WOW TECHNOLOGY's Innovative Radioactive Liquid Waste Treatment - 16128

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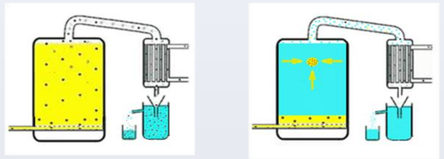
Outperforming liquid RW treatment designed for application in nuclear field and in decommissioning

Fluid Dynamics Technology

WOW proprietary technology performs a **localized molecular separation** between solute and suspended elements and the solvent.

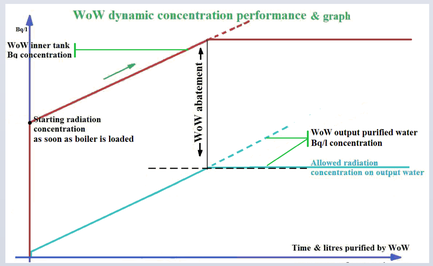


Standard process vs WOW process

The selective evaporation improves the abatement factor or decontamination factor by thousands of times in respect to any standard evaporator.

Continuous Process

Thanks to the **full control of the drag/entrainment effect**, no batches are required to reach the desired Decontamination Factor.



No Secondary Waste

No filters, membranes, resins or additives are used to carry on the process. Moreover, **the equipment self decontaminates** after use.

Automated and Transportable

Fault Tolerant & Failure Proof - Automated and **remote controlled**, the equipment is **modular** for **transportability** and **tailored** to the application.

Tested and Certified

1 Test with first device, at Applied Nuclear Energy Laboratory (LENA) of the University of Pavia

Continuous Operation:	20 litres/day for 39 days
Contaminants Concentration:	1,500 mg/l of ^{133}Cs totally soluted + 2 radioactive tracers: ^{134}Cs (4.2MBq) *few µg*, ^{137}Cs (3.6MBq) *few µg*
Conc. Level Simulation:	4.8 TBq/l typical of HLW *6,000 times higher than Fukushima-Daiichi cooling water*

Certified Results

Min. Decontamination Factor (DF)	**DF > 7,500**
Removal Efficiency	**99.986%**

2 Real case application of the improved device, on LLW: treatment of 1,000lt. of decontamination solution produced by the Radiochemistry Laboratory of the University of Pavia.

Certified Results

RADIOISOTOPES	MEASURED DECONT. FACTORS (DF)
^{137}Cs	40,338
^{134}Cs	39,744
^{241}Am	33,425
^{109}Cd	18,735
^{60}Co	7,581

Final residual concentrated waste solution < 1 Lt

3 **Full scale industrial application: Nuclear repository of Saluggia (IT)**

Certified:
by British National Physics Lab. – NPL
by site operator and University of Pavia - LENA

Continuous Operation:	Average ≈410litres/day for 120 days → total ≈50,000 Lt
Initial liquid characteristics	pH = 4.6; Fluorides <1mg/l; Chlorides ≈15mg/l; Nitrates <5mg/l; Sulfates ≈303mg/l; Phosphates Absent; Sodium ≈22mg/l; Potassium ≈11mg/l; Magnesium ≈6mg/l; Calcium ≈94mg/l.
Radioisotopes	LLW of ^{137}Cs ; ^{60}Co ; ^{241}Am ; ^{90}Sr

Certified Results

Radio-nuclides	Measures by	Decontamination Factor (DF) After 30 Days	After 60 Days	After 90 Days	After 120 Days
^{137}Cs	UNIPV-LENA and by N.P.L.	80,000 (**) (^)	142,000 ÷ 168,000 (**)	107,000 ÷ 412,000 (***)	335,000 (**) (^^)
^{60}Co	UNIPV-LENA and by N.P.L.	56,000 (^)	161,000 ÷ 178,000	520,000 ÷ 685,000	>890,000 (*) (^^)
^{241}Am	UNIPV-LENA and by N.P.L.	>23,000 (^)	>5,290 (*) + >238,400 (*)	>300,000 (*)	>> (*) (^^)
^{90}Sr	UNIPV-LENA and by N.P.L.	>2,044 (*) (^)	>26,200	>66,760 (*) + >96,000 (*)	>91,470 (*) (^^)

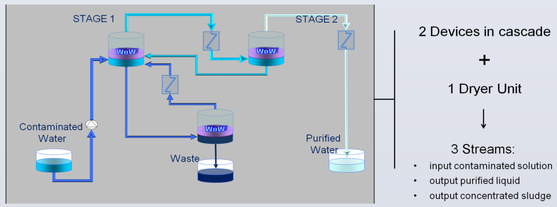
(*) output activity much lower than MDA | (**) Uncertainty 3% | (***) Measures conducted on several samples: output activity is extremely low and concentrated solution of the boiler has some sediments | (^) NPL didn't issue here any test report (ND) | (^^) Test at NPL labs is still on going.

Fukushima-Daiichi case study

Reference data are public parameters of Fukushima-Daiichi:

Water volume to be purified every 120days:	100,000 m^3
Inlet contamination level:	830 MBq/l
Contaminant agent:	137Cs (26kg in total)
Allowable activity in water after treatment:	300 Bq/l
Required Decontamination Factor (DF):	2.77 x 10^6

With reference to full scale certified WoW's Decontamination Factor (DF) ≈330,000 the following feedback cascade configuration & control of concentration has been designed



Considering the following teatment flux:
1° WOW device - 980m^3/day (max stage concentration = 250)
2° WOW device - 840m^3/day (max stage concentration = 130)
3° WOW dryer - 45m^3/day (max stage concentration ≈ 63)

Considering current decontamination solutions the **total DF parameter obtained with this WOW configuration is at least 10,000-13,000 times**, according to public data reports, **greater** than with the currently used systems.

Expected performance for every 120 days operation cycle:

Total volume of contaminated water fed to WOW	**100,000 m^3**
Purified water output (max 300Bq/l)	**99,979 m^3**
Final volume of concentrated waste (*)	**8 m^3**
Final total waste volume ratio	**12,500**

Note (*): where practically all the contamination is concentrated and removed from initial solution. 8m^3 is the minimum volume that can be reached as in this case the concentration of ^{137}Cs radioisotope is 3.23gr/l and so its decay is producing a self-heating up to 26 °C.