MANAGEMENT OF SPENT FUEL FROM RESEARCH REACTOR IN LATIN AMERICA: A REGIONAL APPROACH

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ABSTRACT

This paper reports progress in a Regional Technical Cooperation Project for Latin America (Argentina, Brazil, Chile, Mexico, and Peru), sponsored by the International Atomic Energy Agency/1/..The Project main objective is to define a regional strategy for managing research reactor (RR)spent fuel, which would provide solutions that are technologically and economically suited to the realities in countries involved. In particular, to determine the needs for temporary wet or dry storage of RR spent fuel and to establish forms of regional cooperation for:(a) storage (operational, interim, and final) of spent fuel or its derivatives;(b) harmonization among the participating countries of safety rules and regulations, and (c) communicational strategies and public information. Argentina, Brazil, and Chile have returned some of their spent fuel to the USA, but this option will cease to be viable in May 2006. Consequently, it was deemed appropriate and timely to identify and assess all possible options that might be implemented in the region. This paper has two purposes: first, to describe a database of inventories of RR irradiated fuel in the participating countries; and second, the main activities already being conducted or planned within the framework of the project from the coordinators point of view. Finally, plans for the second phase of the project in 2003-2004 will be outlined.

INTRODUCTION

In Latin America, many research reactors (RR) have been in operation since the late fifties, and a significant amount of spent fuel has accumulated. Table 1 shows the RR constructed in Latin America. It can be seen that several reactors have been shut down, e.g. those in Uruguay and Venezuela. The spent fuel elements (SFE) from these reactors have already been sent back to the USA and these RR will be decommissioned.. The transport of the SFE from Uruguay and Venezuela to Savannah River in the USA was performed by TRANSNUCLEAIRE in September 1998 (when 19 SFE, 20% enriched from Uruguay and 56 SFE from Venezuela, IVIC, were transported) and in 1999 (when the remaining 2 failed SFE from Venezuela were transported together with the Brazilian SFE), as reported in the 21st RERTR Conference/3/. The RR in Colombia was completely modified by General Atomic in the 1990s, when the old SFE were sent to USA and were replaced by new LEU TRIGA-type fuel. This new TRIGA RR, the IAN-1 (presently operated by INGEOMINAS), remains shut down due to reorganization within the Nuclear Sector in Colombia

Table 1. Research Reactors in Latin America/2/

Country	*Facility*	*Power(k W)*	*Type*	*Status*
ARG	RA-0	0.01	ZPR TANK	OPER
ARG	RA-1	40.00	TANK	OPER
ARG	RA-2	0.03	ZPR	SHUT
ARG	RA-3	5,000.00	POOL	OPER
ARG	RA-4	0.00	ZPR Homogeneous	OPER
ARG	RA-6	500.00	POOL	OPER
ARG	RA-8	0.01	ZPR	OPER
BRA	ARG	0.20	ARG.	OPER
BRA	IEA-R1	5,000.00	POOL	OPER
BRA	IPEN-MB 01	0.10	ZPR TANK	OPER
BRA	IPR-R1	100.00(200)	TRIGA-Mark I	OPER
CHI	RECH-1	5,000.00	POOL	OPER
CHI	RECH-2	2,000.00	POOL	*
COL	IAN-R1	100.00	POOL FE TRIGA	*
MEX	CHI-Mod9000	0.00	SUBCR	OPER
MEX	CHI-mod2000	0.00	SUBCR	OPER
MEX	SUR-100	0.00	ZPR Homogeneous.	DEC
MEX	TRIGA Mark III	1,000.00	TRIGA Mark III	OPER
PER	RP-0	0.00	ZPR Tank	OPER
PER	RP-10	10,000.00	POOL	OPER
URU	RU-1	1.00	POOL	SHUT
VEM	RV-1	3,000.00	POOL	SHUT

(*)Note: IAN-R1 and RECH-2 although operative, presently are shut down.

. As shown in Table 1, the only countries that have RR and have concerns related to spent fuel storage are Argentina (RA-3; RA-6), Brazil (IEA-R1), Chile (RECH-1), Mexico (TRIGA), and Peru (RP-10). Moreover, most of these countries have returned part of their spent fuel to USA, with Argentina, having returned most of their HEU MTR SFE in 2000 (207) /3/, Brazil having returned LEU and HEU MTR SFE in 1999 (127) /4/, and Chile, their SFE in two consignments, the first in 1996 (28), and the second in 2000 (30) /5/. The concerns of these countries were based on the fact that in May of 2006 for discharged fuel (May 2009 with cool off), the option to send SFE to USA will cease, and that National solutions for countries without Nuclear Power Programs will be very difficult to implement. These concerns were the driving force for the initiation of the IAEA Regional Project. The objectives of the Project are to provide the basic conditions to define a regional strategy for managing spent fuel and to provide solutions taking into consideration the economic and technological realities of the countries involved. In particular, to determine the basic conditions for managing RR spent fuel during operational and interim storage as well as final disposal, and to establish forms of regional cooperation for spent fuel characterization, safety, regulation and public communication.

Progress in the Project is described below, omitting details of specific activities, but including achievements to date and the manner in which the project is being coordinated and managed. Plans for the second phase of this Project in 2003-2004 are also outlined

SFE DATA BASE AND STORAGE FACILITIES IN LATIN AMERICA

Before describing the project activities, achievements and management structure, the Latin American Spent Fuel database will be presented. Database creation was the first activity of the project. A questionnaire was designed, distributed to all participating countries, and the results were presented at the 1st Regional Workshop of the project in Santiago, Chile, in May-June 2001.

Table 2. Fuel Elements Characteristics

Facility	*Type of Fuel*	*Fuel Mat.*	*Enrichment*	*Cladding Material*
RA-0	Pin	C-UO_2	LEU 19.7%	Aluminum
RA-1	Pin	C-UO_2	LEU- 19.7%	Aluminum
RA-2	MTR	U-Al	HEU 90%	Aluminum
RA-3	MTR	U_3O_8-Al	LEU 19.7%	Aluminum
RA-4	Disk	U-CH_2	LEU 19.7%	Aluminum
RA-6	MTR	U-Al	HEU 90%	Al
RA-8	Pin PWR	UO_2	LEU: 1.8&3.6 %	Zircaloy-4
IEA-R1	MTR	U_3O_8-AL U_3Si_2-Al	LEU 19.9%	Aluminum
IPR-R1	TRIGA Rods	U-Zr-H	LEU 20%	Aluminum
ARGONAUTA	MTR	U_3O_8-Al	LEU-19.0-19.9%	Aluminum
IPEN-MB-01	Pin PWR	UO_2 Pellets	LEU 4.35 %	SS
RECH 1	MTR	U-Al U_3Si_2-Al	HEU-45% LEU- 19.75%	Aluminum
RECH-2	MTR	U-Al	HEU-90%	Aluminum
TRIGA Mark III	FLIP/STD-Rods	$UzrH_{1.65}$/$UzrH_{1.7}$	HEU-70%/LEU-20%	SS-304
RP-10	MTR	U_3O_8-Al	LEU 19.75%	Al Mg 1

The data has been updated at the various coordinators meetings. A summary of the most relevant information from this database is shown in Table 2. It illustrates the main characteristics of the fuel elements utilized in the RRs of the participating countries.

Besides some pin-type FEs, mostly in critical facilities, the dominant fuel type used in the Latin American (LA) RRs is plate-type (MTR), LEU, oxide fuel (U_3O_8-Al) clad in Al, followed by TRIGA-type (U-Zr-H) rods, in Mexico and Brazil. It is important to emphasize at this stage that most of the LA RRs have been converted to LEU, and only a few HEU FE are still in use in the region. These HEU FEs are in RA-6 in Bariloche, Argentina, the Chilean RR (although RECH 1 is being converted, and RECH 2 is not operating), and in Mexico (some FLIP TRIGA FEs). Thus, the LA Region has supported the non-proliferation policy as established in the RERTR program in an exemplary manner, compared to some other regions in the world.

The present RR spent fuel inventory is shown in Table 3. The only reactors with reasons for concern related to storage over medium and long range periods are, RA-3 and RA-6 in Argentina, IEA- R1 and IPR-R1 in Brazil, RECH-1 and 2 in Chile, TRIGA MARK III in Mexico and RP-10 in Peru. The others are zero power reactors, or low power RRs with very low burn up. Taking these facts into consideration and the storage capacities presently available, some projections for the next 10-15 years have been made.

Table 3. SFE inventory at LA RR

RR	*# of FE in Present Core*	*Average # used per year*	*SFE Storage*		*SFE BURNUP% Average*
			At RR	Away RR	
RA-0	183 pin	Life Time Core	17 Dry	-	~ 0
RA-1	223 pin	~0	5 Dry	232 Wet	~10
RA-2	Shutdown	NA-		19 dry 51 plates dry	~0
RA-3	25 MTR FE LEU	~20(at 10 MW); ~3 presently	10 wet	48 Wet	~44
RA-6	31 MTR FE HEU	~0; for future projections~ 5	11 wet	0	~21
RA-8	None	N/A	2020 dry pins	0	~0
IEA-R1	24 LEU, Silicide-4; Oxyde-20	~18, expected for 120 h /week, 5MW	21 wet	0	~30
IPEN-MB-01	680 pins	NA	0	0	~0
IPR-R1	59 rods	NA	0	0	NA
IEN-R1	8 LEU	NA	0	0	NA
RECH 1	30 HEU 4 LEU	~4	9 HEU 1 LEU wet	0	NA
RECH 2	29 HEU	0	0	0	~0
TRIGA Mexico	26 flip 59 std	-	64	0	
RP-10	29 LEU	~3	4	0	NA

Argentina

Presently the spent fuel are storage in a facility called Central Storage Facility (CSF), located about 4 kilometers from RA-3 RR at Ezeiza Nuclear Center. The CSF could be considered a wet operational storage away from reactor since it is located in the RR site. The CSF contains two sectors of in-ground storage tubes for spent nuclear fuel. The front sector has 6 rows with 16 storage tubes per row. The back sector has 6 rows with 17 tubes per row. The storage rows have raised curbs at grade level with a lead filled plug in the top of each storage tube. Total capacity is 198 storage tubes holding a maximum of 2 standard assemblies or 1 control assembly per tube. The tubes are interconnected via a filtration/de ionization system with re circulation capability. Figure 1 illustrates the CSF. Besides the CSF, both RA-3 and RA-6 have in-Reactor wet storage, for cooling before transfer to CSF, with capacity of around 50 SFE in both reactors

. As reported in table 3, presently there are 64 SFE at CSF facility, and so assuming a average number of SFE used per year from RA-3 (at 10 MW) of ~ 20 SFE, this facility could storage spent fuel for ~10 years.

However, given the aging of the facility, CNEA has presented a project to build a new wet facility located also at Ezeiza, in a pool located at the post irradiation facility, taking into account to utilize the infrastructure already existing at this building that will allow operational flexibility and integration with other operations of spent fuel management: inspection, conditioning, etc. This new interim wet storage facility is going to be designed to store all SFE from RR of Argentina. Finally, the Argentinean strategy for spent fuel management is a) Centralize the interim storage of RR spent Fuel, b) Complementary wet cooling of medium range, c) dry interim storage at long range, d) conditioning of the spent fuel for final disposal

Figure 1: SFE Argentinean Central Storage Facility at Ezeiza Nuclear Center

Brazil

Presently, storage facilities at IEA-R1 consist of racks located in the reactor pool with a capacity of 156 assemblies. Figure 2 illustrates the storage area in the IEA-R1 reactor. According to the newly proposed operation schedule (5 MW, 120 hrs per week), 18 to 20 assemblies will be burnt up annually. Currently, 21 storage positions are occupied, suggesting that in 7-10 years the wet storage facility at the reactor will be full. If no provisions are made for increasing storage facilities, the reactor may have to be shut down. Although there are 50 dry storage horizontal tubes (where 3 standard spent fuels per tube can be stored) located in the reactor building, significant modifications will be required before any decision to store spent fuels in these tubes can be taken. In view of these facts, a project to assess and define an "at-reactor" dry storage, with a capacity for~200 SFE has been initiated (the present dry storage could be refurbished or a new dry storage built in a building close to the reactor building).

The IPR-R1 has no short and medium range storage problems, due to its low nominal power. The first fuel assembly replacement is expected to occur only in 2010

Finally, Brazil has not yet defined a policy regarding spent fuel or high level waste disposal. However, given that the Brazilian Legal Framework regarding waste disposal is being defined (first, a national low and medium level waste disposal will be constructed), this issue will be discussed at the National level.

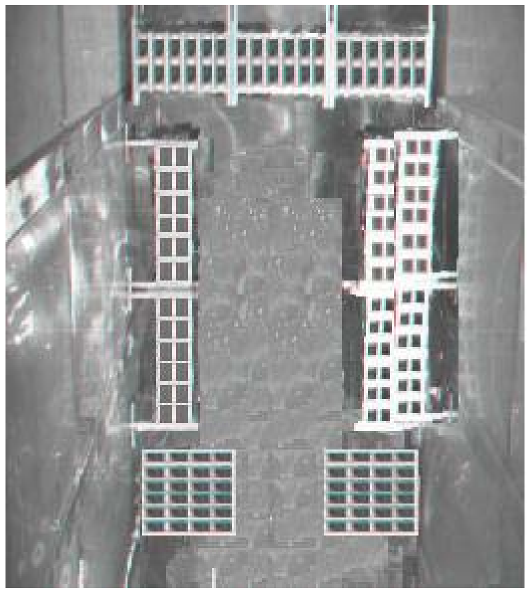

Figure 2: IEA-R1 wet storage

Chile

The storage capacity of RECH 1 is 90 positions in racks inside the reactor pool, designed for safe storage of LEU and HEU SFE, in any combination relying on natural convection for cooling. RECH 2 has an independent pool for storage, with a capacity for 224 elements, as well as 3 racks in the reactor pool where 30 elements can be stored.

According to CCHEN projections, it is estimated that RECH 1 will generate 91 SFE, and RECH 2 , 29 SFE. Therefore, with the independent pool at RECH 2, there is enough storage capacity in Chile for at least 30-35 years (assuming that no corrosion induced damage occurs because good water quality is maintained). Based on these data, dry interim storage or the need to send SFE for final disposal would be necessary only in ~ 2030. The latter option has not yet been defined by CCHEN.

Mexico

The TRIGA MARK III reactor in Mexico can store 120 fuel rods inside the reactor pool and 64 of these positions are presently occupied. There are also 3 storage wells, each with 19 positions. Besides spent fuel storage space, there are spaces for storing new FE. In each of these, there are 4 standard rods

(LEU), 22 FLIP fuel assemblies (HEU), and 3 instrumented FLIP. At the present rate of operation of the Mexican Reactor, there is enough long-range storage capacity.

Even though the Mexican authorities have taken no decisions to the present, some negotiations are going on with USA DOE to repatriate HEU SFE. The negotiations are still on going because of requirement that all FLIP (70%), including the non-irradiated fuel, should be shipped first. Another issue is that the FE in the core can be utilized up to 2006, and given that for shipment, roughly 3 years of cooling is required, the last year to repatriate Mexican SFE to the USA would be 2009, which is allowed by the current take-back program. However, if a decision to ship the SFE by 2006 were to be taken by the Mexican authorities, 118 SFE could be shipped, requiring the purchase of 45 new LEU assemblies. This would place a heavy economic burden on Mexico of having to acquire 45 new LEU elements by 2006 (~US$45,000.00 per element, i.e. a total cost of ~US$ 2 Million). This economic burden could make the return of SFE to the USA non-viable

Peru

. The RP-10 has temporary storage capacity of 120 positions in racks located in the main pool and connected auxiliary pool. Figure 3 illustrates the storage racks in the auxiliary pool.

Presently, only 2 standard SFE and 1 Control Element is stored. Also, at the present levels of operation of the reactor (7.5 MW 16 hrs per week), the number of new SFE would be 3 per year, i.e. Peru has SFE storage space for the next 40 years. Other scenarios considered by Peru, are doubling the time of operation (to 36 hours), and a cycle of 16 days of continuous operation at 10 MW. In the first case, fuel consumption would be ~4 per year, and with continuous operation at 10MW, ~23 per year. With these scenarios, the SFE storage space presently available would be sufficient for 20 years and 5 years, respectively.

Peru is in the process of coming to an agreement with the USA DOE spent fuel return program, and if this agreement is finalized by 2006, Peru would return to the USA, 9 standard FE, and 3 control elements. This would increase the SFE storage capacity to 46 years at the present level of reactor operation.

Even though the Peruvian authorities have not decided on a spent fuel policy, and given that Peru does not presently have a Nuclear Power Program, their participation in the Project is considered to be an opportunity for them to be aware of the problem of SFE storage from the very beginning. Finally, it is worth mentioning that the RP-10 is the newest (1988) and most powerful RR in Latin America (10 MW), and even if it is presently under-utilized, depending on the economy, life time of other RRs in LA, and growth in nuclear medicine in the region, this scenario could change and the scenario of maximum utilization could become a reality

Figure 3: Storage Racks at RP-10

PROJECT DESCRIPTION

The IAEA TC Regional Project, 'Management of Spent Fuel from Research Reactors in Latin America', was divided into 4 subprojects or macro activities since the beginning: (1) spent fuel characterization; (2) safety and regulation; (3) options of spent fuel storage and disposal; (4) public information and communication. This section will describe the activities in each of these subprojects, without going into the technical details, but outlining the main objectives and achievements. Before describing the project activities, the project management will be summarized.

The Project is not part of the Regional Program ARCAL. It is managed and carried out mainly by the participating countries. The Project has a Regional Project Coordinator and National Coordinators in each country, who are responsible for: (a) planning and organizing the activities carried out by the scientists and engineers in their country; (b) internal communication; (c) contact with the IAEA through the regional coordinator; (d) approval of country requests for procurements and human resources; (e) identification of participants in the Project activities; (f) organizing and chairing workshops or meetings held in their country. The Regional Coordinator does the overall planning and organizing, informing all national coordinators about changes, deadlines, and achievements, acting as an facilitator of activities and information exchange among the participating countries, and maintaining coherence between the planned activities and requests (control). The Regional Coordinator reports to the IAEA, through the Project Officer on administrative and financial matters and with the Technical Officer on technical matters. The final approval is always from the IAEA Technical and Project Officers. The coordinators and the IAEA officers meet at least once a year (Coordinators Meetings), for project evaluation, planning, and budget distribution among the countries to conduct the planned activities. The main instruments for project planning and control, are the official IAEA Full Project Status Report, which contains the financial information, and the status of the activities implemented (Human Resources, Workshops, and Procurements), and the Working Time Schedule (WTS), which is a working document for the coordinators and contains information about each activity, the responsible team and leader, start and finish dates, milestones, expected output, status and achievements, and performance indicators. The Regional Coordinator is responsible for reviewing and updating the WTS.

Spent Fuel Characterization

This subproject's objective is a complete database of spent fuel in the region that can be used to make projections and serve as a resource for decision makers. However, the major objectives are to ensure that current wet storage is under optimum conditions and that each country has the tools and know-how to characterize its spent fuel using visual inspection, sipping, and effective burn up determinations. This subproject has held two Regional Workshops (RWS), the 1st in Santiago, where the participant countries presented their experiences to date and work protocols were established; and the 2nd RWS in São Paulo where there was know-how exchange among the participants in the areas of corrosion, sipping, visual inspection, and burn up determination (non-destructive and destructive). Practical demonstrations of these activities were also conducted during this workshop.

The milestones and achievements (outputs) of this subproject were:

1 Data Base: Maintenance of the database is an ongoing activity. The first questionnaire was designed and distributed to all participating countries very early in the Project. The data on fuel, spent fuel characteristics, storage facilities etc has been compiled and a summary of it was described in section II of this paper.

2. Corrosion Monitoring and Surveillance Program: In this activity, a work protocol was established to install corrosion coupons in the different storage facilities to assess the extent of corrosion (mainly localized corrosion or pitting) over a period, and to define optimal water chemistry and duration of wet storage. The protocols for monitoring, and surveillance were established, the coupons were designed, manufactured and distributed to the participants to be installed in their storage facilities. Periodically, the corrosion coupon racks will be withdrawn from the storage basins for evaluation. The Project is also providing funds to upgrade laboratory facilities in the participating countries.

3. Sipping and Visual Inspection: The objective of this activity is to equip all participating countries to implement visual inspection and sipping, the latter to determine cladding failure in SFE. Presently, Brazil (IEA-R1) and Chile (RECH 1) have the equipment to conduct sipping tests, and are sharing the know-how about sipping systems designs with the other countries. Regarding visual Inspection, Brazil and Argentina have systems, but are upgrading them. The other countries are being equipped to carry out visual inspection with funds made available from the Project. Figure 4, illustrates the visual inspection system at the Mexican TRIGA MARK III reactor.

In this subproject, a catalogue of standard images is being prepared, to enable classification of damaged fuels, especially in terms of the number of pits. This subproject is also supporting an R&D program in Brazil to develop eddy current techniques for determining damage to fuels. If this technique is demonstrated to work well, it will enable inspection of the inner plates of MTR type fuels, which is difficult, even visually, at present

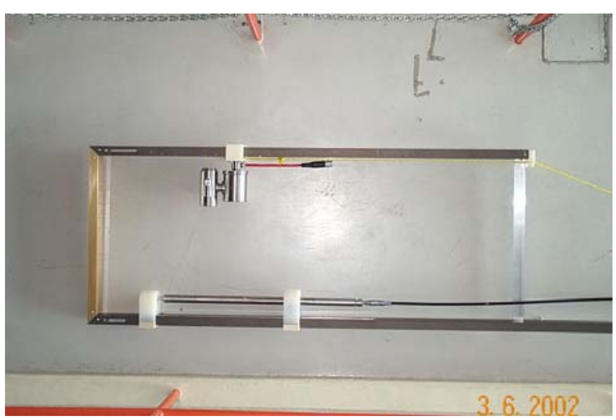

Figure 4: Visual Inspection System Implemented in Mexico under RLA/4/018

4. Burn up measurements and determination: This activity involves destructive measurement of burn up of a U_3Si2-Al FE (designated P04) irradiated in the RA-3 in Argentina. Samples from one plate were measured using ^{150}Nb, ^{233}U, and ^{242}Pu as mass monitors and the measurements were made by mass spectrometry and isotopic dilution /6/ Also, the irradiation condition and P04 data have been sent to all the participating countries for the burn up to be calculated. These results will be compared at a Workshop to be held later this year in Buenos Aires. This comparison will allow harmonization of assessments of burn up determinations in the region.

Non-destructive burn up measurements by gamma spectroscopy are also a part of this subproject. The participating countries have compared their methodologies and with partial support from the project, Chile has installed a NDT system/ 7/

Safety and Regulation

This main objective of this topic is harmonization of Safety Regulation on RR Spent Fuel Management among the regulatory bodies of the participating countries. During 2001, the regulators held a RWS in Mexico, and agreed that the task would be to identify the current regulatory framework internationally and in the participating countries and to take steps toward harmonization of nuclear safety rules and regulation involved in activities related to the back end of the research reactor fuel cycle. Also, the IAEA Joint convention on Spent Fuel Management Safety and Radioactive Waste Management (IAEA-INFCIRC/546) was recognized as a base document to be followed. In the LA region Argentina, had signed and ratified the Joint Convention, Brazil and Peru had signed, but not ratified, and the others countries are still analyzing internally the adequacy to sign it. Also the participant countries agrees to produce drafting guidelines of five documents based mainly in the IAEA ST-1, SS-111, 117, and 118. The documents being draft by the participant countries are:

- Safety Guidance Document on Transportation of Spent Fuel from Research Reactor
- Safety Guidance Document for Operational Storage of Spent Fuel from RR
- Safety Evaluation Document of Storage of Spent Fuel from Research Reactor
- Requirements for Interim storage of spent fuel from RR
- Requirements for Final Storage of SF from RR

During the 1st RWS, the participants defined the content of such documents and assigned responsibilities to write the. These documents will be presented and polished during the 2nd RWS to be held in Lima, October 21-25 2001. After the documents are approved by the participants this will be submitted to the regulatory bodies in the different countries, for consideration as official regulations.

Finally, a glossary of spent fuel terminology in Spanish, Portuguese, and English, with base in the IAEA Safety Glossary, and others documents, mainly the Joint Convention, is being prepared.

Analysis of Options for RR Spent Fuel Storage.

The objective of this subproject is to identify, collect information on, and finally assess in the context of the countries of the region, all the possible options for the back end of the RR fuel cycle currently being implemented, or studied, world wide.

Earlier this year, a RWS was held on this topic, in Cordoba, Argentina, which discussed all known options (interim storage (dry and wet), repository, reprocessing, conditioning, etc.), and started drafting a document on available options to be considered in the region. The final report is expected to be ready by April 2003.

Although there are differences among the countries in the region, there has been consensus regarding medium range option, and it would be dry interim storage. Also, since the HALOX /8/ process for conditioning SFE is being developed in Argentina, one possible option could be to send the SFE to Argentina for conditioning, and then return the waste to the country of origin for interim storage. The final storage will depend on international, regional and national policies. Presently, the legal framework in the region does not allow receiving radioactive waste from foreign countries, and therefore a regional repository is presently out of the question, although technically it is a viable solution.

Independent of the option adopted by the region in the near future, there was consensus about the possible need in the longer term for transport of RR spent fuel or its derivatives between the countries. Therefore, as Brazil has facilities for testing and qualification of Type-B casks, a subproject to develop a concept for a Type-B cask, which could be used by all the reactors of the region, and that could be licensed by the region's regulatory bodies for transport of RR SFE (including transport across regional boundaries) was initiated. The concept is being developed, and if it is accepted, then during 2003-2004 the conceptual design, testing of prototypes and preliminary safety analysis will be conducted. It is hoped that in the biennium 2005-2006 a new regional project would be established with construction and licensing of a regional transport cask as the main objective.

Finally, although not within the scope of the subproject 'options', an activity to harmonize in the region the calculation tools for design and safety analysis of spent fuel management has been included. As a calculation tool, the ORNL package SCALE/9/ was chosen. This Project provided a version of SCALE 4.4 A to all countries, and with the support of DOE, two training courses have been held. The first, held in Mexico, focused on criticality (KENO), and source term (ORIGEN-ARP) calculations; and the second, held in Lima, focused on shielding and cross-section generation for MTRs. These training courses have given the participants the capability to harmonize computational tools for Safe Spent Fuel Management in the region; this one of the most significant achievements of the Project to date.

Public Information and Communication

The objective of this subproject is to develop and continuously implement effective public information and communication strategies on nuclear activities in the countries of the region with particular emphasis on the benefits of RR activities and the consequent necessity to solve the problem of disposition of spent fuel, safely and economically. Also, to pave the way for public acceptance of the option(s) chosen for the back end of the RR fuel cycle, when such a decision is eventually made.

The first activity of this subproject was to assess the present state of public communication in the participant countries. This assessment was performed through a questionnaire, and the diagnosis was that there is a good system, mainly in countries operating nuclear power plants, and in Chile, which has a systematic, successful and well-organized small group involved in public outreach. It is expected that Chile will serve as an example to be followed by the whole region. The first draft of a strategy for the region was also discussed during the RWS held in Santiago.

As a product of the subproject, a brochure is being prepared and this describes the RRs in the region, the benefits produced by them for the public, and the need for safe management and eventual disposition of spent fuel. The target audience for this brochure is initially, public opinion makers, journalists, and politicians.

CONCLUSIONS AND PROJECT EXTENSION FOR 2003-2004

From the initial stages of planning of this project it was clear that to meet its objectives two biennial cycles of IAEA support would be required. During 2001-2002 the achievements were:

- Installing capability in the participant countries to characterize the SFE by visual inspection, sipping, and non-destructive burn up measurements, as well as assessment of burn up determination by a comparison with absolute measurements. The corrosion surveillance program was also initiated, but this program will require several more years to accumulate and evaluate the results;
- The database of RR SFE in the region was completed, and projections for the future were made;
- In safety and regulation, proposals for safety documents related to operational, interim and final storage, and transport were developed as a first step towards harmonization of regulations in the region;
- Computational capability to perform safety analysis and design of storage facilities and a transport cask using the SCALE codes was made available;
- The back end options were discussed among the participant countries, and although a common strategy has not yet been defined, dry interim storage is viewed as a medium range option. The need for a multipurpose, regional transport cask was identified.
- For the first time, at the regional level, an attempt is being made to deal with the public on such controversial subjects, as storage and transport of spent fuel. For the first time, an IAEA Technical Project includes public information and communication. The country representatives had the opportunity to share their experiences and discuss a common strategy.

In short, the Project has performed successfully during 2001-2002, and is an example that could be emulated by other regions of the world.

For 2003-2004 the project is narrowing its activities to concentrate on more specific tasks. Thus the project extension plans are as follow:

<u>Spent Fuel Characterization</u> The only activities to continue will be corrosion surveillance, and R&D on eddy current to inspect spent fuel.

<u>Options</u>: During 2001-2002 the participant countries studied the possible options (interim and final) according to the realities of the region. The need for new short term operational storage facilities in Argentina and Brazil was identified. These countries plan to design new operational dry (in Brazil), and wet storage (in Argentina) facilities. These projects have been included as practical activities for 2003-2004 with open participation from the others countries. It was also identified that the dry interim storage for SF (processed or not) could be an attractive option for the region, and it will be technically and economically studied. Also given that the conditioned SF would probably be in the form for final disposal, conditioning technologies will be studied. Since there is a national R&D plan in the region (HALOX in Argentina) that was offered for co-operative work, the participant countries agreed to work together in this R&D plan. In addition, since there is another process in development in the USA (melt and dilute), which may be used for final disposal in the USA (Yucca Mountain), some Project participants will study and follow up this process. Finally, the design and qualification tests (of prototypes) of a regional Type-B cask will be an activity for 2003-2004.

<u>Safety and Regulation</u>: During 2001-2002, regulators carried out this subproject with little emphasis on operation. They identified the regulatory framework (national and international), and proposed drafting the four documents, or guidelines mentioned above. During 2003-2004 it is expected that these

documents will be formally discussed with the regulatory body of each participating country. Also, all the participating countries will share the Safety Analyses of new facilities and of the Regional Transport Cask currently being designed

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Public Information and Communication: This activity will continue to produce information material and consolidate a common regional strategy.

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