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IMPLEMENTATION OF THE DECLARATION ON THE DENUCLEARIZATION OF AFRICA

Report of the Secretary-General

1. By resolution 34/76 B of 11 December 1979, the General Assembly, inter alia, requested the Secretary-General to prepare, with the assistance of appropriate experts, a comprehensive report on South Africa's plan and capability in the nuclear field and to submit the report to the Assembly at its thirty-fifth session.

2. Pursuant to that resolution, the Secretary-General appointed a Group of Experts on South Africa's Plan and Capability in the Nuclear Field, which met at Headquarters in New York from 25 to 29 February and from 28 July to 8 August 1980. By a letter dated 8 August 1980, the Chairman of the Group of Experts transmitted to the Secretary-General the report which is hereby submitted to the General Assembly.

* A/35/150.

ANNEX

Report of the Group of Experts on South Africa's
Plan and Capability in the Nuclear Field

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Foreword by the Secretary-General

1. The attached report, which is submitted to the General Assembly for consideration at its thirty-fifth session, was prepared by the Group of Experts on South Africa's Plan and Capability in the Nuclear Field, which was appointed by the Secretary-General to assist in the preparation of a comprehensive report on that matter, in accordance with Assembly resolution 34/76 B of 11 December 1979.
2. The Group of Experts, appointed after consultations with Member States, held two sessions, from 25 to 29 February and from 28 July to 8 August 1980, at United Nations Headquarters in New York.
3. The subject matter falls within the context of the denuclearization of Africa, which has been the subject of continuous and active concern in the United Nations since 1961, through General Assembly resolutions calling for the implementation of the Declaration on the Denuclearization of Africa. ^{1/} In 1977 the international community became increasingly alarmed at reports of the construction of a possible nuclear test site by South Africa in the Kalahari Desert. At that time, the Assembly in resolution 32/81 of 12 December 1977, demanded that South Africa refrain from conducting any nuclear explosion on the continent of Africa or elsewhere. In September 1979, reports of an alleged nuclear detonation in the area of the Indian Ocean and South Africa caused more concern, and at the request of the Assembly the Secretary-General reported on the question and conveyed to the Assembly information provided by the States concerned (A/34/674 and Add.1 and 2).
4. Having taken note of that report, the General Assembly, in resolution 34/76 B, requested the Secretary-General to follow the situation closely and to prepare, with the assistance of appropriate experts, a comprehensive report on the question of South Africa's nuclear plan and capability.
5. The Secretary-General wishes to thank the experts for their unanimously adopted report, which he hereby submits to the General Assembly for its consideration. It should be noted that the observations and recommendations contained in the report are those of the experts. In this connexion, the Secretary-General would like to point out that, in the complex field of disarmament matters, in many instances he is not in a position to pass judgement on all aspects of the work accomplished by experts.

^{1/} Official Records of the General Assembly, Twentieth Session, Annexes,
agenda item 105, document A/5975.

I. INTRODUCTION: CONTEXT OF THE STUDY

A. United Nations concern with South Africa's policy of apartheid and with nuclear non-proliferation in Africa

1. Prepared at the request of the General Assembly in resolution 34/76 B, this report on South Africa's plan and capability in the nuclear field is a result of the deep and continuing concern of the United Nations with South Africa's policy of apartheid, its nuclear activities and nuclear non-proliferation in Africa.
2. That concern, which has been repeatedly expressed by the General Assembly over the years, stems from the situation in South Africa resulting from the policies and actions of the apartheid régime, in particular its efforts to consolidate and perpetuate racist domination in the country, its repression of opponents of apartheid, and its repeated hostile acts against neighbouring States. In 1962, the General Assembly, by resolution 1761 (XVII) of 6 November 1962, called on the Government of South Africa to abandon its policies of apartheid, requested Member States to boycott South African goods in order to bring about an abandonment of those policies, and established a Special Committee to keep those racial policies under review when the Assembly was not in session. At its thirty-third session, the Assembly, in resolution 33/183 of 24 January 1979, reaffirmed that apartheid constituted a crime against humanity, proclaimed its full support of the national liberation movement of South Africa and reaffirmed the commitment of the United Nations to total eradication of apartheid. And at its thirty-fourth session, in resolution 34/93 of 12 December 1979, the Assembly reiterated its previous resolution on South Africa's apartheid policies and declared that any collaboration with the racist régime and apartheid institutions was a hostile act against the purposes and principles of the United Nations and constituted a threat to international peace and security.
3. In parallel action, the General Assembly, aware of the dangers of proliferation of nuclear weapons in Africa, called for implementation of the Declaration on the Denuclearization of Africa, adopted in 1964 by the Assembly of Heads of State and Government of the Organization of African Unity and endorsed by the Assembly in resolution 2033 (XX) of 3 December 1965. It has repeatedly, since 1961, called upon all States to consider and respect the continent of Africa as a nuclear-weapon-free zone, and has called for the termination of any nuclear collaboration with South Africa. At its tenth special session, devoted to disarmament, the Assembly declared in its Final Document, in connexion with the establishment of nuclear-weapon-free zones, that in Africa, where the Organization of African Unity had affirmed a decision for the denuclearization of the region, the Security Council should take appropriate effective steps whenever necessary to prevent the frustration of that objective (resolution S-10/2, para. 63 (c)).
4. For its part, the Security Council, in resolution 134 (1960), recognized that the situation in South Africa had led to international friction and, if

continued, might endanger international peace and security; in resolution 181 (1963), being convinced that the situation in South Africa was seriously disturbing international peace and security, the Security Council called upon all States to cease the sale and shipment of arms, ammunition of all types, and military vehicles to South Africa. Then, in resolution 418 (1977), the Security Council, having considered that the policies and acts of South Africa were fraught with danger to international peace and security, imposed an arms embargo against South Africa. In the same resolution, the Security Council decided that all States should refrain from any co-operation with South Africa in the manufacture and development of nuclear weapons. In addition, the Security Council has strongly condemned South Africa's illegal occupation of Namibia, and on five occasions since 1976 it has condemned South Africa's invasion of Angola.

B. Concern about South Africa's nuclear activities

5. South Africa is thus confronted by growing international condemnation of its policy of apartheid and the prospect of eventual total international isolation in a world committed to the eradication of apartheid. It is against this background that South Africa's activities and growing capabilities in the nuclear field are of particular concern. South Africa's past assurances of interest in only the peaceful uses of nuclear energy exhibit considerable ambiguity. Although South Africa has adhered to the partial test ban treaty (Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water 2/), its leaders have repeatedly refused to sign the nuclear non-proliferation treaty (Treaty on the Non-Proliferation of Nuclear Weapons 3/). They have refused to accept safeguards on South Africa's peaceful nuclear activities (so called full-scope safeguards) or to support creation of a nuclear-weapon-free zone in Africa. This refusal to give a commitment to refrain from acquiring nuclear weapons is particularly ominous since there is no doubt that South Africa has the technical capability to make those weapons. These concerns have been greatly enhanced by both the 1977 discovery in the Kalahari Desert of what was reported to be an underground nuclear weapon test site and the detection by a United States VELA reconnaissance satellite in the area of the South Atlantic on 22 September 1979 of a double flash of light resembling the signals from an atmospheric nuclear explosion, an event which has yet to receive a scientifically indisputable explanation. The strong reactions of the world community to those two events show clearly the wide consensus about the need to deal with South Africa's nuclear capability as a very grave threat to the security of the African states and to international peace.

2/ United Nations, Treaty Series, vol. 480, No. 6964, p. 43.

3/ Ibid., vol. 729, p. 161.

II. NUCLEAR ENERGY PROFILE OF SOUTH AFRICA

A. Early history

6. South Africa's nuclear energy activities began in the closing days of the Second World War when, at the request of the United Kingdom of Great Britain and Northern Ireland, South African Prime Minister Smuts ordered a secret survey to be undertaken of his country's potential uranium resources. Steps toward production of the considerable quantities of uranium uncovered in parts of existing gold fields soon followed, including construction, and in 1949 and 1950 the initial operation of pilot plants for extracting and processing the raw uranium ore. Spurred by the incentive of guaranteed price contracts from the Combined Development Agency of the United States of America and the United Kingdom, which both needed additional and secure supplies of uranium for their expanding nuclear-weapon programmes, production of South African uranium began in 1952. By 1955, 19 mines, with 12 extraction plants, were in operation ^{4/} producing 3,000 metric tons of uranium oxide, U_3O_8 (also known as "yellowcake") per year.

7. Initially, the development of uranium production was primarily the responsibility of the Prime Minister, of several other highly placed officials and a few key agency heads, such as the Head of the newly created Council for Scientific and Industrial Research. After passage of the Atomic Energy Act of 1948, control over uranium production and export fell to the South African Atomic Energy Board, which held its first meeting on 15 March 1949. Over the next half-decade the AEB devoted most of its attention to the production of uranium and to the regulation of radio-active materials. ^{5/}

8. By the mid-1950s, however, there was evidence of increasing interest on the part of the AEB and the South African Government as a whole in more basic nuclear research. In 1954, a physics unit was created within the AEB; South Africa joined in the formation after 1954 of the International Atomic Energy Agency (IAEA); a mission was sent to the first International Conference on the Peaceful Uses of Atomic Energy, held at Geneva in 1955; and, while in Europe, that same mission investigated the possible industrial applications of nuclear energy. ^{6/} Moreover, the Council for Scientific and Industrial Research from its inception had emphasized the fundamentals of nuclear physics and research, as exemplified by its acquisition of an accelerator (cyclotron) which began operation in 1955. ^{7/}

^{4/} A. R. Newby-Fraser, Chain Reaction: Twenty Years of Nuclear Research and Development in South Africa (Pretoria: The Atomic Energy Board, 1979), pp. 22-25; and NUS Corporation, Foreign Uranium Supply (Electric Power Research Institute, EPRI EA-725, April 1978), pp. 4-4 - 4-5.

^{5/} Newby-Fraser, Chain Reaction, pp. 24-25, 30-31.

^{6/} Ibid., pp. 31-32; and Kenneth L. Adelman and Albion W. Knight, "Can South Africa Go Nuclear?", ORBIS, vol. 23, no. 3 (Fall 1979), p. 635.

^{7/} Newby-Fraser, Chain Reaction, pp. 26-29.

Similarly, in the mid-1950s, nuclear physics research was begun at the Universities of Witwatersrand and Ptchefstroom. 8/ Culminating the activity of these early years was the South African Cabinet's decision in late 1959 to approve the plans of the South African Atomic Energy Board for the creation of a National Nuclear Research Centre, eventually located at Pelindaba. 9/

B. Nuclear fuel cycle resources, activities and facilities

1. Uranium resources and mining

9. As one of the largest uranium producers in the world, South Africa historically has produced approximately 16 per cent of the market economies' uranium. Peak production in South Africa, 5,850 metric tons uranium from 26 mines, occurred in 1959; when in the 1960s the American and British demand for their weapon programmes declined, production dropped steadily. 10/ But, as the following table indicates, with increased global deployment of nuclear power plants, South African uranium production since 1975-1976 has again picked up. At the same time, the Rossing Mine in Namibia has begun operation. The production of uranium in Namibia obviously has to be seen in the context of South Africa's illegal occupation of that country.

10. Not only their production but also the South African and Namibian uranium resources constitute a significant proportion of those estimated to belong to the market economies. That most recent OECD/IAEA "redbook" projects that approximately 13 per cent and 6 per cent, respectively, of the estimated "reasonably assured" market economy resources, available at less than \$80/kg. U are in South Africa and Namibia; while 19 per cent and 2 per cent of them available at \$80-130/kg. U are so situated. In turn, the "redbook" projects that approximately 6 per cent and 2 per cent of "estimated additional resources" - a more speculative category of reserves - available at less than \$130/kg. U are located in South Africa and Namibia. 11/

11. Moreover, as table I indicates, South African control of Namibian uranium resources enhances its aggregate share of the uranium market as well as the

8/ Ibid., p. 179.

9/ Ibid., p. 42.

10/ NUS Corporation, Foreign Uranium Supply, pp. 4-1 - 4-6; and Nuclear Assurance Corporation, International Data Collection and Analysis, Task Volume 4, "South Africa", prepared for U.S. Department of Energy, April 1979, p. 22-11.

11/ Uranium: Resources Production and Demand, a Joint Report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, December 1979, pp. 18-19.

Table 1
Uranium production in South Africa and Namibia

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
	South African uranium production (in tonnes)	World total production (except USSR, Eastern Europe, China)	1 as % of 2	Internal South African consumption of uranium (in tonnes)	Uranium production in Namibia (in tonnes)	5 as % of 2
Pre-1975	70 076	428 775.2	16.3%	*	0	0
1975	2 488	19 068.1	13.0%	*	0	0
1976	2 758	22 089.8	12.0%	*	654	3.0%
1977	3 360	28 851.7	12.0%	*	2 339	8.0%
1978	3 961	33 900.1	11.7%	*	2 697	8.0%
1979 (planned)	5 195	38 379	13.5%	*	3 692	9.6%
1980 (est. attainable)	6 500	50 100	13.0%	576	4 100	8.1%
1985 (est. attainable)	10 600	98 000	10.8%	374	5 015	5.1%
1990 (est. attainable)	10 400	119 300	8.7%	374	5 015	4.2%
2000 (est. attainable)	10 000	N.A.	N.A.	N.A.	4 615	N.A.

* Little or no internal consumption.

Source: Uranium: Resources, Production and Demand, A Joint Report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency, December 1979.

potential international leverage that such a market share implies. For example, the OECD/IAEA projects that in 1985 nearly 16 per cent of the estimated attainable production capabilities in the market economies will be in southern Africa; but, of that total, Namibia is expected to have 5 per cent. To put it another way, one third of the combined total of reasonably assured resources available at less than \$80/kg. U now controlled by South Africa comes from Namibia. 12/

12. All uranium mined in South Africa itself is processed into U_3O_8 , or yellowcake, and then marketed by the Nuclear Fuels Corporation of South Africa. The Corporation is a private service company owned by those gold mining companies which produce uranium and by a set of seven major mining-finance companies. Uranium from Rossing in Namibia is marketed through the British-based transnational Rio Tinto Zinc Corporation. 13/ Because the South African Atomic Energy Act prohibits revealing the details of uranium contracts' amounts, deliveries, terms, and prices, 14/ only limited information is available on the major purchasers of South African and Namibian uranium.

13. For instance, according to a study sponsored by the Atlantic Institute for International Affairs, South Africa in the period from 1965 to 1977 supplied 27.2 per cent of the uranium imported by the Federal Republic of Germany (which has virtually no indigenous uranium resources); this study also projects that nearly 50 per cent of West German supplies from 1977 to 1986 are likely to come from uranium produced in South Africa or Namibia. 15/ Although France has relied mostly on contracts with Niger and Gabon to supplement its more substantial domestic uranium production, in 1977 the French Commissariat à l'énergie atomique entered into an agreement with Johannesburg Consolidated Industries which entailed France's provision of a \$100 million interest-free loan for gold and uranium development in exchange for 900 metric tonnes of uranium per year for 10 years at a price of \$27/lb. 16/ In turn, according to trade sources, the United Kingdom will purchase 1,300 metric tonnes of uranium per year until 1982 from the Rossing mine in Namibia, or approximately 65 per cent of current British requirements. 17/ Similarly, Taiwan is reported to have signed a contract to purchase 4,000 metric tonnes of uranium between 1984 and 1990 from South Africa. 18/ Demonstrating in

12/ Ibid., pp. 22-23.

13/ NUS Corporation, Foreign Uranium Supply, pp. 4-1, 4-7; and Nuclear Assurance Corporation, "South Africa", p. 22-21.

14/ NUS Corporation, Foreign Uranium Supply, p. 4-3.

15/ Steven J. Warnecke, Uranium, Nonproliferation and Energy Security (Paris: The Atlantic Institute for International Affairs, 1979), pp. 96-97.

16/ "France Secures Long-Term S. African Uranium Supply", Financial Times (London), 7 June 1977.

17/ Nuclear News, July 1978.

18/ World Business Weekly, 14 April 1980, p. 24.

yet another way the dependence of selected Western countries on South African-controlled uranium, it is reported that, after Canada, South Africa is the second most important supplier to the countries of the European Economic Community. 19/

14. The South African Government has formally stated that it will not allow its uranium sales to be a means for increasing the number of nuclear weapon states. 20/ None the less, irresponsible sales of processed uranium by South Africa to countries seeking nuclear weapons or losing access to other sources of uranium, for example because of violations of non-proliferation obligations, 21/ cannot be ruled out.

2. Uranium enrichment

15. According to the semi-official history of the South African Atomic Energy Board, research on the enrichment of uranium began in 1961 under the direction of Drs. A. J. A. Roux and W. L. Grant of the Board. 22/ The existence of this research was known to only a few members of the South African cabinet 23/ until 20 July 1970, when Prime Minister B. J. Vorster announced in a speech before the Parliament that South African scientists had "succeeded in developing a new process for uranium enrichment", a process he claimed was "unique in its concept". Prime Minister Vorster then went on to state that "South Africa's sole objective in the further development and application of the process would be to promote the peaceful application of nuclear energy". 24/ Funds were authorized by Parliament for the construction of a pilot enrichment plant at Valindaba, near the National Nuclear Research Centre at Pelindaba. Concomitantly, the Uranium Enrichment Corporation of South Africa (UCOR), with Drs. Roux and Grant in key positions, was created to carry on the further development and possible commercialization of South Africa's enrichment process. 25/

16. Although many of the features of what now is known as the UCOR-process of enrichment have not been publicly disclosed and, as discussed below, there are

19/ "European Parliament Worried over Dependence on South African Uranium", Nuclear Engineering International, July 1978, p. 11.

20/ George Quester, The Politics of Nuclear Proliferation (Baltimore: The Johns Hopkins University Press, 1973), p. 200.

21/ Zdenek Červenka and Barbara Rogers, The Nuclear Axis: Secret Collaboration between West Germany and South Africa (New York: Times Books, 1978), p. 153.

22/ Newby-Fraser, Chain Reaction, p. 103.

23/ Ibid., p. 91; "South Africa Stirs New Arms Flurry," New York Times, 31 August 1977.

24/ Speech to Parliament, 20 July 1970, reproduced in Newby-Fraser, Chain Reaction, pp. 92-94.

25/ Newby-Fraser, Chain Reaction, p. 103.

different views of the "uniqueness" of the process, 26/ some of its technical characteristics were described by South African scientists at international meetings in the 1970s. 27/ According to their information, the process is an aerodynamic one, similar in some of its aspects to the Becker nozzle process. However, according to the forthcoming revised edition of the standard text on enrichment processes by Professor Manson Benedict and the study of the International Nuclear Fuel Cycle Evaluation (INFCE) on enrichment availability, 28/ it warrants treatment as an independent process and not simply as a minor modification of the Becker process.

17. The distinguishing feature of this process was said in 1975 to be a separating element which, in effect, is a "high performance stationary-walled centrifuge". 29/ According to the semi-official history of the South African nuclear programme, the concept behind the process had its origins in research undertaken by Dr. Grant on the applications of vortex tubes before he joined the Atomic Energy Board. 30/ And in a 1977 presentation, 31/ the process was referred to as an "Advanced Vortex Tube Process". 32/ An equally important part of the UCOR-process was the

26/ Charges that South Africa's UCOR-process was transferred to it by individuals and semi-official organizations in the Federal Republic of Germany, and therefore is not indigenous are assessed below. See paras. 35-37.

27/ A. J. A. Roux, Chairman, and W. L. Grant, General Manager, "The South African Uranium Enrichment Project", Presentation to European Nuclear Conference, Paris, April 1975; A. J. A. Roux, W. L. Grant, R. A. Barbour, R. S. Loubser, J. J. Wannenburg, "Development and Progress of the South African Enrichment Project", Presentation to IAEA Conference on Nuclear Power and the Fuel Cycle, Salzburg, 1977, reprinted in IAEA, Nuclear Power and its Fuel Cycle, IAEA-CN-36/300, pp. 171-182; W. L. Grant, J. J. Wannenburg and P. C. Haarhoff, "The Cascade Technique for the South African Enrichment Process", Presentation to Meeting of the American Institute of Chemical Engineers, Chicago, 1 December 1976, reprinted in IChE, Symposium Series, vol. 73, no. 169, pp. 20-24.

28/ Manson Benedict, "Aerodynamic Processes", mimeo; INFCE, Enrichment Availability, Report of Working Group 2, INFCE/PC/2/2, p. 72.

29/ Roux and Grant, "The South African Uranium Enrichment Project", pp. 4-5.

30/ Newby-Fraser, Chain Reaction, pp. 95-96.

31/ Roux et al., "Development and Progress of the South African Enrichment Project", p. 173.

32/ Among the salient operating characteristics of the UCOR-process are said to be a separation factor of 1.025-1.03 (compared to 1.004 for gaseous diffusion, 1.2-1.5 for centrifuge, and 1.015 for nozzle), low material inventory and consequently short equilibrium time, high energy consumption (3,300 kwh/SWU/year) and operation at a very low cut, 0.05 (i.e., the product stream of slightly more enriched uranium consists of a very small portion - 1/20th - of the feed stream Roux and Grant, "The South African Uranium Enrichment Project", pp. 4-7; Roux et al., "Development and Progress of the South African Enrichment Project", pp. 20-21.

development of a new cascade technique to link together the separating elements through which the material flows in sequence. Called the "helikon" technique, it 33/ was not applied, however, to the pilot plant begun in April 1975. 34/

18. Construction of the pilot facility was completed by March 1977. Initial estimates at the time placed the capacity of this facility at 6 tons separative work units (SWU)/year. 35/ However, according to the official history of South Africa's nuclear programme, further development work had enabled the capacity of the prototype module to be increased to slightly more than 10 tons per annum - an improvement of about 70 per cent over the original design revealed by Dr. Roux in 1975. 36/

19. South Africa's plans originally called for the construction of a commercial enrichment facility with a capacity of 5,000 tons SWU/year to begin operation by 1984. 37/ It was estimated that an additional \$375 million per year in foreign exchange earnings would result from selling low enriched uranium rather than yellowcake. 38/ And all new South African uranium supply contracts contain a clause stipulating that if an enrichment capability exists, uranium delivered after 1986 will be delivered as enriched uranium hexafluoride, or UF₆, 39/ even though plans for a commercial facility have been shelved for financial and other reasons. Instead, the Uranium Enrichment Corporation has announced that the prototype enrichment plant is to be expanded; information provided to INFCE indicates that a total enrichment capacity of about 200-300 tons SWU/year is to be developed by 1985. 40/ In the absence of any other source of supply, less than 200 tons SWU/year

33/ Ibid.; Grant et al., "The Cascade Technique for the South African Enrichment Process", pp. 20-21.

34/ Nuclear News, May 1975.

35/ Manson Benedict, "Enrichment: A Critical Status Report", Paper presented at Meeting of American Nuclear Society, Washington, D.C., 16 November 1976, p. 5.

36/ Newby-Fraser, Chain Reaction, p. 111. That stated capacity for the prototype facility is somewhat larger than, but not inconsistent with, the estimate in the report of the International Nuclear Fuel Cycle Evaluation (INFCE) Working Group 2 on enrichment. See International Nuclear Fuel Cycle Evaluation, Enrichment Availability, Report of Working Group 2, INFCE/PC/2/2, p. 72.

37/ Roux and Grant, "The South African Uranium Enrichment Project", p. 14.

38/ Robert Gillette, "Uranium Enrichment: With Help South Africa is Progressing", Science, vol. 188, 13 June 1975, p. 1091.

39/ Nuclear Assurance Corporation, "South Africa", p. 22-25.

40/ INFCE, Enrichment Availability, p. 73, p. 4, p. 6; "South Africa Becomes Self-Reliant in Fuel", Nuclear Engineering International, August 1977; and "South Africa's Pilot Enrichment Plant", Washington Post, 5 December 1978.

of that enrichment capacity would be needed to replace the possible loss of United States low enriched fuel for the two French nuclear power reactors being constructed at Koeberg 41/ (see para. 27 below). Further, statements by Foreign Minister Botha and Dr. Roux imply that some portion of the expanded Valindaba production facility would be capable of supplying high enriched uranium fuel for South Africa's SAFARI-1 research reactor, fuel also no longer available from the United States. 42/

20. Neither South Africa's pilot enrichment plant nor any laboratory facility for enrichment experiments is covered by IAEA safeguards against diversion to military uses. South Africa has stated its readiness to accept IAEA safeguards on any commercial enrichment facility; 43/ there has been no indication, however, of a comparable readiness in the case of the 200-300 tons SWU/year facility now planned.

3. Nuclear research activities

21. Started in 1959, the National Nuclear Research Centre at Pelindaba is the main governmental nuclear research organization. Pelindaba's centerpiece is a 20 megawatt (thermal) "Oak Ridge type" research reactor called SAFARI-1. It was purchased from the United States under the Atoms for Peace Program and its team of reactor operators were trained as part of that program at the Oak Ridge National Laboratory in the early 1960s. Fueled with approximately 14 kilogrammes of high enriched uranium per year, the reactor first went critical in March 1965. 44/

22. Initially, the United States supplied the necessary fuel reloads; the cooled spent fuel was sent to either the United States or the United Kingdom for reprocessing, and the value of any high enriched uranium separated from that spent fuel was used as a credit on purchases of future fuel reloads. Since 1975, however, the United States Government has refused to authorize shipments of fuel, and in 1976 it required cancellation of pre-existing contracts and the refund of South African deposits. Underlying that United States decision has been its objection to South Africa's unwillingness to sign the non-proliferation Treaty. 45/ Because of this termination of United States fuel supplies, the Atomic Energy Board has been

41/ Approximately 100 tons SWU/year will provide fuel for a 1,000 MWe nuclear power plant.

42/ "South Africa Dismisses Reports of A-Test", Washington Post, 27 October 1979; and "South Africa's Pilot Enrichment Plant", Washington Post, 5 December 1978.

43/ "South Africa Ready to Accept IAEA Safeguards on Commercial Enrichment Plant", Nuclear Engineering International, August 1977.

44/ Newby-Fraser, Chain Reaction, pp. 50-53, 62; and Červenka and Rogers, The Nuclear Axis, pp. 160-163.

45/ Newby-Fraser, Chain Reaction, p. 55; "U.S. Cancels Uranium Delivery Contract with South Africa", Financial Times (London), 6 November 1976; and "South Africans Reported Ready for Nuclear Ban", New York Times, 29 June 1978.

forced to reduce markedly the operating power of the reactor and the number of days it operates in order to stretch the existing fuel. In the absence of replacement fuel, it may become necessary to shut down SAFARI before too long. 46/

23. The SAFARI-1 reactor has been covered by IAEA safeguards since 1967 in accordance with a safeguards/transfer agreement between the IAEA, the United States, and South Africa. 47/ Three to four inspections are performed by IAEA personnel each year. Neither in the course of these inspections nor in the reprocessing of the spent high enriched uranium fuel abroad has there been any evidence that enriched uranium from SAFARI has been diverted. 48/

24. In addition, South Africa possesses an indigenously designed and constructed critical assembly, Pelinduna-Zero, also at Pelindaba. Pelinduna-Zero went critical in 1967 and was part of intensive South African research on the reactor physics and the associated technical aspects of a possible heavy-water power reactor. When financial constraints forced a choice between further research on the power reactor concept or the enrichment concept, the latter took priority and the research on the power reactor was phased out. 49/

25. Nearly 2,000 persons are employed by the Atomic Energy Board, 50/ the majority at the National Nuclear Research Centre near Pelindaba. At this Centre research is conducted on mineral exploration, minerals prospecting and mining, reactor and reactor fuel development, radiation and health physics, metallurgy, reactor safety and operation, and the application of radioisotopes in medicine, agriculture, and industry. 51/ In addition, the Council for Scientific and Industrial Research has continued its support of basic research in nuclear physics and the applications of radioisotopes. Recently, it has begun to build another particle accelerator, in this case an open sector cyclotron comparable to those that exist only in a few advanced industrial countries. 52/ Government-supported research also takes place at the university level. There is work in progress at the Universities of

46/ Newby-Fraser, Chain Reaction, p. 55.

47/ International Atomic Energy Agency, INFCIRC/66/Rev.2, 16 September 1968.

48/ "South Africa, with U.S. Aid, Near A-Bomb", Washington Post, 16 February 1977; H. Grumm, Deputy Director General, Department of Safeguards, IAEA, "IAEA Safeguards - Where Do We Stand Today?", IAEA Bulletin, vol. 21, no. 4 (August 1979), p. 37.

49/ Newby-Fraser, Chain Reaction, pp. 115-125; and Nuclear Assurance Corporation, "South Africa", p. 22-30.

50/ Adelman and Knight, "Can South Africa Go Nuclear?", p. 636.

51/ Nuclear Assurance Corporation, "South Africa", pp. 22-28.

52/ "South Africa to Build Nuclear Accelerator", Financial Times (London), 16 September 1977.

Stellenbosch, Pretoria, Potchefstroom, Cape Town and Witwatersrand on subjects ranging from nuclear medicine to the use of radioisotopes in plant biology. 53/

4. Nuclear power facilities

26. A French Consortium of Framatome, Alstom, and SPIE Batignolles is building two light-water pressurized water power reactors of 922 MWe each at Koeberg on the coast north of Cape Town. The contract for these power reactors, which will be South Africa's first, was signed in August 1976 between the French consortium and the Electricity Supply Commission of South Africa (Escom). The first reactor is to be commissioned in January 1983; the second is scheduled for a year later. Financing is being provided by the French bank Crédit Lyonnais and guaranteed by the French Government. 54/

27. Until recently it was expected that the low enriched uranium fuel for these reactors would be supplied by the United States. An enrichment services contract had been signed in 1974 between South Africa and the United States at a time when it appeared South Africa would buy the Koeberg reactors from a General Electric-led consortium. 55/ However, the commitment to sell the low enriched uranium fuel was reassessed by the Carter Administration in light of its heightened concern about nuclear non-proliferation. Throughout 1977 and into 1978 and 1979, periodic high level discussions were held in which the United States made South African accession to the non-proliferation Treaty a condition for delivering low enriched uranium fuel for Koeberg. 56/ Unwilling to accept that condition, South Africa, as noted above, apparently has decided to expand its pilot enrichment plant to supply low enriched uranium fuel for Koeberg indigenously. However, in the absence of an alternative outside supplier of enrichment services, delays in building the enrichment facility are likely to set back the scheduled operating date of Koeberg-1.

28. Trilateral safeguards agreement between IAEA, France, and South Africa for the Koeberg power station entered into force on 5 January 1977. There were two Agency visits in 1978 and 1979 to verify the progress of construction. The agreement for nuclear co-operation between France and South Africa specifically excludes the reprocessing in South Africa of spent nuclear fuel from this station, and requires that all plutonium extracted in the course of reprocessing of that fuel be stored

53/ Newby-Fraser, Chain Reaction, pp. 136ff.; and Nuclear Assurance Corporation, "South Africa", pp. 22-34.

54/ "Koeberg's Cooling Water Marine Basin Next on Agenda", Nuclear Engineering International, September 1977; Newby-Fraser, Chain Reaction, pp. 126-135; and Nuclear Assurance Corporation, "South Africa", pp. 22-8, 32-35.

55/ Newby-Fraser, Chain Reaction, p. 131.

56/ "South Africans Reported Ready for Nuclear Ban", New York Times, 29 June 1978; "U.S. Tells South Africa to Accept Atomic Curbs or Face Fuel Cutoff", New York Times, 20 December 1977.

outside South Africa in places mutually agreed upon by both countries and under Agency safeguards. 57/ What these provisions mean in practice is that, once sufficiently cooled for transport, the spent fuel will be shipped back to France for reprocessing and not left to accumulate in South Africa. 58/

29. South Africa's plans for further development of nuclear power remain uncertain. However, data provided to INFCE Working Group I on fuel and heavy-water availability project a possible expansion of nuclear generating capacity to 3,000 MWe in 1990, 4,300 to 5,600 MWe in 1995, and 4,300 to 10,000 MWe in the year 2000. These estimates may be considerably inflated. 59/

5. Other facilities

30. South Africa has neither a fuel fabrication nor a reprocessing facility. Fuel for Koeberg is to be made into fuel elements by EUROFUEL, which is a subsidiary of Pechiney-Ugine-Kuhlmann (P.U.K.), Framatome, and Westinghouse. According to Dr. Roux, South Africa, for economic reasons, has not considered fabricating its own fuel elements. 60/ Similarly, with the obligation to reprocess abroad the spent fuel from both SAFARI and Koeberg, there has been no reason for developing a reprocessing capability. (For a discussion of South Africa's capability to build a reprocessing facility as part of a nuclear-weapon programme, see paras. 43-46 below.)

C. Nuclear co-operation with other countries

1. Official co-operation

31. From its inception at the close of the Second World War, the progress and increasing sophistication of South Africa in the nuclear field have been helped at various stages by official contacts and co-operation with several countries. As already noted, both the United States and the United Kingdom provided a financial incentive and technical support for the emergence of the South African uranium mining and extraction industry. Then, in the wake of the United States Atoms for Peace initiative, in the late 1950s and early 1960s, these two countries, and especially the United States, also played a major role in training scientists from South Africa along with those of dozens of other countries. In the words of Dr. A. J. A. Roux, former President of the South African Atomic Energy Board and current Chairman of the Uranium Enrichment Corporation:

57/ Statement by IAEA Representative to the Committee of Experts; "The Text of the Agreement of 5 January 1977 between the Agency, France, and South Africa for the Application of Safeguards in Respect of the Koeberg Nuclear Power Station", IAEA, INF/CIRC/244, 23 February 1977; Newby-Fraser, Chain Reaction, p. 11.

58/ Statement by M. de Guiringaud, "France-Inter", 22 August 1977.

59/ International Nuclear Fuel Cycle Evaluation, Fuel and Heavy Water Availability, Report of Working Group I, INFCE/PC/2/1, pp. 46-47.

60/ "Talks Continuing on U. S. Uranium for South Africa", Financial Times (London), 19 July 1979.

"We can ascribe our degree of advancement today in large measure to the training and assistance so willingly provided by the United States of America during the early years of our nuclear program when several of the Western world's nations co-operated in initiating our scientists and engineers into nuclear science." 61/

32. More specifically, between 1955 and 1965, 11 South Africans, including several eventual heads of research divisions within the Atomic Energy Board and both Drs. Roux and Grant, participated along with many other foreign nationals (256) in the United States Argonne International School of Nuclear Science and Engineering or its successor, the International Institute of Nuclear Science and Engineering. 62/ At the same time, an Agreement for Nuclear Co-operation with a 50-year duration was signed in 1957, under which other South Africans were trained at Oak Ridge and the SAFARI research reactor and other research equipment were sold to South Africa. According to one source, from the inception of that Agreement to 1970, 90 South Africans received training in the United States in nuclear science, engineering, physics, safety, and associated subjects, while from 1970 to 1975 an additional four persons received training. 63/ In turn, though less precise data is available concerning the countries of Western Europe, other, if fewer, South African scientists were trained in the comparable nuclear research centres of France, the Federal Republic of Germany, and Great Britain in the 1960s. 64/

33. Official South African nuclear ties with each of the above countries have declined in the last few years. The cancellation of United States shipments of high enriched uranium fuel for SAFARI-1 is only the most visible manifestation of a drying up of those United States-South African ties in the nuclear field. The construction of the Koeberg plant and continuing French assistance in training the staff to operate these reactors 65/ constitute a significant exception to this changing pattern of official external ties. However, it has been reported both that previous limited South African access to French nuclear technology "is at an apparent standstill" 66/ and that France does not intend to sell additional power reactors to South Africa after honouring the Koeberg contract. 67/

61/ "South Africa, with U.S. Aid, Near A-Bomb", Washington Post, 16 February 1977.

62/ Difficulties in Determining if Nuclear Training of Foreigners Contributes to Weapons Proliferation, Report by the Comptroller General of the United States (Washington, D.C.: General Accounting Office 10-79-2, 23 April 1979), pp. 20-22.

63/ Congressional Research Service, Library of Congress, Nuclear Proliferation Factbook (Washington, D.C.: U. S. Government Printing Office, 1977), p. 317, p. 319.

64/ Newby-Fraser, Chain Reaction, p. 34; and Červenka and Rogers, Nuclear Axis, p. 159.

65/ Newby-Fraser, Chain Reaction, pp. 132-133.

66/ Adelman and Knight, "Can South Africa Go Nuclear?", p. 635.

67/ Červenka and Rogers, Nuclear Axis, p. 169; Richard K. Betts, "A Diplomatic Bomb for South Africa?", International Security, vol. 4, No. 2 (Fall 1979), pp. 102-103.

34. With its present developed nuclear infrastructure and a sizeable cadre of trained engineering and scientific talent, South Africa in the 1980s has become far less dependent on such external assistance. Even if it proceeds more slowly and at greater expense, there is no reason to question the country's capability to carry forward the enrichment programme at least on a reduced scale or to add additional, currently absent components to its nuclear industry, whether a fuel fabrication or reprocessing facility. 68/

2. Unofficial or unconfirmed co-operation

35. In his 1970 announcement that South African scientists had developed a unique enrichment process, Prime Minister Vorster indicated South Africa's readiness to collaborate with other countries in the further development of that process. Though discussions apparently were initiated with individuals and corporations in several countries, those with individuals and organizations in the Federal Republic of Germany were the most promising and by 1973-1974 a network of informal ties had emerged. South African scientists paid periodic visits to the laboratories of Professor Ernst Becker, the developer of the Becker nozzle enrichment process, at the semi-governmental West German Society for Nuclear Research at Karlsruhe and Dr. Becker, in turn, visited Pelindaba. There also were extensive contacts and discussions between the Uranium Enrichment Corporation and the West German firm STEAG, which had the exclusive patent rights to the Becker nozzle process in addition to the industrial capacity, manpower, and access to financing sought by the South Africans in a potential foreign collaborator. This informal set of relationships came to an end, however, in early 1976 when the Corporation and STEAG were unable to reach agreement on the financial arrangements and sharing of risks in any collaborative development of a commercial scale UCOR-process enrichment facility. 69/ By that time, however, South Africa's own enrichment programme was well under way.

36. The extent to which these informal ties contributed to the progress of South Africa's enrichment project is uncertain. Although the official South African contention that only feasibility studies took place probably underestimates the impact of these informalities, 70/ the allegation of some critics - denied by the Government of the Federal Republic of Germany - 71/ that STEAG "handed over" the

68/ Adelman and Knight, "Can South Africa Go Nuclear?", p. 635.

69/ Červenka and Rogers, Nuclear Axis, pp. 60-84, 174-180; Newby-Fraser, Chain Reaction, pp. 92-111; "South Africa's Pilot Enrichment Plant", Washington Post, 5 December 1978; Gillette, "Uranium Enrichment", p. 1092.

70/ Newby-Fraser, Chain Reaction, pp. 105-106.

71/ See Fact v. Fiction: Rebuttal of the Charges of Alleged Cooperation between the Federal Republic of Germany and South Africa in the Nuclear and Military Fields, 5 October 1978.

Becker nozzle process to South Africa and that it became with minor changes the unique UCOR-process ^{72/} is possibly overdrawn. As noted earlier, the standard text on enrichment processes and the INFCE report on enrichment availability give separate treatment to the UCOR-process. Moreover, the scientists and engineers directing the South African programme were well trained, highly regarded in the nuclear engineering profession, and adequately supported by their Government. Consequently, South African claims in 1970 to have developed a unique enrichment process without outside help are not a priori unreasonable. However, it also is plausible that the informal ties with Karlsruhe and STEAG helped South Africa's scientists to overcome various difficulties in scaling up their initial laboratory efforts to a pilot facility both by offering technical advice and by supplying components for that endeavor. ^{73/}

37. Particularly in recent years, there has been growing concern about possible nuclear co-operation between South Africa and Israel. ^{74/} Such speculations grew particularly persistent after Prime Minister John Vorster visited Israel in 1976 and signed various agreements of co-operation. However, there have been no official statements to confirm such co-operation in the nuclear field. Until specific examples of actual nuclear exchanges or transactions can be cited as clear evidence of such co-operation, this whole question remains in a state of uncertainty.

3. South Africa's position as a nuclear supplier

38. It was noted above that while approximately 16 per cent of the available uranium reserves of the non-communist world are in South Africa and Namibia, loss of control of Namibia's resources would significantly reduce (by 33 per cent) South Africa's share of the potential market and any associated leverage. But this point should not be overdrawn; as the earlier analysis also revealed, for uranium importers such as Japan, the Federal Republic of Germany, and to a lesser degree France, uranium from mines in South Africa proper will continue throughout the 1980s to be a significant percentage of their total uranium requirements. That dependency, in turn, may affect their readiness to oppose South Africa's domestic and regional policies.

39. South Africa's plans to become a supplier of nuclear fuel in the 1980s have

^{72/} Červenka and Rogers, Nuclear Axis, p. 84; Anti-Apartheid Movement, Answer to a Denial of the Government of the Federal Republic of Germany Concerning the Military-Nuclear Collaboration between the Federal Republic of Germany and South Africa, Bonn, December 1979.

^{73/} Gillette, "Uranium Enrichment", p. 1092.

^{74/} See, e.g., Robert E. Harkavy, Spectre of a Middle Eastern Holocaust: The Strategic and Diplomatic Implications of the Israeli Nuclear Weapons Program, Monograph Series in World Affairs, University of Denver, Graduate School of International Studies, p. 78.

been modified with its recent decision not to construct a commercial size enrichment facility but only to expand the pilot plant to supply its own domestic requirements. By contrast, transfer in the future by South Africa of uranium enrichment technology to another country cannot be precluded, and, depending on the specifics of such a sale - e.g., whether with or without safeguards and the degree of South African concern about the potential end use of its technology by the buyer - the adverse non-proliferation impact of such transfers could be high. The readiness of the South African Government to stand by its earlier statement that it would not act in such a manner as to increase the number of nuclear-weapon States could be undermined by a number of factors running the gamut from the attractions of trading enrichment technology for advanced conventional arms to its heightened isolation from the international community.

D. Safeguards

1. Unsafeguarded facilities

40. The pilot scale enrichment facility is not covered by IAEA safeguards (see para. 20 above). Moreover, while the South African Government had indicated a readiness to accept safeguards on the now-shelved commercial plant, it has not made a comparable offer in regard to the expanded enrichment plant that it decided to build instead. As discussed below, these unsafeguarded enrichment facilities could be used to produce nuclear explosive material.

2. Safeguarded facilities

41. The SAFARI-1 research reactor and the Koeberg nuclear power plant are covered by IAEA safeguards. These include materials accounting and reporting procedures; containment of materials, e.g., of cooling spent fuel, to specified areas with continuous automated surveillance and monitoring; and periodic inspections by the IAEA. ^{75/} (In addition, cooled spent fuel from the Koeberg reactors is to be returned to France.)

^{75/} See Nuclear Proliferation Safeguards, A SIPRI Monograph written by Benjamin Sanders (Cambridge: MIT Press, 1975), pp. 25-47.

III. SOUTH AFRICA'S NUCLEAR WEAPON CAPABILITY

A. Alternative routes to nuclear explosive material

42. Access to sufficient quantities of nuclear explosive material is the first requirement for any country setting out to make a nuclear weapon. Either weapon-grade uranium or plutonium can be used. Natural uranium contains 0.7 per cent of the isotope 235 and as such cannot be used to make fission bombs. For weapons purposes it is necessary to increase the uranium 235 fraction considerably. For technical and economic reasons the high enriched uranium used in nuclear weapons will contain as much as 90 to 95 per cent uranium 235. The other nuclear explosive material, plutonium, can be produced by "burning" uranium in a controlled chain reaction in a dedicated production reactor. The resulting weapon-grade material has a low content of certain undesired plutonium isotopes. Alternatively, plutonium can be diverted from the spent fuel rods of nuclear power reactors in which its creation is an automatic by-product of the generation of electricity by nuclear fission. This reactor-grade material has a different isotope composition but can be used to produce a nuclear explosive. However, its use introduces complications in the design and fabrication, in particular, of a powerful device, which are not easily overcome even with considerable experience in the nuclear weapon field. Furthermore, the yield of the device will in general be low and cannot be predicted with the accuracy possible if weapon-grade material had been used. With either source of plutonium, it is also necessary to acquire a reprocessing plant to separate the plutonium from the fission products and residual uranium in the spent fuel. 76/

B. Availability to South Africa of nuclear explosive material

1. Production of weapon-grade uranium

43. To produce weapon-grade high enriched uranium of more than 90 per cent U-235, the amount of separative work needed is approximately 200 SWU/kg. Using that figure and the available information on South Africa's enrichment project, estimates can be made of the amount of highly enriched uranium South Africa could have produced by August 1977 (the time of the discovery of a reported nuclear weapon test site in the Kalahari Desert) and by September 1979 (the time of the September 22 "double flash of light" in the area of the South Atlantic). It should be pointed out, however, that because these estimates are based only on open and partial information, they are subject to an element of uncertainty.

76/ Technical requirements are discussed in Albert Wohlstetter et al., Moving Toward Life in a Nuclear Armed Crowd?, Pan Heuristics, Report prepared for the U.S. Arms Control and Disarmament Agency, 22 April 1976, pp. 22-45; Office of Technology Assessment, U.S. Congress, Nuclear Proliferation and Safeguards (New York: Praeger, 1977), pp. 139-147.

44. Assuming that the pilot plant has the capacity indicated by South Africa for the prototype module - 10 tons SWU/year - its maximum production could be close to 50 kilogrammes of high enriched uranium per year provided it was built and optimized for that purpose. Parts of the plant had been in operation since April 1975, but full capacity apparently was not reached until March 1977. ^{77/} Such a delay would not be out of line with the experience of other countries which have built and operated enrichment facilities. None the less, assuming full operation of the plant from March 1977 for producing high enriched uranium, table 2 estimates the quantities of high enriched uranium that South Africa could have produced by August 1977 and September 1979 respectively. It also estimates the quantities that could be produced until 1985, when the larger 200-300 tons SWU/year facility is to be completed.

Table 2

Estimated potential

Production of high enriched uranium
by South Africa

A.			B.
<u>Production</u>			<u>Total as at</u>
By March 1977	15 kg	August 1977	36 kg
March-August 1977	21 kg	Mid-1979	128 kg
August-December 1977	17 kg	End of 1980	203 kg
1978	50 kg	End of 1984	403 kg
January-June 1979	25 kg		

45. Depending on the design sophistication, the minimum amount of high enriched uranium required for a 20 kiloton device may range in practice from 15 to 25 kilogrammes. Consequently, by August 1977 South Africa could have had sufficient material to make one or, at the most, two fission bombs. In turn, again depending on the sophistication of the weapon design, sufficient material could have been available by mid-1979 for making upwards of seven or eight fission bombs. Thus it cannot be doubted that, had it decided to do so, South Africa by mid-1979 could have produced sufficient weapon-grade uranium for at least a few nuclear weapons.

46. Current plans call for the expanded uranium enrichment facility being built by South Africa to have a capacity of 200-300 tons SWU/year. If designed and operated for that purpose, this additional capacity could produce about

^{77/} Newby-Fraser, Chain Reaction, p. 111.

1,000 to 1,500 kilogrammes of high enriched uranium per year, enough for making several dozen fairly sophisticated fission bombs. But even without using the extra capacity of the expanded pilot plant to produce high enriched uranium, South Africa by 1985 still could have produced sufficient high enriched uranium for making 15 to 20 fission bombs.

2. Additional steps necessary to acquire plutonium

47. There is widespread agreement among technical experts that given South Africa's nuclear infrastructure and level of expertise it is capable of building a plutonium production reactor and associated reprocessing facility. For sophisticated facilities, investment costs would range from \$250 to \$500 million, require 5 to 75 engineers, 150 to 200 skilled technicians over 5 to 7 years (A/35/392).

48. Once the Koeberg nuclear power reactors are completed, the storage pools of that plant will contain a potential source of plutonium. Although the spent fuel is to be returned to France, there still would be present in South Africa after 1990 at least four fuel loads - one in each of the reactors and one in each of the reactors' "storage pools" awaiting sufficient cooling for shipment to France. However, spent fuel diversion would be easily detectable and, as long as no indigenous source of fuel is available, would lead inevitably to the shutdown of the two power reactors by cessation of fresh fuel supply, not to mention the international measures following the seizure. It must again be emphasized, moreover, that while reactor-grade plutonium can be used in a bomb its characteristics and the unpredictability and reduced efficiency associated with its use would make it a far less preferable nuclear explosive material, especially when other alternatives are readily available to South Africa. And, as already noted, building a reprocessing plant for separating that plutonium probably would be within South Africa's capability, given its technological, engineering, chemical and scientific base.

3. External sources of high enriched uranium

49. The danger of theft of weapon-grade high enriched uranium or plutonium has been a subject of much recent concern. There has been some speculation that small quantities of both materials already have been stolen from fuel fabrication facilities in the United States. ^{78/} None of that speculation links South Africa to the disappearances in question. In light of the difficulties, risks, and limited quantities of material so attainable, other available routes to nuclear explosive material probably would appear preferable to a South African Government seeking nuclear-weapon capability.

50. The United States in 1975 discontinued shipments of high enriched uranium fuel for the SAFARI-1 research reactor. Past high enriched uranium spent fuel shipped

^{78/} "U.S. Acknowledges Possibility of Uranium Theft," New York Times, 28 April 1978; Nucleonics Week, 14 June 1979, p. 7.

by the United States to South Africa has been sent abroad for reprocessing and there is no evidence that any of it was diverted to military purposes. 79/

C. South Africa's capability to design and fabricate a nuclear explosive device

51. There is no reason to doubt the broadly accepted conclusion that South Africa is capable of constructing a first generation fission weapon of moderately sophisticated design. 80/ Not only is a great deal of formerly classified information concerning the principles and design of fission weapons now available in the open literature, 81/ but there also is a considerable pool of trained personnel within South Africa's nuclear establishment. In addition, the associated technical skills necessary for building a nuclear weapon, in such areas as materials handling, precision machining, high explosive technology, and metallurgy, could be drawn from South Africa's mining, engineering and construction, conventional explosives and arms, chemical, and uranium-processing industries. Further, as indicated by the successful design, engineering and implementation of such large industrial projects as South Africa's enrichment project and its synthetic fuels project, organizational skills required for carrying out major projects also are available in that country.

52. Any estimate of how long after having developed a fission or atomic weapon it might take South Africa to design and build a fusion or thermonuclear weapon are highly uncertain. The design principles of a thermonuclear device are not widely known. However, it is generally acknowledged that a fission device, presumably tested, has to be used as a trigger. Furthermore, the engineering, materials handling, and fabrication requirements are considerably more complex than those for fission weapons. 82/ The experience of the first five acknowledged nuclear-weapon States illustrates this uncertainty; the number of years taken after the initial detonation of a fission device to develop thermonuclear weapons ranged from three to eight years. For that reason rapid acquisition of thermonuclear weapons by a South Africa with nuclear potential is not to be taken for granted.

D. Means of delivery

53. South Africa already possesses a variety of suitable delivery systems, mostly high performance aircraft. For example, its Mirage F1s, Mirage IIIs, Canberras, Buccaneers, and Shackletons all could carry a first or early generation fission

79/ Grumm, "IAEA Safeguards - Where Do We Stand Today?", p. 37.

80/ See, e.g., Adelman and Knight, "Can South Africa Go Nuclear?", p. 636. Rochlin, "The Development and Deployment of Nuclear Weapons Systems in a Proliferating World", p. 12.

81/ See, e.g., Greenwood et al., Nuclear Power and Weapons Technology, pp. 3-6.

82/ William Van Cleave, "Nuclear Technology and Weapons," in Nuclear Proliferation Phase II, eds. Robert M. Lawrence and Joel Larus (Lawrence: University Press of Kansas, 1974), pp. 54-55.

weapon weighing 450 to 1,100 kilogrammes of the sort South Africa is probably capable of manufacturing. Larger, bulkier and heavier weapons of from 2,500 to 4,500 kilogrammes could be delivered by commercial aircraft or military transports. Alternatively, eventual development by South Africa of either short and intermediate range ballistic or cruise missiles for delivering well-packaged sophisticated nuclear weapons is not to be precluded. 83/

83/ The Military Balance 1979-1980 (London: International Institute for Strategic Studies, 1980); Rochlin, "The Development and Deployment of Nuclear Weapons Systems in a Proliferating World", pp. 12-16.

IV. SOUTH AFRICA'S NUCLEAR WEAPON CALCULATIONS

A. South Africa's military and political posture

54. The fundamental guideline underlying the foreign policy and military strategy of the Republic of South Africa was formulated as follows in that Government's 1977 White Paper on defence: "the principle of the right of the white nation to self-determination is not subject to discussion". ^{84/} Any discussion of South Africa's military and political posture, therefore, must start from the special situation created by apartheid, not only in South Africa itself but in the region as a whole. Traditional concepts of national security interests, threat perceptions, and defence may apply only to a limited extent in a situation where the military and defence policy of that country is aimed chiefly at maintaining by any necessary means the domination of the white minority. In fact, the greatest threat to peace in the region stems from a racist régime's denial of basic rights to the overwhelming majority of the population and its willingness to use strong repressive means, both internally and externally, to preserve its interests and privileges.

55. In the following discussion of the South African Government's military and political posture these fundamental circumstances must be clearly borne in mind. The defence policy of the Republic of South Africa is one of upholding the apartheid system by military means. However, the views and actions of the South African Government with regard to its security situation obviously also must be discussed and treated as reality, whether drawing on official South African statements or on what might be perceived to be the actual policy behind the official attitude.

56. A significant reassessment and shift of South Africa's military and political posture occurred in the mid to late 1970s. The more outward policy of attempting to gain the co-operation of more conservative African States that characterized the early 1970s gave way to a strategy of "Fortress Southern Africa". ^{85/}

^{84/} White Paper on Defence, 1977 (Pretoria: Government Printer, 1977).

^{85/} Robert S. Jaster, South Africa's Narrowing Security Options, Adelphi Papers Number One Hundred and Fifty-Nine (London: International Institute for Strategic Studies, 1980), pp. 27-30; Kenneth A. Adelman, "The Strategy of Defiance: South Africa", Comparative Strategy I, Nos. 1 and 2 (1978); and "South Africa Tells Its Terms for Peace", New York Times, 15 May 1979.

57. In addition to strengthening the forces for suppression of domestic uprising, the Government of South Africa is devoting increased attention to building up its conventional forces for widescale military actions. Defence spending rose steeply from almost 700 million rand in 1974-1975 to 1,400 million rand in 1977 and over 1,800 in 1979-1980. Or, in comparison to the early 1970s when 12-13 per cent of the budget and 2.5 per cent of GNP were devoted to defence, almost 20 per cent and 5 per cent respectively were so devoted in the late 1970s. 86/ A considerable part of these increases went for procurement of equipment to buttress the credibility of South Africa's newly emphasized conventional forces: artillery, armoured personnel and battle vehicles, anti-tank weaponry, long-range strike aircraft, and patrol boats. 87/ Moreover, the objective of South Africa's military planning, preparations, and training programmes is the capability to carry out extensive military operations on or across its borders with conventional forces while at the same time suppressing internal uprising. 88/

58. Also reflecting this heightened sense of threat in the late 1970s has been the increased role of the military in South Africa. For example, the period of military training has been steadily increased. More importantly, the Chief of the Defence Staff has come to play a major role in the policy-making process, while at a lower level representatives of the South African Defence Force now sit in on all interdepartmental discussions and decisions. 89/

59. A further aspect of "Fortress Southern Africa" is the increasingly explicit and less ad hoc outward extension of the South African strategic zone to embrace events not simply on that country's own immediate borders but also in neighbouring countries. 90/ Presaged by prior instances of direct South African political intervention in her neighbours' affairs, the heightened emphasis on what South Africa unilaterally has defined as its extended strategic zone was explicitly articulated in the 1979 White Paper on Defence. 91/ Reported heavy South African financial and military support to the former Muzorewa government in Zimbabwe throughout 1979, as well as South Africa's apparent intention to retain a military presence in Namibia while keeping close control over political events there, were congruent with that

86/ Jaster, South Africa's Narrowing Security Options, p. 28.

87/ Ibid., "Hidden Arms Power", To the Point (Sandton, South Africa), 4 May 1979.

88/ Jaster, South Africa's Narrowing Security Options, p. 28.

89/ Ibid., pp. 28-29.

90/ Ibid., pp. 33-34, 38; Gutteridge, "South Africa's Defence Posture", p. 30; and "South Africa Accepts Decision in Rhodesia but Issues a Warning", New York Times, 5 March 1980.

91/ White Paper on Defence, 1979 (Pretoria: Government Printer, 1979), p. iii, i.

more interventionist posture. 92/ In turn, characteristic of this far-reaching military policy in recent years have been attacks by South Africa's forces against neighbouring African countries.

60. It appeared for a while that this hard line toward the outside world would be accompanied internally by a limited programme of domestic reform under the new government of Prime Minister Botha. Mentioned as proposed changes were constitutional reform, reduction of economic and social discrimination, revision of pass laws for selected categories of black workers, and extension of some trade-union rights to blacks. 93/ However, little, if any, progress was made in 1979; pass laws remained as before, while Parliamentary action was not forthcoming in lessening economic and social discrimination. Most importantly, Prime Minister Botha's recent speeches have made it clear that blacks will play virtually no role in working out any new constitution and that apartheid and separate development remain unassailable tenets of South Africa's ruling National Party. 94/

61. A final concomitant of "Fortress Southern Africa", including the hard line on Namibia, is South Africa's readiness to accept its international isolation. 95/ For over two decades, South Africa has sought to ally itself with the West, particularly by stressing its geo-strategic importance on account of its location astride the sea lanes and its mineral resources. 96/ Although not having completely abandoned their aspirations for such ties, South Africa's leaders now appear to be turning in part to ties with other so-called "garrison states" similarly suffering from varying degrees of international isolation. 97/

92/ Jaster, South Africa's Narrowing Security Options, p. 34; and "South Africa has Forces Operating Inside Rhodesia", Washington Post, 1 December 1979.

93/ Ibid., pp. 35-36; "Botha Pushes Easing of Apartheid but Doubts Remain among Blacks", New York Times, 22 May 1979; and "Mugabe Triumph Stirs Talk of S. African Reform", Washington Post, 10 March 1980.

94/ "South Africa Ignoring Rhodesian Lesson", Washington Post, 20 May 1980. See also Adelman and Knight, "Can South Africa Go Nuclear?", pp. 644-645; Robert I. Rotberg, "How Deep a Change?", Foreign Policy, Number 38 (Spring 1980); and Randall Robinson, "Investments in Tokenism", Foreign Policy, No. 38 (Spring 1980).

95/ Jaster, South Africa's Narrowing Security Options, pp. 42-43; Gutteridge, "South Africa's Defence Posture", p. 31; "South Africa's Tilt Away from the West", Christian Science Monitor, 5 July 1979.

96/ J. E. Spence, "South Africa and the Defence of the West", Survival, vol. XIII, No. 3 (March 1971).

97/ See "Motives and Disincentives to Nuclear Proliferation: The 'Garrison States'", by Pierre Lellouche, Groupe d'Etude et de Recherche de Politique Internationales.

B. Nuclear weapons and South Africa's political and military posture

62. The general points made at the beginning of the last chapter about the necessity to discuss this problem in the context of apartheid equally apply with regard to nuclear weapons as a possible addition to the South African military forces. Because of the extreme dangers pertaining to such weapons, they take on especially ominous dimensions in the hands of a régime desperate to preserve its privileged position and determined to fight off every attempt to eradicate the apartheid system. For such desperation particularly invites irrational responses, miscalculations, and extreme initiatives. The following presentation of the possible incentives and disincentives for South Africa's acquisition of nuclear weapons summarizes the views presented in various analyses on this topic.

63. South Africa's acquisition of nuclear weapons would not be inconsistent with the preceding posture of "tightening the laager". ^{98/} Notwithstanding its superior conventional armaments, South Africa might try to justify its possession of nuclear weapons as a deterrent. Moreover, by possibly intimidating other African Governments, nuclear weapons could also help to support extended involvement and intervention elsewhere in the region. In turn, one means of projecting an image of potential desperation in defence of white supremacy would be to test and deploy a rudimentary nuclear force. And not least of all, by acquiring nuclear weapons it might be thought possible by leaders of South Africa to demoralize black South Africans, lessening the risk of internal unrest, and to buttress the morale of white South Africans concerned by the heightened threat and their growing international isolation. ^{99/}

64. Acquisition and deployment of nuclear weapons, none the less, also would carry with it important risks and costs, not least of which would be still greater diplomatic and political isolation, the grave prospect of complete and comprehensive United Nations sanctions, an increased legitimacy for intervention against South Africa by extra-regional military forces, and the loss of a possible bargaining chip for preserving at least minimal ties with the West. ^{100/} In light of these costs, many analysts believe that, were it to "go nuclear", South Africa would stop short of openly testing and deploying nuclear weapons. Instead, adopting a strategy of latent proliferation, it could covertly stockpile weapons and rely, much as Israel is thought by many observers to have done, on unconfirmed but widely credited rumoursthat it had those weapons in order to further its purposes.

^{98/} Jaster, South Africa's Narrowing Security Options, p. 34.

^{99/} Adelman and Knight, "Can South Africa Go Nuclear?", pp. 642-644; Betts, "A Diplomatic Bomb for South Africa?", pp. 101-105; Lewis A. Dunn, "Half-Past India's Bang", Foreign Policy, No. 36 (Fall 1979), p. 78.

^{100/} Betts, "A Diplomatic Bomb for South Africa?", pp. 104-105; Jaster, South Africa's Narrowing Security Options, p. 45.

C. South Africa's nuclear declaratory policy

65. Public and semi-private statements by South Africa's leadership on the subject of nuclear-weapon acquisition have been ambiguous. Some past statements, as, for instance, the words of the new President of the South African Atomic Energy Board, Dr. J. W. L. de Villiers, assert that "we're not interested in anything /other than/ the peaceful application of nuclear energy". 101/ By contrast, there are other statements similar to that of former Information and Interior Minister Cornelius P. Mulder contending that:

"If we are attacked, no rules apply at all if it comes to a question of our existence. We will use all means at our disposal, whatever they may be. It is true that we have just completed our own pilot plant that uses very advanced technology, and that we have major uranium resources." 102/

Or, in the words of the Finance Minister, Owen Horwood: "I, for one, reject absolutely and entirely that anyone should tell us what we should do /with our nuclear potential"/ 103/

66. Perhaps most illustrative of this ambiguous posture were a series of official South African statements made or authorized by then Prime Minister Vorster - or said by the United States Government to have been so authorized - in the fall of 1977 during the crisis over the discovery of a reported nuclear-weapon-test site in the Kalahari Desert. On 23 August 1977 President Carter announced in a press conference that

"... South Africa has informed us that they do not have and do not intend to develop nuclear explosive devices for any purpose, either peaceful or as a weapon; that the Kalahari test site, which has been in question, is not designed for use to test nuclear explosives; and that no nuclear explosive test will be taken in South Africa now or in the future". 104/

Not only did the last part of the promise not preclude co-operation in a test outside of South Africa's territory, but two months later Prime Minister Vorster stated during an interview with a United States television network that

"I am not aware of any promise that I gave to President Carter ... I repeated a statement which I have made very often that, as far as South Africa is

101/ "Mystery A-Blast: South Africa Could Have Done It", Christian Science Monitor, 29 October 1979.

102/ "South Africa, with US Aid, Near A-Bomb", Washington Post, 16 February 1977.

103/ "Hands Off Our Nuclear Policy - Horwood", Financial Times (London), 31 August 1977.

104/ "President Carter's News Conference of August 23", Department of State Bulletin, 19 September 1977, p. 376,

concerned, we are only interested in peaceful development of nuclear facilities." 105/

The next day, however, the United States Department of State in a formal statement disagreed with Vorster's contention and said that the Prime Minister had formally repeated just such assurances on all three points in a letter of 13 October 1977 to President Carter. 106/

67. Comparable ambiguity still characterizes the official position in Pretoria. 107/ At the very least that suggests that South Africa's leaders may be tempted to exploit the impression that South Africa may be a latent nuclear-weapon State.

V. TWO INDICATORS OF A POSSIBLE SOUTH AFRICAN NUCLEAR WEAPON CAPABILITY

A. The reported test site in the Kalahari Desert (1977)

68. Concern about South Africa's intentions in the nuclear field was augmented considerably in the late summer and early fall of 1977 when evidence was uncovered suggesting that a nuclear-weapon test by South Africa was imminent. In August of 1977 Soviet diplomats informed the main Western capitals 108/ and Tass issued a formal statement to the effect that work was nearing completion in South Africa on the creation of the nuclear weapon and preparations were being held for carrying out a test (see appendix I). That same Tass statement also called for international co-operation to prevent a South African test, 109/ while a Tass commentary the next day reiterated this warning and call for action. 110/

69. United States reconnaissance satellites apparently had not been monitoring events in this region of the globe, even though their flight tracks sometimes did pass over the Kalahari Desert. However, after examining the Soviet data, the United States ordered new reconnaissance missions. Photographs from those United States satellites definitely confirmed the existence of what professionals in the intelligence and nuclear weapon communities thought was a nuclear-weapon-

105/ "U.S. Disagrees with Vorster on A-Weapons", Washington Post, 25 October 1977.

106/ Ibid.

107/ "South Africa Dismisses Reports of A-Test", Washington Post, 27 October 1979.

108/ Pravda, 9 August 1977.

109/ Ibid.

110/ Pravda, 10 August 1977.

test site. It included a hole for an underground test and a tower and other structures usually associated with underground testing of nuclear weapons. 111/ American authorities then informed other capitals of this.

70. With the evidence mounting of a possible imminent South African nuclear-weapon test, the Ministries of Foreign Affairs of France, the United Kingdom, the Federal Republic of Germany, the United States, and the Soviet Union moved in mid-August 1977 to deter that possible test. 112/ French Minister for Foreign Affairs Louis de Guiringaud warned that if a test occurred "France will condemn it and take action accordingly," 113/ while, similarly, the United States spoke of the "serious implications" of a test, called the matter of "gravest concern," and sought assurances from South Africa about the reports of an imminent test. 114/ Indicating their seriousness, the Western nations are reported to have threatened privately to break diplomatic relations if South Africa tested a nuclear weapon. 115/

71. South Africa consistently denied the reports that a nuclear-weapon test was imminent, calling them, in the words of Foreign Minister Roelof F. Botha, "wholly and totally unfounded". 116/ But faced with growing pressure from these Western Governments, South Africa provided those previously cited assurances (see para. 66) that it had no nuclear weapons and did not intend to conduct any nuclear explosive tests now or in the future. 117/ However, such statements made by the Government of South Africa were not consolidated by the readiness of that Government to allow representatives of the international community access to the possible nuclear test site or to adhere to the Treaty on the Non-Proliferation of Nuclear Weapons. The behaviour of South Africa created suspicion of serious contingency preparations in readiness for a possible future nuclear explosive test. The unanimous adoption of resolution 418 (1977) by the Security Council later that

111/ "U.S.-Soviet Exchange about South Africa Said to Improve Ties", New York Times, 29 August 1977.

112/ Ibid.

113/ "The Enriched Uranium Route", Financial Times (London), 24 August 1977.

114/ "United States Asks South Africa about A-Bomb Plan", New York Times, 21 August 1977.

115/ "South African Stirs New A-Arms Flurry", New York Times, 31 August 1977.

116/ "South Africa Says It is Not Planning Atomic Bomb Test", New York Times, 22 August 1977.

117/ "President Carter's News Conference of August 23", Department of State Bulletin, 19 September 1977, p. 376.

year imposing an arms embargo on South Africa is one of the consequences of what may be called the Kalahari crisis.

B. The 22 September 1979 event

72. Following a disclosure on ABC-TV - a private American television network - the United States Department of State issued on 25 October 1979 the following statement:

"The United States Government has an indication suggesting the possibility that a low yield nuclear explosion occurred on September 22 in the area of the Indian Ocean and South Atlantic including portions of the Antarctic continent and the southern part of Africa. No corroborating evidence has been received to date. We are continuing to assess whether such an event took place." 118/

Nearly one year later, what actually occurred on 22 September has yet to be conclusively established. The indication of a possible nuclear explosion was provided by two "bhangmeters" on a United States VELA satellite placed in orbit in 1970 to monitor compliance with the 1963 partial nuclear-test-ban. At 3 a.m. (local time) on 22 September 1979, these sensors observed a flash of light consistent with that caused by a nuclear explosion on or near the earth's surface. The VELA's sensors at that instant had been watching an area about 3,000 miles in diameter, encompassing, as the preceding statement notes, southern Africa, the Indian Ocean, the South Atlantic, and some of Antarctica. 119/ Consequently, the initial presumption of many United States officials and scientists was that a nuclear explosive device with a yield of about two to four kilotons had been detonated by South Africa in the Southern Hemisphere. 120/

73. In late 1979 an ad hoc panel of non-government scientists was convened by Dr. Frank Press, Science Adviser to President Carter, to assist in determining the likelihood that the light signal was from a nuclear explosion. Based on thorough study, the report of this ad hoc panel (A/35/358, appendix) concluded:

"1. The light signal from the September 22 event strongly resembles those previously observed from nuclear explosions, but it was different from the others in a very significant way. The discrepancy suggests that the

118/ The Department of State Bulletin, 25 October 1979.

119/ Eliot Marshall, "Flash Not Missed by VELA Still Veiled in Mist", Science, vol. 206, 30 November 1979, p. 1051; "U.S. Officials Uncertain about that Event near South Africa", Washington Post, 27 October 1979.

120/ "U.S. Monitors Signs of Atomic Explosion near South Africa", New York Times, 26 October 1979.

origin of the signal was close to the satellite rather than near the surface of the earth. In order to account for the September 22 VELA signal as coming from a nuclear explosion, one must hypothesize particularly anomalous functioning of the instruments (bhangmeters) that observed the event.

"2. The bhangmeters on the VELA satellites have been triggered by and have recorded many previous nuclear explosions. They have also recorded hundreds of thousands of other signals, mostly from lightning and cosmic ray particles striking the light sensors. In addition they have been triggered several hundred times by signals of unknown origin, 'zoo events.' A few of these zoo events had some of the characteristics associated with signals from nuclear explosions, although they could be distinguished clearly from nuclear explosion signals upon examination of their complete time histories.

"3. The search for nuclear debris and for geophysical evidence that might support the hypothesis that a nuclear explosion was the source of the September 22 event has so far only produced data that is ambiguous and 'noisy'. At this date, there is no persuasive evidence to corroborate the occurrence of a nuclear explosion on September 22.

"4. Based on the lack of persuasive corroborative evidence, the existence of other unexplained zoo events which have some of the characteristics of signals from nuclear explosions, and the discrepancies observed in the September 22 signal, the panel concludes that the signal was probably not from a nuclear explosion. Although we cannot rule out the possibility that this signal was of nuclear origin, the panel considers it more likely that the signal was one of the zoo events, possibly a consequence of the impact of a small meteoroid on the satellite."

74. In reaching its conclusion that there is no persuasive corroborative evidence of a nuclear explosion, the ad hoc panel took into account, for example, the fact that other United States monitoring systems for detecting the seismic, airborne or waterborne acoustic signals linked with the shock wave of a nuclear explosive either were negative or recorded very weak signals which could not be clearly ascribed to the 22 September event. It also noted that an initial report (A/34/674/Add.1) in mid-November from the Institute of Nuclear Science at Wellington, New Zealand that it had found traces of fall-out in rainwater was not borne out by additional examination, while other attempts to find nuclear debris proved unavailing. Also evaluated as possible corroborative evidence was the occurrence of a traveling ionospheric disturbance, observed by the Arecibo radar in Puerto Rico, moving from south-east to north-west during the early morning of 22 September. But, on the grounds that up until the sighting of this disturbance, there had been only limited observation on which to base an estimate of the frequency of natural occurrence of such a disturbance, the presence of a tropical storm near Arecibo which could have generated an ionospheric disturbance, and uncertainty about the velocity - and thus the origin - of the signal, the ad hoc panel rejected this disturbance as evidence.

75. Similarly, the requests of the Secretary-General and the Special Committee Against Apartheid immediately following the announcement of the 22 September event that Member States provide any information that they might have about that event also failed to turn up corroborative evidence. Of the States that replied to these particular inquiries, 121/ none had any such information. Other information, including the report of the ad hoc panel, was later supplied to the Secretary-General by the United States while inconclusive replies also were received from New Zealand and the United Kingdom.

76. Nevertheless, some questions still remain, particularly since the details regarding the recorded signals and the monitoring equipment, American or other, have not been fully disclosed. According to some experts with experience in nuclear-weapon testing, there are conditions under which a very low yield nuclear explosion could result in no observable radio-active fall-out after 24 hours. If such a device were detonated at a low altitude, for example, its fall-out might not be carried into the higher atmosphere and could quickly come down to earth with local winds and rains. 122/ In fact, it has been reported that instances of nuclear explosions without confirmation by nuclear debris detectors have occurred; these explosions were confirmed however by other, not necessarily geophysical, means. 123/ Moreover, other more speculative information, such as reports of a South African naval task force in the region, have yet to be discredited, 124/ and, as the ad hoc panel report notes, the explanation provided in the report of the 22 September event itself is not fully credible. Further, the ad hoc panel report does not discuss the possibility that the lack of persuasive corroborative evidence may reflect not that no explosion occurred but that some country tested a nuclear device but went to great pains to cover its tracks.

77. Finally, there is so far no undisputed scientific explanation of the light signal recorded by the VELA Satellite on 22 September 1979. The initial presumption that there had been a nuclear explosion by South Africa or any other country in the South Atlantic area has not been substantiated; nor has it been fully disproved.

121/ The following States replied: Bahamas, Cuba, Guinea-Bissau, Lesotho, Netherlands, Philippines, Suriname, Trinidad and Tobago, and United Kingdom.

122/ "Officials Hotly Debate whether African Event was Atom Blast", Washington Post, 17 January 1980.

123/ Marshall, "Flash Not Missed by VELA Still Veiled in Mist", p. 1051.

124/ "South African Ships in Zone of Suspected N-Blast", The Guardian, 31 January 1980.

VI. RECENT INITIATIVES IN THE NUCLEAR FIELD
INVOLVING SOUTH AFRICA

78. International attempts to isolate South Africa and put pressure on it to abandon its apartheid policy also have focused on the nuclear field. These attempts have partly coincided with other international efforts to prevent the further proliferation of nuclear weapons, in this case to a country with a well developed nuclear infrastructure which for many years has been ranked among the so-called near nuclear countries. At the same time, concern has been expressed particularly by some Western States that total international isolation of South Africa in the civilian nuclear field, leaving it to go it alone, would increase both South Africa's resolve not to accept international safeguards and its incentives to acquire nuclear weapons. Taking issue with that position, the majority of States has expressed its belief that any nuclear collaboration with South Africa comprises a threat to international peace and security. Still others have suggested a more conditional approach to this dilemma, namely that all States which continue to collaborate with South Africa in the nuclear field should stop such collaboration unless South Africa accepts both the non-proliferation Treaty and full-scope international safeguards.

79. The United Nations has taken many initiatives concerning South Africa's activities in the nuclear field. Since the adoption of its resolution 1652 (XVI) of 24 November 1961, the General Assembly has strongly supported the establishment of Africa as a nuclear-weapon-free zone. For the past several years, it also has adopted resolutions by large majorities calling for a ban on all nuclear co-operation with South Africa. This could also be seen as part of efforts in the Assembly to proscribe economic co-operation with South Africa in general and particularly in the important energy field (see resolution 33/183 L of 24 January 1979). Moreover, the United Nations has taken actions to bring about the independence of Namibia, a step which would reduce South Africa's controlling share of the global uranium exports market (for example, Security Council resolution 385 (1976)). Other initiatives under the auspices of the United Nations, more concerned with the gathering of information, are exemplified by the United Nations Seminar on Nuclear Collaboration with South Africa, held in London in 1979 (see S/13157), and the hearings on Namibian uranium.

80. Since late 1977 the United States, as previously noted, has been attempting to gain South Africa's agreement to join the nuclear non-proliferation Treaty and accept full-scope safeguards. In exchange, the United States has offered to continue nuclear co-operation, including shipments of fuel to Koeberg and SAFARI-1. Underlying the United States position has been the assumption that the benefits of South Africa's adherence to the Treaty and acceptance of safeguards on all its peaceful activities would outweigh the costs of dealing with and legitimizing both that régime and its nuclear activities. In particular, it is believed that South Africa's acceptance of full-scope safeguards would place needed controls on its uranium enrichment activities and help clarify some of the ambiguity surrounding its nuclear weapon intentions. 125/

125/ "South Africans Reported Ready for Nuclear Ban", New York Times, 29 June 1978; Betts, "A Diplomatic Bomb for South Africa?", pp. 108-109.

/...

81. There is little evidence, in any case, that South Africa is ready to make the concessions for restored nuclear co-operation that the United States has demanded. 126/ To justify that refusal, South African spokesmen argue that the nuclear weapon States have failed to meet their obligations to transfer peaceful nuclear technology under article IV of the Treaty, that the Treaty is an affront to sovereignty, and that the commercial secrecy of South Africa's civilian uranium enrichment project would be affected adversely. 127/ None the less, it is readily apparent that reluctance to foreclose the nuclear weapon option and possible adoption of a latent proliferation strategy play a key part as well.

82. Since the early 1960s, there has been growing support among the African countries and others for denuclearization of Africa. 128/ But little progress has been made in pursuit of a specific treaty, and most of the effort until now has gone into passing resolutions and statements of principle. Even were a treaty to be negotiated successfully, however, South Africa probably would reject it, 129/ not least once again because of that country's apparent unwillingness to give up the option to make a nuclear weapon.

83. Combined with its unrelenting commitment to apartheid, South Africa's unwillingness to accede to either the nuclear non-proliferation Treaty or full-scope safeguards, as well as its negative attitude toward a nuclear-weapon-free zone has led many countries to challenge the merits of permitting South Africa's continued participation in international nuclear training, exchange and commerce. Moreover, a coalition of African countries and their supporters have succeeded in forcing reduced South African participation in the IAEA. Largely in reprisal for its policy of apartheid, in June 1977, the IAEA Board of Governors decided to replace South Africa with Egypt as a designated member of the Board, while in 1979 the credentials of the South African delegation to the twenty-third regular session of the IAEA General Conference, held in New Delhi, were rejected. 130/

126/ Jaster, South Africa's Narrowing Security Options, pp. 45-46; Betts, "A Diplomatic Bomb for South Africa?", p. 113.

127/ Newby-Fraser, Chain Reaction, pp. 7-8; "South Africa is Calm Amid Nuclear Furor", New York Times, 28 August 1977.

128/ William Epstein, "A Nuclear-Weapon-Free Zone in Africa?", Occasional Paper 14 (Stanley Foundation, 1977).

129/ Betts, "A Diplomatic Bomb for South Africa?", p. 110.

130/ Statement submitted by IAEA.

VII. CONCLUSIONS

84. In carrying out its mandate concerning South Africa's plan and capability in the nuclear field, the group of experts has sought to make its evaluation as factual and concise as possible on the basis of available information. However, because of gaps in the availability of reliable information, some of the specific assessments are subject to an element of uncertainty.

85. Beginning with the development of its uranium mining and extraction industry, South Africa's nuclear energy activities have advanced steadily since the Second World War. On its own, South Africa is one of the largest uranium producers in the world and until recently it has produced approximately 16 per cent of the uranium produced by the market economy countries. By its illegal occupation of Namibia and the resultant control of Namibian uranium resources South Africa has been able to increase its share of the international uranium market. Such an enhanced market share may imply greater potential international leverage. South Africa is now developing its civilian nuclear power capacity (i.e., the Koeberg power plant) which can be seen in the light of South Africa's over-all energy situation. Increased independence in the energy field would make South Africa less sensitive to pressure in that area from the world community's action in response to the country's policies.

86. At various stages -- the early development of its uranium mining industry, the training of personnel and the start up of basic nuclear research activities, and the construction of nuclear reactors -- South Africa's progress and increasing sophistication in the nuclear field has been helped by co-operation with several countries, corporations and institutions.

87. There is no doubt that South Africa has the technical capability to make nuclear weapons and the necessary means of delivery. South Africa has vast uranium resources of its own. It has an unsafeguarded enrichment facility capable of producing weapon-grade uranium and it is building another enrichment facility with an even higher capacity. Furthermore, it has access at home to the technical skill and expertise needed for a military nuclear programme. Because of its growing enrichment capacity South Africa's lack of access to a nuclear reactor designed to produce plutonium is not an obstacle.

88. Critical details about South Africa's unsafeguarded enrichment facility and its use are highly classified by that country. That makes it difficult to assess to the full extent South Africa's actual development and capability in the military nuclear field. Discovery of a reported nuclear weapon test site in the Kalahari desert in 1977 strongly suggests that preparation for a nuclear explosive device test was under way in South Africa in 1977. The event of 22 September 1979, without a scientifically undisputable explanation, further strengthened suspicions in the world community of South Africa's plans and intentions. By August 1977, South Africa could have had sufficient material to make a fission bomb, and by mid-1979 it could have produced sufficient weapon-grade uranium for at least a few nuclear weapons.

89. South Africa's official and semi-official statements on the subject of nuclear weapon acquisition have been ambiguous and provide little insight into South Africa's intentions and plans. A discussion of this topic must take into account the very special situation arising from South Africa's international isolation because of its apartheid policy. The diplomatic and political costs of South African acquisition and deployment of nuclear weapons would be high, and quite possibly disastrous, if those weapons ever were used. Nevertheless, desperate to preserve the apartheid system, South Africa's leaders may eschew a rational weighing of costs and gains. Instead, they might try to justify the acquisition of nuclear weapons as a last resort to attempt to preserve white supremacy by intimidating neighbouring countries or as a device to demoralize black South Africans and, conversely, to buttress the morale of the white population.

90. Because overt acquisition of nuclear weapons would entail serious risks and costs for South Africa, its leaders could prefer a strategy of latent proliferation; that is, South Africa could covertly stockpile nuclear weapons but stop short of openly testing and deploying them. This strategy would be made possible by South Africa's possession of unsafeguarded sensitive nuclear facilities. It would also rely on unconfirmed but widely credited rumours that South Africa had those weapons to serve its purposes and plans.

91. Without underestimating the extreme dangers of nuclear weapons in general, they take on especially ominous dimensions if in the hands of a régime desperate to preserve white supremacy. Traditional concepts of security interests and perceptions of threat may apply only to a very limited extent in a situation where the greatest threat actually stems from a racist régime's denial of basic rights to the overwhelming majority of the population and where such a régime is prepared to use strong repressive means to preserve its interests and privileges. Such a situation clearly invites illogical responses and actions by South Africa.

92. The proliferation of nuclear weapons to any country is a matter of serious concern to the world. The introduction of nuclear weapons to the African continent, and particularly in such a volatile region as southern Africa, not only would be a severe blow to worldwide efforts at non-proliferation but also would upset many years' efforts to spare the African continent from the nuclear arms race and to make it a nuclear-weapon-free zone. Judgements of the consequences of that development only can be pessimistic.

93. The strong reaction of the world community to the reported Kalahari test site and its persistent concern about the 22 September event amply testify to the great concern with which the world regards South Africa's capability and plans in the nuclear field. As long as South Africa refuses to give a commitment to refrain from acquiring nuclear weapons and its position remains the main obstacle to creation of a nuclear-weapon-free zone in Africa, and as long as it refuses to accept international safeguards on critical sensitive parts of its nuclear programme, its capability and plans in the field will continue to be a matter of concern to the world community. Owing to the possibility of irresponsible co-operation in the nuclear field by South Africa with some countries that might have nuclear weapon aspirations, the role of South Africa as a contributor to the

proliferation of nuclear weapons cannot be ruled out. The acquisition of nuclear weapons by that country would have to be treated as a grave threat to the security of the African States and to international peace. All this makes it necessary to have South Africa adhere to the nuclear non-proliferation Treaty and to place all its nuclear facilities under IAEA safeguards.

94. Therefore, and bearing in mind the unrelenting action of the United Nations in condemning the policies and practices of South Africa's apartheid régime, and in particular the recent imposition by the Security Council of an arms embargo and its call for cessation of co-operation in developing nuclear weapons, it is still the primary responsibility of the Members of the United Nations and of the international community as a whole to continue to follow closely South Africa's activity in this field and to take whatever necessary action aimed both at the eradication of apartheid and the prevention of further proliferation of nuclear weapons.

APPENDIX I

Statement by TASS quoted in Pravda, 9 August 1977

There is information to the effect that the Republic of South Africa is now nearing the completion of its efforts to produce nuclear weapons and that immediate preparations are being made to test these weapons.

The authorities of the Republic of South Africa, stubbornly persisting in their policy of racial oppression and apartheid against the African population and resorting to acts of aggression against neighbouring African States, are attempting by force of arms to halt the inevitable process of elimination of the colonial-racist order in southern Africa. To this end the Republic of South Africa is perfecting its war machinery and is equipping its armed forces with the most up-to-date military technology, aircraft, missiles, tanks and artillery of various kinds.

In recent years the press of many States, including Western States, has carried reports of the efforts made in the Republic of South Africa to establish the necessary scientific and technical base for the production of its own nuclear weapons. The Republic of South Africa has not signed the Treaty on the Non-Proliferation of Nuclear Weapons, to which more than 100 States have already acceded. In developing its military production and in acquiring up-to-date weapons, the Republic of South Africa has relied on the support of certain Western States belonging to NATO, and also of Israel, despite the well-known decisions of the United Nations prohibiting the granting of assistance to South Africa in the field of armaments.

The possession of nuclear weapons by the racist régime of Pretoria would constitute a most direct threat to the security of the African States; it would lead to a sharp escalation of instability and tension in southern Africa and would increase the nuclear threat to all mankind. The action taken by the authorities of the Republic of South Africa to acquire nuclear weapons, with the support of certain States, is at variance with the efforts made by many countries and the United Nations to prevent the proliferation of nuclear weapons throughout the world. This action is incompatible with the demands of African countries, as embodied in United Nations decisions, for the conversion of the African continent into a nuclear-free zone. By choosing to produce its own nuclear weapons, the Republic of South Africa has issued a challenge to all peoples.

TASS is authorized to make the following statement. The manufacture of nuclear weapons in the Republic of South Africa would have the most serious and far-reaching implications for international peace and the security of peoples.

The leadership of the Soviet Union feels that the most urgent and effective efforts on the part of all States, the United Nations and international public opinion, are needed in order to prevent the production of nuclear weapons in the Republic of South Africa and to avert the danger of the proliferation of such weapons. The Soviet Union, which has consistently and resolutely advocated steps to avert the threat of a nuclear war, is willing, for its part, in co-operation with other States by all possible means to promote the achievement of this goal.

APPENDIX II

Statement made by the Minister for Foreign Affairs of France,
Mr. de Guiringaud, on French radio, "France-Inter",
22 August 1977

- Q. We learned a few moments ago that the French Government and you yourself had approached the South African authorities because of more precise indications - according to the text given us - that South Africa intended to manufacture atomic bombs. This intention is mentioned in a statement by the Tass News Agency on 9 August 1977. Can you give us some information regarding this matter?

It was the first surprise of your journey. The Soviets were accusing you of assisting the South Africans to manufacture atomic bombs.

- A. There are two points to be made on this subject: first, the Soviets have accused the South Africans of making preparations, not for an atomic bomb, but for a nuclear explosion; and, second, we did indeed receive information that South Africa was preparing for an atomic explosion, which, according to the South African authorities, was for peaceful purposes. We know what a peaceful atomic explosion is; however, it is not possible to distinguish between a peaceful atomic explosion and an atomic explosion for purposes of military nuclear testing. We therefore warned South Africa that we would regard such testing as endangering all the peace processes under way and as having potentially serious consequences with respect to our relationship with South Africa. That is what the clarifying statement made by my Ministry this morning referred to.

(...) The Framatome contract with South Africa provides for the construction of two nuclear power stations at Koelberg, near the Cape. It stipulates that the reprocessing of fuels from these power stations will be done in France and that the plutonium will not be returned to South Africa. It is therefore untrue and altogether dishonest to say that these power stations could help South Africa to acquire the atomic weapon.
