WOSMIP IX

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Overview project of a new Fission Radioisotope Production Plant in Argentina and the planned noble gas emission mitigation system.

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History of Fission R.I. Production in Argentina

- **1977** Construction of first α,β,γ cells
- **1978** First experiences in radiochemical process of Mo-99 separation
- **1980** Development of irradiation targets (HEU)
- **1985** Expansion of the facility
- **1985** First commercial production of Mo-99
- **1993/1994** RA-3 HEU fuel converted to LEU fuel
- **1994** Construction of new line of hot cells
- **2002** R.I. Production conversion from HEU to LEU
- **2005** First commercial production of I-131

38 years experience producing Fission Radioisotopes. First country to produce R.I. with LEU technology.

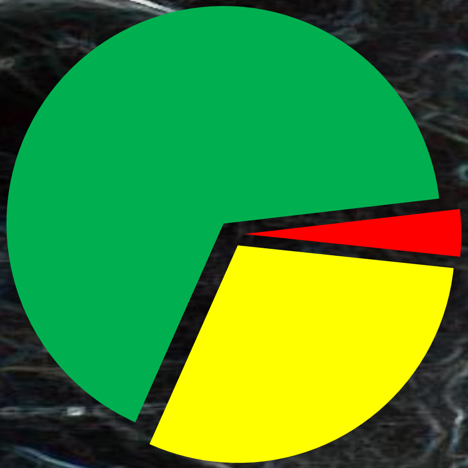
Present PPRF Facility

Method use for Noble Gases Abatement:
CONTAINMENT Simple by storing NG enough for it decayment in holding tanks.

Hot cell Ventilation system: absolute filters and impregnated charcoal columns to trap iodine. Not NG trap system.

Present PPRF Facility

Noble Gases (NG)

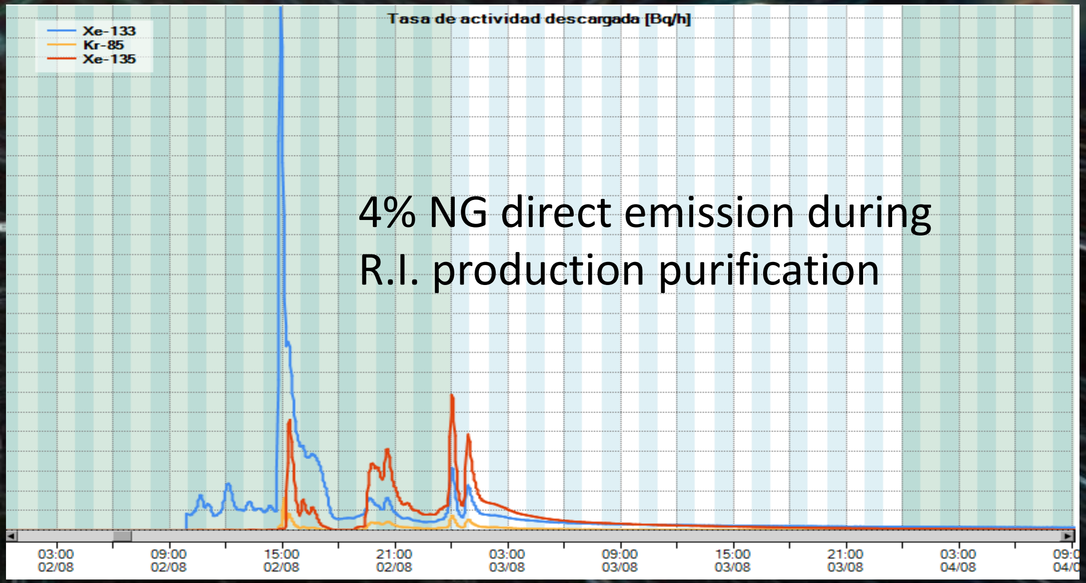


66 % NG due to PURIFICATION STEPS (NG + AIR) This gases are initially stored.

30 % NG due to alkaline DISSOLUTION STEP (NG + HYDROGEN). Stored

4 % NG DIRECT EMISSION DUE TO PURIFICATION STEPS (NG + AIR) leaks through connecting different purification steps, so reach directly hot cell ventilation system.

CNEA engineer radioisotope production system seeks to **continue reduce this 4 %** so NG not reach hot cell ventilation system without decayment.



New PPRF

New PPRF designed production:

Mo-99: 2500 Ci/week - 6 days calibrated

I-131: 500 Ci/week - 14 days calibrated

New PPRF producing 2500 Ci/week of Mo-99 will manipulate around **$9x10^{14}$ Bq of fresh Xe-133 every week.**

RA10 Reactor

OCTOBER 2023 : The **civil work is 100% completed** and the **overall project has reached 80% completion.**

Engineered Abatement Methods Considered for NEW PPRF

1. CONTAINMENT
2. ADSORPTION
3. HYDROGEN OXIDATION/REDUCTION
4. HYDROGEN CHEMICAL REACTIONS (CNEA Innovative method)
5. HYDROGEN DIFUSION (CNEA Innovative method)

	CONTAINMENT	ADSORPTION	OXIDATION/ REDUCTION	CHEMICAL REACTIONS	DIFUSION
DESCRIPTION	Simple by storing NG enough for it decayment in holding tanks.	INVAP´s designed NG trapping system. NG are concentrated in small individual columns with adsorbates.	COPPER OXIDE CONVERTER. Technology tested and validated by CNEA in the 90´. NG are concentrated and isolated in small individual tanks.	CNEA Innovative method. Hydrogen reacts forming hydride. NG are concentrated and isolated in small individual tanks.	CNEA Innovative method. Hydrogen diffuses though a metal membrane. NG are concentrated in small individual tanks.
ADVANTAGES	Can be implemented for NG mix with air or mix with hydrogen. Simple method. Need few devices (vacuum pumps). Minimum maintenance	Reduce 50 times space use comparing with normal storage tanks.	Technology highly used in industry. Needs low storage volume. Converts/separates 98/99% of hydrogen. Hydrogen is separated as water.	Reduce 100 times space used comparing with normal storage tanks. Reduces needed space comparing with copper converter method. Very low maintenance (Passive method). No need heating. Unexpensive material. Pure hydrogen can be vented or converted to water.	No need of regeneration. Converts/separates 99,99 % of hydrogen. Reduce 100 times space use comparing with normal storage tanks. Reduce needed space comparing with copper converter method. Hydrogen can be directly vented or converted to water.
DISADVANTAGES	Large volume of tanks so bigger facilities and shielding. Facility higher construction costs.	Requires maintenance, strict humidity and gas flow rate control	Only NG from dissolution step. Requires long regenerations to reuse. Associates NG emissions due to regeneration. Needs Heating	Only NG from dissolution step. Oxygen and humidity control. Hydrogen is storage several weeks as a metal compound, not directly converted. Hydride must be regenerated decreasing vessel pressure after NG decayment. Nowadays no rutinary tested in radioisotope production.	Only for NG from dissolution step. Needs Heating. Needs to generate differential pressure in both sides of the membrane. Nowadays few worldwide membrane manufactures. Nowadays no rutinary tested in radioisotope production.

CNEA Membrane/Hydride equipments

CNEA Prototypes membrane and hydride equipment were tested in present PPRF plant with successful results.
Membrane separated pure hydrogen, no detection of NG in this stream.
Hydride reduced partial pressure and freed enough volume to avoid NG venting during a production year with actual tanks.

November 2023

CNEA Industrial Membrane+Hydride equipment is under construction, 95% completed. Both methods in one equipment.
Seek to evaluate advantages/disadvantages of membrane and hydride hydrogen separation in rutinary production.
Expected goal: validate both in rutinary production in actual PPRF facility in 2024/2025.

CONCLUSIONS

Engineered Abatement Methods Considered for NEW PPRF:

For **NG + Air:** Containment + adsorption in small adsorbent columns – minimum 8 weeks dacayment before release.

For **NG + Hydrogen:** tests are nowadays carried out to choose the best method of treatment between copper converter, membrane and hydride or a combination – Any case, minimum 8 weeks dacayment before release.

Expected future results in New PPRF Facility:

Total NG emission/week: 1% or less total NG inventory

THANK YOU

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