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TECHNICAL CO-OPERATION

PROJECT SCHEDULES FOR 1991-92

C. Project summaries

NATIONAL INPUT: Scientific and other staff (9 persons), laboratory space and some **equipment** are able. All local costs are covered by the long-term AEOI programme.

AGENCY INPUT: To finalize the work, the Agency has been requested for the continuation of technical support and provision of equipment such as high pressure liquid chromatography units with accessories for the characterization of trace labelled organic impurities in technetium-99m labelled radiopharmaceuticals and in labelled RIA reagents. Some expertise covering quality control methods for technetium-99m generators, radiopharmaceutical preparations of technetium-99m and RIA reagents are also foreseen.

LONG-TERM IMPACT: The project will result in the production of radiopharmaceuticals and RIA kits to meet the demand in Iran.

3. URANIUM EXPLORATION (IRA/3/002) B1

YEAR	Experts		Equipment		Fellowships			Training	Sub-contracts		Total		Grand total	
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$		NCC \$
1991	5	44,250	-	-			-		-			44,250		44,250
1992	5	48,500	50,000			-	-	-		-	-	96,500	-	98,500
1993	5	48,750	70,000	-		-	-	-	-	-	-	118,750		118,750

Total expenditure to 30 September 1990: **\$541,504 (TACF)**

OBJECTIVES: To complete the evaluation of airborne data, the preparation of maps, their integration and necessary follow-up exploration programme.

BACKGROUND: The Atomic Energy Organization of Iran intends to embark on a nuclear power programme and uranium exploration in Iran represents an effort to search for adequate resources to meet future domestic needs. In this context, Iran is among the few countries in the world with a relatively strong exploration programme. The Agency is giving assistance under a long-term project on the processing of existing airborne data, and the preparation of maps and follow-up interpretation and in-depth study.

NATIONAL INPUT: Local staff, laboratories and some equipment as well as a budget covering all local resources are available under this on-going project. Maps are being produced on the basis of information stored on magnetic tapes.

AGENCY INPUT: The Agency has been requested to continue technical assistance by providing expertise on a comprehensive programme which will include advice on geology, geophysics, geochemistry, analytical chemistry, mineralogy and borehole logging. Help to upgrade the laboratory has been also **requested**.

LONG-TERM IMPACT: It is expected that the project will result in the transfer of knowledge on a comprehensive uranium exploration programme, the training of local specialists and the assessment of uranium resources in Iran.

4. ORE DRESSING AND LEACHING OF URANIUM ORES (IRA/3/003) B1 New

YEAR	Experts		Equipment		Fellowships				Training	Subcontracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC \$	
1991	1	8,850			-		-		-			8,850		8,850
1992	1	9,300	10,000		-							19,300		19,300
1993	1	9,750	20,000		-							29,750		29,750
1994	1	10,200	30,000	-	-							40,200		40,200

OBJECTIVES: To set up a properly equipped dressing laboratory. To prepare a feed that permits the best balance of uranium recovery by optimized leaching conditions.

BACKGROUND: The Atomic Energy Organization of Iran is involved in a comprehensive research and development programme for uranium exploration and production to satisfy the future needs of the nuclear power plant programme. The elaboration of ore dressing and leaching technology for local uranium ores and the setting up of ore dressing laboratory are the main objectives.

NATIONAL INPUT: Preparations for the project have been made. Eight persons are assigned directly to the project. Equipment for chemical analyses, tanks for conventional leaching and a PVC column for column leaching are available. Special buildings including laboratories and workshops, have already been completed. Any development costs and operating costs in local currency will be provided by the Government.

AGENCY INPUT: The Agency has been requested to provide expertise on ore processing, physical *beneficiation of minerals and hydrometallurgy. Advice, training of local specialists and the provision of equipment have been also requested.*

LONG-TERM IMPACT: *The project will result in the transfer of knowledge on ore dressing and leaching of uranium ores excavated in Iran and in the setting-up of an ore dressing laboratory.*

5. RESEARCH REACTOR CORE CONVERSION (IRA/4/017) 16

YEAR	Experts		Equipment		Fellowships				Training	Subcontracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC \$	
1991	1	8,850	10,000									18,850		18,850
1992	1	9,300										9,300		9,300

Total expenditure to 30 September 1990:

\$2,082 (TACF)

OBJECTIVES: To improve the research reactor safety and performance through conversion of the core from high-enriched to low-enriched uranium fuel.

BACKGROUND: The reactor is a swimming pool research reactor of 5 MW nominal power, moderated and cooled by light water. The reactor was put into operation in 1967 and the original high-enriched fuel is still in use. This is a cause of operational difficulties and at present only a few hours of operation at 1 to 2 MW is possible. The Reactor Division of the Nuclear Research Centre in Teheran is currently engaged on core conversion from high- to low-enriched uranium. The new reactor fuel is expected to arrive in Iran during 1990. Work on the up-grading of the reactor instrumentation and the preparation of a safety analysis report are under way. Recent INSARR mission assessed the situation and recommended action to improve nuclear safety.

NATIONAL INPUT: Fresh low-enriched fuel has been purchased from Argentina and the reactor is undergoing a core conversion. The necessary staff and a budget in local currency are available.

AGENCY INPUT: The Agency has been requested to continue technical assistance by providing expertise to retrain operations personnel, advise and review the safety analysis report and contribute to the upgrading of the reactor instrumentation.

LONG-TERM IMPACT: It is expected that the project will result in a high performance, safe research reactor which will be used for isotope production, experimental physics and training purposes.

VARIABLE ENERGY CYCLOTRON LABORATORY (IRA/4/019) G5 New

YEAR	Experts		Equipment		Fellowships				Training	Sub-contracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC \$	
1991	1	8,850	-	-	-	-	-	-	-	-	-	8,850	-	8,850
1992	1	9,300	-	100,000	-	-	-	-	-	-	-	9,300	100,000	109,300
1993	1	9,750	80,000	200,000	-	-	-	-	-	-	-	89,750	200,000	289,750
1994	-	-	20,000	250,000	-	-	-	-	-	-	-	20,000	250,000	270,000

OBJECTIVES: To assist the Islamic Republic of Iran in the construction of a cyclotron for production of short-lived radioisotopes for clinical applications.

BACKGROUND: Nuclear medicine applications are well established in Iran in many hospitals and there are increasing demands for pharmaceuticals labelled with cyclotron produced short-lived radioisotopes for clinical applications. To fulfil the demand, the Atomic Energy Organization of Iran has decided to construct a variable energy cyclotron laboratory for the production of gallium-67, tellurium-201, iodine-123, carbon-11, nitrogen-13, oxygen-15 and fluorine-18 labelled components for positron emission tomography. The cyclotron will be situated in the Nuclear Research Centre for Agriculture and Medicine in Karadj, where infrastructure preparations have already started. The cyclotron installation will be bought using local funds.

NATIONAL INPUT: A site for the cyclotron is available at Nuclear Research Centre in Karadj. The building, the laboratory space and the cyclotron are under national responsibility. Annually US \$ 2 million are reserved for equipment and US \$ 1 million for operation. A local staff of 20 persons, including 6 scientists, will be involved in the project.

AGENCY INPUT: The Agency has been requested to supply expertise, training of local specialists and some laboratory and interface equipment needed for the cyclotron. Advice on the selection of the cyclotron and on the work plan for the project has been requested.

LONG-TERM IMPACT: It is expected that the project will help to prepare the infrastructure and work plan for the project and will result in the construction of the cyclotron, which will produce the radioisotopes needed for advanced nuclear medicine procedures in Iran.

7. ACCELERATOR-BASED ANALYTICAL TECHNIQUES (IRA/4/020) G4 New

YEAR	Experts		Equipment		Fellowships				Training	Sub-contracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC \$	
1992	1	9,300	30,000	-	-	-	-	-	-	-	-	39,300	-	39,300
1993	1	9,750	30,000	-	-	-	-	-	-	-	-	39,750	-	39,750
1994	1	10,200	50,000	-	-	-	-	-	-	-	-	80,200	-	80,200

OBJECTIVES: To help bring about efficient utilization of the particle accelerator available in the country through the introduction of advanced, precise and accurate techniques for the determination of tracer elements in different samples.

BACKGROUND: A Van de Graaff accelerator is operational in Iran and there is a group working on nuclear techniques for analysis in various scientific and industrial applications. On the basis of the available experience, the Atomic Energy Organization of Iran decided to improve utilization of the

particle accelerator through the introduction of advanced, precise and accurate techniques for the determination of elements in different samples of interest to many fields of the national economy. A study of a variety of possible applications will also be performed.

NATIONAL INPUT: A group of nuclear physicists is already working and has governmental support for their activities. A 3 MV Van de Graaff accelerator, three different beam lines with complete vacuum systems and some other equipment is available. All operating costs will be covered by the counterpart.

AGENCY INPUT: The Agency has been requested for expertise and training on proton induced X-ray emission (PIXE) and Rutherford backscattering analyses, and some equipment for up-grading of laboratory such as PIXE and RBS analyses instrumentation and sample preparation equipment.

LONG-TERM IMPACT: It is expected that the project will result in the establishment of a laboratory for trace element analysis using a Van de Graaff accelerator and appropriate nuclear techniques.

8. NUCLEAR TECHNIQUES IN WHEAT PRODUCTION (IRA/5/008) D2

YEAR	Experts		Equipment		Fellowships		Training		Sub-contracts		Total		Grand total	
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$		NCC \$
1991	1	8,850		-	-	-	-				-	8,850	-	8,850
1992	1	9,300	-	-	-	-	-	-	-	-	-	9,300	-	9,300

Total expenditure to 30 September 1990:

\$120,458 (TACF)

OBJECTIVES: To continue radiation and isotope-aided studies for increasing wheat production through the development of superior varieties and the introduction of more efficient fertilizer and irrigation water management practices.

BACKGROUND: The Department for the Application of Isotopes in Agriculture of the Nuclear Research Centre in Karadj is using isotope techniques to obtain improved management of fertilizer and irrigation water. The Plant Breeding Group is continuing work on wheat mutants and promising results have been obtained after three years of field experiments. Soil and nitrogen-15 fixation studies will be performed in the near future. More experimental evidence is needed to provide arguments for extensive practical use in Iran.

NATIONAL INPUT: Local staff have been carrying out field studies for some years to derive new crop mutants. The results are promising and have been submitted to the Ministry of Agriculture for approval.

AGENCY INPUT: Under this on-going project, the Agency has been requested to continue its assistance in 1991-92 by providing expertise in plant breeding, soil fertility, soil physics and irrigation, and plant physiology.

LONG-TERM IMPACT: It is expected that the project will lead to the **development** of higher yielding varieties of wheat and promote the more efficient use of fertilizers and irrigation water in the country's main agricultural areas.

**9. INDUSTRIAL APPLICATION OF RADIOTRACERS AND SEALED SOURCES (IRA/8/009) F1
New**

YEAR	Experts		Equipment		Fellowships				Training	Sub-contracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC	
1991	1	8,850			-	-		-	-	-	-	8,850	-	8,850
1992	1	9,300	70,000	100,000	-	-	-	-	-	-	-	79,300	100,000	179,300
1993	1	9,750	80,000	100,000	-	-	-	-	-	-	-	89,750	100,000	189,750

OBJECTIVES: Transfer of knowledge on the use of radioisotopes in industry and on radiotracer technology. Applications industries such as chemical, mineral, petroleum, sugar, wood, paper, cement and steel are considered.

BACKGROUND: Radiotracer techniques and nuclear gauging have great potential in the Islamic Republic of Iran and industries which would utilize them have already been identified in the country. To promote the techniques, the Atomic Energy Organization Iran has organized a group in the Radioisotope Department of the Nuclear Research Centre in Teheran. The group is to work on the prototype development of level, thickness and density gauges and some of the prototypes developed show promise for industrial applications. The group is also preparing itself for research and development work on radiotracers and industrial sources.

NATIONAL INPUT: A staff of 12 persons, including 4 scientists, laboratories and other facilities and equipment plus adequate funds are available.

AGENCY INPUT: To help the country, the Agency has been asked to provide expertise and training on radiotracer techniques and nuclear gauging, and to help set up a laboratory for the production of sealed sources and to provide some equipment needed for the programme.

LONG-TERM IMPACT: It is expected that the project will result in the transfer of **knowledge** on the use of radioisotopes and the establishment of a group of national specialists working on the subject. A long-term objective is the application of the techniques in local industry.

10.

REVIEW OF THE BUSHEHR NUCLEAR POWER PLANT (IRA/9/011) AI

YEAR	Experts		Equipment		Fellowships				Training	Sub-contracts		Total		Grand total
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$	NCC \$	
1991	8	70,800	-	-	-	-	-	-	-	-	-	70,800	-	70,800
1992	8	74,400	-	-	-	-	-	-	-	-	-	74,400	-	74,400

Total expenditure to 30 September 1990: **\$296,335 (TACF)**

OBJECTIVES: To assist Iran in assessment of the status of the Bushehr nuclear power plant before the restart of plant construction. To advise on criteria for the licensing of the repair from the nuclear safety point of view. To help develop the infrastructure in the country for the construction work on the plant.

BACKGROUND: The Atomic Energy Organization of Iran (AEOI) is building two nuclear power plants in Bushehr. Construction was however halted about ten years ago and some damage was caused by bombardment of the main and auxiliary buildings. The growing need for electric power in Iran and the investment made in Bushehr have led to a decision to complete the plant and to use local capabilities to the maximum extent. In this respect, development of an infrastructure in Iran, a technical evaluation of the existing damage and the establishment of licensing criteria for the plant are among the main tasks for the Nuclear Power Plant Division of the AEOI.

NATIONAL INPUT: A local staff of 500 people is involved in the project. The country is negotiating with the nuclear power plant supplier the conditions under which the project will be completed.

Meanwhile, local work is continuing to prepare the infrastructure for the completion of the plant, perform analyses and carry out maintenance and repair works.

AGENCY INPUT: The Agency has been requested to continue technical assistance in 1991-92 in accordance with the recommendations of the experts and in line with the work plan. Provision of expert services in nuclear safety, quality assurance, project management and the development of educational capabilities in Iran are foreseen.

LONG-TERM IMPACT: It is envisaged that the Agency support will contribute to the safe repair and rehabilitation of the damaged structure and components of the Bushehr nuclear power plant as well as to development of the infrastructure and national capabilities.

11. STRENGTHENING RADIATION PROTECTION IN IRAN (IRA/9/012) HO New

YEAR	Experts		Equipment		Fellowships		Training		Sub-contracts		Total		Grand total	
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$		NCC \$
1991	1	8,850	40,000	100,000	-							48,850	100,000	148,850
1992	1	9,300	40,000	50,000				-				49,300	50,000	99,300
1993	1	9,750	50,000	50,000			-	-	-			59,750	50,000	109,750
1994	1	10,200	50,000	50,000	-							80,200	50,000	110,200

OBJECTIVES: To upgrade the radiation protection laboratory in the Islamic Republic of Iran.

BACKGROUND: The National Radiation Protection Department of the Atomic Energy Organization of Iran covers all the radiation protection activities in the country and the department is the competent authority for all radiation protection matters. The various activities include: personnel monitoring service, internal dosimetry, environmental monitoring and meteorology, radiation surveillance at nuclear research centres, training and education on radiation protection. A RAPAT mission has appraised the situation and recommended up-grading of obsolete equipment. Radiation protection has high priority in the country.

NATIONAL INPUT: At present a large building is available and a new building is under construction. Further staff (28 persons) will be recruited for the project. All operating costs are covered from national sources.

AGENCY INPUT: The Agency has been requested to help upgrade the laboratories and replace obsolete and used equipment. Some expertise and training on specific topics is also needed.

LONG-TERM IMPACT: It is expected that the project will contribute to the upgrading of the laboratory for radiation protection in Iran.

12. INSTALLATION OF INCINERATOR (IRA/9/013) CI New

YEAR	Experts		Equipment		Fellowships		Training		Subcontracts		Total		Grand total	
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$		NCC \$
1991	1	8,850		-	-					-	-	8,850		8,850
1992	1	9,300	-		-			-				9,300	-	9,300

OBJECTIVES: To re-establish the design and technological process of the incineration of the existing incinerator components and to install the facility.

BACKGROUND: The Atomic Energy Organization of Iran is stimulating the nuclear power programme and reanimating the development of the infrastructure needed. The incineration installation was bought for radioactive treatment work for the Bushehr nuclear power plant and for ten years has remained in boxes owing to lack of experience and documentation. An engineering group is working in the

Esfahan Nuclear Technology Centre (ENTC) to re-establish the design and technological process of the incineration. A recent WAMAP mission appraised the results positively.

NATIONAL INPUT: The radioactive waste incinerator is available but not installed. The group is working on the re-design of the technological circuit and the installation of the incinerator.

AGENCY INPUT: The Agency has been requested to provide expertise to help the group finish the job and put the incinerator into operation.

LONG-TERM IMPACT: It is expected that the project will result in an operational incinerator and its use in the nuclear power plant programme for radioactive waste treatment.

13. WASTE MANAGEMENT OF URANIUM TAILING (IRA/9/014) C3 New

YEAR	Experts		Equipment		Fellowships		Training		Sub-contracts		Total		Grand total	
	Months	CC \$	CC \$	NCC \$	Months	CC \$	Months	NCC \$	CC \$	CC \$	NCC \$	CC \$		NCC \$
1992	1	9,300			-		-		-		-	9,300		9,300

OBJECTIVES: To optimize effluent treatment conditions and design the liquid waste treatment and tailing disposal system for the uranium ore processing pilot plant.

BACKGROUND: The Atomic Energy Organization of Iran (AEOI) is giving high priority to uranium extraction from local raw material and an ore processing pilot plant with an ore processing capacity of 1 to 3 t/d will start up in the near future. To deal with liquid wastes containing radium-226, the AEOI initiated a project with the objective of optimizing the effluent treatment. A further goal is the design of a liquid waste treatment and tailing disposal system for the uranium ore processing pilot plant.

NATIONAL INPUT: The group of three specialists is working on the technology of the safe handling of radioactive wastes from uranium mining and milling in Iran. They have a laboratory, some equipment and a budget to cover all local expenses.

AGENCY INPUT: The Agency has been requested for expert advice to help assess the project and advise on its implementation.

LONG-TERM IMPACT: It is expected that the project will help ensure the safe handling of the radioactive wastes from uranium mining and milling in Iran.