

cent, but a concentration of 3 per cent is necessary in order to sustain a chain reaction in an LWR. Some 90 per cent enrichment is required before use in HTGRs, the majority of submarine propulsion units or fission weapons. This process of enrichment is not linear, and as much enrichment effort, or 'separative work' as it is usually termed, may be involved in achieving enrichment from, say 0.7 to 1 per cent as from 10–90 per cent.

There are six main techniques for increasing the concentration of U-235:

Gaseous Diffusion

This was the first method of enrichment to be commercially developed. The process relies on a difference in the mobility of different isotopes of uranium when they are converted into gaseous form. In each gas diffusion stage uranium hexafluoride gas (UF₆) is pumped under pressure through a porous nickel tube (a cascade) which causes the lighter gas molecules containing U-235 to pass through the porous walls of the tube more rapidly than those containing U-238. This pumping process consumes large amounts of energy. The gas which has passed through the tube is then pumped to the next stage, while the gas remaining in the tube is returned to lower stages for recycling. In each stage, the concentration of U-235 is increased only slightly, and enrichment to reactor grade requires a facility of approximately 1200 stages. Enrichment to weapons grade requires about 4000 stages. Industrial scale facilities of this type require electricity supplies of hundreds of megawatts of power.

Gas Centrifuge

In this type of process uranium hexafluoride gas is forced through a series of rapidly spinning cylinders, or centrifuges. The heavier U-238 isotopes tend to move to the side of the cylinder at a faster rate than the lighter molecules containing U-235. The gas at the centre is removed and transferred to another centrifuge, where the process is repeated. As it moves through a succession of centrifuges, the gas becomes progressively richer in the U-235 isotope. Electricity requirements for this process are relatively low compared with gaseous diffusion, and as a consequence this process has been adopted for most new enrichment plants.

Aerodynamic Separation/Becker Process

The Becker technique involves forcing a mixture of hexafluoride gas and either hydrogen or helium through a nozzle at high velocity and then over a surface in the shape of a curve. This creates centrifugal forces which act to separate the U-235 isotopes from the U-238. Aerodynamic separation necessitates fewer stages to achieve comparative enrichment levels than either gaseous diffusion or gas centrifuges but consumes much more energy.

Laser Enrichment

The laser enrichment technique involves a three stage process; excitation, ionization and separation. There are two techniques to achieve these effects, the 'Atomic' approach, and the 'Molecular' approach. The Atomic approach is to vaporize uranium metal and subject it to a laser beam at a wavelength that excites only U-235 molecules. The vapour is then exposed to a second laser beam that ionizes the U-235 atoms, but not the unexcited U-238 atoms. Finally, an electric field sweeps the U-235 atoms onto a collecting plate. The Molecular approach also relies on differences in the light absorption

frequencies of uranium isotopes, and begins by exposing molecules of uranium hexafluoride gas to infra red laser light. U-235 atoms absorb this light, thereby causing an increase in their energy state. An ultra-violet laser can then be used to break up these molecules and separate the U-235. This process has the potential to produce very pure U-235 with minimum energy requirements, but has not yet advanced to an industrial scale level of production.

Electro-Magnetic Isotope Separation (EMIS)

The EMIS process of enrichment is based on the fact that an electrically charged atom, travelling through a magnetic field, moves in a circle whose radius is effected by the ion's mass. EMIS is achieved by creating a high current beam of low energy ions and allowing them to pass through a magnetic field created by giant electro- magnets. The lighter isotopes are separated from heavier isotopes by their differing circular movements.

Chemical Separation

'Chemical Separation' is something of a misnomer as the differing isotopes of an atom are chemically identical. This form of enrichment exploits the fact that ions of these isotopes will travel across chemical 'barriers' at different rates because of their different masses. There are two methods to achieve this: the method developed in France of solvent extraction; and the process of ion exchange used in Japan. The French process involves bringing together two immiscible liquids in a column, giving an effect similar to that of shaking a bottle of oil and water. The Japanese ion exchange process requires an aqueous liquid and a finely powdered resin which slowly filters the liquid.

Reprocessing

This is a process whereby the uranium and the plutonium in spent fuel discharged from a reactor is separated from the other 'fission products' by chemical means. It may then be recycled into reactor fuel or, in the case of plutonium, may be used in weapons. Reprocessing is usually carried out using mechanical and solvent extraction techniques, and occurs in three steps.

Solution

After a period of storage to reduce their radioactivity the fuel assemblies are cut into short sections in what is termed the 'head-end' stage. These pieces are then placed in a nitric acid solution to dissolve the fuel. This acid solution is centrifuged to remove undissolved solids, and chemically treated in preparation for the separation process.

Separation

In this separation stage the 'Plutonium Uranium Recovery by Extraction' (PUREX) method may be employed, with the solution being fed into extraction columns and mixed with various chemicals. The plutonium and uranium emerge from this in the form of nitrates.

Purification

The third stage involves purifying the recovered materials. Recovered uranium can be recycled into new fuel, although sometimes this involves further enrichment. Recovered plutonium may be used as fuel in breeder reactors, to make mixed oxide (MOX) fuel or, if of a suitable isotopic composition, to make weapons.

Section 2

The Evolution of the Nuclear Non-Proliferation Regime, 1945-1970

Introduction

In the mid-1960s, it was assumed by many knowledgeable commentators that as information on the design and manufacture of nuclear explosives became more accessible, and supplies of uranium increased, the number of states possessing nuclear weapons would rise. However, both superpowers, the United States (US) and the Soviet Union (USSR), were motivated to prevent this if they could. The US was concerned that it might be dragged by nuclear-armed allies into a catastrophic war that it could not control. The USSR had realised following the first Chinese nuclear test that unlike the US, several nuclear-weapon states (NWS) could soon border its territory.

The two most recent nuclear proliferators were France (1960) and China (1964): those regarded as technically equipped to follow them

within the next ten years were either allies of the United States (Australia, Canada, the Federal Republic of Germany, Italy and Japan); states pursuing policies of armed neutrality (Sweden and Switzerland); or states involved in acute regional conflicts (India, Israel, the Republic of Korea and Taiwan, Province of China). Perceptions of technological determinism held by many contemporary commentators suggested that "those who could, would". Confronted by this threat, the two superpowers sought to change these expectations by erecting a consensual, political and institutional barrier to further nuclear proliferation building on their intermittent negotiations since 1945 to limit their own nuclear arms race and engage in nuclear disarmament.

Attempts to Control Nuclear Weapons, 1945-1965

In June 1946 the US had submitted the Baruch Plan to the UN Atomic

Energy Commission. Its remit was to make proposals for both the elimination of nuclear weapons and the implementation of international control over the exploitation of all aspects of nuclear energy. This plan proposed international managerial control or ownership over all potential weapon-related nuclear facilities, as well as powers to licence and inspect all other atomic energy activities. The USSR responded by submitting a plan based on national, rather than international, ownership and control over nuclear facilities. Neither plan was to be implemented. The US meanwhile passed legislation imposing rigorous national controls over the transfer of nuclear-related information and materials, believing that there was a 'secret' surrounding atomic weapons which could be denied to others.

In September 1949 the USSR exploded its first atomic explosive device, and in October 1952 the United Kingdom followed. These events demonstrated that the 'secret' of creating a fission explosive was no longer the exclusive monopoly of the US and, could be acquired by the indigenous efforts of other states. In parallel, newly discovered uranium deposits in Canada, the US and Australia indicated that the ability of existing Belgian-Canadian-UK-US arrangements to monopolise world supplies and trade in uranium ore could not last. In parallel, any increased global supply of uranium would open the way to the use of nuclear energy as a civil power source. Moreover, such facilities could be operated to both produce civil power and weapon-usable plutonium, as the UK was doing at Calder Hall, its first nuclear power station, opened in 1956.

These developments, among others, led US President Eisenhower to make his 'Atoms for Peace' speech to the UN General Assembly in December 1953. This proposed that the NWS should assist other states in developing the peaceful uses of atomic energy. This would be accomplished by the US and USSR making matching transfers of weapon-usable fissile material to an international nuclear agency, which in turn would supply it to others for peaceful uses.

Negotiations on the creation of this agency started in 1954, based upon the USSR's 1946 concept of national ownership and management of all nuclear activities within a state. This was to be overlaid by international arrangements providing assurances that these activities were not being used for military explosive purposes. They culminated in a multilateral conference on the statute of the new International Atomic Energy Agency (IAEA), held in New York during September and October 1956. This agreed the details of a legal statute giving it the power to start its work in Vienna in July 1957. It had a triple remit of assisting in the development of nuclear energy for peaceful purposes; providing assurances that facilities and materials for such purposes were not being diverted to other uses; and providing early warning if they were.

By then, the US had embarked on two related bilateral activities made possible by changes contained in its Atomic Energy Acts of 1954 and 1958. The first was the negotiation of Agreements for Co-Operation in the Peaceful Uses of Atomic Energy with many states. These, legitimised transfers of information, technology and materials forbidden by earlier legislation. The second was the passing of specific information on its nuclear weapon designs to allies to facilitate the procuring of equipment to enable them to use their own aircraft and missiles to deliver US-owned nuclear bombs and warheads in times of war.

The first of these arrangements undermined the launch of the IAEA. States preferred to seek assistance and materials bilaterally from the US, rather than multilaterally through the IAEA, and arrangements to assure the agreed use of this US assistance were made on a bilateral, rather than multilateral, basis. As a consequence it was 1959 before the IAEA was given the opportunity to exercise its safeguarding powers over nuclear materials through an agreement for it to supply Canadian uranium to a Japanese research reactor.

There were several motivations behind the arrangements for supplying technical information on US weapons to allies. One was reduce the costs to the US of providing the West's nuclear deterrent capability. Another was to head-off the active national nuclear weapon programmes of its allies, with the French one being the most advanced. The hope was that potential US "nuclear sharing" would freeze these programmes. The nuclear weapons earmarked for transfer to allies were to be stored under US military custody in the countries involved, and no formal transfers were to occur unless hostilities were well established.

The US Atomic Energy Act of 1958 also made arrangements for collaboration with nuclear-weapon state allies which had made

'substantial progress in the development of atomic weapons' It authorised collaboration in the development and manufacture of nuclear weapons to occur with such countries, but no transfer in peacetime of complete nuclear devices. At the time, only the United Kingdom qualified for this. In the 1970s similar arrangements were made with France.

An additional complication for the development of the IAEA's functions was the establishment in January 1958 of a regional nuclear organisation within the framework of the European Communities (EC), the European Atomic Energy Community (EURATOM). This was tasked with co-ordinating EC nuclear energy development and implementing a regional safeguards system to ensure that materials were not diverted 'to purposes other than for those which they are intended'. These safeguards were based on ideas similar to those in the Baruch Plan, with EURATOM having legal ownership over all the fissile materials in member states, except those in the French, and later the UK, military programmes. It dealt directly with the enterprises involved, rather than the governments within whose jurisdiction they were situated. The US negotiated an Agreement for Co-operation with EURATOM, and accepted that it, and not the IAEA, would safeguard materials and facilities transferred under this Agreement.

During the early 1960s, several developments relevant to nuclear non-proliferation were therefore occurring in parallel. One was the slow evolution of the IAEA and its international safeguarding activities; the second the implementation of plans to provide allies of the United States with nuclear weapons; a third the dissemination of nuclear knowledge to a wide range of states to enable them to develop the peaceful applications of nuclear energy; and a fourth the development of a nuclear disarmament negotiating process.

In 1961, spurred on by the request from Japan, the IAEA had promulgated its first set of arrangements for implementing Agency safeguards on nuclear materials and facilities, known by the number of their IAEA information document, Information Circular (INFCIRC) 26. This was soon superseded by INFCIRC/66. In its final form in 1968 this incorporated a set of technical principles and procedures for the verification of compliance with safeguards agreements. It covered research and power reactors, spent fuel reprocessing plants, fuel fabrication and conversion plants and fuel and materials storage facilities, but excluded uranium enrichment plants or production facilities for the heavy water used as a moderator in some nuclear reactors.

After 1962 the US started to transfer to the IAEA responsibility for monitoring the civil nuclear transfers it had made under its bi-lateral Agreements for Co-operation. In addition, as orders started to be placed for nuclear power reactors by states in Western Europe and elsewhere, a condition for their supply by the US and the United Kingdom became acceptance of INFCIRC/66 safeguards over their operations, thus further strengthening the authority of the Agency.

Nuclear disarmament negotiations between the US, the USSR and some of their allies were initiated in the mid-1950s when the theoretically unlimited destructive capacity of thermonuclear, as against atomic, weapons started to be fully appreciated. The aim was to first halt the nuclear arms race, and then reverse it through the dismantlement of existing nuclear weapons. Halting the nuclear arms race was seen to involve two distinct activities: the qualitative one of preventing further testing of nuclear devices, in order to freeze nuclear weapon development at its existing levels; and the quantitative one of halting the production of fissile materials for military purposes, thus limiting the numbers of nuclear weapons that could be built by the existing nuclear weapon states. Two other activities were also taking place on a wider, multilateral basis. In 1959 an attempt was made to reach agreement on measures to prevent the emplacement of nuclear weapons in a specific geographical area through the Antarctic Treaty, while in 1958 Ireland had initiated moves within the UN General Assembly to highlight the dangers posed by additional states acquiring nuclear weapons. Its efforts culminated in 1961 in the 'Irish Resolution' being adopted by the UN General Assembly. This called for agreed measures to prevent the transfer of nuclear weapons to additional countries (dissemination) and for all states to refrain from the transfer or acquisition of such weapons (proliferation).

Although negotiations on a comprehensive ban on nuclear testing (CTBT) sustained a test moratorium by the three existing NWS from 1958-61, they failed to produce agreement on a treaty. Irreconcilable differences existed over the intrusiveness of its verification system. In 1961 the USSR resumed testing, followed rapidly by the US. In 1963 the attempt to agree a CTBT immediately was abandoned in favour of

a treaty which banned tests in all environments except underground, the Partial Test-Ban Treaty (PTBT). In the next year the attempt to reach an agreement on a cut-off of the production of fissile material for military purposes was shelved in the light of the increasing numbers of nuclear power plants under construction in the NWS. This appeared to make it impossible to provide credible assurances on compliance, especially in states such as the USSR where the state owned all its nuclear facilities, making the distinction between military and civil use somewhat arbitrary. This decision was communicated through unilateral statements on measures to limit their future production of fissile materials for military purposes made by the leaders of the three initial NWS in the Spring of 1964.

The demise of active attempts to place quantitative and qualitative limits on the existing nuclear arms race coincided with a more comprehensive attempt to address nuclear disarmament through the medium of UN negotiations on General and Complete Disarmament (GCD). This arose from NATO's commitment to fighting a ground war with nuclear weapons. Underpinning this was the Warsaw Pact's perceived qualitative superiority in conventional weaponry, and the realisation that agreement on nuclear disarmament would only be possible if both conventional and nuclear weaponry were addressed in parallel. In 1962 a set of guidelines for future nuclear disarmament negotiations was agreed, known as the Macloy-Zorin principles. It was also recognised that negotiating GCD as a single package was impractical, and that the most practical way forward was to disaggregate its elements and conduct work on them sequentially. The result was a new work-plan, the Decalogue, which started with a CTBT and moved on to agreements on termination of the production of fissile material for military explosive purposes (a Fissile Material Cut-off Treaty or FMCT) and a nuclear weapon non-dissemination and proliferation agreement. While these actions might not reduce the global numbers of deployed warheads, they would create a nuclear disarmament process and improve confidence between those involved in it.

The development by the US in the later 1950s of bombers with intercontinental range, ballistic missiles (ICBMs) with similar ranges and submarine-launched ballistic missiles (SLBMs) had generated concern among its Western European allies that a decoupling was imminent in the minds of US leaders between the collective defence of Europe and the unilateral defence of the US homeland. The Europeans therefore sought enhanced guarantees from the US that any USSR aggression in Europe would meet with a nuclear response. These focussed on the idea of creating a NATO or Western European strategic nuclear force, capable of both striking at Moscow and giving Western European governments direct involvement in its operation and decision making.

Initial proposals were for a mixed-manned force of surface vessels equipped with US Polaris ballistic missiles (the multilateral force or MLF). Later proposals included the creation of an Allied Nuclear Force (ANF) through which the UK and some US strategic forces would be committed for use by SACEUR. The USSR and its allies strongly opposed these proposals, and favoured the idea of negotiating a nuclear-weapon-free zone in Central Europe as proposed by the Polish Foreign Minister, (The Rapacki plan).

The Negotiations on the NPT

It was in this international context of stalled nuclear disarmament negotiations, acute tensions over the nuclear aspects of European security, and proposals for delimiting specific geographical areas as nuclear-weapon-free zones that serious discussions, and then negotiations, started on a treaty on the Non-Proliferation of Nuclear Weapons (NPT). Both the US and the USSR had mutual interests in pursuing this item in the Decalogue, and after considerable informal consultations the 1965 UN General Assembly adopted Resolution 2028 containing guidelines for negotiation of such a Treaty. These stated:

- it should be void of any loopholes which might permit nuclear or non-nuclear weapon states to proliferate nuclear weapons in any form;
- it should embody an acceptable balance between the mutual responsibilities and obligations of the nuclear and non-nuclear weapon states;
- it should be a step towards the achievement of GCD, and more particularly nuclear disarmament;
- it should have acceptable and workable provisions to ensure its effectiveness; and

- nothing contained in it should adversely affect the right of any group of states to conclude nuclear-weapon-free zone (NWFZ) treaties.

In early 1966, the multilateral negotiating forum for disarmament agreements was the Eighteen Nation Disarmament Committee (ENDC). This contained several leading non-aligned states, as well as a number of allies of the two superpowers and was linked to, but not part of, the United Nations system, although it met in UN premises in Geneva. The US and USSR were co-chairmen, but the negotiations made relatively slow progress.

In the autumn of 1966 the US and USSR started bilateral discussions on how to word the sections of the treaty dealing with nuclear transfers from the NWS and the non-acquisition of such weapons by the non-nuclear weapon states (NNWS). This wording had to permit the continuance of existing US-UK collaboration, as well as existing NATO arrangements for the transfer of nuclear weapons in the event of hostilities. From a USSR perspective, the key issue was to prevent any MLF type of arrangement being authorised by the treaty. Early in 1967 language was agreed between the two states on these issues (articles I and II of the Treaty), based on the contemporary US nuclear energy legislation. This prohibited the transfer by its government of complete nuclear explosive devices to any other state or international entity in peacetime, and foreclosed on any move by the alliance to adopt multilateral nuclear-weapon sharing. It also meant that the NPT had no provision to explicitly prohibit the storage and deployment of NWS nuclear weapons in a NNWS.

Debate within the ENDC then focused throughout the remainder of 1967 on how to create an effective verification system for the Treaty. Although all parties to the negotiations were agreed that the IAEA should be responsible for its operation, there was disagreement over EURATOM. Several of the Western European states had no national systems for the monitoring and control of their nuclear energy activities, relying on EURATOM for this. The USSR considered this a form of self-policing, rather than independent monitoring, and argued that it did not offer it and its allies adequate assurances that Western European states, in particular West Germany, would uphold their non-proliferation obligations. It wanted full IAEA safeguards to apply to all states. The US's NNWS allies by contrast were arguing that any verification system should be as non-intrusive as possible, and above all offer no commercial advantages to the NWS who were not to be the subject of safeguards. The dispute was settled in early 1968 through wording for Article III which to allow EURATOM to make an agreement with the IAEA over how Agency safeguards were to apply to EURATOM states.

The text of Article III eventually agreed left two issues undecided or ambiguous: the detailed nature of its IAEA verification system and the obligations of parties to the treaty in respect of transfers to non-parties. While the text indicated that the safeguards system was to focus only on materials, not facilities and materials as was the case with the INFCIRC/66 arrangements, the details were left to the IAEA Board of Governors to decide. In the case of the latter issue, it was unclear whether transfers to non-parties were permissible if the recipient state had an INFCIRC/66 safeguards agreement with the Agency, or whether it also had to accept safeguards over all nuclear materials within its jurisdiction (known variously as NPT, full-scope or comprehensive safeguards) before any transfer could be allowed.

Article IV was also open to differing interpretations. On the one hand it stated an obvious fact related to the nature of state sovereignty, namely that all states had an 'inalienable right' to economic development, and thus to 'develop research, production and use of nuclear energy for peaceful purposes'. On the other, the implementation of this right should be 'in conformity with Article I and II of this Treaty'. Thus although NPT NNWS parties were committing themselves voluntarily to conditions on the exercise of their peaceful right to nuclear energy, the Treaty also recognised the apparently contradictory fact that their rights to peaceful uses were intrinsically 'inalienable'.

Two further articles of the eventual treaty, Article V dealing with peaceful nuclear explosions and Article VII dealing with NWFZ proved relatively uncontroversial. In order to prevent any state acquiring a nuclear weapon under the guise of it being a device for use in a civil engineering project, all work by its NNWS parties on any type of nuclear explosive device was banned. However, Article V permitted the supply of such devices for 'peaceful' purposes by existing NWS. Negotiation of detailed arrangements for this was again left to the IAEA. In the case of NWFZs, Latin American states had decided by 1967 to go ahead with their own regional treaty, partly motivated by a belief that

early agreement on an NPT was unlikely. The resultant Treaty of Tlatelolco opened for signature in February 1967 and prohibited the acquisition, storage and deployment of nuclear weapons, rather than nuclear devices. However, it had its own regional verification system, which included provisions for challenge inspection, and a secretariat, OPANAL.

Two other elements of the draft Treaty continued to generate significant problems throughout 1967: Article VI and related parts of the Preamble; and Articles VIII and X. The debate over Article VI and the Preamble was essentially over the commitments that would be made by the three nuclear weapon states negotiating the Treaty to engage in nuclear disarmament. Neither China nor France was involved in the negotiations. Among other things, both regarded them as aimed at rolling-back their newly acquired nuclear weapon status.

The debate over the Preamble centred on attempts by the NNWS, particularly India and Mexico, to set out a clear list of priorities for future nuclear arms control negotiations, starting with a CTBT. This would determine the strength of the commitment by the NWS to move towards nuclear disarmament; what other related objectives they were to seek to achieve; and what priority might be attached to them. The outcome was that the achievement of a CTBT was listed first in the preamble, followed by references to the cessation of the manufacture of nuclear weapons, the liquidation of existing stockpiles and the elimination from national arsenals of nuclear weapons and their means of delivery.

By contrast, Article VI emerged as a commitment that:

Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.

This text left opaque whether it was to be read as a listing of priorities, or whether each action had equal priority. Also, it committed the NWS to 'negotiate in good faith' on such measures, but not agree or implement them.

The debates over Articles VIII and X were almost entirely conducted through bi-lateral consultations between the US and West Germany and the US and Italy, and in NATO forums. The uncertain nuclear security situation perceived to exist by some of these US allies; a lack of belief on their part in the permanence of the existing US nuclear extended deterrence commitments; and an unquestioned belief in the durability of the USSR nuclear threat made them unprepared to give up permanently the option of acquiring their own nuclear weapons. Although the draft treaty text contained provision for a state to give three months notice of withdrawal if '...extraordinary events, related to the subject matter of this Treaty, have jeopardised the supreme interests of its country...', this was not seen to cover situations where gradual changes in the international environment and in US policy made such withdrawal seem prudent. What was therefore sought by West Germany and Italy was a text giving all parties the right to withdraw from the Treaty at the end of fixed periods of time. Also, states would have to make positive decision to continue in membership, rather than this being automatic. This would allow the parties to review their security situation at these dates and decide to make a conscious decision to continue to accept the Treaty's constraints on acquiring nuclear weapons or making a decision, purposeful or otherwise, to abandon them.

Not unnaturally, the US and USSR were both opposed to the weakening of the text implied by such wording. However, the US was concerned that if these concerns were not addressed by the treaty some of its major NNWS allies, such as Italy, West Germany and Japan, might refuse to sign it. By a scheduled NATO summit at the end of 1967, a compromise west-west arrangement had been negotiated consisting of two elements. One was the insertion into Article VIII of a paragraph mandating the three NWS, who were also to be the depositary governments for the treaty, to convene a conference to review the implementation of the treaty five years after its entry into force. If the parties so chose, they could then request the convening of further review conferences at five year intervals. The second was an addition to Article X of paragraph 2, which stated:

twenty-five years after the entry into force of the Treaty, a conference shall be convened to decide whether the treaty shall continue in force indefinitely, or shall be extended for an additional fixed period or periods. This decision shall be taken by a majority of the Parties to the Treaty.

The intent of these elements was to offer the allies of the US the opportunity every five years to collectively review the security context for their non-possession of nuclear weapons. After twenty five years it gave them the possibility of making at a collective decision to terminate the Treaty by agreeing that its duration should consist of a further short, fixed term or alternatively a series of renewable fixed periods.

In these circumstances, it was not surprising that the non-aligned members of the ENDC found their concerns less than fully reflected in the final text of the Treaty. Although their right to develop nuclear energy for peaceful purposes was emphasised, and partial commitments were made on nuclear disarmament, no mention was made in the text of a further issue they regarded as very significant: nuclear security assurances. Since both superpowers were providing their alliance partners with extended nuclear security guarantees, they argued that they should also provide the non-aligned states with similar legally binding commitments through the new treaty until such time as nuclear disarmament made them irrelevant. Specifically, they were seeking negative assurances that the NWS would not attack them with nuclear weapons, and positive ones that they would go to their aid if they were attacked with such weapons.

Such an insertion would have undermined the existing NATO doctrine of being prepared to initiate the use of nuclear weapons against the territory of the NNWS allies of the USSR in a European ground war. It could thus not be contemplated by the US or its allies. Positive assurances were equally difficult to contemplate, as they implied an open-ended commitment to aid all NNWS parties in all circumstances. More specifically, they would place the US in a difficult situation if Israel *in extremis* threatened its neighbours with such weapons. A further issue was whether the assurances should only apply to NPT parties, or to all states. As a consequence, the treaty text which the two co-chairmen submitted to the ENDC on 11 March 1968 contained no reference to such assurances. This omission was one reason, among others, why India indicated that it was not prepared to sign this text. However, the three NWS did give practical recognition to these non-aligned concerns particularly those of the Arab states, by passing through the UN Security Council on 19 June 1968 resolution 255, whereby the Security Council and 'above all its nuclear weapon State permanent members, would have to act in accordance with their obligations under the United Nations Charter' in the event of a nuclear attack upon a NNWS.

This resolution was passed a week after the co-chairmen's draft treaty, with further amendments, had been passed to the UN General Assembly for its commendation. As a consequence of the Assembly passing a resolution to this effect, the NPT was opened for signature on July 1 1968. It was signed that day by the three depositary states, and came into force on 5 March 1970 when the required 40 states had ratified it.

The NPT that eventually emerged in 1968 had several unique characteristics. One was that it recognised the existence of two classes of state, NWS and NNWS. The former were defined as those which had exploded a nuclear device prior to 1 January 1967. The two classes of state had different rights and duties under the Treaty. Thus non-proliferation was tacitly accepted as a positive objective even if nuclear disarmament continued to be a future goal. A second was that the Treaty contained a delicate balance between three sets of commitments: the nuclear non-proliferation ones made by the NNWS; the nuclear disarmament ones made by the three NWS depositary states; and the 'inalienable' rights of the NNWS parties to develop or acquire all types of peaceful nuclear technology, in return for acceptance of IAEA safeguards over all fissile materials within their jurisdiction. This meant that it was open to any of its parties to place paramount or exclusive emphasis on any one of these aspects. A third was that while it prohibited the acquisition of all types of nuclear explosives by NNWS, its negotiating history indicates that in 1968 it was not the intention of the US, the UK and their western allies that the Treaty should proscribe the stationing of a NWS's nuclear weapons on the soil of an NPT NNWS; to prohibit plans for their transfer in the event of war; or to prevent assistance by one NWS to another.