WATER-RADD INSTRUMENT FOR CONTINUOUS MONITORING OF ALPHA AND BETA RADIONUCLIDES.

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1. Who we are and what we do

2. Why WATER-RADD

3. What is WATER-RADD

4. Laboratory results

5. Field application

6. Conclusions
Water and Environment Technology

Adasa stands out for its intensive technological specialisation and an extensive knowledge and experience of the water sector.

- 25 years of experience.
- Highly qualified workforce with international strong experience in integration global solutions.
1 Worldwide Activity

Countries with permanent location of COMSA EMTE Group
(Spain, France, Poland, Portugal, Romania, Switzerland, Algeria, Brazil, Argentina, Peru, Venezuela, Chile, Honduras, Mexico, Australia)

Countries operated in
(Spain, Portugal, France, Italy, Belgium, Romania, Poland, Croatia, Malta, Turkey, Iceland, Mexico, Venezuela, Peru, Chile, Argentina, Honduras, USA, Morocco, Algeria, Mauritania, Ghana, Guinea, Cape Verde, Australia)
1 Sectors of Operation

- Freshwaters
- Dammed Waters
- Dams
- Groundwater
- Seawaters
- Air Quality
- Meteorology
- Drainage Networks
- Rainwater Regulation Reservoirs
- Waste Water Treatment Plants
- Drinking Water Treatment Plants
- Seawater Desalination Plants
- Water Supply and Distribution Networks
- Irrigation Systems
Areas of Activity

- Environmental Quality
- Hydrology
- Automation and Control Systems
- Information Systems
- Hydraulic Infrastructures
WATER-RADD INSTRUMENT FOR CONTINUOUS MONITORING OF ALPHA AND BETA RADIONUCLIDES

1 ADASA PRODUCTS

www.adasaproducts.adasasistemas.com

www.adasasistemas.com
Why WATER-RADD

1

2

3
2 Why WATER-RADD

2

3
Why WATER-RADD

- RADIOACTIVITY IN WATER STREAMS (PREPOTABLE WATER)
    - Tritium – 100Bq/l
    - Total Indicative dose – 0.1 mS/year

- RD140/2003
  - Total Indicative dose – 0.1 mS/year
  - Tritium – 100 Bq/l
  - Gross Beta (without Tririum) – 1 Bq/l
  - Gross alpha – 0.1 Bq/l
Why WATER-RADD

DIR 98/83/EC
RD140/2003
Why WATER-RADD

DIR 98/83/EC
RD140/2003

SAMPLING

What is happening between sampling?
Why WATER-RADD

CONTINUOUS MEASUREMENT

Radioactivity can change between measurements

DIR 98/83/EC
RD140/2003
Why WATER-RADD

CONTINUOUS MEASUREMENT
Radioactivity can change between measurements

TECHNOLOGY
Plastic Scintillation microspheres

DIR 98/83/EC
RD140/2003
What is WATER-RADD

- Continuous measurement of 3H, gross beta, gross alpha activities.
- Automatically takes sample (no human intervention).
- Configurable time measurement.
- Automatic cleaning process with configurable period.
- Automatic calibration process with configurable period.
  - H3 dissolution: 20000 Bq/l.
  - Sr-90/Y-90 dissolution: 90 Bq/l.
  - Am-241 dissolution: 90 Bq/l.
  - Distilled water.
What is WATER-RADD - Parts

- **ELECTRONICS**
  - aquaControl-HT
  - FPGA
  - HV Power supply

- **DETECTOR**
  - PSm cell + 2 PMT
  - Active Guard: PS + 2 PMT
  - Passive Guard: Lead

- **HIDRAULICS**
  - 7 peristaltic pumps
  - 3 active standard + distilled water
  - Cleaning solution
  - Waste
3 What is WATER-RADD - Workflow

- Configuration
  - Measurement time
  - Calibration and cleaning period
  - Activities for each active standard.
  - Alarm threshold
  - Communication parameters

- Advanced configuration
  - Pump injection times
  - Coincidence time
  - Dead time
  - PMT voltage
  - Threshold voltage
What is WATER-RADD - Output

- 3H, gross alpha and gross beta activities
- Alarms
- Energy spectrum
- Calibration results (efficiency, background)
- RAW data (diagnostic)
  - Registered counts every base time
    - PMT counts
    - Coincidence counts
    - Accumulated Dead time
  - Energy spectrum for each base time
  - Instrument temperature
What is WATER-RADD - Remote Control Center

Collects the information from each WATER-RADD and stores all the information in a BBDD

- Ethernet port for local control
- 3G modem for remote control
- MODBUS-IP

For each WATER-RADD device:

- Read / Write configuration
  - Counting time
  - Calibration period
  - Cleaning period
- Read / Write Advanced configuration
  - Coincidence time
  - Dead time
  - Injection time
- Download time stamp data (historical)
  - Measure
  - Calibration
  - Processes
  - Alarms
- Download real time data
- Send instructions
  - Start / Stop measuring
  - Calibrate
  - Clean
4 Laboratory Results

- Background counts, efficiency, Lc, LLD
- Cleaning process
- Cell stability
4 Laboratory results – Background, Eff, Lc, Ld

<table>
<thead>
<tr>
<th>Bkg (cpm)</th>
<th>3H</th>
<th>Gross β</th>
<th>Gross α</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.60</td>
<td>10.63</td>
<td>14.22</td>
<td></td>
</tr>
<tr>
<td>eff (%)</td>
<td>0.31%</td>
<td>66.16%</td>
<td>58.43%</td>
</tr>
<tr>
<td>V (l)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t (h)</th>
<th>3H Ld (Bq/L)</th>
<th>Gross β Ld (Bq/L)</th>
<th>Gross α Ld (Bq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>538.48</td>
<td>5.04</td>
<td>6.59</td>
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<tr>
<td>5</td>
<td>234.89</td>
<td>2.23</td>
<td>2.91</td>
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</table>

<table>
<thead>
<tr>
<th>t (h)</th>
<th>3H Lc (Bq/L)</th>
<th>Gross β Lc (Bq/L)</th>
<th>Gross α Lc (Bq/L)</th>
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<tbody>
<tr>
<td>1</td>
<td>257.80</td>
<td>2.47</td>
<td>3.24</td>
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<tr>
<td>5</td>
<td>115.29</td>
<td>1.10</td>
<td>1.45</td>
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</tbody>
</table>
Laboratory Results – Cleaning process

- Cleaning process
  - Goal: No change on efficiency detection and background noise.
  - Different kind of solutions have been tested in order to clean the cell of radionuclides and microbial biofilms without changing the efficiency of the detector.

- Standard Cleaning process uses:
  - 60ml of distilled water
  - 60ml of cleaning solution

- After a Cleaning process background is measured in order to evaluate the effectiveness of the cleaner.

<table>
<thead>
<tr>
<th>Time</th>
<th>Process</th>
<th>Counts (cpm)</th>
<th>std</th>
</tr>
</thead>
<tbody>
<tr>
<td>29/05/2012 12:46</td>
<td>H2O</td>
<td>13.43</td>
<td>0.47</td>
</tr>
<tr>
<td>29/05/2012 15:06</td>
<td>After sample</td>
<td>14.17</td>
<td>0.49</td>
</tr>
<tr>
<td>29/05/2012 17:36</td>
<td>After 3H</td>
<td>16.18</td>
<td>0.52</td>
</tr>
<tr>
<td>29/05/2012 20:26</td>
<td>After beta</td>
<td>14.24</td>
<td>0.49</td>
</tr>
<tr>
<td>29/05/2012 23:16</td>
<td>After alfa</td>
<td>14.56</td>
<td>0.49</td>
</tr>
<tr>
<td>30/05/2012 0:46</td>
<td>After alfa</td>
<td>13.16</td>
<td>0.47</td>
</tr>
<tr>
<td>30/05/2012 3:06</td>
<td>After sample</td>
<td>13.37</td>
<td>0.47</td>
</tr>
<tr>
<td>30/05/2012 5:26</td>
<td>After sample</td>
<td>14.27</td>
<td>0.49</td>
</tr>
</tbody>
</table>
100 hours of continuous pumping test.

- Background and 3H, 90Sr/90Y detection efficiency remain constant.
- Equivalent to 4-6 measurements per day during a month.
5 Field application
Field application - Installation
5 Field application - Installation

- aquaMOSTRA (refrigerated Automatic Sampling Equipment)
- Water-Radd gives an instruction to take sample at the same time
Field application - Communication

Remote Data Center
IP: 10.0.5.36

Local Data Center
IP: 10.20.30.40
MASK: 255.0.0.0

WATER-RADD
IP: 10.20.30.100
MASK: 255.0.0.0
6 Conclusions

- New instrument has been developed for dissolved radioactivity surveillance

- Automatic and continuous measurement has been achieved

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- Centro para el Desarrollo Tecnológico Industrial (CDTI)
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