



# AUTORIDAD REGULATORIA NUCLEAR



Autoridad Regulatoria  
Nuclear  
Presidencia de la Nación Argentina



# **Biodosimetry: Latin American Biological Dosimetry Network (LBDNet)**

***23rd WiN Global Annual Conference-  
Women in Nuclear Meet Atomos for Peace***

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**Autoridad Regulatoria Nuclear**



## **BIODOSIMETRY- BIOLOGICAL DOSIMETRY (CYTOGENETICS)**

- Biological Dosimetry allows individual dose assessments based on the effect produced by ionizing radiation on a given biological parameter. The biological endpoint being scored is chromosomal aberrations (dicentric), relying on a lymphocytes culture from the patient's blood. The measured yield of chromosome aberrations is referred to a calibration curve to obtain the whole body absorbed dose
- The quantification of unstable chromosome aberrations (dicentric) is the most reliable biological method for estimating individual whole-body doses of recent, acute, uniform exposures to external irradiation/internal contamination with radionuclides such as  $^{137}\text{Cs}$  and  $^3\text{H}$  that distribute uniformly in the body
- Biological Dosimetry has become a routine component of accidental dose assessment, complementing physical and clinical dosimetry. In this regard, it is a support tool for National Radiation Protection Programs and Emergency Response Schemes



# **CYTOGENETIC DOSIMETRY (BIOLOGICAL DOSIMETRY)**

## **BIODOSIMETRY (role):**

1. Radiological/nuclear **accidents**: to guide medical treatment (emergency response)
2. Radiation protection: **workers** with personal dosimetry above the permitted limits
3. **Clinical** applications: e.g. to support treatment decisions in patients with differentiated thyroid carcinoma under  $^{131}\text{I}$  therapy; BM dose assessment, to avoid myelotoxicity threshold
4. Long-term **health risk studies** following radiation exposure (radiation epidemiology)-FISH and EPR (retrospective dose)
5. Development of biomarkers
6. Evaluation of individual radiosensitivity



## The Latin American Biological Dosimetry Network (LBDNet)

- It has been observed that victims of accidental overexposures show better chance of survival if they receive medical treatment early.
- The increased risk of scenarios involving mass casualties has stimulated the development of tools that would help the medical doctors to treat victims.
- The Biological Dosimetry has become a routine test to estimate the dose, supplementing physical and clinical dosimetry.
- One of the existing strategies to afford mass casualty events is the use of cytogenetic networks to enlarge the capabilities for rapid triage and reference dose assessment, sending blood samples (or pellets), slide preparations or electronically transmitted images.



## **NETWORKING**



### **The Latin American Biological Dosimetry Network (LBDNet)**

- **The LBDNet was established in 2007 in the frame of the IAEA's Technical Cooperation Project RLA/9/054 Strengthening National Systems for Preparedness and Response to Nuclear and Radiological Emergencies with the purpose of mutual assistance in case of a radiation emergency.**
- **Organization and activities within the LBDNet are performed as recommended by the ISO 21243 standard**

## ***LBDNet***

- ✓ Based on a voluntary and consensual participation of laboratories, qualified in the selected cytogenetic techniques
- ✓ Representation of laboratories is institutional and not personal
- ✓ Consists of 7 reference laboratories responsible for the biological dosimetry from:

1. Argentina- Autoridad Regulatoria Nuclear (ARN)
2. Brazil-Instituto de Radioprotección y Dosimetría (IRD)
3. Chile-Comisión Chilena de Energía Nuclear (CCHEN)
4. Cuba-Centro de Protección e Higiene de las Radiaciones (CPHR)
5. Mexico- Instituto Nacional de Investigaciones Nucleares (ININ)
6. Peru-Instituto Peruano de Energía Nuclear (IPEN)
7. Uruguay-Instituto de Investigaciones Biológicas Clemente Estable



# THE MISSION



- To strength the service capacities of Biological Dosimetry laboratories existing in the region to provide an early biodosimetric response for mutual assistance, integrated to the National Radiological Emergency Plans
- To provide support to other Latin American countries that do not have biological dosimetry laboratories
- To work cooperatively and articulately with other international networks

Besides, the LBDNet support inter-comparison exercises to keep standard goals on biological dosimetry preparing and sending processed blood samples for cytogenetic analysis or uploading cytogenetic images to the internet network created to share and discuss results obtained by any laboratory of the Network

# NETWORK ACTIVATION AND MAINTENANCE



## Network design

- ✓ At the national level, the laboratories work within national emergency response systems
- ✓ At the international level, the network cooperates with the IAEA Incident and Emergency Centre (IEC) in the frame of the Convention of Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, and with other assistance systems such as REMPAN/WHO-Global Biodosimetry Laboratories Network
- ✓ The network is opened for collaboration with laboratories in other countries in the region and from other regions, as well as for collaboration with other national and regional networks. Laboratories from Bolivia, Costa Rica, Ecuador, Venezuela and Paraguay have joined LBDNet activities



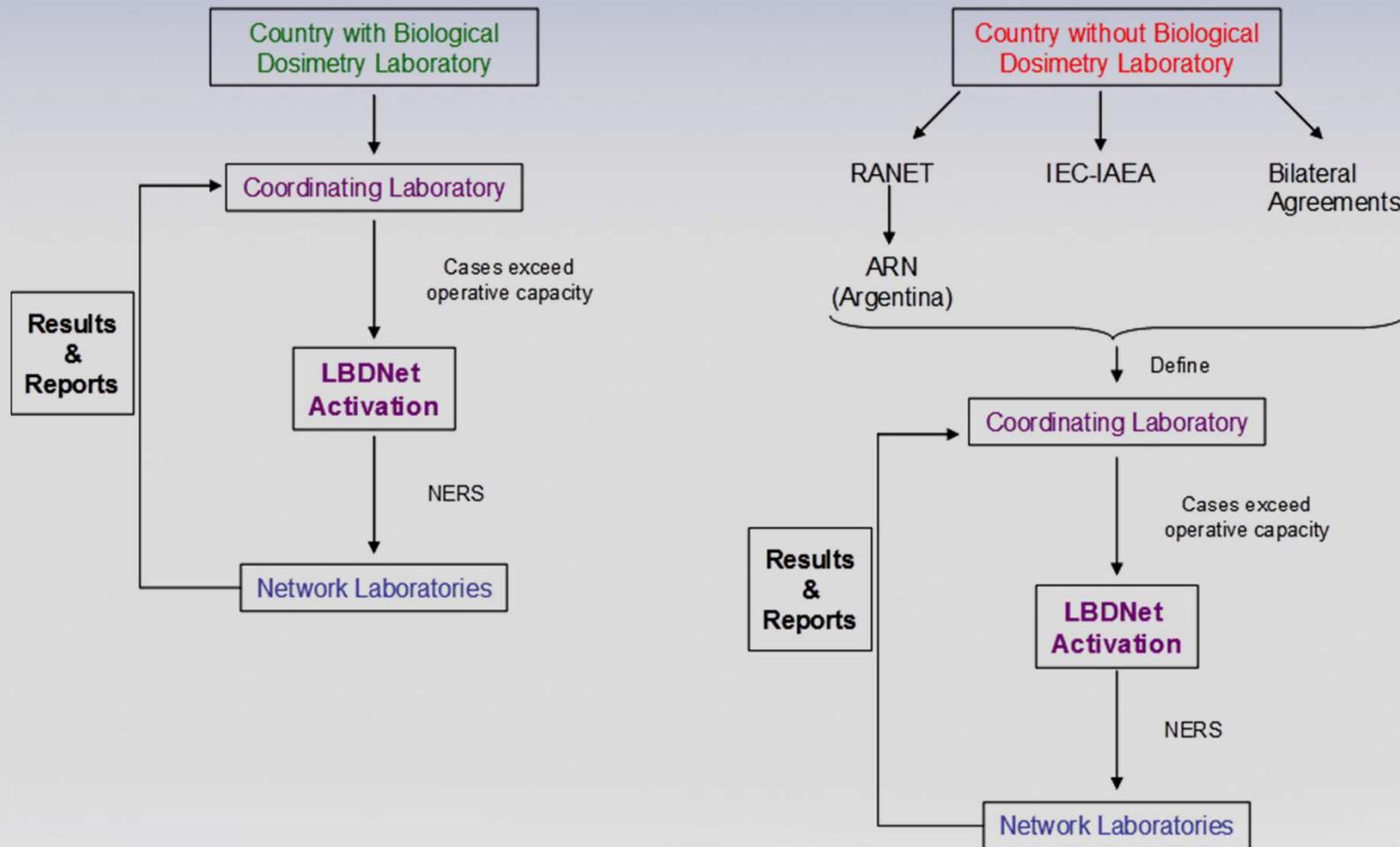


### **IN NORMAL SITUATION:**

*Each laboratory of the network has the same hierarchical level (consortium of reference laboratories) and interact among them through training, exercises, drills and intercomparison exercises*

# NETWORK ACTIVATION IN EMERGENCY

ACCIDENT



The BD laboratory of Argentina is the region's laboratory registered under IAEA- RANET system (since 2008) and accredited under ISO17025:2008 and ISO19238:2014 standards



## *Biological dosimetry assistance in radiological accidents occurred in the Region before and after LBDNet*



In the framework of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency- IAEA and / or bilateral agreements





- At present, the response of the network in an emergency situation involves the use of the **dicentric analysis**

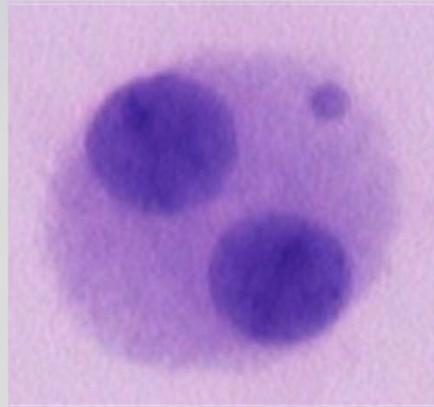


- The technical procedures status of the region was evaluated and the conformity to ISO 19238 and IAEA's EPR-Biodosimetry 2011 was determined.

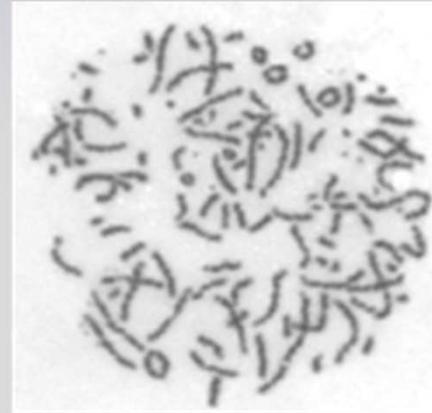
## LBDNet Tools



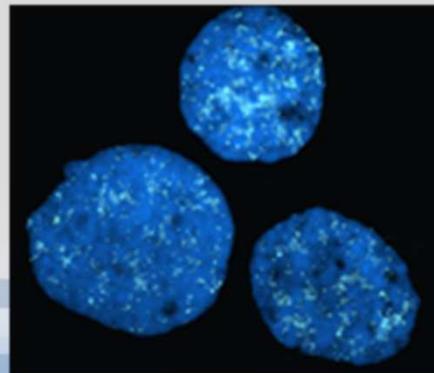
Most of the laboratories have implemented other established techniques for biodosimetry such as Cytokinesis blocked micronucleus assay, FISH technique, PCC-ring induction and the H2AX assay



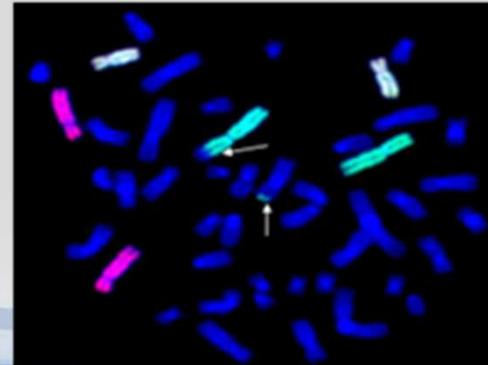
Micronuclei



PCC rings



$\gamma$  H2AX Foci



FISH



***Many thanks***

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