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SOUTH AFRICA: A COMING NUCLEAR-WEAPON POWER?

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1. Introduction.

The development of nuclear technology does not necessarily lead only to civilian applications. The Indian experience, for instance, indicates that the boundary between peaceful and military uses of nuclear technology is vague indeed. There is no such thing as solely peaceful nuclear technology, because it can be equally well used for military purposes if so desired. This is one reason why there are no grounds to take at face value the statements of, for example, Brazilian and South African authorities to the effect that the nuclear programmes of these countries serve peaceful purposes only. This is especially so because these two countries are not parties to the Non-Proliferation Treaty (NPT) and hence not bound by its safeguard system which aims at 'preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear devices' (article III. 1. of the NPT). It may be concluded that the adoption of the IAEA safeguards is an indication, although by no means an absolute one, that a non-nuclear weapon state (NNWS) is not going to acquire nuclear weapons.

According to Sverre Lodgaard there are three main motives for going nuclear. First, nuclear weapons give prestige and status to their owners: rank in the international

system depends strongly on the possession of these weapons. Secondly, there are economic benefits for going nuclear. Civilian spin-offs of military R & D in the nuclear field are considerable and the nuclear status may also increase the role of the nuclear weapon state (NWS) in the international nuclear market. Thirdly, motives of national security, real or imagined, may also justify the development of nuclear weapons. Lodgaard has also shown that the motives of security policy may be quite different for different nations, ranging from the great power contestors such as France, China and India to antagonistic dyads (Israel/Arab states and India/Pakistan) to regional power centers in the making (Iran, Brazil and Indonesia), to mention a few prevalent examples.¹

It might be useful to recapitulate briefly the ways by which nuclear weapons can be produced. A fission explosion can be produced by three different techniques; by assembling a critical mass of plutonium, by using highly enriched uranium or by uranium 233, which is of secondary importance for the time being. Natural uranium contains two main isotopes: uranium 235 and uranium 238 which exist in natural uranium in the proportion of one to 139 (atoms). In other words the isotope U-235 makes only 0.7 per cent of the natural

uranium, the rest being U-238. Uranium enrichment means, to put it simply, that the proportion of U-235 is increased above its natural value. The enrichment level of ca. 3 per cent makes it possible to use the uranium in power reactors, while the weapon-grade uranium should be 80—90 per cent pure in uranium 235. There are, however, views that even 40 per cent of U-235 would be enough for nuclear weapons.

Uranium enrichment has so far been the preferred way of producing thermonuclear weapons, although plutonium 239 would be a cheaper and an easier alternative as far as fission weapons are concerned. Plutonium is produced when uranium is burnt in a nuclear reactor. A plutonium atom (Pu-239) is particularly amenable to the fission process. To obtain relatively pure plutonium 239 — a 70 per cent concentration may be enough for the production of a nuclear bomb — the fuel rods must be removed from the reactor much earlier than is the case in the production of electricity. Plutonium is separated from the fuel rods in *reprocessing plants* which are in commercial use complex and costly chemical establishments.

There are three main methods of enriching uranium: the gaseous diffusion method, the ultracentrifuge method and the jet nozzle procedure. The *gaseous diffusion method* has high energy consumption and needs large-scale cooling facilities. To obtain enriched uranium at a reasonable price large establishments are needed. This method is most suitable to great powers with extensive energy supplies. The *ultracentrifuge method* requires less energy and smaller plants; hence it would be economically more attractive for smaller nations wanting to acquire enrichment technology. Finally the *jet nozzle technology* requires only low initial investment costs, but it has a very high power consumption thus presupposing the availability of cheap electricity.² There are several other possible enrichment methods of which *laser enrichment* seems to be of special relevance. The main difference between the laser technology and other enrichment methods is that in the laser process U-235 and U-238 can be separated by a single or at most by a few 'shots', while other methods require

even thousands of stages to produce weapon-grade uranium. This means that the laser method is economically advantageous, but on the other hand more prone to greatly speed the proliferation of nuclear weapons. The laser technology has been developed predominantly in the United States so far; both in ERDA's laboratories and in the facilities of Exxon Nuclear Company.³

2. Uranium resources and production in South Africa

I now turn to examine the potentialities of South Africa to become a nuclear power and especially a nuclear-weapon power in the light of the determinants briefly analyzed in the preceding chapter. South Africa is one of the most important producers of uranium in the world. Uranium is extracted there as a by-product in the mining of gold. The exploitation of South Africa's uranium reserves started in 1950 when an Anglo-American agency, Combined Development Agency, installed equipment in gold mines to produce uranium oxide. This is an explanation for the fact that in South Africa those companies, e.g. Anglo-American Co., Rand Mines, General Mining, Consolidated Goldmines and Anglovaal, which are active in gold mining also produce uranium. The bulk of uranium mining takes place in the area south of Johannesburg, although one must recall that in Namibia there are rich uranium reserves of which some are already under exploration and development.

Foreign interests have been involved in the exploitation of uranium deposits in Namibia since the late 1960s. Foreign investment in the development of those resources was ultimately expected to amount to £ 750 million, or more than all previous investments combined. According to the *UN Chronicle*, 'the size of the investment reflects not only the growing importance of uranium as an alternative to petroleum as a source of energy but the intensified support by foreign interests of South Africa's continued illegal occupation of Namibia, as well as South Africa's own growth as a nuclear power'.⁴

The world distribution of uranium resources, those falling to the price range

below \$ 15 per pound, can be seen in the table below:

Table 1 *Estimated world resources of uranium; data available in January 1975*

	Reasonably assured reserves, '000 tons	Estimated additional reserves, '000 tons
United States	320	500
Australia	243	80
South Africa	186	6
Canada	144	324
Niger	40	20
France	37	25
Gabon	20	5
Others	80	35
Total	1080	1000

The figures show that in the case of known uranium resources South Africa is in a very prominent position in the world uranium market. If one considers the estimated additional resources as well as those belonging to the price range of \$ 15—30 per pound the picture changes drastically.⁵ The situation appears to be that at present South Africa's position is considerably stronger than it will be in the future when countries will have to resort to new and more costly reserves which hardly exist in South Africa. This conclusion can be further corroborated by the fact that in estimates made for 1973 South Africa's position was stronger than in estimates concerning the year 1975.⁶

So far South Africa has exported the uranium recovered from her soil as concentrates ('yellow cake') to be enriched elsewhere, i.e. in the United States which has traditionally had a monopoly in the commercial production of enriched uranium. Thus the United States has been able to reap the benefits of processing uranium; enrichment is said to add to the value of uranium by some 50 per cent. Although the methods of enriching uranium have been kept secret to the utmost, the U.S. monopoly is gradually breaking down in this sector especially as a consequence of the efforts of West Europeans to build up their own enrichment

capacity (*Eurodif* and *Urenco*). The efforts of South Africa to build its own capacity point in the same direction. In a way South African uranium has been a typical case of the processing gap: uranium ore is mined in South Africa, partly by the aid of foreign capital, but exported for enrichment mainly in the United States.

An interesting feature in the world uranium market is that since 1975 a uranium cartel, called *The Uranium Marketing Research Organization*, has been operative. This cartel is composed of the governments of Australia, Canada, France and South Africa as well as of a British Company Rio Tinto-Zinc. The U.S. government as well as American uranium producers are outside the cartel. Soon after the establishment of the cartel the members decided that their uranium production quotas would differ between the period until 1977 and the period of 1978—80 in the following manner:

Table 2 *Production quotas within the Uranium Marketing Research Organization, per cent*

	Until 1977	1978—1980	Change
Canada	33.4	23.2	—10.2
France	23.8	19.3	— 4.5
South Africa	21.8	19.3	— 2.5
Australia	17.0	24.4	+ 7.4
Rio Tinto-Zinc	4.0	13.8	+ 9.8
Total	100.0	100.0	

One of the most visible measures of this club has been the increase in the uranium prices which has hit especially American producers like Westinghouse. The nature of this cartel can naturally be interpreted in many ways, but it seems to contain a tendency to counteract the U.S. domination in the nuclear sector. This tendency becomes evident when one observes that U.S. producers and exporters of nuclear reactors, which have sold fuel at low prices to those buying American reactors, have to pay higher prices to the cartel for their uranium than other purchasers.⁷

Although various background conditions only partially favour the continued operation of the uranium cartel,⁸ its emergence is significant as such. Its establishment

coincides with the tendency of the United States to lose her former monopoly in all significant sectors of the nuclear industry, viz. reactors, enrichment services and re-processing.⁹ In the case of South Africa the membership in the uranium cartel indicates that she may be worried by the gradual decline of her role in the world uranium market and wants to compensate this tendency by trying to extract higher prices from her customers. This move implies a certain degree of independence from the United States whose government and nuclear industry resist the newly-emerged cartel. This is no doubt a bit surprising when one takes into account the vulnerable international position of the Vorster government whose supporter the United States has been. An explanation to this state of affairs may be that the South African government has become a little more self-confident with its new enrichment capacity, which in turn would increase her freedom of action vis-à-vis the United States by providing higher income to South Africa as a consequence of the increased level of processing of the uranium.

3. Uranium enrichment in South Africa

The Prime Minister of South Africa, Johannes Vorster, announced in a public speech in July 1970 that the South African Atomic Energy Board, established in 1957, had developed a new process for uranium enrichment, and described this achievement as 'unequalled in the history of our country'. Vorster also tried to convince the world that South Africa's nuclear energy programme was devoted exclusively to peaceful purposes. He also pointed out that South Africa was 'prepared to collaborate in the exploitation of this process with any non-Communist country desiring to do so, but subject to the conclusion of an agreement safeguarding our interests'. Vorster gave arguments for South Africa's interest in uranium enrichment capacity, e.g. the capital savings achieved through the use of locally enriched uranium in the large nuclear power programme of the country and its willingness as a major producer of uranium to develop processing capacity. These arguments were, however, somewhat

transparent because, in the opinion of an observer, the technical status of the announced enrichment capacity was hardly as impressive as claimed by Vorster. Secondly, South Africa could not in any case invest as much capital as the development of a full-fledged enrichment capacity would have required. Hence a call for foreign partners was a natural outcome.¹⁰

By making the call for foreign partners Vorster ignored the fact that West German and French researchers had cooperated in the nuclear field with their South African colleagues at least since 1967. Even before that, probably since 1964, West German experts and firms had helped to develop missiles in South Africa which had founded the Institute for Rocket Research in 1963. At the beginning of the 1970s South Africa was able to launch its first air-to-air missile and soon after that the mass production of missiles was started.¹¹ The aid of West Germany to South Africa's missile and nuclear programmes was at the beginning probably a simple *quid pro quo* in the sense that the latter had sold uranium oxide to West Germany at least since 1969. One should also note that a West German company Urangesellschaft GmbH invested in 1970 about DM 70 million, together with Rio Tinto-Zinc and South African capital, in uranium mining in Namibia.¹²

Although France and West Germany provided some technical expertise, the precise amount of which is very difficult to determine, South Africans seemed to have acted to a great extent on their own. The construction of an operational plant for the uranium enrichment was, however, different from the pilot plant at Valindaba. The final decision to start construction was made in May 1973. Approximately at the same time some West German firms, including at least STEAG (= Steinkohlen-Elektrizitäts AG, a branch of the Ruhrkohle) and Gesellschaft für Kernforschung, started to explore the South African enrichment process and investigate possibilities for co-operation. This resulted in August 1973 in the first agreement between STEAG and the South African state-controlled Uranium Enrichment Corporation (UCOR). This agreement met internal difficulties in the Federal Republic and hence a new agreement was concluded during the spring of

1974 between STEAG and UCOR. This agreement implies an economic feasibility study of comparative costs of the South African enrichment process.¹³

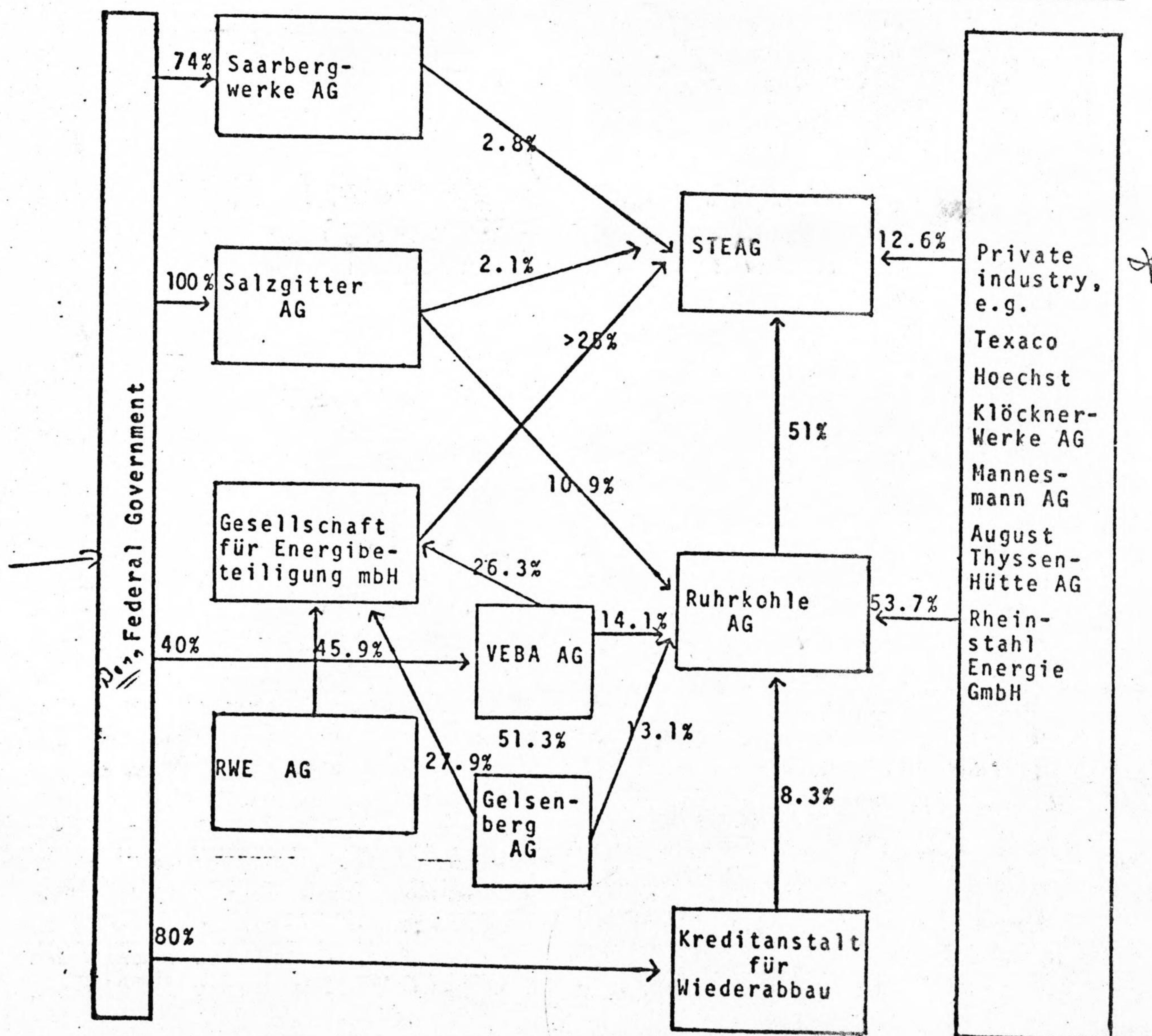
The Bonn government vigorously defended the agreement against critics insisting that it would not allow West German nuclear technology to be used in the construction of nuclear weapons and that the contract concluded between STEAG and South African authorities was by no means an agreement between governments. West German authorities further claimed that the agreement did not contain an exchange of technical information but that STEAG had merely agreed to carry out a feasibility study.¹⁴ The same story was told at Johannesburg where the importance of this deal for South Africa was strongly underlined:

A major new strategic industry, with

incalculable benefits to South Africa in diverse fields, could result from a feasibility study by the Uranium Enrichment Corporation and overseas concerns into the possibility of large-scale commercial uranium enrichment in this country. If the study yields positive results, it will put South Africa into the forefront of energy production in an increasingly energy-hungry world; it will add directly and significantly to this country's export earnings, and it will spin off into non-nuclear industry by creating a bigger demand for highly sophisticated local technology, which in turn will put this sector of the South African economy into a more favourable export position.¹⁵

The arguments by the Bonn government that it was not involved in the deal between STEAG and UCOR sound somewhat hollow when one looks at the ownership patterns of STEAG.¹⁶

Figure 1. Ownership pattern of the STEAG



STEAG
90%
Hes

The figure clearly shows that although STEAG is in the final analysis in the hands of big private corporations through Ruhrkohle, the Federal Government still has a considerably say in its decision-making through various state-controlled corporations which have shares in STEAG. The Gesellschaft für Kernforschung, which has also shown interest in cooperating with South Africans, is 90 per cent in Federal control. Against this background the claims by the Bonn government are not entirely credible. It should be also mentioned that the Chairman of the Board of STEAG has been Gerhard Stoltenberg, a prominent Christian Democratic politician.¹⁷

17 FRG
firms involved

STEAG has not been the only West German firm which has become involved in the South African nuclear business. It is illuminating to note that a majority of West German firms, which are active in the nuclear sector, have subsidiaries in South Africa; in 1973 the number of these subsidiaries amounted to seventeen.¹⁸ It has been also claimed that MAN, a Nürnberg-based machinery manufacturer, has exported compressors to be used in the South African nuclear enrichment plant. MAN has flatly denied these accusations and stated that these compressors have been delivered to conventional power plants. The fact remains, however, that these types of compressors can also be used in nuclear plants and that MAN has delivered similar compressors to Karlsruhe precisely for that purpose.¹⁹

Names

Other West German firms operating in the nuclear field in South Africa include Uranerzbergbau GmbH & Co. KG which is largely controlled by RWE AG which in turn owns shares, through Gesellschaft für Energibeteiligung mbH, Urangesellschaft mbH & Co. KG has imported uranium from Rössing mines in Namibia which are controlled by Rio Tinto-Zinc. STEAG controls one-third of the shares of Urangesellschaft as does also VEBA AG which has in turn control in STEAG through Ruhrkohle and more indirectly also through the Gelsenberg-Ruhrkohle link. Nukem (= Nukleare Chemie und Metallurgie), which is partly owned by RWE, has participated in the construction of the equipment of the Rössing mines.²⁰ These pieces of information strongly indicate that there is a group of

West German corporations, affiliated in one way or another with STEAG, that have activities in the South African nuclear sector. Thus the question is of no accidental cooperation but of deliberate policy of a certain group of corporations.

The contract between STEAG and UCOR had also some implications for the domestic policy in West Germany. The documents, published during the autumn of 1975, by the African National Congress, showed, among other more important things, that Lt. Gen. Günther Rall, who was the West German representative to the NATO Military Committee, had made a secret trip to South Africa and had visited the nuclear research center at Pelindaba. After this incident became known Mr. Leber, West German Defense Minister, had to order the retirement of Rall.²¹

The precise character of the South African enrichment process was secret for quite a while. According to an American expert the South African process means that 'a high-speed stream of gas, a mixture of uranium hexafluoride and hydrogen flows along a path that allows centrifugal force to separate the heavier uranium-238 from the fissionable uranium-235'. This method is essentially similar to the jet-nozzle process which West Germans have developed at the Karlsruhe Atomic Energy Research Institute, the only major difference being that it consumes less energy.²² This similarity is no coincidence but was probably largely due to the two-way flow of researchers and engineers between Karlsruhe and Pelindaba. This flow provided 1200 odd South African researchers and engineers participating in the enrichment project technical expertise which helped them to develop their own enrichment process which, in the final analysis, leans heavily on West German know-how. This point can be argued by referring to the fact that still in 1973 UCOR had to obtain a license from STEAG for its enrichment process. If the South African process had been completely indigenous no license would have been needed.²³

On the basis of this information it seems to be justified to conclude that West German support gave rise to the South African enrichment capability and once the method was further developed STEAG came into the picture and then helped in solving some

of the remaining technical bottlenecks and in estimating the costs of the commercial use of the enrichment process. This mostly took place through the exchange of experts between STEAG and the South African Atomic Energy Board whose relations have been characterized as 'pretty close for a while'.²⁴ It seems to be confirmed that South Africa could hardly have produced that advanced enrichment method in that brief time without the support of West German business interests and technical expertise. The facts taken up so far also indicate that business interests, i.e. the struggle for markets, have been the main determinant in West German-South African nuclear deals if the situation is looked upon from the West German perspective. Thus the question is more of salesmanship than of statesmanship, as one author has described the present situation in the international nuclear trade.²⁵

By the aid of West German know-how South Africans were able to complete their enrichment plant at Valindaba in 1976 — the contract between STEAG and UCOR ran out on 31 March 1976. A much bigger plant is, however, under planning and it is assumed to be ready by the middle of the 1980s. The capacity of the plant is predicted to be half of that projected for a plant to be built by the French-led Eurodif consortium.²⁶

Several economic motives can be found for the activities of West German firms in the South African nuclear enrichment business. Economic explanations can be drawn from two different levels. At the level of firms one relatively powerful explanation of West German interests in the collaboration with South Africa is the fact that in this way they were able to extend their nozzle enrichment technology to a new country whose own efforts had resulted in a somewhat similar solution. It is to be noted that the nozzle technology had not been applied on a commercial scale in any country, not even in West Germany. Urenco, in which West Germany, the Netherlands and the United Kingdom are members, opted for the centrifuge separation process. From this perspective it is logical that STEAG concluded an agreement with South Africa, because it could ensure that if its nozzle process did not result in commercial applications, in West Germany, it could still

participate in a relatively similar enrichment process in South Africa whose enrichment technology is furthermore assumed to be more economical than the West German nozzle method. Related motives probably prevailed also in the nuclear deal between West Germany and Brazil, originally concluded in 1975, which contained the delivery of the jet-nozzle enrichment method as a part of the complete nuclear fuel cycle.

In other words the aim was to create a stable basis for the delivery of the enrichment technology controlled by STEAG and other firms. In the case of the deal with Brazil (Kraftwerkunion (KWU)), which is a joint venture of Siemens and AEG-Telefunken, committed itself to provide reactors, while STEAG was responsible for the delivery of enrichment technology. Following the same procedure KWU was willing to sell reactors also to South Africa,²⁷ but as we shall see later on this plan collapsed. In other words there seems to be a nuclear lobby in West Germany which seeks possibilities of marketing their products abroad, not caring very much about the purposes for which they are used.

It is, however, possible to find several factors which indicate that in the West German end of the link the question is not only of private economic motives, although they are probably dominant ones. Private firms cannot act without at least the implicit approval of their governments in as delicate a matter as the trade of nuclear equipment with South Africa. That is why one should also seek for political and military motives. Their existence is in fact indicated by the example of relations between West Germany and Australia. When the Prime Minister of Australia, Gough Whitlam, visited Bonn in early 1975, he took up the idea that the countries should start cooperating in the nuclear sector so that the West German technology would be exchanged for Australian raw materials. The Bonn government did not feel, however, sufficient interest in this suggestion.²⁸

One apparent motive for the West German willingness to provide South Africa with enrichment technology and expertise is the possibility of satisfying the uranium needs of its nuclear industry. The Federal Republic gets 40 per cent of its natural uranium from South Africa. Export of enrichment expertise

competition

Economic motives

see from AEG Telefunken

other motives

(see) FRG uranium needs

can be seen as a vehicle in guaranteeing further supplies of uranium from South Africa.²⁹

As Australia possesses, however, considerable uranium reserves, greater than South Africa, it may be concluded that the availability of uranium is not the motive for West German collaboration with South Africa, although it may well complement other motives. In fact the provision of enrichment knowledge and technology to South Africa can be seen in the context of other deals involving military technology. Arms transfers from the Federal Republic to South Africa have been relatively modest if compared with major suppliers to South Africa, viz. France, the United States, the United Kingdom and even Italy. Instead, the Federal Republic is more eager to sell military and military-related technology. This is especially evident in the provision of electronics which is essential to the development of a 'modern' army. Both Siemens and AEG-Telefunken are heavily involved in the supply of components to the Project Advokaat which is an advanced military communications system to improve the defense of the Cape route.³⁰ As will be seen later, Siemens and AEG-Telefunken tried to obtain through Kraftwerkunion orders from South Africa for their nuclear reactors.

All this indicates that the supply of enrichment knowledge and technology to South Africa is only a part of West German supplies of military-related technology to that country, and from this perspective not so surprising. Military-related support to South Africa is in turn related to the strategic interests of the West, in the Cape route and consequently in South Africa in particular. This interest has been shared by most NATO countries, West Germany among them. It may be even argued that the Cape route is more important to Western Europe than to the United States, because West Europeans are more dependent on this route for their oil supplies from the Persian Gulf area than the United States which has, besides a lower dependence on imported oil, several other routes to transport the oil she needs.

It is, however, almost impossible to indicate conclusively that political, i.e. the preservation of South Africa as a pro-Western fortification, and military, i.e. the defense

of the Cape route, motives have determined the provision of West German enrichment technology to South Africa. It can be stated, however, that these motives have had a certain, although perhaps a modest role in the nuclear collaboration between West Germany and South Africa.³¹ In fact private economic motives and longer-term political and military interests coincide to a large extent in relations between these two countries. This tendency is, on the other hand, made controversial because of increasing international and national constraints related to cooperation with the racist government of South Africa.

4. The U.S. connection

The United States has been involved in the South African nuclear business at least since 1952 when the first uranium plant was opened under a tripartite British-U.S.-South African agreement. At that time, the USA and Britain were the sole purchasers of South African uranium. South Africa bought her first nuclear reactor, Safari I, from the United States in the early 1960s. It was installed with the aid of the U.S. corporation Allis Chalmers. South African nuclear scientists were sent to the U.S. Atomic Energy Commission laboratory at Oak Ridge for training.³² In 1974 the Oak Ridge-based U.S. Nuclear Corporation exported 45 kilograms of enriched uranium to a research reactor in South Africa. The uranium delivered was highly enriched which is especially amenable for use in nuclear weapons. The Nuclear Regulatory Commission (NRC), which is the only U.S. body able to grant licenses for the exportation of nuclear material, approved the sale only after South Africa agreed to IAEA safeguards that prohibit the diversion of uranium out of the research reactor.³³ The United States has also provided enriched uranium to South Africa in 1975 and 1976 (and in fact already in the 1960s). All these deliveries have been safeguarded. It is also maintained that the United States has promised to sell enriched uranium to the two French-American nuclear power plants (see below) during the period 1981-84. In all the United States has sold or is committed to selling 300 pounds of weapon-grade uranium, of

Military motives

U.S. Arms

U.S. Govt

Siemens & AEG-Telefunken

which is atomic bombs could be produced, to the South African research reactor.³⁴

U.S. support for the South African uranium enrichment plant has taken place so that an American corporation Forboro Co. sold in 1973 to Pelindaba two large computers which have no doubt been of great help, because South Africa has no indigenous capacity in that field. Project Hous-ton, as the deal was called, took originally place almost secretly, although the intelligence community was aware of it.³⁵ U.S. support has been in fact indispensable to the South African nuclear programme, because it could not have obtained highly enriched uranium from any other source than the United States, and it might have been difficult to buy the kind of computers needed elsewhere.

A.J.A. Roux, Chairman of the South African Atomic Energy Board, probably had good reason to say in October 1976, in a seminar at Johannesburg: 'We have advanced so far thanks to the aid and training which the United States kindly provided us during the first years of our nuclear programme'³⁶ This statement refers to the fact that the U.S. aid was most visible in the construction of South Africa's first research reactor.

5. The French connection

It has already been noted above that international competition in the reactor market is becoming stronger. The case of the delivery of two power reactors to South Africa is a good illustration of this tendency. This deal is related to the construction of two nuclear power plants, to the so-called Kroeber project, to be completed in 1982-83. As Vorster stated in 1970 South Africa was, however, in dire need of financial and technical assistance to be able to realize her nuclear power programme. West German firms had come to her aid in the field of enrichment, and a deal had to be concluded on the reactor side.

In May 1975 it became apparent that three consortia were willing to supply reactors to South African nuclear power plants, namely — a consortium consisting of General Electric (USA), Rijn-Schelde-Verolme, Verenigde Bedrijven Bredero, Ingenieursbureau Comprimio (Netherlands), and Brown-

Boverij International Corporation (Switzerland).

— West German Kraftwerkunion, and

— French Framatome which is an association of the Creusot-Loire group and Westinghouse.

Fierce competition between these groups of firms followed. General Electric applied for the Nuclear Regulatory Commission licenses to sell two big nuclear power plants to South Africa; their total value was estimated at two billion dollars. The deal, which would have been safeguarded by the IAEA, would have also included the transfer of enriched uranium for these reactors. These two reactors would have produced 1000 megawatts of electricity each. According to one estimate nuclear power plants of this size annually produce 453 kilograms of plutonium which, in turn, would have made possible to construct in principle tens of atomic bombs. In the Federal Republic the Kraftwerkunion urged the Bonn government to guarantee the export contract sought.

These efforts came to nothing, however, and the reactor deal was finally concluded with Framatome. As mentioned above it was controlled by Westinghouse (45 per cent) and Creusot-Loire (55 per cent), and is licensed by Westinghouse to make pressurized water reactors (PRWs). Nowadays the share of Westinghouse in this company has been declining. The role of Framatome in the nuclear market has been somewhat ambiguous; on one hand it is a right arm of Westinghouse, in particular in Europe, while in some countries — like Spain, Libya and Iran, it has in fact competed with the U.S. mother firm. This competition has not been too severe, at least not in the South African case, because the United States is committed to provide enrichment services for the two South African power reactors up to a maximum capacity of 2000 megawatts, regardless of which nation supplies them. The deal between Framatome and South Africa was concluded in August 1976.³⁷

In this connection a highly justified question is why South Africa selected France as her partner for nuclear cooperation. Activities of West German and American firms in the South African nuclear business would have given grounds to predict that

competition

note US Ex Im agreement

Framatome

never get the

①

one of these countries would have been opted for. The technological level of development of the field in these countries would also have influenced in the same direction. Political considerations may explain at least a part of the situation. Both in West Germany and in the Netherlands, whose firms participated in a consortium with Swiss and U.S. companies, there were strong voices in the anti-apartheid groups and in the church circles against nuclear collaboration with South Africa. During the spring of 1976 also leading political circles in West Germany and in the Netherlands showed cooler attitudes towards the apartheid policy than before.³⁸ This tendency naturally did not satisfy South Africans, and when France has normally been indifferent as to the apartheid policy, and has willingly sold arms and other valuables to South Africa, the deal was concluded with Framatome which at the same time guaranteed the availability of American technological knowledge via Westinghouse as well as enriched uranium.

The case of South Africa clearly indicates that unilateral decisions not to sell nuclear facilities do not help very much in the prevention of nuclear proliferation. If one government makes a decision to this end there are other governments which allow their firms to export these facilities. The question is of salesmanship rather than of statesmanship. That is why multilateral control mechanisms are needed, and this is in fact the direction in which major nuclear exporters are now striving.

6. South African motives

Earlier I have already considered the relative weight of economic, political and military motives in the West German participation in the South African nuclear business. It was concluded that private economic motives seemed to prevail, although also political and military motives contributing largely to the same end also exist. The same conclusion can be extended also to the United States which has acted on the basis of a mixture of private and public motives. What is then the situation in South Africa, is it going to build up a nuclear device or is the question simply of economic

motives and hence of the peaceful use of nuclear energy?

There is no accurate knowledge of the present status of South Africa in the field of nuclear armament. It is, however, evident that she has full technical capacity to develop nuclear weapons if she so wishes. There is enough enriched uranium available, due to the U.S. exports during the past years and gradually also to local enrichment activities. The pilot plant at Valindaba is not subject to international or bilateral safeguards, and hence the diversion to military uses would not face serious problems, in particular when this sort of pilot plant can usually produce weapon-grade uranium.³⁹ This state of affairs is concordant with the point made by Frank Barnaby that perhaps too much attention is paid to large-scale enrichment and reprocessing facilities in discussions concerning prospects for the proliferation of nuclear weapons because they can be also manufactured by the aid of small-scale research reactors and pilot enrichment facilities.⁴⁰

There are several authoritative views emphasizing the South African potentiality to acquire nuclear weapons. The Vice-President of the South African Atomic Energy Board stated after the Indian explosion in May 1974 that South Africa had the capacity of making a bomb and was in fact technologically more advanced than India in the nuclear field. In the same connection Dr. Alberts emphasized that South Africa, with one-quarter of the uranium resources of the non-socialist world, was in a bargaining position equal to that of any Arab country with a lot of oil, in terms of the world energy crisis. In 1975 Prime Minister Vorster stated in an interview that his country already had the technological prerequisites to produce nuclear devices.⁴¹

There are even views that South Africa may already have nuclear weapons in her possession. More frequent are statements that although technological prerequisites exist, it will take, at maximum four more years to construct a bomb. It is also maintained that this period could be easily reduced to two years, and in austere conditions, to some months.⁴² All this means that the capability to construct a nuclear device clearly exists, but what about intentions: is South Africa going to become a nuclear-

See Tel.
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weapon power of any importance? If one looks at possible constraints in South Africa's way towards a nuclear-weapon power the first factor worth bearing in mind are the IAEA safeguards and their possible role in preventing South Africa from becoming a nuclear-weapon power.

As has been pointed out above the United States has required the introduction of safeguards to the provision of enriched uranium to South Africa. It is not known to me whether safeguards are applied to the reactor deal between France and South Africa. In any case South Africa is not a party to the NPT and hence safeguards do not apply to the indigenous processes of which the uranium enrichment capacity is the most important one. Hence nobody can prevent South Africa from becoming a nuclear-weapon power if she so wishes. Even if safeguards are applied there are several ways of becoming a nuclear-weapon power:⁴³

— there are deficiencies in the control of the safeguards; it may be noted that the control of reactors is easier than the control of enrichment plants and reprocessing plants.

— countries can give up the safeguard system if they consider it undesirable or too restrictive. No punishments follow from this sort of move.

— some countries are in a better position than others to circumvent existing safeguard methods: 'A country with uranium reserves and an enrichment capability designed for the export of enriched fuel would have ample capability to acquire a stockpile of highly enriched uranium for possible use in nuclear weapons. More than enough highly enriched uranium for large nuclear weapon stockpile would be overtly carried in export inventories'.⁴⁴

These factors make that the NPT regime contains loopholes which should be blocked up somehow. A study group has arrived at the following conclusion:

it has become apparent that in addition to the NPT, a 'second track' is needed to take care particularly of the nonmembership of France (a current supplier) and of the non-NPT countries developing nuclear power, such as Argentina and Brazil, India and Pakistan, Israel and Egypt, South Africa and Spain. As a result of this situation there are gaps in the non-

weapons commitments and the safeguards coverage of the NPT regime. While specific equipment and materials acquired by the non-NPT states from member states are subject to IAEA safeguards, those that are indigenously constructed, or received from a non-NPT supplier state, may not be safeguarded.⁴⁵

These serious problems are considered at present in many different connections. I am not going to dwell upon them, however, but conclude simply that the existing safeguard arrangements do not necessarily prevent South Africa from becoming a nuclear power.

At first glance it might appear natural to conclude that the Vorster government has good political and military reasons for acquiring nuclear weapons and strengthening its position in that way. Government changes in Angola and Mozambique, increasing demands of independence for Namibia and the oscillating position of Rhodesia could be expected to contribute to the nuclearization of South Africa. This is no doubt true, but there are also other relevant arguments which lead to somewhat contrary conclusions. First, nuclear weapons cannot be easily used in guerilla warfare and in urban fighting as a kind of counterinsurgency weapon. Nuclear weapons would not remove the most immediate threat to the Vorster government for the simple reason that they are difficult to use in guerilla warfare. Furthermore, it should be borne in mind that South Africa has a conspicuous superiority in conventional armaments to the Black African states south of Sahara, and hence the marginal military utility of nuclear weapons would be negligible, at least if the present situation will persist.

There are, however, other arguments. First, it is entirely conceivable that nuclear weapons could be used as an instrument of blackmail vis-a-vis some Black African countries and indirectly even vis-a-vis the United States in diplomatic and related negotiations. One should also recall that South African nuclear weapons might conceivably have a role in the overall Western strategy, especially in the defense of the Cape route.

There are thus both pros and cons in the military utility of nuclear weapons in South Africa. The situation with economic motives

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 (1) W seems to be much more clear-cut. One of the economic factors is simply the increase in the degree of processing the uranium, the reserves of which are not, after all, endless in South Africa. By increasing the degree of processing there are better opportunities to enter the world market in which there is still a considerable measure of monopoly which can be weakened by using indigenous enrichment capacity as a springboard. Access to the world market would increase South Africa's export earnings. Estimates of these extra earnings differ, however, considerably from each other. Newsweek states that the uranium-enrichment business could yield South Africa 1000 million dollars a year in export revenues, while Gillette gives a much more modest figure of 375 million dollars.⁴⁶

(2) An additional economic factor involved in the development of nuclear power in South Africa is that the electricity supplies of the country could be guaranteed more easily by nuclear power than by importing oil or trying to extract oil from the coal. Energy considerations may also play a role in South Africa's vigorous development of nuclear power programmes.

(3) In any case, South Africa has a capacity to become a nuclear-weapon power if she so chooses, and even during a relatively brief time span. Economic motives appear to be strong both in the supplier and receiver ends of the link. The development of nuclear weapons as a by-product of the application of nuclear power for peaceful purposes is not, however, hampered by that fact. There are in fact very few contradictions in the development of both military and civilian nuclear capacity, but they can be brought about also simultaneously, although to serve somewhat different aims.

7. Is the South African bomb a necessity?

In the present atmosphere of international relations it is only natural that the South African nuclear programme and its implications for the capability to construct a bomb have resulted in strong critical voices which have been naturally enough directed also to the countries and companies which have assisted her to implement these plans. At the non-governmental level anti-apartheid

groups and progressive church circles in various countries have been mostly responsible for these critical activities. One should not either forget the role of the information disseminated by the African National Congress on the military collaboration of some Western governments with South African racist regime.

United Nations has been also concerned with South African plans to acquire nuclear weapons. The General Assembly adopted in its 31st session in December 1976 a resolution in which it was stated the concern that

further development of South Africa's military and nuclear-weapon potential would frustrate efforts to establish nuclear-weapon-free zones in Africa and elsewhere as an effective means for preventing the proliferation, both horizontal and vertical, of nuclear weapons and for contributing to the elimination of the danger of nuclear holocaust.⁴⁷

This resolution deals only with the implications of South African nuclear-weapon potential for nuclear-weapon-free zones and is phrased in a fairly moderate tone compared with the a resolution from The Fifth Conference of Heads of State or Government of Non-Aligned Countries at Colombo in August 1976:

The Conference was particularly concerned at the growing nuclear and military collaboration of certain Governments with the Apartheid regime. It condemned the deal recently concluded by the French Government to provide nuclear reactors to South Africa. It denounced with equal force any form of agreement providing military equipment to that regime, and in this connection noted, in particular, the recent decision by France to sell submarines, and by Israel to sell missile-equipped corvettes to South Africa. The Conference called upon the United Nations Security Council to impose a mandatory arms embargo against South Africa. Further the Conference called upon member states to separately and collectively impose such sanctions including an oil embargo against France and Israel for persistently violating United Nations General Assembly Resolutions against the supply of arms to South African Apartheid regime.⁴⁸

There are naturally several means by which great and middle powers can try to prevent the proliferation of nuclear weapons in the periphery. These means do not confine to sticks only — e.g. embargoes —

but carrots may be equally well used. In the case of South Africa there are, however, factors — first of all, the almost universally condemned policy of *apartheid* of the Pretoria regime — which make that the carrot policy is difficult to apply. In other words the policy of pressuring South Africa, both in the nuclear and *apartheid* issues, is the only feasible way of trying to prevent

South Africa becoming a nuclear-weapon power.⁴⁹ After all South Africa is so dependent on the technology and investments of major Western powers that their pressure, if they want to apply it, is bound to be at least modestly effective. This conclusion is especially relevant in the case of the policy of the U.S. Government vis-a-vis South Africa.

NOTES:

1. Sverre Lodgaard, Reviewing the Non-Proliferation Treaty: Status and Prospects. *Instant Research on Peace and Violence* 1, 1975, pp. 7—23.
2. See, e.g., P. Boskma, Uranium Enrichment Technologies and the Demand for Enriched Uranium, in Bhupendra Jasani (ed.), *Nuclear Proliferation Problems*. SIPRI, Uppsala 1974, pp. 56—69, and Ole Pedersen, Developments in the Uranium Enrichment Industry. *International Atomic Energy Agency Bulletin* 1, 1977, pp. 40—52.
3. See in particular Barry M. Casper, Laser Enrichment: A New Path to Proliferation. *Bulletin of Atomic Scientists* 1, 1977, pp. 28—41. Information on the laser technique was publicly available already in early 1975, see Walter Sullivan, New Laser Technique Seen Simplifying Nuclear Process. *International Herald Tribune*, April 25, 1975. Sullivan mentions that the new technique has also been achieved by scientists in the Soviet Union.
4. See Facts on Nuclear Proliferation. A Handbook. Prepared for the Committee on Government Operations. United States Senate, Washington, D.C. 1975, pp. 79 and 99, and UN Chronicle 11, 1976, p. 62.
5. James Cameron & Maurice Hansen, Uranium Resources and Supply. *International Atomic Energy Agency Bulletin* 1, 1976, pp. 12—18.
6. See Uranium Resources: Key to Expanded Nuclear Energy, OECD Observer No. 67, 1973, pp. 14—15.
7. The Uranium Dilemma: Why Prices Mushroom? *Business Week*, November 1, 1976, pp. 90—91, and Plausch im Klub. *Der Spiegel*, September 6, 1976, p. 128.
8. See Mason Willrich & Philip Marston, Prospects for a Uranium Cartel. *Orbis* 1, 1975, pp. 166—84.
9. For a more thorough analysis of this tendency see Paul Joskow, The International Nuclear Industry Today. The End of the American Monopoly. *Foreign Affairs* 4, 1976, pp. 788—803.
10. See, e.g., Aldo Cassuto, Can Uranium Enrichment Enrich South Africa? *World Today* 10, 1970, pp. 419—27, and The Near-Nuclear Countries and the NPT. SIPRI, Uppsala 1972, pp. 32—33.
11. Imperialist Military Collaboration with South Africa. *World Peace Council*. Helsinki 1975, pp. 32—34.
12. Ibid., p. 34, and Mike Muller, The Enrichment Politics of South Africa's Uranium. *New Scientist*, May 2, 1974, p. 253.
13. See Jens Klopp et al., Verdeckter Rüstungstransfer. Beiträge der BRD zur militärischen Stärkung der Republik Südafrika (II). *Blätter für deutsche und internationale Politik* 8, 1976, pp. 931—32, and Imperialist Military Collaboration... op.cit. 1975, pp. 35—36.
14. Muller op.cit. 1974, p. 252, and Murray Seeger, Trial Testimony in South Africa Indicates West German A-Link. *International Herald Tribune*, November 26, 1975.
15. Tony van der Watt, Nuclear Field Study Puts SA in World Leader Class, *The Star* (Johannesburg), June 8, 1974. Dr. Peter Lock from Hamburg has kindly provided me with this as well as other material.
16. The figure is adapted from Klopp et al. (II) ... op.cit. 1976, p. 930.
17. See, e.g., Alfred Babing, BRD-Südafrika — imperialistische Bündnispolitik und Monopolintressen. *IPW-Berichte* 2, 1976, pp. 46—47, and *Handelsblatt*, October 15, 1975, quoted by Babing.
18. See Imperialist Military... op.cit. 1975, pp. 16—18.
19. Nicholas Colchester, Bonn Denies South-African Nuclear Deal. *Financial Times*, September 27, 1975, and Kontroverse um nukleare Zusammenarbeit mit Südafrika. *EPD-Entwicklungspolitik* 3, 1977, p. 1. In this connection it may be interesting to note that the Supplies Division of the Bundeswehr furnishes NATO codification numbers for the MAN deliveries; see Press Release. *Anti-Apartheid Bewegung*. Bonn, March 18, 1977, p. 2.
20. Klopp et al. (II) ... op.cit. 1976, pp. 936—38.
21. Seeger op.cit. 1975 and Colchester op.cit. 1975.
22. See Robert Gillette, Uranium Enrichment: With Help, South Africa is Progressing. *Science*, No. 4193, June 13, 1975, pp. 1090—91.
23. E.g. Klopp et al. (II) ... op.cit. 1976, pp. 932—34.
24. Gillette op.cit. 1975, p. 1091.
25. See Walter, Patterson, Exporting Armageddon. *New Statesman*, August 27, 1976, p. 264.
26. See South Africa Reveals New Uranium Process. *Newsweek*, May 5, 1975, p. 46, and Joining the Nuclear Club. *Newsweek*, February 21, 1977, p. 7.
27. Klopp et al. (II) ... op.cit. 1976, pp. 937—38.
28. For further details see Hans Detlef Lass, Warum Brasilien und Südafrika, warum nicht Australien? Ein unbeachtetes Kapitel deutscher Nuklearpolitik 1975. *Teknologie und Politik*, No. 4 (March 1976), pp. 83—85.
29. Klopp et al. (II) ... op.cit. 1976, p. 939. One should also note that the United Kingdom Atomic Authority concluded in 1971 a deal with Riofinex, a subsidiary of Rio Tinto Zinc, to supply Britain with 7500 tons of uranium ore between 1973 and 1980 from the Rössing mine in Namibia; see Defense and Aid Fund Information (London), January-June 1971, p. 457.
30. See Imperialist Military... op.cit. 1975, pp. 12—15 and 23—29, Signe Landgren-Bäckström, Southern Africa. The Escalation of

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- a Conflict. SIPRI, Uppsala 1976, pp. 135—47, and Jens Klopp et al. Verdeckter Rüstungs-transfer — Beiträge der BRD zur militärischen Stärkung der Republik Südafrika. Blätter für deutsche und internationale Politik 5, 1976, pp. 502—510.
31. Klopp et al. op.cit. 1976, pp. 503—504.
 32. Landgren-Bäckström op.cit. 1976, pp. 148—49. General Electric has been also involved in nuclear deals with South Africa; for instance, in 1966 it bought an undisclosed amount of South African uranium from its subsidiary for reactors it was installing outside the United States. Already in 1971 the U.S. Atomic Energy Commission named General Electric as one of the American reactor manufacturers which could tender for the nuclear power station under planning in South Africa: see General Electric — Apartheid and Business in South Africa. Corporate Information Center of the National Council of Churches. New York 1972, p. 20.
 33. Thomas O'Toole, U.S. Shipped South Africa Enough U-235 for 7 A-Bombs. International Herald Tribune, April 16, 1975.
 34. Abraham Ribicoff, A Market-Sharing Approach to the World Nuclear Sales Problem. Foreign Affairs 4, 1976, p. 765.
 35. Thomas O'Toole, U.S. Sold Two A-Computers for Secret South African Plant. International Herald Tribune, May 27, 1976.
 36. Washington Post, reprinted in Helsingin Sanomat, February 17, 1977.
 37. Seeger op.cit. 1975, Ribicoff op.cit. 1976, p. 765, Massimo di Nola, Nuclear Industry Prepares for Boom. Vision, No 41 (April 1974), pp. 45—49 (information on Framatome can be found on p. 46), and Karl Heinz Dejung & Adrien Claude Zöller, Nuclear Collaboration with South Africa: Documentation on the Reception of the Nairobi Recommendations by Western European Churches. World Council of Churches. Unit II — Justice and Service, Geneva 1976, pp. 3—4.
 38. See, e.g., Dejung & Zöller op.cit. 1976.
 39. See the interview with Rudolf Rometsch, General Inspector of the IAEA, Plutonium-Verluste gibt es immer. Der Spiegel, December 20, 1976, pp. 30—34. See also Joining the Nuclear Club. Newsweek, February 21, 1977, p. 7.
 40. See Frank Barnaby, Can Nuclear-Weapon Proliferation Be Prevented? Bulletin of Peace Proposals 1, 1977, pp. 7—14.
 41. See Dejung & Zöller op.cit. 1976, 25 pp., Helsingin Sanomat, June 1, 1976, Washington Post, reprinted in Helsingin Sanomat, May 17, 1976, and Helsingin Sanomat, February 17, 1977.
 42. See Landgren-Bäckström op.cit. 1976, p. 148, and William Epstein, The Last Chance. Nuclear Proliferation and Arms Control. New York 1976, pp. 236—37.
 43. For some general comments on the IAEA safeguards see Sverre Lodgaard, International Nuclear Commerce: Structures, Trends, and Proliferation Potentials. Bulletin of Peace Proposals 1, 1977, pp. 21—22. A similar constructive but critical attitude is adopted, for example, by Richard K. Betts, Paranoias, Pygmies, Pariahs and Nonproliferation. Foreign Policy, No. 26 (1977), pp. 174—75.
 44. The quotation is from Mason Willrich, Nuclear Power Development and Nuclear Weapon Proliferation, Anne Marks (ed.), NPT: Paradoxes and Problems. Washington, D.C. 1975, pp. 63—64.
 45. International Plutonium Managements and Non-Proliferation Strategy. Arms Limitation and Disarmament. Seventeenth Strategy for Peace Conference Report. The Stanley Foundation. Warrenton 1976, p. 35.
 46. Newsweek, May 5, 1976, p. 46, and Gillette op.cit. 1975, p. 1091.
 47. See Implementation of the Declaration on the Denuclearization of Africa. Report of the First Committee. United Nations, General Assembly, A/31/379, 7 December 1976.
 48. See Resolution on South Africa. The documents of the Colombo Conference have been published, for instance, in Review of International Affairs (Beograd), No. 634 (September 5, 1976), p. 24.
 49. A similar conclusion is offered, although on somewhat different grounds, by Betts op.cit. 1977. p. 183.