

AIRGRAM

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FROM : Amembassy: TEL AVIV

DATE: February 13, 1963

SUBJECT: Israeli Program for Nuclear Reactors

REF : Embassy's A-85 of August 7, 1963 and A-128 of August 17, 1962
Rome's A-115

BEGIN OFFICIAL USE ONLY: The visit to Israel of Dr. Abraham Friedman, USAEC Representative at the Paris Embassy, furnished an opportunity to assess the present status and the future plans of Israel's reactor program. Dr. Friedman arrived on January 24 and departed on February 2. During this time, he visited the Weizmann Institute, the Technion, the Hebrew University and the Israel Atomic Energy Commission (IAEC) installations at Nahal Soreq and Rehovoth. He also had two meetings with Professor Ernst Bergmann, Chairman of the IAEC. An Embassy officer was present during some of these visits and meetings. Observations and conclusions are summarized in the following.

Nahal Soreq

The Soreq Research Establishment (SRE), located on the sea shore about 15 miles south of Tel Aviv, is the major IAEC facility now in operation. The major equipment item is a five megawatt swimming-pool reactor partially paid for through the USAEC "Atoms for Peace" program. A reasonably large and fully functioning laboratory has grown up around this reactor (see organization diagram, Enclosure 1). Scientists from the Weizmann Institute, the Hebrew University and the Technion are making considerable use of the facilities. In addition to the research program, the SRE reactor is in demand as a training tool for students of nuclear engineering in the Department of Nuclear Sciences of the Technion (see below).

The research program at SRE appears to be completely open and unclassified, and is described in some detail in the IAEC's semi-annual reports. The SRE staff this year includes two visiting Americans, Dr. Robert M. Levy, a Reserve Officer in the US Navy, and Dr. Krieger, a health

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physicist on leave from the US Public Health Service. Dr. Bergmann has informed the Embassy that he hopes the number of American scientists doing research at SRE can be expanded. An effort is also being made to solicit grants and contracts from various agencies of the American Government.

Dimona

During Dr. Friedman's briefing sessions at the Embassy, it was agreed that no effort would be made to solicit an invitation for him to visit the Dimona establishment, and no invitation was extended. The security restrictions surrounding this project inhibited discussion by most Israeli scientists. However, Professor Bergmann and Professor Shimon Yiftah (Chief of the Nuclear Reactor Program Committee of IAEC) volunteered some comments on Dimona. They stated that Dimona was intended strictly as a research reactor with a power of 24 megawatts, that construction was well advanced, and that completion could be expected in late 1964 or in 1965. Dr. Bergmann concluded his statement with "There is nothing to see at present in Dimona. When it is finished, I promise to send you a personal invitation to come see it".

Technion

The Israel Institute of Technology (Technion) in Haifa will unquestionably serve as the major training center for reactor technicians and engineers, now in very short supply in Israel. A training program was started 2½ years ago under the direction of Associate Professor Shlomo Yiftah, Chairman of the Department of Nuclear Sciences. At present this Department has a staff of six professionals, and offers four courses on reactor technology to undergraduate majors in Electrical Engineering and Mechanical Engineering. It has also started graduate programs leading to the M.Sc degree (7 students) and to the D.Sc. degree (5 students).

The Department of Nuclear Sciences is housed in very cramped quarters on the old campus. The training facilities are quite primitive, but include an analog reactor simulator and various types of nuclear instrumentation. Extensive use is made of the SRE reactor for the more sophisticated training of graduate students.

Plans are well advanced for the construction of a \$2 million "Nuclear Center" at the new campus in Technion City, about five miles north-east of Haifa. These plans include expenditure of \$700,000 for two buildings; the remainder of the money to be spent for a variety of training equipment including a training reactor (probably a Triga Mark II), a neutron pulser, a sub-critical assembly of natural Uranium and heavy water (the USAEC is to be approached for the loan of these materials), and a radio-chemistry laboratory.

A grant of \$350,000 toward the cost of the Center has been received from the Sherman Foundation of Wales, a British philanthropy. Other funds are being sought. The GOI has agreed to match contributions received from private sources.

Further information on nuclear and reactor research at the Technion will be provided in a separate airgram.

Nuclear Power Program

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The nearly complete lack of fossil fuels in Israel has inspired active discussion for many years of the desirability of constructing nuclear reactors for the generation of electric power. An official GOI committee headed by Professor Yiftah and including representatives of the IAEC and the electrical utilities completed an exhaustive study of this question in May 1962. A summary of their report was released to the press on January 1, 1963, and a translation of the report into English will be released within the next week or two. A brief summary of the considerations and conclusions of the Yiftah Committee, based on statements by Professor Yiftah, follows.

In May, 1962, the total electrical generating capacity of Israel was slightly under 500 megawatts. Generating stations now under construction will raise the total capacity of Israel to about 700 megawatts by the beginning of 1965. Projections of the growth of population and per capita consumption indicate that plans must be made at once for the addition of another 500 megawatts of generating capacity during the period 1965-70. The Yiftah Committee concludes that these 500 megawatts of power should be furnished by four stations each of 125 megawatt capacity.

The Committee then addressed itself to the question of whether one of these 125 megawatt stations should be powered with a reactor. It was admitted that the capital cost of a nuclear power station would be roughly twice that of a station powered with fuel-oil, and that the total cost of the energy furnished by the nuclear station would be 20 percent or so higher even after account is taken of the lower fuel cost. However, it was believed that these economic disadvantages might be offset by other considerations, including the value of experience in nuclear technology and the reduction in Israel's almost complete dependence on foreign sources of fuel. The Committee recommended that the GOI "seriously consider" proceeding with the construction of a nuclear power station.

Assuming that a favorable determination is made on this question, the Committee then dealt with two other questions: the location of the reactor and the type of reactor. In considering the possible locations of a nuclear power plant, the Committee pointed to the rapid settlement of the northern half of Israel and urged that several appropriate locations be reserved for later use. Four possible sites, all located on the Mediterranean Coast, were proposed. The one apparently favored at the present is near Nahal Soreq, the location of the SRE laboratories. Advantages of this site are its proximity to Tel Aviv, the fact that seismic, geological and hydrological surveys of the area have already been completed, the availability of coolant water, and the existence already of an exclusive control of the area.

The choice of the type of reactor proved less easy, and the Committee failed to reach a definite recommendation. The final resolution of this question is of great interest as it should give the Embassy an indication of the direction which the atomic energy program of Israel is likely to take during the next ten years. The four reactor types analyzed were: (1) enriched Uranium, light water; (2) natural Uranium, heavy water; (3) natural Uranium, graphite moderated, gas cooled; and (4) enriched Uranium, boiling water.

The third and fourth of these reactor types have apparently been rejected on economic grounds. Advantages of the enriched Uranium-light water reactor are its lower cost and the fact that Israel could benefit from the very considerable experience of General Electric and others in this type of reactor construction.

The natural Uranium - heavy water reactor, in spite of its higher cost and the relative lack of experience with it in other nations, holds out strong appeal to many in the GOI, particularly to Professor Bergmann. Israel is very anxious to reduce its present dependence on other nations for fuel; there is an even stronger desire to avoid dependence on any single nation for supplies of either conventional or nuclear fuel. Considerable importance is therefore attached to the existence of low-grade uranium ore in the Israeli phosphate beds (presumably near Arad). Professor Yiftah believes that the processing of this ore into reactor fuel would not be economically competitive with fuel purchased on the world market, but that in a crisis it could be done. END OFFICIAL USE ONLY

BEGIN SECRET: Israeli actions on the disposal or reprocessing of exhausted fuel elements from power reactors will give a clear indication of the nation's intentions with regard to the development of nuclear weapons. IAEC officials show great reluctance in accepting safeguard procedures, obviously out of fear of foreclosing this avenue. In answer to an inquiry about Israel's plans for reprocessing exhausted fuel elements, Professor Yiftah stated that he did not believe that Israel would be justified in establishing the necessary metallurgical facilities, at least until several large power reactors were in operation. He believes that initially Israel would contract with some foreign nation for these services. If this proves impractical, the exhausted fuel would be buried for possible later use.

Professor Yiftah stated that his Nuclear Reactors Committee remains in being, and that their next task would be detailed planning of a power reactor at some particular site.

Ultracentrifuge Research

Dr. Friedman was informed that the theory of enrichment of U-235 by gas centrifugation was being studied in the Isotope Separation Department of the Soreq Research Establishment.

Cooperation Between the IAEC and the French AEC

In the laboratories visited there was little clear evidence of Franco-Israeli cooperation in reactor research. However, it was noted that the principal figures in Israeli reactor research seemed to have close and friendly relations with some of the leading French atomic scientists. This was particularly evident in the case of Dr. Bertrand Goldschmidt, Head of Foreign Relations for the French AEC, who had visited IAEC installations during the week of January 20, 1963. Goldschmidt is regarded as the number 3 man in the French AEC.

Comments and Conclusions

(1) There is no question that Israel plans to devote a significant portion of its resources to the development of competence in the field of nuclear reactors. GOI officials seem to be fully aware of the significance of nuclear

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technology as a means of promoting the nation's economic self-sufficiency. The problem of long-term security against attack or blockade also weighs heavily.

(2) The Embassy believes that the GOI is not making a serious effort to construct nuclear weapons at the present time. GOI officials appear to be confident that the IDF can cope with any armed attack that may be made on Israel within the next few years. They also are aware of the serious deficiencies in technology that must be remedied before Israel can participate in either the civilian or military applications of atomic energy, and therefore appear to be directing the nation's atomic program in the following directions:

- (a) The gaining of experience in the construction and operation of reactors, and a large increase in the number of men trained in reactor technology. Israel now has very few specialists in this field.
- (b) The expansion and improvement of Israel's inadequate skill and facilities for metallurgical research. This is an area where French excellence could prove of great value to Israel.
- (c) Further training in American laboratories of many of Israel's leading atomic scientists. Professors Neeman, Low and Anbar (see Enclosure 1) are planning to spend next year in American universities. Professor Israel Dostrovsky, who has spent the past 18 months at the Brookhaven National Laboratory, is reported to be considering another year's extension of his visit.

(3) If the interpretation of the preceding section is correct, the very effective screen of security surrounding the Dimona project seems unnecessary. The Embassy believes that this secrecy probably results in part from Israel's acute sense of national sovereignty and in larger part from a firm decision not to foreclose the possibility of a nuclear weapons program should the course of Middle East events make it necessary at a later time. This assumed decision will receive a large measure of confirmation if the GOI proceeds with the construction of large power reactors of the natural Uranium-heavy water type while rejecting international safeguard procedures in the processing of the exhausted fuel.

(4) If the GOI later decides to proceed with a nuclear weapons program, the major hurdle to be overcome will be the preparation of adequate amounts of weapon-grade fissionable material. Israel has demonstrated competence in the preparation and handling of conventional explosives, so the construction of a detonator mechanism can probably be completed without introducing additional delay. It is possible that preliminary research on detonator design is already under way. END ~~SECRET~~

FOR THE AMBASSADOR:

R. T. Webber

Robert T. Webber
Scientific Attache

Report retained by CT
Enclosures:

- (1) Organization diagram of the SRE (UNCLASSIFIED)
- (2) Biographical information on E.D. Bergmann, S. Yiftah, and W. Rottenstein (OOB)

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ENCLOSURE #2

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Biographical Information

Much of the information in this Airgram is based on conversations with Professors Bergmann and Yiftah, and with Dr. Rottenstein, the leaders of Israel's reactor program. Biographical material follows:

Ernst David BERGMANN - Born in Karlsruhe on October 18, 1903; educated through the Ph.D. degree at the University of Berlin; employed as an Assistant in the Chemical Institute of the University of Berlin from 1923-33; came to Palestine in 1934; Scientific Director of the Daniel Sieff Institute and the Weizmann Institute, Rehovoth, 1934-52; since 1952 has simultaneously held the positions of Professor of Organic Chemistry at the Hebrew University, Chairman of the Atomic Energy Commission, and Director of Defense Research for the Ministry of Defense. At the present time, Bergmann normally spends two days a week (Sunday and Monday) in Jerusalem attending to academic duties; the remainder of the time is largely spent in the Israel Defense Forces compound in Hakiryah, Tel Aviv. He is regarded as a highly competent scientist and an intensely dedicated Israeli, and has mastered the diplomatic art of presenting a completely open and frank attitude while actually communicating a very limited amount of information. Speaks fluent English, French, German and Hebrew.

Shimon YIFTAH - Born in Safed, Israel on March 18, 1922; educated through the Bachelor's degree in Electrical Engineering at the Technion; received his Ph.D. in Physics at the Sorbonne (Paris) under the guidance of Professor de Broglie; in 1958-60 studied reactor physics at the Argonne National Laboratory; since 1960 has simultaneously held the positions of Associate Professor and Head of the Department of Nuclear Sciences at the Technion, Head of the Reactor Physics Department at the Soreq Research Establishment, and Chairman of the GOI's Nuclear Reactors Program Committee. Also reported to be ³/₄ Full Colonel in the IDF. At present Yiftah normally spends three days a week (Sunday, Wednesday and Thursday) attending to academic duties in Haifa; the remaining time is divided between the IAEC offices in Tel Aviv and the Soreq Research Establishment. Regarded as a competent scientist-engineer. Speaks fluent English, French and Hebrew.

W. ROTTENSTEIN - Born in Amsterdam in about 1920; fled to Great Britain in 1940; graduate education at the University of London leading to the Ph.d. in Physics; taught physics at the Battersea Technical College in London prior to 1958; visiting scientist in the reactor program at the Brookhaven National Laboratory, 1958-60; Senior Lecturer (and principal deputy to Professor Yiftah) in the Department of Nuclear Sciences at the Technion since 1960. Speaks fluent Dutch and English and moderately fluent Hebrew.

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