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MOBILE HOT CELL FOR THE CONDITIONING OF HIGH ACTIVITY SOURCES

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Necsa, South Africa

Background

- Proper management of spent sealed radioactive sources a priority
  - Developing countries: Poor accounting systems and/or lack of expertise/funds
- Spent High Activity Radioactive Sources (SHARS) especially problematic
- No standard procedures or suitable technologies
- In 2003 – concept of a mobile hot cell evaluated by international team of experts

Project Development

04 05 06 07 08 09 10

Phase I

Design
Requirements
Basic Design
Operational SA

Phase II

Detail Design
Operational SA
Manufacturing
Construction
Procedures
License to operate
Demonstration

Phase III **Implementation**

Sudan
Tanzania
Uruguay

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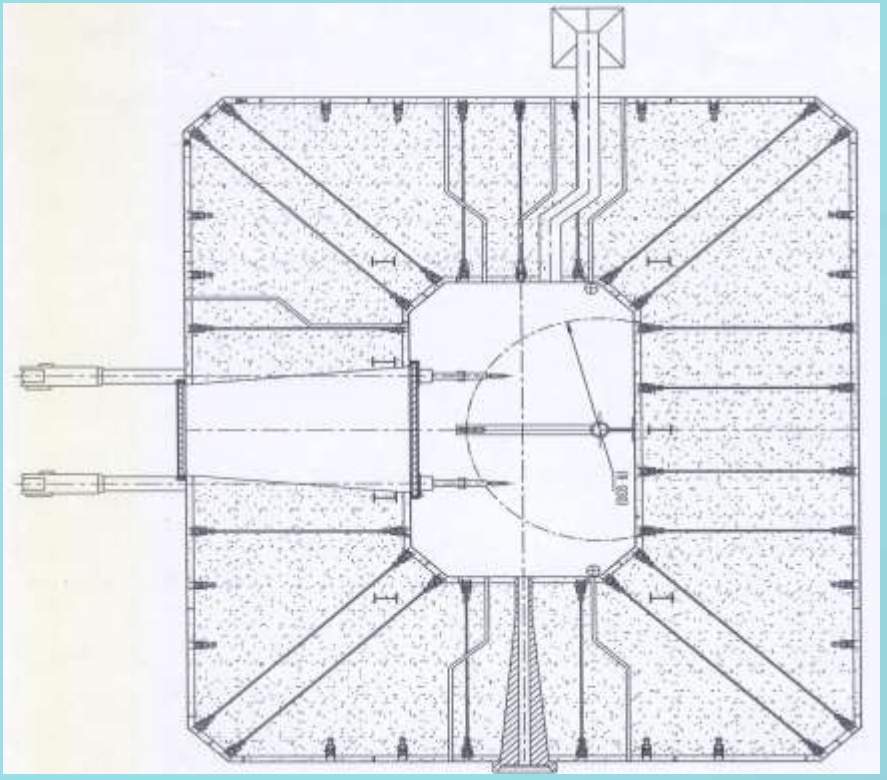
Application of Unit

- Transport unit into country – assemble and prepare for operation
- Removal of SHARS from working shields and transfer into long term storage shield
  - Removal of head/irradiator from working device
  - Partial dismantling of head/irradiator outside cell
  - Placement inside cell and further dismantling
  - Removal of SHARS
  - Encapsulate in stainless steel capsule – welding and leak testing
  - Placement into LTSS
  - Stored safely and securely
- Dismantle unit and transfer to next country

Design of Unit

View from the top



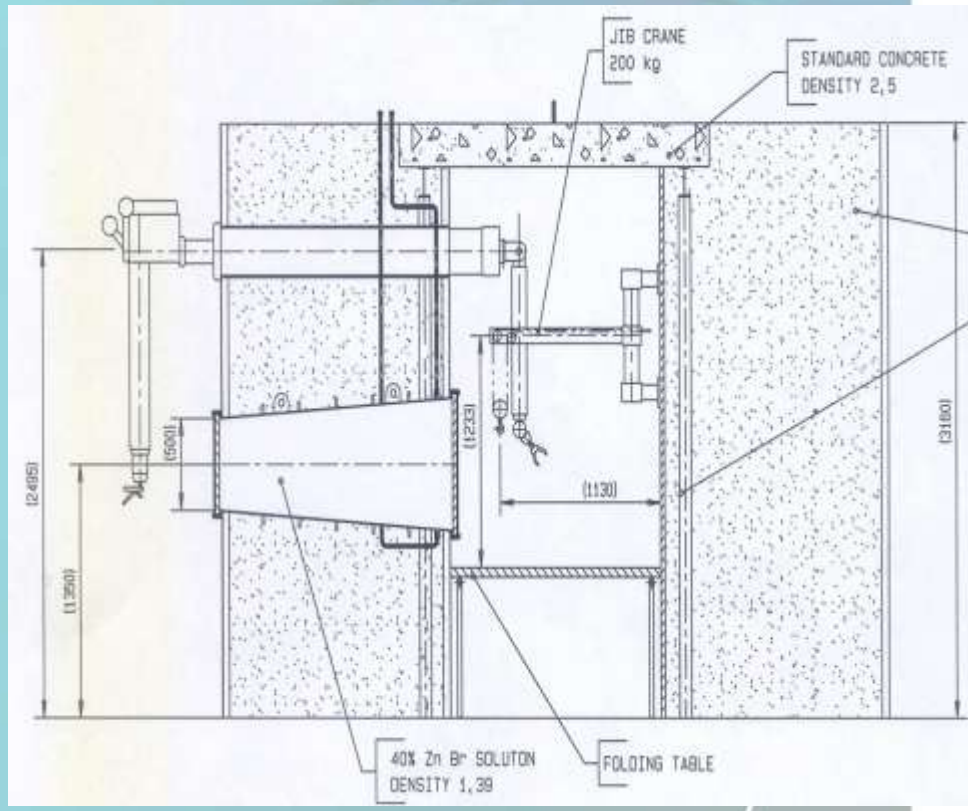
Cell walls – Double cavity wall 1,55 m thick - filled with river sand with density of 1,6 - Mild steel “shuttering” plates
Working volume 1,6 m x 2,5 m x 3 m high

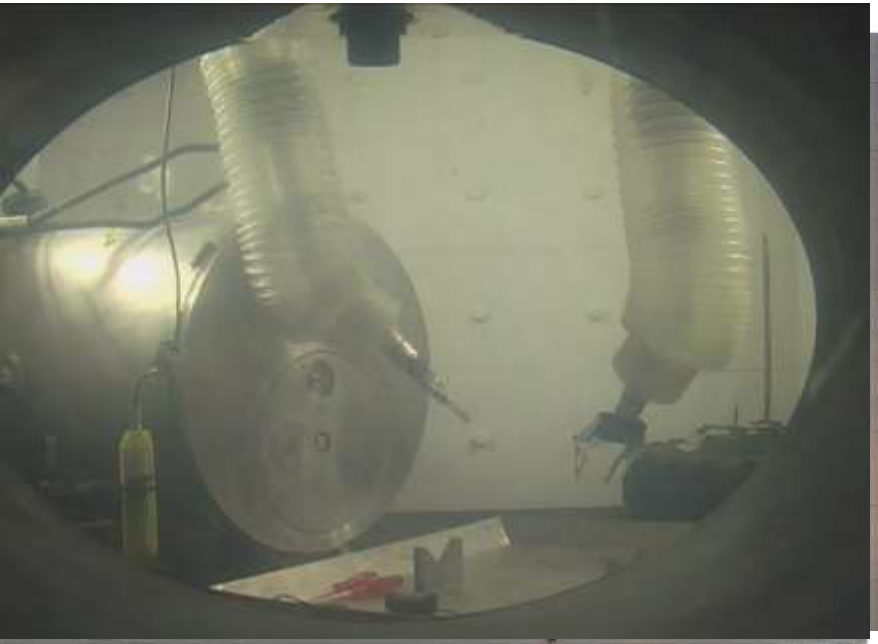
Design of Unit

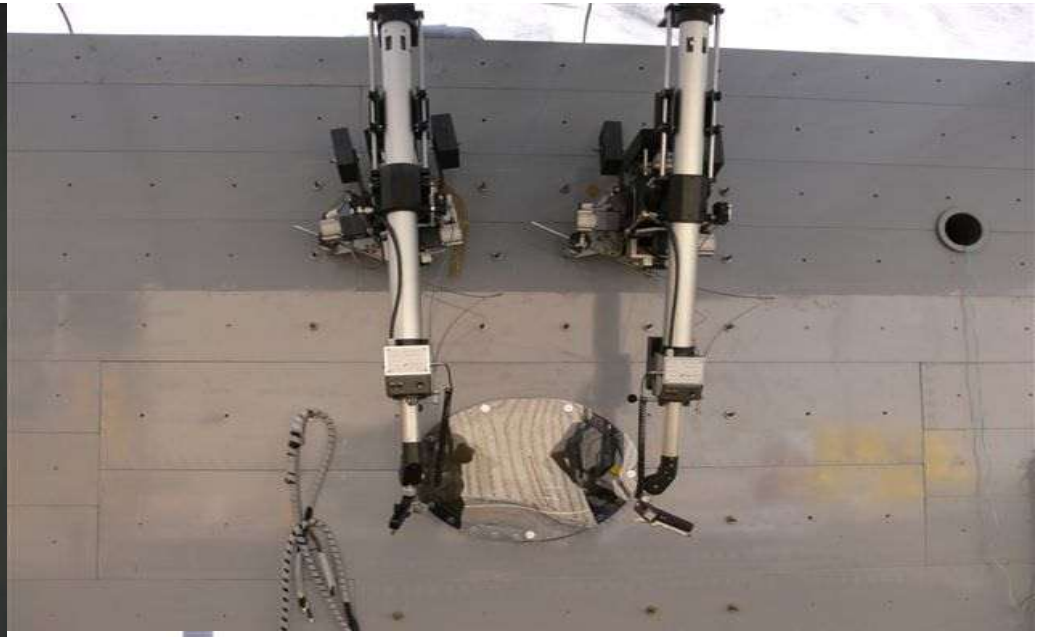
Roof – 3 x 0,23 m thick concrete slabs
Window – oval shaped steel container with polycarbonate ends - filled with 50% ZnBr2
Telescopic manipulators with 20 kg lifting capacity

Auxiliary Equipment
Jib crane on inside
Exhaust ventilation unit
360º camera coverage on inside
Table with tools, welding and leak testing equipment
Lighting
A-frame crane over unit

View from the Side







Demonstration of Unit

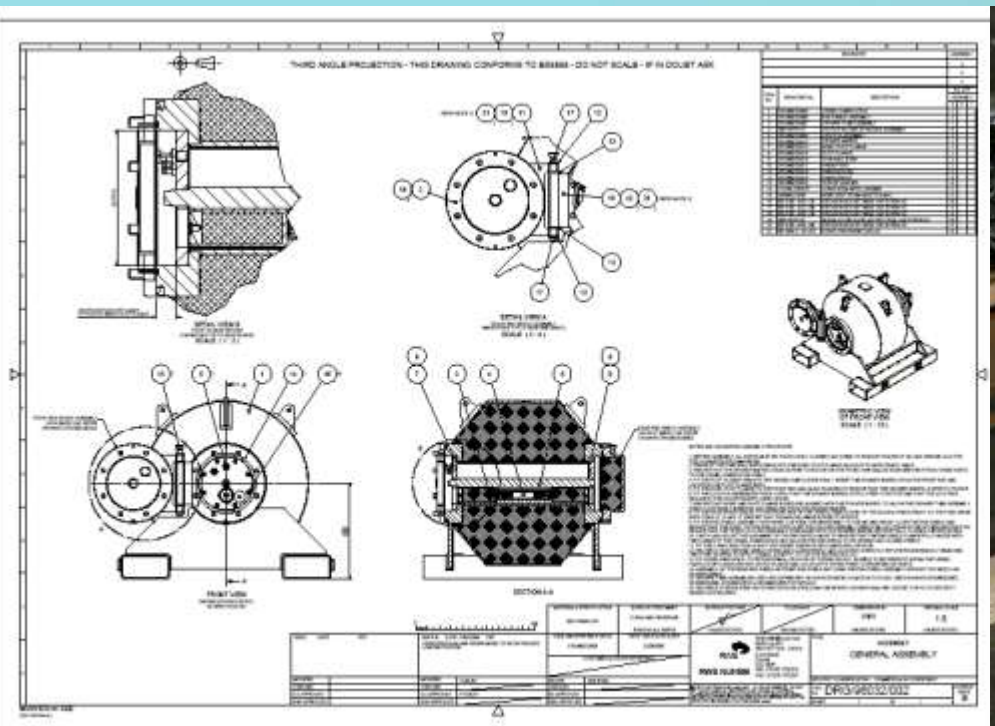
- March 2007 – pilot operation performed at Necsa
- 2133 Ci Co-60 source conditioned
- Witnessed by peer review team – USA (Los Alamos and NRC), UK, Belgium, Sudan and South Africa)
- Exposures well within modeled and calculated values – maximum 109 µSv
- Conclusion
  - SHARS Installation qualified
  - SHARS teams qualified

Advantages

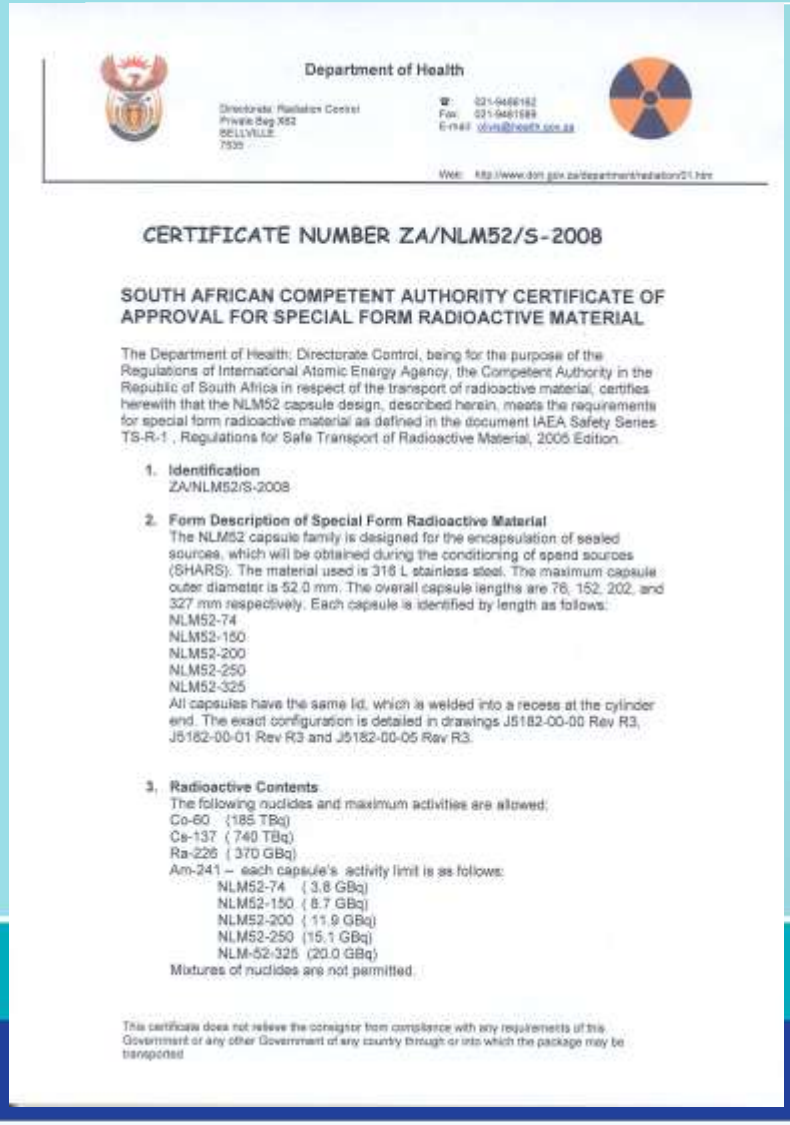
- Safety proven
- Allows for easy transportation
- Inexpensive
- Easy to operate
- Easy to assemble

Long Term Storage Shield

- Designed by RWE Nukem (UK)
- 4 Drawers with 10kCi capacity



Special Form Material



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Web: http://www.doh.gov.za/department/radiation/01.htm

CERTIFICATE NUMBER ZA/NLM52/S-2008

SOUTH AFRICAN COMPETENT AUTHORITY CERTIFICATE OF APPROVAL FOR SPECIAL FORM RADIOACTIVE MATERIAL

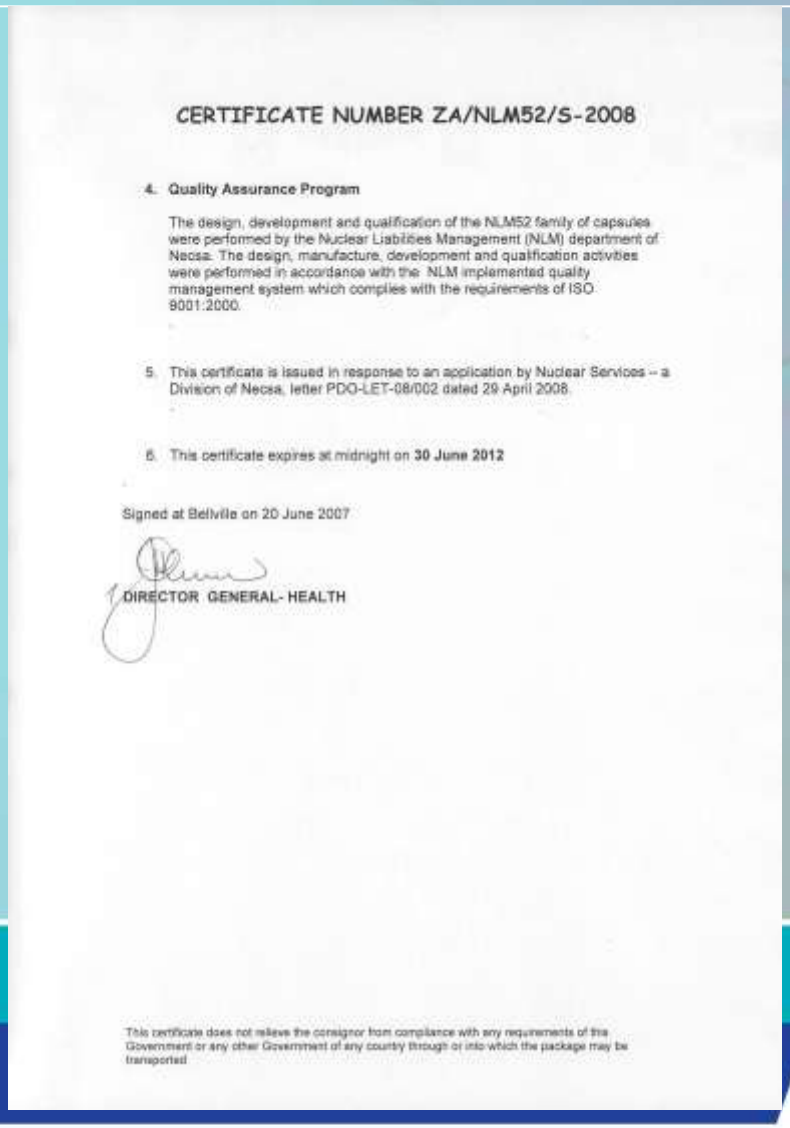
The Department of Health: Directorate Control, being for the purpose of the Regulations of International Atomic Energy Agency, the Competent Authority in the Republic of South Africa in respect of the transport of radioactive material, certifies herewith that the NLM52 capsule design, described herein, meets the requirements for special form radioactive material as defined in the document IAEA Safety Series TS-R-1 , Regulations for Safe Transport of Radioactive Material, 2005 Edition.

1. **Identification**
   ZA/NLM52/S-2008

2. **Form Description of Special Form Radioactive Material**
   The NLM52 capsule family is designed for the encapsulation of sealed sources, which will be obtained during the conditioning of spend sources (SHARS). The material used is 316 L stainless steel. The maximum capsule outer diameter is 52.0 mm. The overall capsule lengths are 76, 152, 202, and 327 mm respectively. Each capsule is identified by length as follows:
   NLM52-74
   NLM52-150
   NLM52-200
   NLM52-250
   NLM52-325
   All capsules have the same lid, which is welded into a recess at the cylinder end. The exact configuration is detailed in drawings J5182-00-00 Rev R3, J5182-00-01 Rev R3 and J5182-00-05 Rev R3.

3. **Radioactive Contents**
   The following nuclides and maximum activities are allowed:
   Co-60 (185 TBq)
   Cs-137 (740 TBq)
   Ra-226 (370 GBq)
   Am-241 – each capsule's activity limit is as follows:
   NLM52-74 (3.8 GBq)
   NLM52-150 (8.7 GBq)
   NLM52-200 (11.9 GBq)
   NLM52-250 (15.1 GBq)
   NLM-52-325 (20.0 GBq)
   Mixtures of nuclides are not permitted.

This certificate does not relieve the consignor from compliance with any requirements of this Government or any other Government of any country through or into which the package may be transported



CERTIFICATE NUMBER ZA/NLM52/S-2008

4. **Quality Assurance Program**
   The design, development and qualification of the NLM52 family of capsules were performed by the Nuclear Liabilities Management (NLM) department of Necsa. The design, manufacture, development and qualification activities were performed in accordance with the NLM implemented quality management system which complies with the requirements of ISO 9001:2000.

5. This certificate is issued in response to an application by Nuclear Services – a Division of Necsa, letter PDO-LET-08/002 dated 29 April 2008.

6. This certificate expires at midnight on **30 June 2012**

Signed at Bellville on 20 June 2007

DIRECTOR GENERAL- HEALTH

This certificate does not relieve the consignor from compliance with any requirements of this Government or any other Government of any country through or into which the package may be transported

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Impact test

Percussion test

Heat test

Leak test

- Weld qualified during Special Form certification.
- Field confirmation test by Vacuum bubble test according to ISO 9978:1992(E): International standard: “Radiation Protection – Sealed radioactive sources – leakage test methods” par 6.2.1

NLM52 Special Form Capsule welding log

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Capsule info

Capsule no				
Cylinder no		Lid 1 no		Lid 2 no

Verified compliance (review inspection report)

Name	Date	Signature

This sheet is based on PDO-OP-002 Rev 0

		Action	Paraf	Date
Bottom lid weld	1	Perform 'Motor Calibration' (attach print-out)		
	2	Perform 'Test Weld' (attach print-out)		
	3	Gas pressure at least 200kPa and flow 15L/min		
	4	Lid pressed correctly in position		
	5	Attach the applicable weld head capsule holder for cylinder length		
	6	Insert capsule		
	7	Position weld needle using spacer		
	8	Fill capsule with argon and return quickly in weld head		
	9	Position weld head and execute weld (attach print-out)		
Compliance	10	Visual inspect weld		
	11	Perform helium leak test on weld (attach report)		
	12	Seal welded capsule in plastic		

Weld not leaking and visual sound

Name	Date	Signature

Content	13	Record content:		
Top lid weld	14	Attach the applicable weld head capsule holder for cylinder length		
	15	Perform 'Motor Calibration' (attach print-out)		
	16	Perform 'Test Weld' (attach print-out)		
	17	Gas pressure at least 200kPa and flow 15L/min		
	18	Place open filled capsule in weld head, position welding needle using spacer		
	19	Remove capsule from head		
	20	Fill open capsule with argon and place lid in position		
	21	Press lid correctly in position		
	22	Insert capsule in weld head		
	23	Position weld head and execute weld (attach print-out)		
Compliance	24	Visual inspect weld		
	25	Bubble test		

Performed as prescribed, weld visual sound and no leaks detected

Name	Date	Signature

PDO-FRM-003 Rev 1

QA

- Data sheet completed per capsule
- Evidence of all processing steps
- After bottom lid weld, capsule helium leak tested
- Record of contents
- More detail of sources on other forms

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The Way Forward

- Further developments
  - Licensing – LTSS as transport container
  - Security – Improve the Design of LTSS
- Integration of the Borehole disposal concept and SHARS conditioning facility

Summary

- SHARS installation successfully demonstrated - safe.
- Safety and security ensured
- Mission completed – Sudan, Tanzania and Uruguay
- Pre-mission – Philippines and Brazil