



SYMPOSIUM SMALL MODULAR REACTORS FOR NUCLEAR POWER

Brazil, July 23, 2014

Conclusion of Construction and Start-up of Atucha II NPP

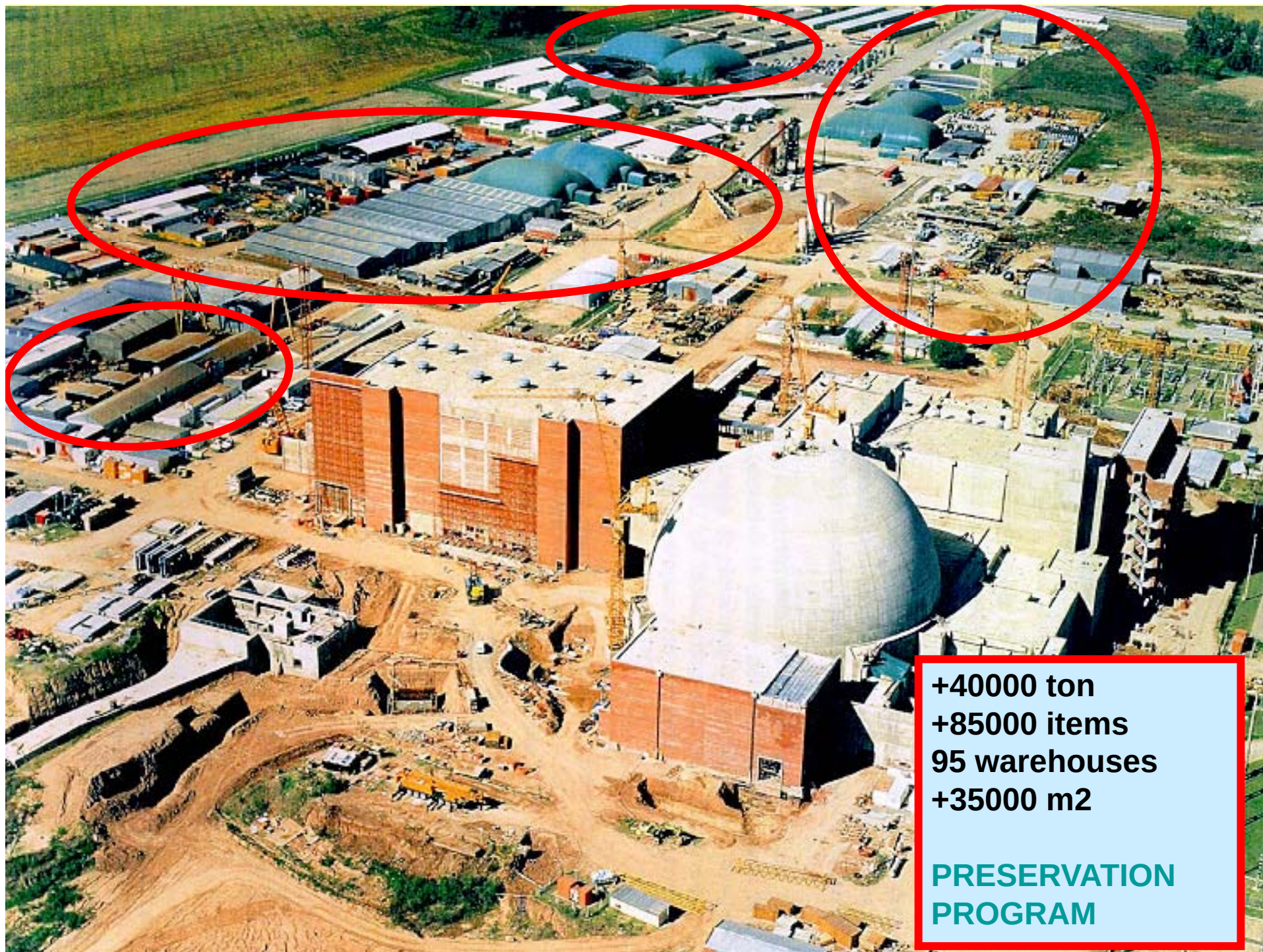
José Luis Antúnez



NUCLEOELÉCTRICA ARGENTINA S.A.



Atucha I-II June 2006



+40000 ton
+85000 items
95 warehouses
+35000 m2

**PRESERVATION
PROGRAM**



NUCLEOELECTRICA ARGENTINA S.A.

ATUCHA II – TECHNICAL CHARACTERISTICS

Overall Plant Data

- Reactor type: Heavy water moderated and cooled natural uranium reactor
- Generator output at terminals: approx. 745 MW
- Total thermal power transferred to the steam water cycle: 2174 MW
- Total thermal power transferred to the moderator coolers: 220 MW

Reactor Coolant and Moderator Systems

- Total coolant circulation flow (2 loops): 10300 kg/s
- Total moderator circulation flow: 890 kg/s
- Conditions at RPV outlet: 115 bar at 313 °C
- Moderator temperature inlet: 140 / 195 °C
- Heavy water inventory: 640 Mg



NUCLEOELECTRICA ARGENTINA S.A.

ATUCHA II – TECHNICAL CHARACTERISTICS

Reactor Core

• Number of coolant channels	451
• Active core length	5300 mm
• Total Uranium inventory	85.1 MG
• Fuel burnup at equilibrium	7500 MWd/MgU
• Shape of fuel assembly	37-rod cluster
• Cladding tube outer diameter	12.9 mm

Reactor Pressure Vessel (RPV)

• Internal diameter	7368 mm
• External overall height	approx. 14068 mm
• Total weight of the lower part	710 Mg
• Total weight of closure head	305 Mg
• Cylindrical shell thickness + cladding	290 + 6 mm



NUCLEOELECTRICA ARGENTINA S.A.

ATUCHA II – TECHNICAL CHARACTERISTICS

Steel Containment

- Diameter/thickness 56 m / 30 mm

Steam Generator (2)

- Type U-tube heat exchanger
- Height 21000 mm

Reactor coolant pump

- Type single-stage centrifugal
- Discharge head 135 m
- Power (cold condition) 11500 kW

Pressurizer

- Overall height 15000 mm
- Total free volume 85 m³



ATUCHA II – TECHNICAL CHARACTERISTICS

Steam turbine-generator plant

- Main steam flow rate 957 kg/s
- Main steam pressure at SG outlet 55.9 bar
- Main steam moisture at SG outlet 0.25%
- Condenser circulating water flow rate 38400 kg/s
- Turbine design: double flow 3-cylinder single shaft turbine
- Speed 1500 rpm
- Generator 838 MVA
- Voltage 21 kV



PHWR NPP 745 MWe (gross), 692 MWe (net)

Signature of Contracts:	May 9, 1980
Original Parties:	CNEA/KWU
Construction Period:	7 years
Total Cost estimation:	US\$ 1800 MM
First of a program of 4 NPP's	



-Siemens-KWU: Main Contracts (Not “Turn-key”):

- Supplies**
- Services**
- Warranties**
- Transfer of technology**
- Fuel design**

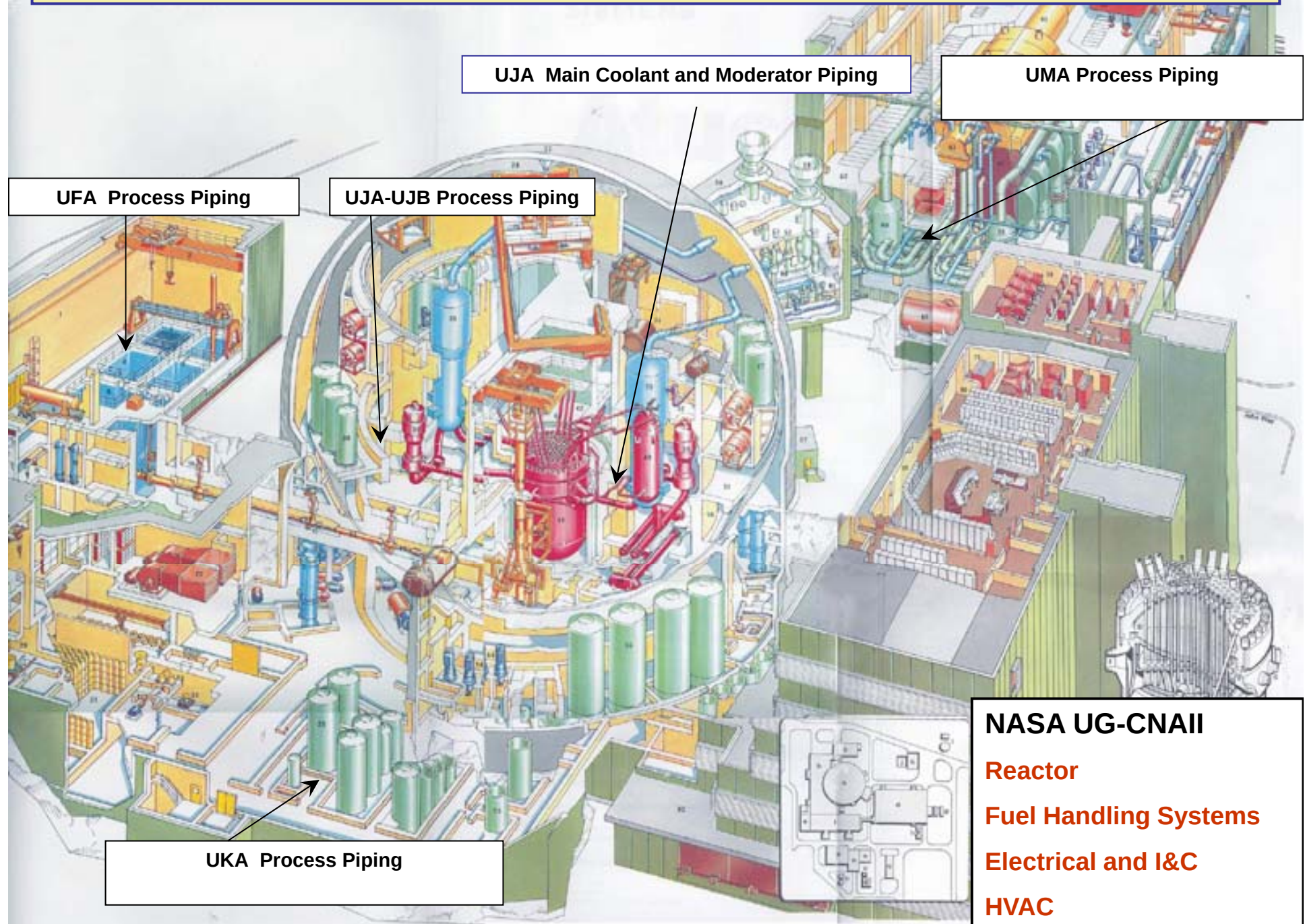
**-Jointly Owned Co.(ENACE) = Architect-Engineer
for the four NPP's**



THE NEW APPROACH TO THE PROJECT (2006)

- NA-SA Architect Engineer and Design Authority**
- Two simultaneous Projects:**
 - Recover local capacities**
 - Completion of Atucha II**

ATUCHA II ELECTROMECHANICAL INSTALLATION – ALLOCATION OF MAIN WORK SUB-PACKAGES





Additional infrastructure facilities – New workshop for Mechanical and Electrical Component inspection and refurbishment ¹²





Inspection of Main Coolant Pumps



Inspection of Main Coolant Pumps



NUCLEOELECTRICA ARGENTINA S.A.

LICENSING DOCUMENTATION

OPERATION

- Q Manual for Operation
- Operation Structure
- Technical Specifications
- Operation Manual & Emergency Procedure

MAINTENANCE

- Maintenance Manual
- Ageing Management Program
- Pre-Service Inspection Program & In-Service Inspection Program



NUCLEOELECTRICA ARGENTINA S.A.

SAFETY & CORE DESIGN (NEUTRONIC & TH) CODES

Calculational Tools used for Atucha II

- RELAPS
- RISKSPECTRUM
- PUMA
- TRNSURANUS
- GOTHIC
- RELAPS/MACCS
- DRAGON
- COBRA
- CFX
- MNCPS



NUCLEOELECTRICA ARGENTINA S.A.

LICENSING DOCUMENTATION

Design and Construction

- Safety Analysis Report (PSAR / FSAR)
- Probabilistic Safety Analysis (PSA) Levels I, II and III
- Relevant design modification

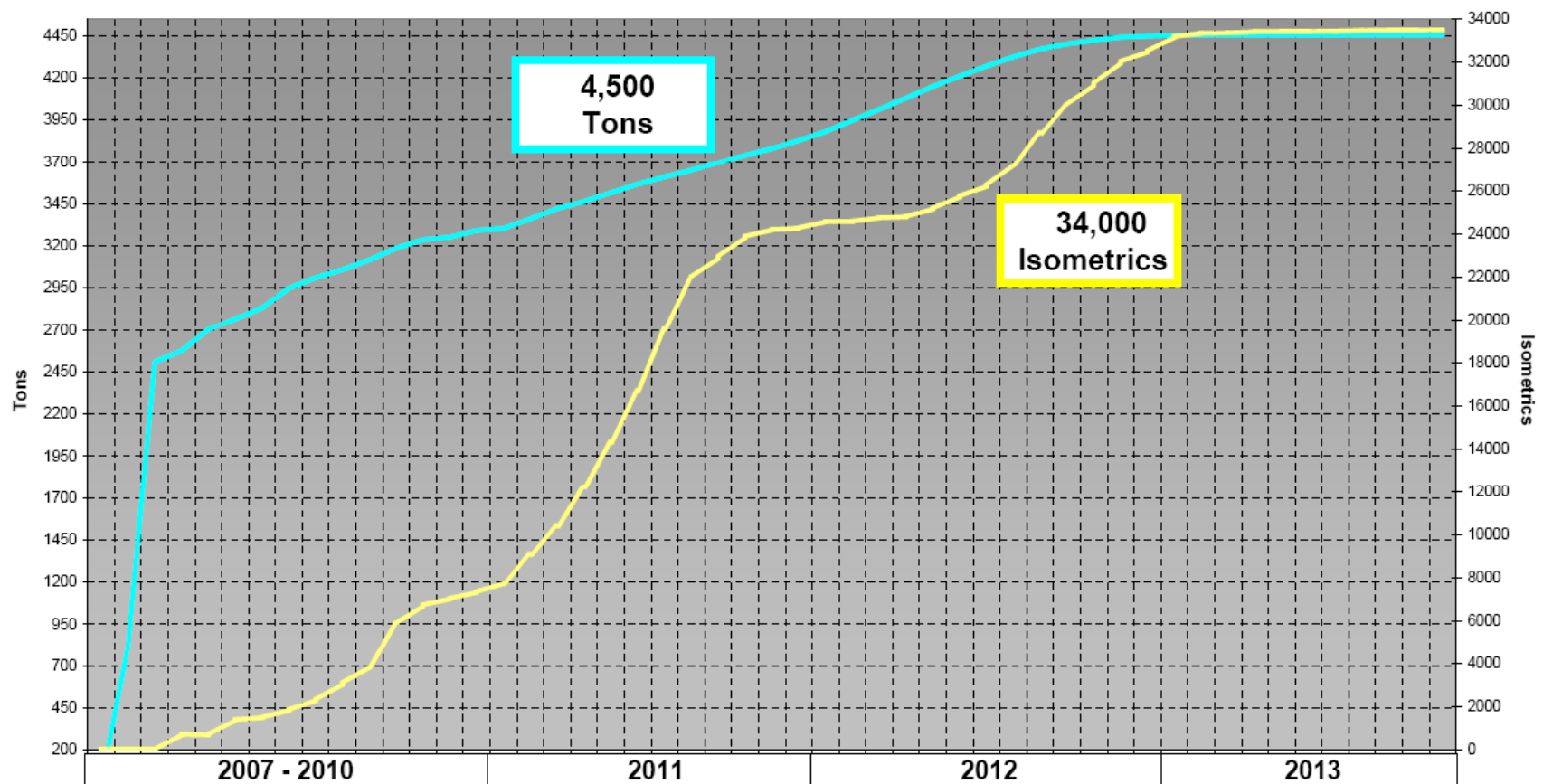
Safety, Security and Safeguards

- Contingency Plan
- Radiological Protection Manual
- Security Report
- Safeguards Report
- Post Fukushima Stress Test



NUCLEOELECTRICA ARGENTINA S.A.

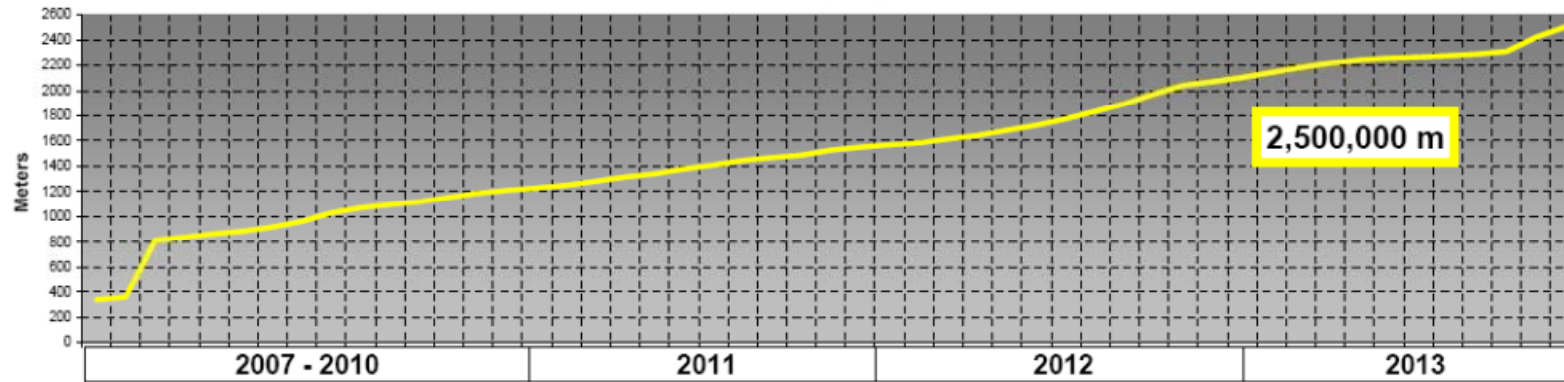
Piping Erection and Hand over of Isometrics to Precommissioning



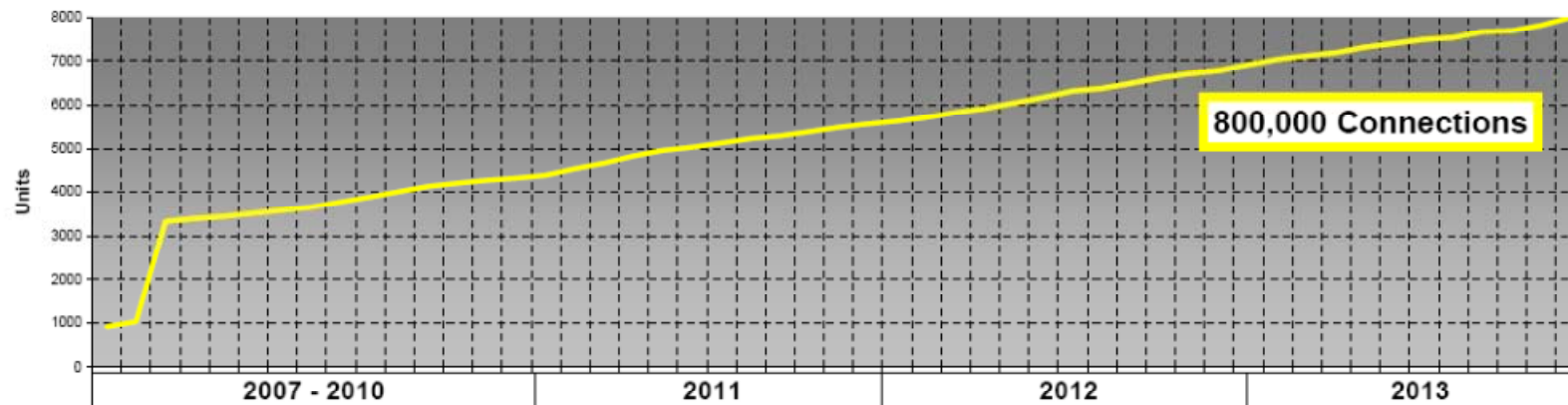


NUCLEOELECTRICA ARGENTINA S.A.

Cable Laying (meters)



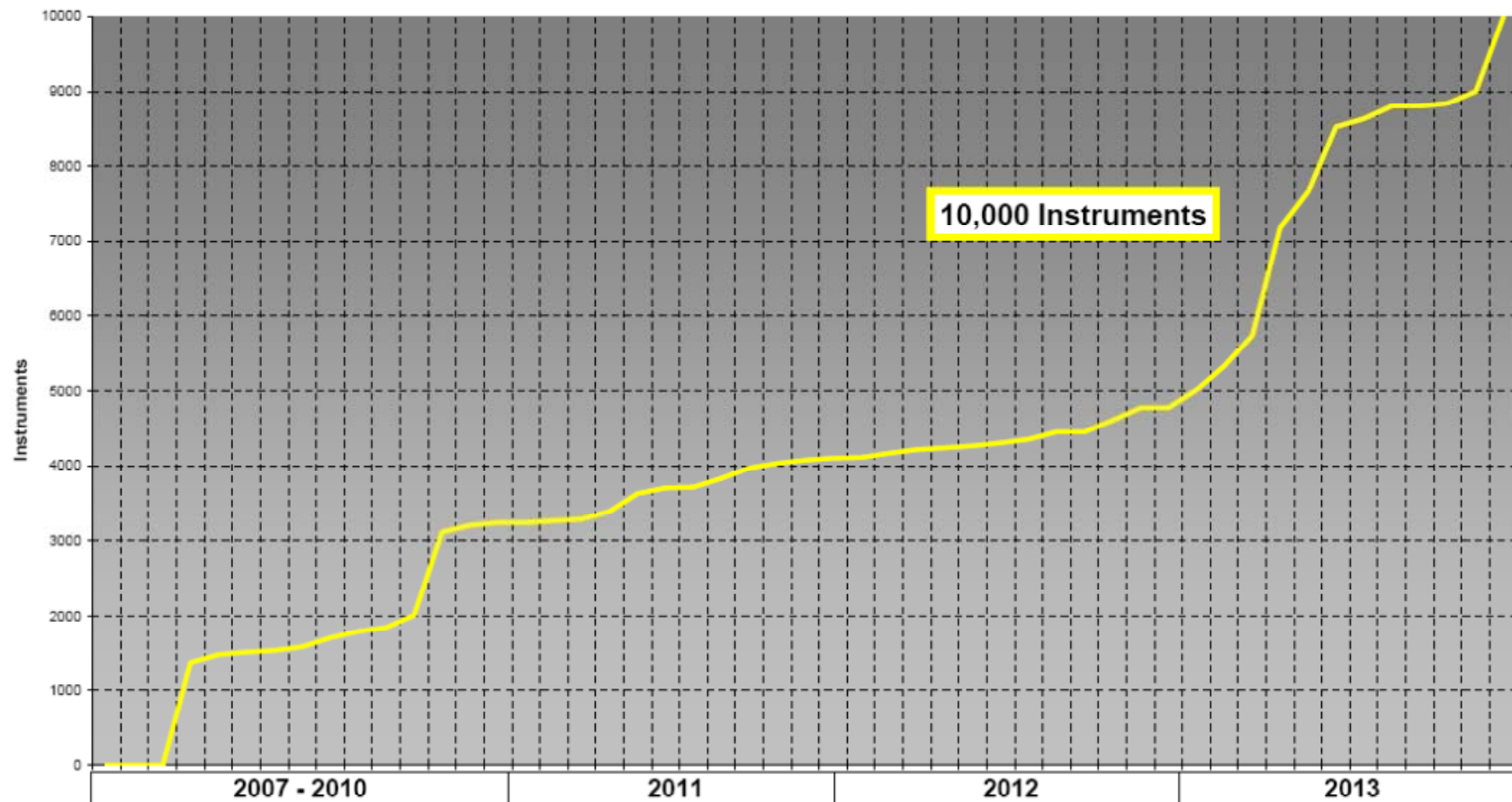
Cable Connections





NUCLEOELECTRICA ARGENTINA S.A.

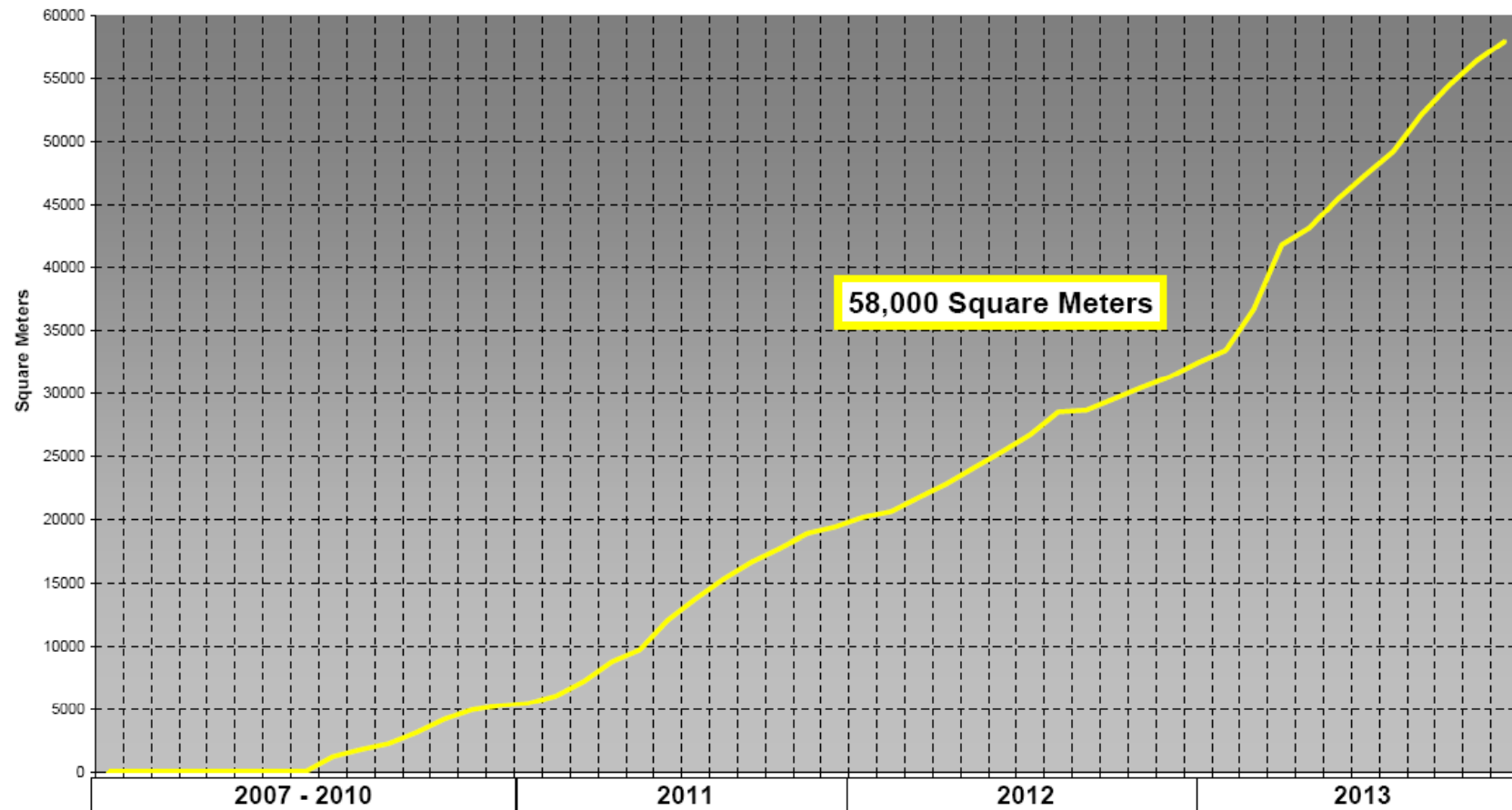
Field Instruments





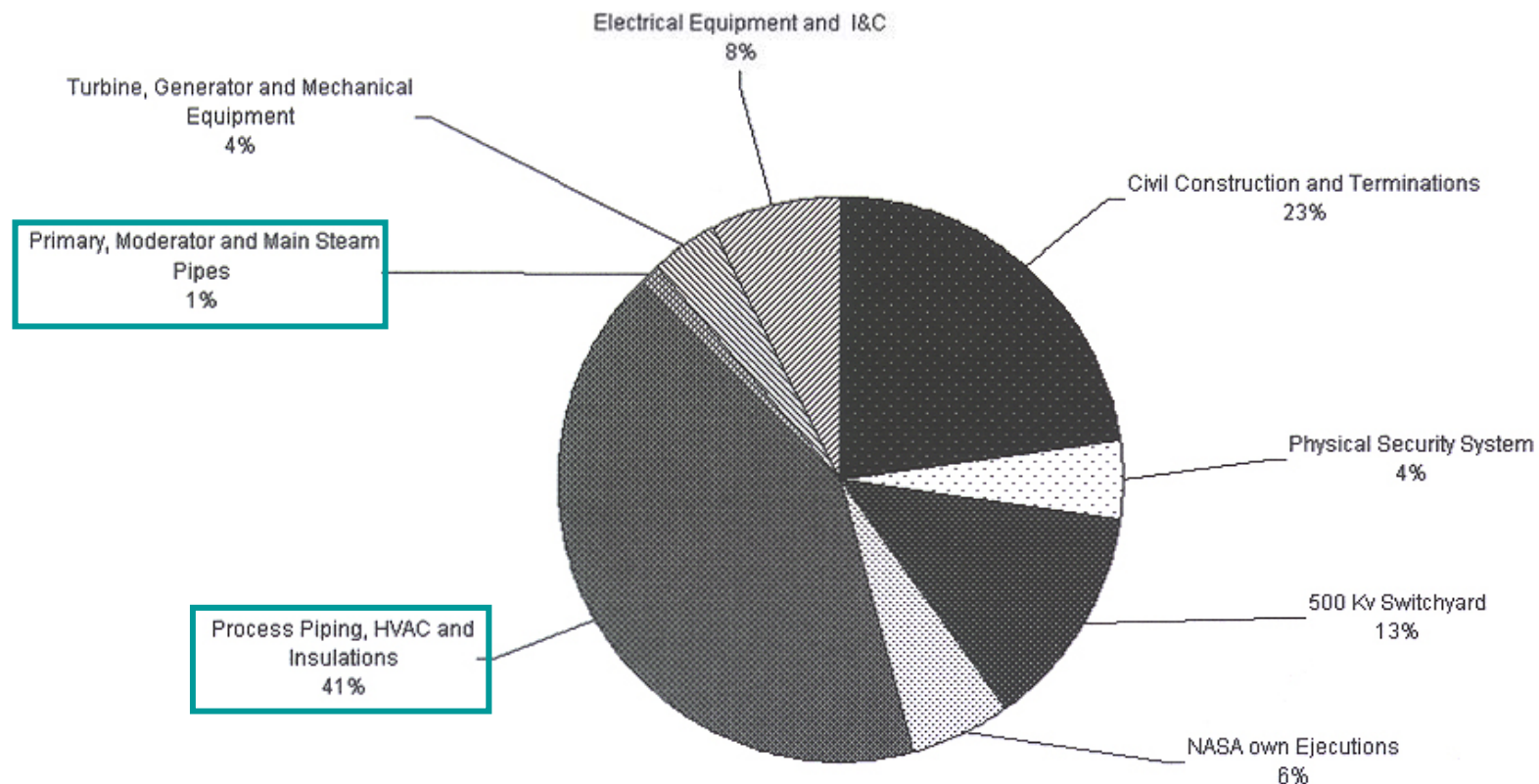
NUCLEOELECTRICA ARGENTINA S.A.

Insulation



Definition of major work packages and participation of local companies in Piping Erection

ATUCHA II NUCLEAR POWER PLANT



TOTAL OF CONSTRUCTION AND ERECTION PACKAGES



NUCLEOELECTRICA ARGENTINA S.A.

CHANGES IN SCOPE OF PROJECT DURING COMMISSIONING (AFTER COMPLETION OF CONSTRUCTION)

	SEPTEMBER 2011	AUGUST 2013	VARIATION
ISOMETRICS	31817	33455	5,1%
CABLES	35721	37240	4,2%
PROCESS-ORIGINATED DESIGN CHANGES	368	384	4,3%
AS-BUILT-ORIGINATED DESIGN CHANGES	13380	14267	6,6%



NUCLEOELECTRICA ARGENTINA S.A.

ATUCHA II IN NUMBERS

- **ENGINEERING DOCUMENTS** 130,000
- **CIVIL WORKS (Completion)** 32,000 m³ concrete
- **MECHANICAL EQUIPMENT** 36,000 tons
- **PIPING** 4,500 tons
(34,000 isometrics; 16,000 valves; 700,000 welds)
- **ELECTRICITY & INSTRUMENTATION** 2,500,000 m of cables
(800,000 connecting points; 1.600 switchgears & panels; 10,000 field instruments)
- **INSULATION** 58,000 m²
- **COMMISSIONING & START UP** 500 systems
(1,300 pressure test circuits; 18,000 Mechanical tests; 12,500 Electrical tests;
33,000 Instrumentation tests)
- **PURCHASE ORDERS & CONTRACTS** 15,000



NUCLEOELECTRICA ARGENTINA S.A.

ATUCHA II IN NUMBERS

- **2,200,000 engineering manhours (95% local)**
- **42,000,000 construction & erection manhours (99% local)**
- **Construction peak 7,200 direct personnel (June 2010)**
- **5,500,000 meals served**



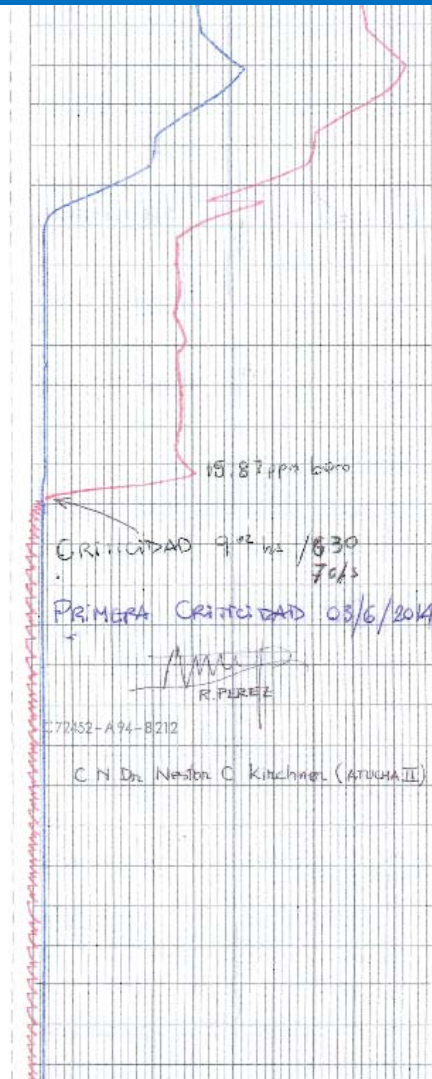
May 2013



NUCLEOELECTRICA ARGENTINA S.A.

PRIMERA CRITICIDAD

June 3, 2014
9.02 AM





NUCLEOELECTRICA ARGENTINA S.A.

