealt with in the *IAEA Safeguards Glossary*, p.16

[16] See Chapter "The Iraqi Nuclear Threat"

b) Sensitive Nuclear Facilities

Several very sensitive nuclear facilities in Iraq are not subject to safeguards under the Iraq-IAEA safeguards agreements. The uranium target manufacturing facility, the small-scale "hot" laboratory capable of separating and handling small quantities of plutonium, the installation designed for training personnel in the operation of separation plants, the radioactive waste treatment plant and other R&D support facilities are not included in the design information provided by Iraq to the IAEA.

As the role of IAEA inspectors is limited to the verification of declared materials only, they have no authority to check activities in other facilities. Therefore, as long as Iraq maintains that it is not processing plutonium or fabricating fuel in these facilities, they will remain outside the scope of safeguards.

Inspection Procedures

The IAEA maintains that the effectiveness of its safeguards depend on the cooperation of the state concerned.[17] Therefore, these safeguards can only be as effective as the state concerned permits.

a. Under the terms of the Iraq-IAEA safeguards agreement, Iraq is entitled to accept or to reject designated inspectors and, indeed, it has exercised that right: since 1976 only Soviet and Hungarian inspectors have been reported to have visited Iraq.[18] Only recently was the designation of a French national as an inspector for Osirak approved by Iraq, but to date he has not visited that country for the purpose of carrying out an inspection.[19]

Dr. Sigvard Eklund, IAEA Director-General, was reported to have stated that *"this practice has unfortunately led to retaliatory discrimination, distortions of the recruiting pattern, and effective* [sic!] *deployment of inspectors in the field."*[20]

---

[17] *A Short History of Non-Proliferation*. Vienna: IAEA, February 1976, p.20

[18] Senator Cranston's statement of 18 June 1981 (see footnote 13)

[19] Richter's testimony of 19 June 1981 (see footnote 11)

[20] US General Accounting Office, *The Nuclear Non-Proliferation Act of 1978 Should Be Selectively Modified. Report to the Congress of the United States by the Comptroller General*. Washington, DC: OCG-81-2, 21 May 1981, p.46

b. Iraq is entitled to determine the time of the proposed inspection and, in practice, inspectors arrive in Iraq only after prior notice is given. Even had the IAEA ever attempted to exercise its right to carry out an inspection without advance notification - as provided for by Article 84 of *INFCIRC*/172 - Iraq would have been able to employ various tactics and manoeuvres to delay the actual inspection, thus enabling it to cover up diversions or other clandestine activities.

c. Delaying tactics can prevent inspections for long periods of time and, in such cases, the IAEA is forced to accept them without protest. For example, Iraq took advantage of this loophole in November 1980, when it notified the IAEA that, due to the war with Iran, it would be unable to accept IAEA inspectors. This took place at a time when a large quantity of weapons-grade uranium fuel was stored in Iraq. The IAEA admitted that it was concerned about the situation,[21] but was unable to act upon this concern. Such a unilateral action could have been repeated by Iraq on future occasions, when even larger quantities of weapons-grade material might have been in its possession.

Further obstacles to regular inspections and safeguards are possible due to political upheavals, as exemplified by the recent revolution in Iran where, for two years, the IAEA was prevented from carrying out its safeguards tasks.

d. Inspections must be planned so as to reduce to a minimum the possible inconvenience and disturbance to the state concerned.[22] Accordingly, inspections are not necessarily carried out under the most favourable conditions. For example, the inspection carried out in Iraq in January 1981 was reportedly conducted in darkness. The inspectors used flashlights and were limited in their visual inspection of the fuel. Several fuel elements could not be verified because they were said to be locked in a vault and the key could not reportedly be located at the time.[23]

The annual *Safeguards Implementation Report for 1980* of the Director General of IAEA states that

---

[21] See IAEA Public Information Division's letter to the editor, *International Herald Tribune*, 26 November 1980, p.4

[22] *INFCIRC*/172, Article 9

[23] Senator Cranston's statement of 18 June 1981 (see footnote 13)

> *"...the Secretariat, in carrying out the safeguards programme of the Agency, did not detect any anomaly which would indicate the diversion of a significant amount of safeguarded nuclear material—or the misuse of facilities or equipment under certain agreements—for the manufacture of any nuclear weapon, or to further any other military purpose, or for the manufacture of any other nuclear explosive device."*[24]

In the aftermath of the IAEA inspection in Iraq in January 1981, the IAEA Board of Governors issued a statement which asserted that *"all nuclear material was satisfactorily accounted for."*[25]

The degree of confidence that can be placed in this statement has been questioned. Slobodan Nakicenovic—who served for 13 years as Director of IAEA's Division of Safeguards and Inspections and later as Director of Operations—discussed this issue in an interview on *Austrian Radio* on 17 June 1981. He claimed that the agency inspectors never conclude or state that there were no diversions. They only state that they did not detect diversion (emphasis added). Richter put it more bluntly:

> *"The difficult part of the* (inspector's) *job is that you must prepare yourself mentally to ignore the many signs that may indicate the presence of clandestine activities going on in the facilities adjacent to the reactor, facilities which you were not permitted to inspect.... You will now complete a standard report, filling in the blanks, you will try to forget that you have just been party to a very misleading process."*[26]

The Right to Withdraw from NPT

According to Article X of the NPT

> *"Each Party shall in exercising its national sovereignty have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal... three months in advance."*

In view of the above constraints on IAEA safeguards, Iraq can secretly proceed as far as possible with all its plans for making nuclear weapons and, when ready, merely notify the IAEA and the United Nations Security Council that it is withdrawing from the NPT.

---

[24] *Safeguards. The Safeguards Implementation Report for 1980*, IAEA, GOV/2028, 11 May 1981, p.5

[25] IAEA, Press Release PR 81/4, 27 February 1981

[26] Richter's testimony of 19 June 1981 (see footnote 11)

This issue of the abrogation of NPT membership was discussed by Dr. Rudolf Rometsch, former IAEA Deputy Director-General, Department of Safeguards. He maintained that

> *"...the 'abrogation risk' has to be understood and accepted. This is a new notion in the non-proliferation discussion. It designates the risk that a sovereign State might at any time—according to the rules or by breaking them—abrogate a safeguards agreement or a treaty partnership. We have to live with such risks."*[27]

The Absence of Back-Up Safeguards

In 1976 Iraq was reported to have objected strongly to a trilateral safeguards agreement (France - IAEA - Iraq) on the grounds that the NPT does not require it. Subsequently, the conclusion of a bilateral safeguards agreement between Iraq and France, similar to the one signed by Canada and Finland in 1976, was proposed. Such arrangements are common practice in nuclear cooperation agreements, aimed at ensuring the continuity of safeguards even in the event of the expiration of IAEA safeguards agreements. The Canada-Finland bilateral safeguards agreement states that, *"if international safeguards pursuant to NPT should for any reason cease to be applied..., standby safeguards mechanisms shall be implemented."*[28]

However, the exchange of letters[29] of 11 September 1975 between France and Iraq (supplementary to the agreement of 18 November 1975), which entered into force on 4 November 1976, does not provide for the implementation of such a standby safeguards mechnism should IAEA safeguards cease to be applied.

In clause (2) these letters provide that, in the event of the expiration of the Iraq-IAEA safeguards agreement of 29 February 1972, Iraq undertakes to conclude, within 3 months preceding the date of expiry, a trilateral agreement with France and the IAEA *"ensuring the peaceful and non-explosive utilization of the materials, nuclear materials, installations, equipment and technical know-how provided by France to Iraq under the Franco-Iraqi Agreement."*

---

[27] R. Rometsch, "Fuel Cycle Safeguards,": Remarks at Annual Meeting of the Institute of Nuclear Materials Management, Arlington, VA, June 1977

[28] Canada, Department of External Affairs, "Canada-Finland Sign Nuclear Agreement," Communique No. 15, 5 March 1976, p.2. Emphasis added

[29] *INFCIRC*/172/Add.1. September 1979

It should be noted, however, that in this clause there is no explicit mention of a safeguards mechanism, the type of safeguards agreement to be concluded or the manner of its effective application in Iraq. Nor is there any explicit specification that the purpose of the envisaged agreement would be the implementation of safeguards that would verify, as stated in Article 2 of the Iraq-IAEA safeguards agreement, that source or special fissionable material *"is not diverted to nuclear weapons or other nuclear explosive devices."* In contrast, clause (2) of the exchange of letters merely refers to *"ensuring the peaceful and non-explosive utilization of the materials, nuclear materials,..."*

Furthermore, the exchange of letters states in clause (3) that, in the event that the above-mentioned trilateral agreement has not entered into force before the end of the three-month period, or if *"the safeguards applied by the IAEA pursuant to the Iraq-IAEA agreement should cease to be applied effectively..., those provisions of the Iraq-IAEA agreement which concern safeguards shall continued to be applied..."*

This clause ostensibly provides for a continuance of IAEA safeguards. However, it is not clear how they could be applied if, in the language of the exchange of letters, those same IAEA safeguards have already *"ceased to be applied effectively."* Moreover, the IAEA would not be in a position to insist legally that the safeguards continue to be applied once its agreement with Iraq has expired.

On this very point Paul Szasz clearly states:

> *"Since the Agency's safeguards rights in each case derive from a safeguards agreement, they cease upon the expiration or denunciation of the agreement. Whether or not the undertaking to use such material only for peaceful purposes persists past the termination of the agreement, it is clear that the Agency's control cannot continue and thus the State is free to do as it wishes."*[30]

Thus, the exchange of letters only legally obliges Iraq in relation to France to conclude an agreement. It does not provide explicitly for the implementation of a standby safeguards mechanism in Iraq; nor does it, alternatively, ensure that the IAEA would be obliged to continue the safeguards if the trilateral agreement is not concluded. The difference is of crucial significance since, as Szasz observes:

---

[30] Szasz, *op. cit.*, p.593

> *"Safeguards...cannot be carried out within the jurisdiction of a State without its consent - which naturally is recorded in an international agreement. Nor, on the other hand, can the Agency be obliged to carry out safeguards except on the basis of an agreement to which it is a party."*[31]

If any back-up safeguards agreements are in existence, they have remained unpublished.

Much has been said about the deterrent effect of the continuous presence of French technicians in Osirak. However, the reliability of this is doubtful, considering the hasty exodus of most foreign experts from Iraq in October 1980, following the outbreak of the Iraqi-Iranian war, while the highly-enriched uranium still remained in Osirak, and the severe restrictions on entrance and movement imposed by Iraq on the few remaining foreigners.

THE INEFFECTIVENESS OF INTERNATIONAL SANCTIONS

The preceding discussion is a step-by-step analysis of the limitations imposed on IAEA safeguards relating to Osirak, as well as an indication of the possible diversion paths Iraq could choose on its way to the acquisition of nuclear weapons.

The ratification of the NPT, and the conclusion of a safeguards agreement with the IAEA in connection with it, enabled Iraq legitimately to acquire nuclear materials and technologies under the guise of peaceful uses—though its choice of nuclear materials and facilities cannot be logically explained in terms of a developing research programme for the peaceful uses of atomic energy.

However, from the safeguards point of view, Iraq's preference for an Osirak-type reactor and the supporting facilities acquired from Italy points to a calculated attempt to exploit limitations of the IAEA safeguards techniques regarding MTRs, for the purpose of embarking on a nuclear weapons programme without risking detection. Iraq could proceed as far as possible in its nuclear weapons programme within the framework of NPT and, once ready, it could exercise its right of withdrawal from the NPT on three months notice. Iraq could also abrogate its safeguards agreement with the IAEA—with no known back-up safeguards in force—without fear of sanctions or of incurring any other major risks.

---

[31] Szasz, *op. cit.*, p.564

/...

It is doubtful whether there is an effective international response to non-proliferation violation, even if such violation is detected by the IAEA. The restrictions imposed on the ability of international bodies to take action in the framework of the NPT were clearly defined by the IAEA itself: *"History has shown that the extent to which international bodies can impose fully effective sanctions on national governments is limited."*[32] Moreover, the IAEA does not possess enforcement powers.

The immediate halt of nuclear fuel supplies could be an effective measure. However, halting these supplies might have little significance because, at the time of withdrawal from the NPT, Iraq might already have at its disposal sufficient quantities of material for its nuclear weapons programme. Moreover, such a reaction on the part of a supplier would be unlikely, because Iraq could be expected to threaten with retaliation. Iraq's status as a major oil exporter, along with the support of other Arab oil-exporting states, renders effective international sanctions against it virtually impossible.

---

[32] *A Short History of Non-Proliferation, op. cit.*, p.22

THE DIPLOMATIC EFFORT

Iraq's uninhibited efforts to acquire a military nuclear capability lent a growing sense of urgency to Israel's apprehensions, which gave rise to a diplomatic effort to forestall an Iraqi nuclear weapons programme. Israel's search for relief met with an ever-increasing corroboration of its reading of Iraq's designs and potential in authoritative international quarters but, alas, remained futile.

Since 1975, Israel conducted diplomatic contacts at various levels with governments which Israel believed could prevent this dangerous development. Israel was careful to ensure that these contacts would remain as discreet as possible, in order to enable all those approached to have maximal freedom to take action.

Israel shared its concern with France, whose assurances focused mainly on the inspection procedures of the IAEA and provided Israel with little solace. The Government of Italy was similarly and repeatedly approached by Israel about its role in aiding Iraq's nuclear programme. Like the Government of France, Italy asserted its faith in IAEA inspection.

Concurrently, the Government of Israel invited the views of the Government of the United States on Iraq's nuclear agreements. The United States apprised Israel that it viewed these developments seriously, and that it was prepared to try to persuade the Governments of France and Italy to exercise extreme caution in their nuclear dealings with Iraq.

A detailed account of the diplomatic efforts made by Israel in its attempt to mitigate the situation follows:

Israel initiated its enquiries, contacts and approaches to the Government of France regarding the nuclear relations between that country and Iraq immediately after the visit of the then Prime Minister of France, Jacques Chirac, to Baghdad in November 1974, when negotiations on nuclear cooperation between the two countries began. At that time, officials of the Embassy of Israel in Paris expressed their concern over the provision of advanced nuclear technologies to Iraq, a country which maintained

/...

that it was in a state of war with Israel.

During a visit to Paris in April 1975, the then Deputy Prime Minister and Foreign Minister of Israel, the late Yigal Allon, discussed the threat to Israel of possible French-Iraqi nuclear cooperation in meetings with the then President of France, Valéry Giscard d'Estaing, Prime Minister Chirac and Foreign Minister Jean Sauvagnargues In these discussions Mr. Allon expressed Israel's growing apprehension at the possibility of the misuse of nuclear technology and materials by Iraq, and stressed that the utmost care should be taken to prevent it.

A framework agreement for nuclear cooperation between France and Iraq was concluded on 18 November 1975. The Government of Israel immediately enquired of those responsible for nuclear energy matters in the French Ministry for Foreign Affairs as to the details of the agreement, and was informed that an MTR of the Osiris type, fuelled by uranium enriched to 93% and manufactured by the Technicatom Company, was being offered to Iraq.

In January 1976 the Ambassador of France in Israel was asked for clarifications of the nuclear relationship between Iraq and France. In response, confirmation was received that the sale of an Osiris-type reactor to Iraq was under consideration.

On 27 January 1976, in his reply to a motion in the Knesset (Israel's Parliament), Mr. Allon summarized the Israeli diplomatic efforts up to that point:

> *"I share the concern of the proponents of the motion and, like them, see the need to discuss the problem...Israel is actively following the collaboration existing in the nuclear field between Arab states and advanced technological states. We point out at every opportunity the dangers involved in making available technological nuclear aid to countries liable to exploit it for their aggressive aims in the region. We do all we can when such dangers become known.*
>
> *"When the news was published of negotiations between France and Iraq concerning the acquisition of a French nuclear reactor by Iraq, I instructed our embassy in Paris to make a number of enquiries about the reliability and details of that report, for the reason I mentioned at the beginning of my remarks. At this stage we have received a number of clarifications and are continuing to deal with the matter."*

On the same day, Mr. Allon once again expressed to the Ambassador of France Israel's anxiety about his country's nuclear ties with Iraq, and voiced his regret at the signature of the nuclear cooperation agreement with it. He asked the ambassador

/...

to convey to his government the Knesset's concern, and added: *"The furnishing of nuclear capabilities to irresponsible states in the Middle East is a dangerous act."*

On 4 April 1976 the French-Iraqi nuclear cooperation agreement entered into legal force and the negotiations between the two countries intensified.

In the first half of 1976, after it became clear that the supply of an Osiris-type research reactor was at the core of the French-Iraqi agreement, Israel also approached the Government of the United States with the request that all possible steps be taken to prevent the implementation of that agreement.

During that same year, the scope of Israel's contacts with American officials expanded. It became apparent that, already then, the United States administration shared Israel's concern about various aspects of the transaction, and that it apparently had approached the Government of France for clarifications.

During the visit of the then Foreign Minister of France, Louis de Guiringaud, to Israel on 30-31 March 1977, Mr. Allon again expressed Israel's alarm at the supply to Iraq of an Osiris-type reactor, along with 93%-enriched weapons-grade uranium. M. de Guiringaud endorsed the Israeli findings as to the dangerous and proliferative nature of such highly-enriched uranium, but expressed his belief that sufficient safeguards existed. Furthermore, he added, France was engaged in technological development which would enable the fuelling of the Osiris reactor with uranium enriched to no more than 20%. This matter was later discussed in two separate conversations between M. de Guiringaud and the Ambassador of Israel to France in the fall of 1977 and the beginning of 1978. These talks, however, offered Israel no relief.

It soon became apparent that solving the technical problems involved in operating the Osiris-type Iraqi reactor with fuel enriched to about 20% would delay its completion, which appeared to have been contractually scheduled for 1980. Iraq insisted on France's adherence to the original terms and schedule of the agreement. It was obvious that, in order to do so, France would have to deliver 93%-enriched uranium to Iraq, in spite of what it might have wished to do. Israel's concern over this possibility that weapons-grade fissionable material, as well as a reactor with highly dangerous characteristics and specifications, would come into Iraq's possession and under its control, was too serious to be allayed by the referral to IAEA inspection and safeguards.

/...

In a further conversation between the Ambassador of Israel to France and M. de Guiringaud in October 1978, it was learned that the first shipment of 93%-enriched uranium fuel would be made to Iraq during 1980, and the French foreign minister was unable at that time to ascertain whether the French scientists would have been able to complete their experiments on low-enriched uranium fuel by then. On that occasion, the Ambassador of Israel voiced his opinion that the initial delivery of highly-enriched uranium might well make an eventual changeover to less-enriched fuel more problematic, mainly because of Iraq's stand.

When the then Foreign Minister of Israel, Moshe Dayan, visited Paris in January 1979, he informed the then Prime Minister of France, Raymond Barre, of Israel's growing concern about France's nuclear cooperation with Iraq. Mr. Dayan also emphasized his concern about Iraq's increased arms purchases, its efforts to achieve a nuclear capability, its unabated enmity towards Israel and its close ties with the Soviet Union.

In a conversation in July 1979 with the then Foreign Minister of France, Jean François-Poncet, it again became clear to the Ambassador of Israel to France that 93%-enriched uranium would indeed be furnished to Iraq for the fuelling of its Osirak reactor. On 28 July 1980, following the French delivery to Iraq of an initial shipment of 12 kg of 93%-enriched uranium, the Foreign Minister of Israel, Yitzhak Shamir, requested of the French chargé d'affaires in Israel to convey to his government Israel's increasing alarm over the scope and nature of the nuclear aid France was extending to Iraq. Mr. Shamir expressed profound concern about the danger inherent in the creation of an Iraqi nuclear capability, pointing out that Iraq had actively participated in wars against Israel in 1948, 1967 and 1973, and that it continued to regard itself to be in a state of war with Israel. He asked that the Government of France be reminded of its previous intentions to substitute uranium of low enrichment in the future, and to ensure tight safeguards on the uses to which Iraq would put the reactor.

In the summer and fall of 1980, high-level contacts were also maintained between the Governments of Israel and the United States concerning Iraq's nuclear capability and intentions. Israeli officials asked their American counterparts to make every possible effort to prevent Iraq from acquiring a military nuclear potential. In those contacts U.S. officials left little doubt that they viewed Iraq's nuclear development with concern.

On 8 April 1981, President Reagan transmitted to the United States Congress the *U.S. Arms Control and Disarmament Agency 1980 Annual Report*, which included the following statement:

/...

"As a party to the NPT, Iraq has undertaken to accept safeguards on all its peaceful nuclear activities through the International Atomic Energy Agency, and has made an international legal commitment not to receive, manufacture, or otherwise acquire nuclear weapons or other nuclear explosive devices. However, Iraq's nuclear program has been moving very rapidly, and both the speed and the breadth of the program as well as its inclusion of weapons-usable materials, has prompted concern now heightened by the Iran-Iraq War." (emphasis added)

In the summer of 1980, Foreign Minister Shamir addressed himself to the Foreign Minister of Italy, Emilio Colombo. He pointed out that Iraq's hostility towards Israel, the character of its regime, its declared intention of destroying Israel and its active participation in three wars against Israel since 1948, all obliged Israel to express its deepest concern that Iraq was being given a massive destructive capability. In view of the above, he called upon the Government of Italy to refrain from strengthening Iraq's capacity to endanger Israel's existence.

In his response in the early fall of 1980, the Foreign Minister of Italy stated that his government was fully aware of Israel's concerns. He added that the Government of the United States had also approached his government on this subject on various occasions. Italy was opposed to the proliferation of nuclear weapons but, as Iraq had signed the NPT, Italy had decided on scientific cooperation with that country.

Israel also made its views known to the Italian defence authorities. In their response, they declared that it would definitely be necessary to suspend Italy's nuclear ties with Iraq if indications were to appear that Italy had erred in its evaluation of the significance of the aid it was extending to that country, or of Iraq's intentions with regard to the use of that aid.

In a conversation with his Italian counterpart in New York on 26 September 1980, Mr. Shamir once again raised the problem of nuclear cooperation between Italy and Iraq. As this meeting took place only four days after Iraq had attacked Iran, the Foreign Minister of Israel stressed that the events in the Gulf urgently indicated the need to assess Iraq's intention of developing nuclear facilities since, in the minds of Iraq's leaders, no clear distinction existed between views and acts of war.

In the light of Iraq's war against Iran, the Government of Israel expressed even more forcefully to the Government of France the gravity with which it viewed the existence of dangerous nuclear activity in an irresponsible country such as Iraq. In a conversation with his French counterpart in New York on 26 September 1980, Mr. Shamir pointed out the dangers for the region and for the world posed by that war, which had

/...

highlighted the extremist and aggressive character of Iraq, and which made Iraq's pursuit of a military nuclear capability even more disturbing. From Israel's point of view, he explained, France's assertion that it could effectively control and supervise Iraq's nuclear activities in all circumstances was of little reassurance, particularly when considered in the light of the evacuation of French, among other, Western technicians from Iraq following the outbreak of the Iraqi-Iranian war. Mr. Shamir added that Israel was compelled to consider the possible combined effects of the nuclear assistance which was being extended to Iraq by France and Italy.

The Foreign Minister of France emphasized that, although he understood Israel's concern, France did not share it. He added that France furnished Iraq with nuclear technology and equipment for research purposes and that its nuclear cooperation with Iraq was based on France's evaluation that Iraq had no plans to manufacture nuclear weapons — at least not at that stage — though he could not take a stand with regard to possible developments in the distant future. He further stated that, in his country's judgment, the alternative of withholding nuclear technology from Iraq was unacceptable.

French nuclear assistance to Iraq was also a prominent issue in a conversation between President Giscard d'Estaing and Mr. Shamir on 4 October 1980. Israel's position on this issue was again presented to the French president by its opposition leader Shimon Peres, M.K. (Member of Knesset), on 15 January 1981.

The above data leave no doubt as to the concerted diplomatic efforts Israel made from 1975 on to prevent the extension of nuclear aid to Iraq which could help that country achieve a military nuclear capability. Unfortunately, these efforts neither resulted in allaying Israel's concerns, nor in practical steps to withhold such aid. Iraq's nuclear programme proceeded apace and was on the verge of culminating in the fulfilment of that country's military nuclear ambitions.

In an interview with the Israeli daily *Maariv*, on 12 June 1981, Foreign Minister Shamir summarized the diplomatic efforts pursued by the Government of Israel with France, Italy and the United States concerning the grave threat posed to its existence by Iraq's nuclear programme.

> *"Ever since Iraq decided to build this reactor with France's assistance in 1975, Israel has not rested and has not ceased in its political efforts to prevent this danger. The agreement between Iraq and France was signed when Chirac was Prime Minister of France and Saddam Hussein, Iraq's present ruler, was vice-president. When Israel realized what the object of the reactor was, it made great efforts to influence France to prevent its delivery. The late Foreign Minister Allon invested substan-*

/...

tial energy on this issue. Foreign Minister Dayan continued these contacts in his visit to Paris, in his talks with President Giscard d'Estaing and with Foreign Minister François-Poncet. At that time, contacts were made with the Italian government. Its members were apprised of the gravity of providing a state and a regime such as Iraq with the possibility of manufacturing nuclear weapons.

"We have had many conversations with the representatives of the American administration, beginning in the Carter period with Secretaries of State Cyrus Vance and Edmund Muskie, and now with the members of President Reagan's administration.

"On several occasions, they promised to intervene with the French and Italians to try to influence them not to supply the Iraqis with enriched uranium and the equipment necessary for manufacturing nuclear weapons. The Americans kept their promise and tried to use their influence with the French and the Italians, but without any success. The French and the Italians replied that there was no danger that the Iraqis would manufacture nuclear weapons, and the Americans passed this reply on to us... Our prime minister raised the matter again with the United States secretary of state, Alexander Haig, who was en route to Israel. The Americans never cast doubts on the facts we presented and never tried to convince us that there was no basis for concern."

/...

LEGAL ASPECTS OF ISRAEL'S ACTION AGAINST OSIRAK

Israel's action against Osirak constituted a legitimate act of self defence, based on the principles of international law. The exercise of this right resulted from a specific constellation of factual circumstances which posed an intolerable threat to Israel. These circumstances included the imminent realization by Iraq of its plans to acquire a military nuclear capability, Iraq's declared maintenance of a state of war with Israel and its persistent denial of Israel's right to exist, and the failure of Israel's diplomatic efforts to prevent the extension of foreign assistance to Iraq in the implementation of its nuclear programme.

Moreover, in addressing itself to this threat, Israel was faced with a situation in which the reactor was about to become operational, after which any Israeli action limited to material objectives only could have resulted in the release of lethal radioactive pollution causing injury to civilians. In these circumstances, the time factor became a crucial element in Israel's decision.

THE RIGHT OF SELF-DEFENCE

Self-defence is an inherent right in customary international law, arising from the existence of a threat to the state defending itself, the lack of any alternative course of action in the prevailing circumstances, and the use of proportionate action to counter the threat.

Article 51 of the United Nations Charter confirms the existence of this customary right as *"the inherent right of individual or collective self-defence"* in the event of *"an armed attack"*.

Developments in the nature, technology and effectiveness of modern weaponry require a consequential, interpretative adjustment to the notion of a threatened or actual armed attack. Leading jurists have related to this adjustment, basing their opinions on the relationship between the provisions of Article 51 of the United Nations and the factual circumstances inherent in preparations for atomic warfare - a factor seen by some as an *"armed attack"* within the meaning of Article 51.

/...

D. Bowett, in his authoritative book *Self-Defence in International Law*, states:

> *"No state can be expected to await an initial attack which, in the present state of armaments, may well destroy the state's capacity for further resistance and so jeopardize its very existence."*[1]

Similarly, the late Sir Humphrey Waldock, until recently President of the International Court of Justice, observed:

> *"To cut down the customary right of self-defence beyond even the Caroline doctrine does not make sense in times when the speed and power of weapons of attack has enormously increased. Indeed, in the Atomic Energy Commission [Document A.E.C./18/Rev. 1, p.24] it has been suggested that—assuming atomic weapons to be controlled by Convention—preparations for atomic warfare in breach of the Convention would in view of the appalling power of the weapon, have to be treated as an 'armed attack' within Article 51. But even without atomic weapons modern developments in warfare lend force to the interpretation of that Article which has just been put forward."*[2]

In their book *The Political Foundations of International Law*, Morton A. Kaplan and Nicholas de B. Katzenbach state:

> *"Even though Article 51 permits collective self-defence and even though Article 52 has been interpreted to permit supranational defensive blocs such as NATO, the Charter restriction of self-defence to cases of armed attack undoubtedly is not fully adequate to defense problems of the present age."*[3]

The authors also state:

> *"The only serious defect of Article 51 is the limitation to 'an armed attack', a limitation that may be both naive and futile in an atomic age, or, for small states, in an age of jet planes and fast tanks.*

---

[1] D. Bowett, *Self-Defence in International Law*. Praeger Publishers Inc., New York, 1958, pp.191-192

[2] H. Waldock, "The Regulation of the Use of Force by Individual States in International Law." *81 Recueil des Cours*, Vol. II, 1952, p.498. See also M. McDougal & Feliciano, *Law and Minimum World Order*. Yale University Press, New Haven, 1961, p.238, who observe:

> *"The second major difficulty with a narrow reading of Article 51 is that it requires a serious underestimation of the potentialities both of the newer military weapons systems and of the contemporary techniques of non-military coercion..."*

[3] Morton A. Kaplan & Nicholas de B. Katzenbach, *The Political Foundations of International Law*. John Wiley & Sons Inc., New York, 1961, pp.212-213

/...

> *"Must a state wait until it is too late before it may defend itself? Must it permit another the advantages of military build-up, surprise attack, and total offense, against which there may be no defense? It would be unreasonable to expect any state to permit this—particularly when given the possibility that a surprise nuclear blow might bring about total destruction, or at least total subjugation, unless the attack were forestalled."*[4]

M. McDougal saw this right to self-defence as authorizing a state

> *"...which, being the target of activities by another state, reasonably decides, as third party observers may determine reasonableness, that such activities imminently require it to employ the military instrument to protect its territorial integrity and political independence, to use such force as may be necessary and proportionate for securing its defense."*[5]

Concerning the nature of the intentions and structure of the state posing the threat, McDougal adds:

> *"The explicit and consistent public utterances of its official spokesmen, the totalitarian character of its internal structures of authority and the monolithic character of its demanded system of world public order raised grave question about the genuineness of the...dedication* (by the state concerned) *to the basic principle of minimum order, that violence and coercion are not to be used as instruments of expansion across state lines."*[6]

In a similar vein, Brunson MacChesney comments:

> *"Critics of the self-defense argument contend that self-defense is too dangerous an instrument, and therefore the United Nations Charter must be so construed as to forbid its invocation. But the alternatives seem even more dangerous. Conceding, as these critics do, that states whose survival is threatened will nonetheless react to such threats, such responses will then be either outside or above the law. Surely this cannot be more desirable."*[7]

---

[4] *Ibid.*, pp.211-212

[5] Myres S. McDougal, "The Soviet-Cuban Quarantine and Self-Defense." *57 American Journal of International Law*, Washington, D.C., 1963, pp.597-598

McDougal placed this within the context of general community organization, adding:

> *"It has indeed been accepted principle that a target state may make a first, provisional decision that the conditions of necessity are such as to require it immediately to employ the military instrument for preservation of its territorial integrity and political independence. Given the continuing ineffectiveness of the general community organization to act quickly and certainly for the protection of states, no other principle could be either acceptable to states or conducive to minimum order."* (pp.598-599)

[6] *Ibid.*, p.601

[7] Brunson MacChesney, "Some Comments on the Quarantine of Cuba." *(Ibid., p.597)*

/...

In view of the positions taken by the jurists quoted above, it becomes evident that the concepts of "armed attack" and the threat of such an attack must be read in conjunction with, and related to the present-day criteria of speed and power, and placed within the context of the circumstances surrounding nuclear attack—including the preparations for it and the consequences resulting from it.

THE MAINTENANCE BY IRAQ OF A STATE OF WAR WITH ISRAEL

The active maintenance by Iraq of a state of war with Israel was an essential component of Israel's perception of the threat presented by Iraq's realization of its nuclear military aims. The existence of such a state of war has been clearly indicated by Iraq's active participation in three major wars against Israel[8] and its continued rejection of any form of peaceful settlement between Israel and its neighbours based on Security Council Resolutions 242 and 338[9] (see also Chapter "The Iraqi Regime").

Noting Iraq's policy of maintaining a state of war with Israel, Arthur J. Goldberg, former Associate Justice of the Supreme Court of the United States, pointed out the logical consequences of such a policy in a letter to Prime Minister Begin on 16 June 1981:

> *"...Iraq, by its own choice, is in a state of war with Israel and... Israel, therefore, had the legal right to seek to destroy such an installation. It is relevant, in this context, that Israel, contrary to Iraq, has expressed its willingness to make peace with Iraq, in accordance with Resolutions 242, 338 and other relevant resolutions of the United Nations Security Council."*

LEGITIMATE MILITARY OBJECTIVES IN ARMED CONFLICT

The status of certain nuclear installations within the context of armed conflict is referred to in the 1977 *Protocol Additional to the Geneva Conventions of 12 August 1949* (Protocol I), which defines military objectives as:

---

[8] Hussein A. Hassouna, *The League of Arab States and Regional Disputes*. Oceana Publications, Dobbs Ferry, New York, 1975, pp.241-283

[9] *"Iraq's attitude toward Israel has been notably hostile, even by Arab standards, for decades. The Baghdad Government announced on Oct. 22, 1973, when the Security Council called for a cease-fire in the October War, that Iraq did not consider itself 'a party to any resolution, procedure or measure in armistice or cease-fire agreements or negotiations or peace with Israel, now or in the future'."* (Eric Pace, "Iraq, as Usual, Takes the Hardest Line of All." *The New York Times*, 28 November 1976)

> *"...those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage."*[10]

In Article 56(1) the Protocol contains a provision which prohibits attacks against dams, dykes and *"nuclear electrical generating stations."* The provision is qualified and does not apply if such installations provide *"electric power in regular, significant and direct support of military operations and if such attack is the only feasible way to terminate such support."* (Article 56(2)(b)). Research reactors such as Osirak are not mentioned.

In any event, at the time of Israel's action, Osirak was an installation which, on the one hand, was due to become, later in 1981, the central element of Iraq's military nuclear programme and, on the other, it had not been activated and its destruction did not, therefore, threaten radioactive damage.

During the discussions of the diplomatic conference in which this protocol was negotiated and drafted,[11] several delegations stressed that the use of such installations for military purposes would lead to loss of immunity (from attack).[12]

The Delegation of the United States referred to this aspect of the problem as follows:

> *"39. ...A total ban on attacks against those installations, even when they were used for military purposes and when the damage to the civilian population was not disproportionate to the military advantage anticipated, could not be justified.*
>
> *"40. Those installations should be regarded as military objectives if, owing to their nature or use, they contributed effectively and directly to the enemy's military effort or if, at any given moment, their partial or total destruction or their neutralization offered a distinct military advantage."*[13]

---

[10]Article 52(2) of Protocol I

[11]Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflicts, Geneva, 1974-77

[12]*Official Records*, Vol. XIV, p.157

[13]*Ibid.*, p.158

The Rapporteur of the special working group set up to draft Article 56 (G. Aldrich, USA), stated in his report to the conference:

> *"...it must always be recognized that an attack is not justified unless the military reasons for the destruction in a particular case are of such extraordinary and vital interest as to outweigh the severe losses which may be anticipated.*
>
> *"...it seems clear that production of arms, ammunition, and military equipment would qualify as direct support of military operations..."*[14]

A basic consideration underlying the action by Israel was the fact that Osirak was about to become activated and critical. Any attack after the activation of the reactor would, as stated above, have brought about the release of radioactive pollution, causing collateral damage to the civilian population in the vicinity.[15]

---

[14] Document CDDH/III/264/Rev. 1, *Official Records*, Vol. XV, p.351-352

[15] See Appendix B: "Environmental radiation affects had Osirak been destroyed after its activation"

A NUCLEAR-WEAPON-FREE MIDDLE EAST

The Israeli diplomatic effort to forestall the Iraqi nuclear weapons programme was but one aspect of a series of activities and initiatives it undertook to prevent the spread of nuclear weapons to the Middle East. Israel has supported the principle of non-proliferation whenever this issue has come under discussion in international fora; it has also joined multilateral arms control agreements and has supported resolutions aimed at preventing the proliferation of nuclear weapons. Israel ratified the Partial Test Ban Treaty on 15 January 1964 and the Outer Space Treaty on 18 February 1977.

THE NON-PROLIFERATION TREATY (NPT)

On 10 June 1968 Israel voted in favour of United Nations Resolution 2373 adopting the text of the NPT. It did so in the belief that this would enhance practical and satisfactory solutions for the prevention of nuclear weapons proliferation. In subsequent years, Israel has studied the NPT's various aspects in reference to the conditions prevailing in the Middle East and has concluded that the turbulent and constantly shifting conditions still prevailing in the region prevent the treaty's implementation in good faith on the part of many of the states in it.

A central assumption of the NPT is the existence of conditions of peace, which do not exist today in the area. With the exception of Egypt, the Arab states do not recognize Israel's right to exist, are continuously preparing themselves to destroy it and are mostly opposed to negotiating with it. A number of Arab states have added reservations with regard to Israel to their signature of disarmament treaties or of the NPT. In addition, Israel is aware that more than a dozen Arab states, as well as Pakistan, are not party to the NPT, and that a number of Arab signatories to the NPT have not fulfilled their obligations in accordance with it.

FULL-SCOPE SAFEGUARDS

Of central significance in this context are full-scope safeguards. The safeguards system as thus far developed is, in the context of the Middle East, quite out of pace with the growth of the proliferation threat:

a) Those Arab states, as well as Pakistan, which are not party to the NPT are not subject to full-scope safeguards. Pakistan, for example, is considered to have all its known nuclear facilities under IAEA safeguards, but has embarked concurrently on the reprocessing and uranium-enrichment courses, through the acquisition of unsafeguarded equipment, by exploiting loopholes in nuclear exporters' guidelines.

b) Not all parties to the NPT in the Arab world have concluded agreements with the IAEA on full-scope safeguards, although doing so is an inseparable part of their undertakings pursuant to the NPT. Others failed to conclude full-scope safeguards agreements within the timetable set out in Article III/4 of the NPT. Syria, for instance, has in recent years carried out significant activities aimed at the establishment of a nuclear infrastructure, while failing to fulfill its safeguards obligations twelve years after ratifying the NPT.

c) Some Arab states which are party to the NPT have been reported to be involved in the unsafeguarded transfer of nuclear material. Libya, for example, was reported in 1979 to have participated in an unsafeguarded international uranium transaction between Niger and Pakistan, i.e., two states that have not signed the NPT. Libya has also purchased several hundred tons of uranium from Niger, apparently without reporting this to the IAEA.

d) At the beginning of November 1980, Iraq barred French personnel and IAEA inspectors from supervising and examining the reactors and weapons-grade fuel supplied to it. In the light of Iraq's determination to joint the "nuclear club," this action raised uncertainties about the fate of the weapons-grade fuel in this war zone. It also demonstrated that the effectiveness of safeguards against diversions to non-approved nuclear projects depends on political considerations, i.e., on the willingness and full cooperation of the state concerned.

These examples indicate that, given the nature of the relationship between the parties involved, the act of subscribing to the NPT, or unilateral adherence to full-scope safeguards, cannot in itself be considered a guarantee against the proliferation of nuclear weapons to the Middle East, since the area is characterised by the repeated violation of international obligations in this field. Restraints of a technical or institutional nature alone can hardly protect the area from nuclear proliferation.

TOWARDS AN EFFECTIVE NON-PROLIFERATION REGIME IN THE MIDDLE EAST

The prevention of the spread of nuclear weapons to the Middle East can best be assured by a regional non-proliferation regime and by arms control arrangements freely arrived at and negotiated in good faith by the states of the area. An effective non-proliferation regime must be based on the establishment of a system of mutually binding obligations among all the states of the region, which would assure each of them of the others' compliance with the terms of a freely negotiated convention.

Israel believes that the most effective way to prevent the spread of nuclear weapons to the Middle East is the creation of a nuclear-weapon-free zone in the region, modelled on the Tlatelolco Treaty, which is based on the initiative of the states of the region and on direct negotiations among them. Israel has repeatedly given expression to this idea and, since 1974, had advocated it annually at the United Nations General Assembly.

On 30 October 1980, at the 35th session of the General Assembly, Israel submitted Draft Resolution A/C.1/35/L.8, which spelled out this proposal by calling upon

> *"...all states of the Middle east and non-nuclear-weapon states adjacent to the region, which are not signatories to any treaty providing for a nuclear-weapon-free zone, to convene at the earliest possible date a conference with a view to negotiating a multilateral treaty establishing a nuclear-weapon-free zone in the Middle East."*

It also urged all states of the region to state, by 1 May 1981, their willingness to participate in such a conference. To Israel's great regret, its proposal was rejected by a number of Arab states, most significantly by Iraq, whose representative at the 36th meeting of the First Committee of the United Nations General Assembly held, on 20 November 1980, that Israel's draft resolution was *"of no practical value."* Nevertheless, Israel voted affirmatively in support of an Egyptian draft resolution on this subject which was adopted unanimously by the UN General Assembly in December 1980.

In a letter dated 9 June 1981 to the UN Secretary-General, Israel further elaborated its proposal. It formally and urgently requested all states of the Middle East, and states adjacent to the region, to

> *"...indicate in the course of 1981 their consent to the holding of a preparatory conference to discuss the modalities of such a conference of States of the Middle East, with a view to negotiating a multilateral treaty establishing a nuclear-weapon-free zone in the Middle East."*

/...

With full awareness of the many political differences among the states of the Middle East, and without prejudice to any political or legal claim, it is incumbent upon all the states of the region, for the sake of their common future, to take concrete steps towards the establishment of a nuclear-weapon-free zone in the Middle East. Israel's proposal still stands.

Appendix A. The plutonium production potential of Osirak

A1. Introduction - plutonium production in nuclear reactors

Plutonium (Pu) is produced in reactors fuelled with natural or slightly enriched uranium. In reactors fuelled with highly enriched uranium, Pu can be produced by adding natural or depleted uranium targets.

In an operating reactor, 2.4×10^{24} (or 4 moles) neutrons per year are emitted by fissions for each MW(th) of reactor power. In a natural uranium-fuelled reactor 35÷40% of these neutrons are absorbed in ^{238}U to produce about 350g of Pu per 1 MWY*of energy released (conversion ratio of about 0.8). In a slightly enriched uranium fuelled reactor the portion of neutrons absorbed in ^{238}U is smaller and so is the production rate of Pu.

In a reactor fuelled with highly enriched uranium the production of Pu in the fuel is negligible, because of the small amount of ^{238}U in it. However, such a fuel has a great amount of excess reactivity and, to maintain criticality, about 50% of the neutrons have to be absorbed in the core and in the out-of-core materials (leakage).

It is possible to utilize a large fraction of these neutrons for Pu production by absorbing them in ^{238}U. This can be done by using targets containing natural or depleted uranium inside and/or outside the reactor core.

To obtain an estimate of the Pu production potential of a highly enriched uranium-fuelled reactor, it is reasonable to assume that about 30% of the neutrons in such a reactor can be absorbed in ^{238}U. Since 4 moles of neutrons are emitted per 1 MWY*of energy released, such a reactor has the potential of producing about 290 g Pu per year per each MW(th) of the reactor power.

---

*Megawatt Year

/...

Thus, a reactor fuelled with highly enriched uranium, operating at a power of 70 MW(th) and a load factor of 0.8, has the capability of producing about 16 kg of Pu each year.

A2. The Osirak ("Tammuz 1") reactor

The Osirak is a tank-type reactor fuelled by highly enriched uranium (93%) moderated and cooled by light water. Its rated power output is 70 MW(th) which is rather high for a research reactor. This reactor is basically a copy of the French Osiris reactor, which is described in detail in Ref. 1.

The reactor core is a parallelopiped with dimensions of 70×62×60 cm^3 encased in a zircaloy "chimney". The core contains 56 available positions arranged in an 8×7 array with an 8.7 cm pitch. The 56 equivalent sites are usually occupied by 31 standard fuel elements and 6 control elements, while the remaining sites can be used for experiments.

There are several possible arrangements of the fuel elements in the core. One of these is shown schematically in Fig. 1.

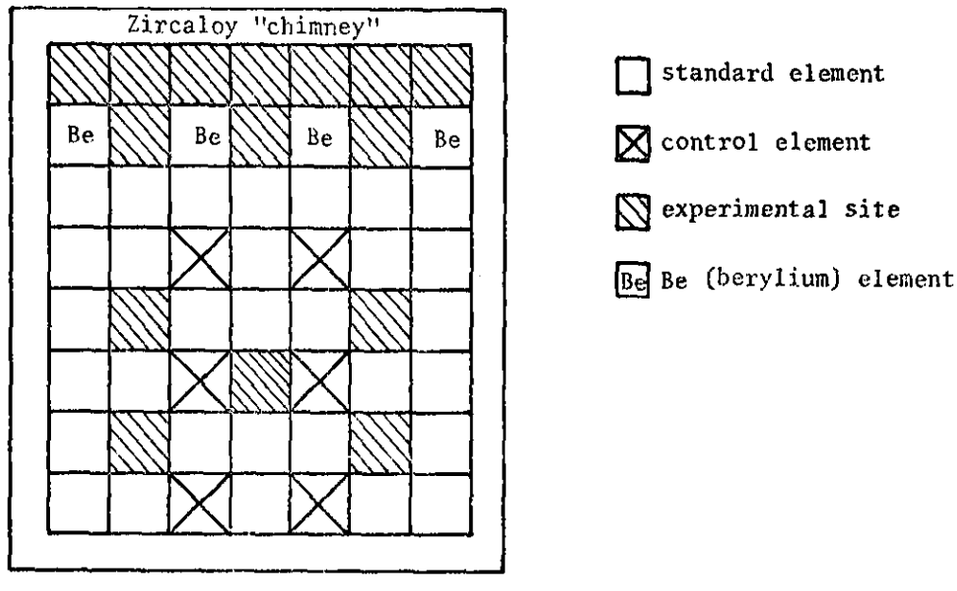

Figure 1. A possible arrangement of elements in the core.

/...

Each standard fuel element is composed of 24 plates of U-Aℓ alloy (26 w/o U). The plate thickness is 1.27 mm including 0.38 mm thick Aℓ cladding on both sides. Each control element is composed of 20 plates of U-Aℓ alloy. The total mass of ^{235}U is 390 g per standard element and 262 g per control element. The side plates of each fuel element contain 500 parts per million of ^{10}B. The ^{10}B in the core stabilizes the reactivity so that the change in the effective multiplication constant during the fuel cycle is less than 1%.

A typical core similar to the one shown in Fig.1 has an initial loading of 13.7 kg ^{235}U. Its effective multiplication constant is 1.09, in a clean cold state at the beginning of the fuel cycle. The refuelling cycle is 49 days with a load factor of 0.8. The maximum allowed burn-up level of a fuel rod is about 45% (Ref. 1).

A3. The possibility of plutonium production in Osirak

Pu can be produced in the Osirak reactor by placing target elements, consisting of natural or depleted uranium, inside the "chimney" and/or outside the "chimney" (external blanket).

The in-core arrangement presented in section A3.1 is considered practical in the near future, because it is technologically simple and could be easily concealed from IAEA inspection.

The external blanket configuration is presented in section A3.2 as a future possibility to produce more Pu. This configuration requires major alterations in the reactor systems and is more difficult to conceal from IAEA inspection.

/...

Calculations were performed to estimate the Pu production potential of the Osirak reactor. Unit cell calculations were conducted with the one-dimensional transport code WIMS[2], and the core calculations were carried out with the three-dimensional diffusion code CITATION[3], using two energy groups.

The major assumptions made in the calculations were:

(a) The overall power is 70 MW(th).

(b) The annual load factor is 0.8.

(c) Thermo-hydraulic limits in standard fuel elements should not exceed the limits of the original core.

(d) Thermo-hydraulic limits in the target elements should not exceed conventional limits.

(e) The reactor should be operational for such a length of time so that the average burn-up level of the unloaded fuel is 45%.

(f) The excess reactivity of the core should always be more then 2%.

A3.1 *Addition of target elements to the core grid*

The easiest way of producing significant quantities of Pu in the Osirak core is to add target elements to the core grid. In this way the existing cooling system is sufficient to remove the excess heat generated in the target elements.

A schematic drawing of a possible configuration of the core grid is provided in Fig. 2.

/...

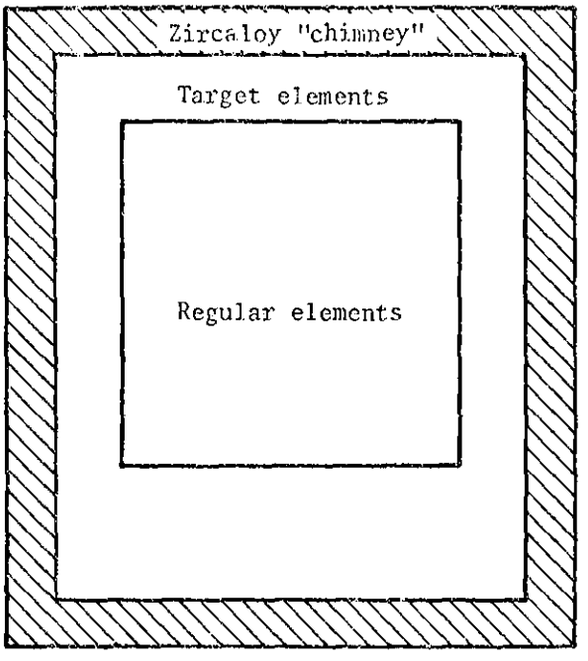

Figure 2. A possible schematic configuration for producing Pu inside the Osirak core.

The regular (including control) elements (93% enriched uranium) occupy 5×5 sites in the center of the core grid. The other 31 sites are occupied by the target elements.

Different types of target elements, consisting of natural or depleted uranium in metal or oxide form, were considered. Among them were PWR type fuel elements, which could be produced in the fuel fabrication laboratory which Iraq acquired from Italy. According to the calculations it is possible to produce in all types of target elements considered 6÷10 kg of Pu annually. The power evolved in the target elements was about 20 MW(th) for natural uranium and 10 MW(th) for depleted uranium fuel elements. Thus the enriched fuel consumption is lowered by 10÷20% when uranium targets are added to the

/...

original Osirak core. In order to produce weapon-grade plutonium (with atomic ratio of ^{240}Pu to ^{239}Pu less than 7%) an annual uranium consumption of less than ten tons is sufficient.

A3.2 *Addition of target elements to both core and reflector*

About 30% of the neutrons produced in the Osirak core leak to the reflector. In order to make use of a larger percentage of these neutrons for the production of Pu, the "chimney" could be surrounded by target elements, in addition to the in-core elements.

In order to remove the additional heat generated in the out-of-core target elements, considerable modifications in the cooling system are required.

Several configurations for producing Pu, both inside and outside the "chimney", have been calculated. The maximum annual Pu production of 18 kg was obtained for a configuration with a 50 cm thick external blanket. For thinner and technologically more practical blankets the production rate would be reduced to 12÷15 kg per year.

The enriched fuel consumption would be reduced up to 50% of the original Osirak core. The annual natural uranium consumption is again in the order of 10 tons.

A4. Conclusions

(a) By adding target (^{238}U) elements to the Osirak core within the "chimney", it is possible to produce up to 10 kg of Pu annually. No changes in the reactor cooling system are required.

80 kg of enriched uranium (the amount provided for in the Franco-Iraqi agreement) should suffice for the operation of Osirak for 2÷3 years.

In this period, 20÷30 kg of Pu could be produced, consuming 10÷20 tons of natural or depleted uranium.

/...

(b) By placing target elements both inside and outside the "chimney" it is possible to produce up to 15 kg of Pu annually. Such a configuration requires modifications in the reactor cooling system. The operating period, utilizing 80 kg of enriched uranium, is thus stretched to 3÷4 years, producing about 50 kg of Pu and consuming several dozens of tons of natural or depleted uranium.

References

1. *Reacteur Osiris*, Rapport descriptif, CEA-R-3984, 1970.

2. J.R. Askew, F.J. Fayers, and P. B. Kenshell, "A general description of the lattice code WIMS", J. Brit. Nucl. Energy Soc. 5, 564-585 (1966).

3. T.B. Fowler, D.R. Vondy and G.W. Cunningham, *Nuclear Reactor Core Analysis Code: CITATION*, ORNL-TM-2496(Rev.2), Oak Ridge National Laboratory, 1971.

Appendix B. Environmental radiation effects had Osirak been destroyed after its activation

B1. Introduction

An estimate is presented, calculating the environmental radiation effects in the event of the destruction of the Iraqi reactor after its activation.

In this report two main possibilities are presented:

(a) A bomb breaches the reactor containment and causes rupture of the cooling systems, bringing about a loss of coolant accident (LOCA) and causing a total core meltdown with a possibility of very large fractions of the fission product aerosols being emitted through the opening in the containment.

(b) Same as (a) but with a direct hit causing a partial or total core destruction.

B2. Assumptions

(a) *Reactor power*: 70 MW(th).

(b) *Irradiation times*: 5 to 60 days (the longest planned average irradiation period) were considered.

(c) *Radioactive isotope inventory:* The hazards were calculated utilizing the same radioactive fission products as in the consequence model of the

/...

Rassmussen Report (WASH-1400)[1] (^{58}Co, ^{60}Co and several other irrelevant isotopes were excluded from the WASH-1400 list). The inventory was calculated with the CINDER[2] computer code utilizing Osiris reactor data[3].

(d) *Release factors*: The reactor core is made of a U-Aℓ alloy. Based on the works of Parker *et al.*[4,5] the following release factors were chosen for the LOCA type accident:

Material	Release factor
Noble gases	1
Iodine and its compounds	0.25÷1 *
Tellurium and its compounds	0.15÷0.5 *
Cesium	0.15
Ruthenium	0.005
All others	0.002

* The ranges indicate the consideration of plate out and other scavenging processes.

As a working hypothesis for the second type of accident, the PWR-1 (of the WASH-1400 report [1]) release factors were chosen. One should remember that in this type of scenario, part of the core may melt, part of it is crushed and powdered, etc.

It should be emphasized that in both cases, because of abundance of debris in the containment area, the effect of the plate out may be considerable. In this case a decrease by a factor of 3÷4 of the LOCA release factor (excluding the noble gases) is assumed.

/...

(e) *Effective release heights*: Two release heights, ground level and 50m thermal buoyancy, were chosen.

(f) *Meteorological conditions*: Two distinct weather models were chosen:

1. D-stability category (according to the Pasquill-Gifford categories[6]) and wind speed of 5 m/sec. These are the general conditions assumed for the sunrise, sunset, high-wind speed and overcast periods.
2. F-stability category accompanied by a wind of 2 m/sec. This is typical for a clear night.

(g) *Release rate*: Instantaneous release is assumed.

(h) *Deposition velocity*: A range of deposition velocities was assumed[7] for different cases: For the noble gases V_d = 0 in all cases. For iodine and its compounds V_d = 0.8÷1.0 cm/sec was assumed. For all other isotopes V_d = 0.1÷0.3 cm/sec was assumed.

(i) *Distances*: Cloud travel distances of 5, 10, 15, and 20 km were chosen for the calculations.

B3. Results

Table 1 presents the results of the calculations. For each of the chosen irradiation times, meteorological conditions and exposure type, a range of results, according to the different assumptions, is presented.

The results for the following exposure types are presented:

(a) The whole-body external gamma dose received from the exposure to the passing radioactive cloud.

(b) The thyroid exposure due to the inhalation of radioactive isotopes from the cloud.

(c) The 24-hour external gamma dose due to the radiation from surfaces contaminated by the fallout from the passing cloud.

/...

(d) The total weighted exposure (external and internal) for the first 24 hours following the release, calculated by the ICRP-26 method [8].

Because of its dominance over the values for the exposure for other critical organs, only the thyroid doses are included in Table 1. However, all relevant exposures to other organs (such as lung, GI tract, total bone marrow and bone) are included in (d).

B4. Discussion

(a) The results of this risk assessment show a distinct possibility of a very severe radiological accident occurring, should a "hot" reactor be struck during an air raid. When the potential doses are compared with those in the US PAG's (Ref. 9) the British ERL's (Ref. 10), and even to the relatively "lenient" German PAG's (Ref. 11) it must be concluded that such an accident would have created an immediate need for massive protective activities, even at distances greater than 15 km from the reactor.

Such activities might include large scale evacuation, limitation on the use of food and water and on traffic over a large area, extensive decontamination efforts, etc. Additional remedial efforts would have to include medical treatment of many radiation casualties.

(b) Calculations show a possibility of lethal doses (mainly due to high doses to bone marrow[1]), occurring up to several kilometers from the reactor. The mortality rate depends, of course, on the type of medical treatment available to the casualties.

/...

Table 1. Dose ranges for the different assumptions and exposure types.

Exposure type	Distance (km)	Dose range (rem)			
		5-day irradiation		60-day irradiation	
		D-stability	F-stability	D-stability	F-stability
External cloud dose	5	5.6-12.6	48-85	6.4-14.4	54-96
	10	1.4-3.6	14-24	1.6-4.0	15-26
	15	0.9-1.9	7.4-12	1.0-2.1	7.8-12
	20	0.6-1.1	4.3-7.5	0.6-1.2	4.5-7.9
Thyroid inhalation dose	5	240-810	1500-5000	430-1440	2700-8900
	10	80-260	400-1300	140-470	720-2400
	15	45-180	200-680	80-320	370-1200
	20	30-100	110-360	50-170	200-650
External dose from contaminated surfaces for the first 24 hours	5	10-33	60-210	12-40	80-260
	10	3-10	17-56	4-13	20-70
	15	2-6	9-28	2-7	10-35
	20	1-4	4-15	1-5	5-20
Total weighted dose for the first 24 hours	5	25-76	*	35-110	*
	10	9-25	50-140	12-35	70-190
	15	5-14	25-70	7-20	35-95
	20	3-9	13-42	4-12	20-60

*The weighting method of ICRP[8] does not apply due to the possibility of of early fatalities.

/...

(c) Results of the study also indicate a distinct possibility of late fatalities. In the area of Baghdad itself, one might expect an addition of some dozens of cancer cases during each of the 25 years following the accident.

Note: 10^6 man-rem are estimated to cause approximately 100 cancer cases during the 25 years following the exposure.

(d) The world has not yet experienced a nuclear reactor disaster of such a large scale, involving, besides coping with the plume exposure phase, a long-term and extensive process of rehabilitating the stricken area. It is estimated that such an operation would necessitate international cooperation on a major scale, for a period of several months at least.

(e) In addition to the calculated estimates, one must take into account the public reaction to any radioactive release into the atmosphere. The experience in the Three Mile Island incident, which involved an almost negligible release, shows that the public outcry is likely to be totally out of proportion to the actual situation professionally and calmly evaluated.

B5. Summary

There is no doubt, from all available points of view, that the destruction of the Iraqi reactor, even a short time following its start-up, would have resulted in extremely high population exposures, and because no proper emergency organization exists for such cases, in potential loss of life, especially in the areas adjacent to the reactor.

The rehabilitation of the area, if at all possible, would have been extremely difficult, and time consuming, and would have entailed effort and aid on an international level.

/...

References

1. *Reactor Safety Study. An Assessment of Accident Risks in US Commercial Nuclear Power Plants. Appendix VI: Calculation of Reactor Accident Consequences*, WASH-1400 (App. VI), USAEC, Washington DC, August 1974; NUREG-75/014, US Nuclear Regulatory Commission, October 1975.

2. T.R. England, *CINDER - A One-Point Depletion and Fission Product Program*, WAPD-TM-334, Bettis Atomic Power Laboratory, Westinghouse Electric Corp., Pittsburgh, August 1962.

3. *Directory of Nuclear Reactors*, Vol. 6: Research, Test, and Experimental Reactors, IAEA, Vienna, 1966.

4. G.W. Parker, G.E. Creek, C.J. Barton, W.J. Martin, and R.A. Lorenz, *Out-of-Pile Studies of Fission-Product Release from Overheated Reactor Fuels at ORNL*, ORNL- 3981, Oak Ridge National Laboratory, July 1967; *Nuclear Safety Program Semiannual Progress Report for Period Ending June 30,1963*, ORNL-3483, 13 September 1963; *Nuclear Safety Program Semiannual Progress Report for Period Ending December 31, 1963*, ORNL-3547, March 1964.

5. T.J. Thompson and J.G. Beckerley, Editors, *The Technology of Nuclear Reactor Safety*, Vol. 2: Reactor Materials and Engineering, MIT Press, Cambridge, Mass., 1973.

6. D.G. Turner, *Workbook of Atmospheric Dispersion Estimates*, PB-191482, US Public Health Services, Washington, DC, 1970.

7. D. H. Slade, Editor, *Meteorology and Atomic Energy 1968*, Air Resources Labs., Environmental Science Services Administration, Silver Spring, MD, July 1968.

8. *Recommendations of the International Commission on Radiological Protection*, ICRP Publication 26, Pergamon Press, Oxford, 1977.

9. *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*, EPA-520/1-75-001, Environmental Protection Agency, Washington, DC, 1975; Rev. June 1979.

10. Medical Research Council (UK), *Criteria for Controlling Radiation Doses to the Public After Accidental Escape of Radioactive Material*, HMSO, London, 1975.

11. H.J. Hardt, W. Preuss, and A. Tietze, *Features of Nuclear Accidents Affecting Emergency Measures*, IAEA-SM-215/57, IAEA, Vienna, 1977.
