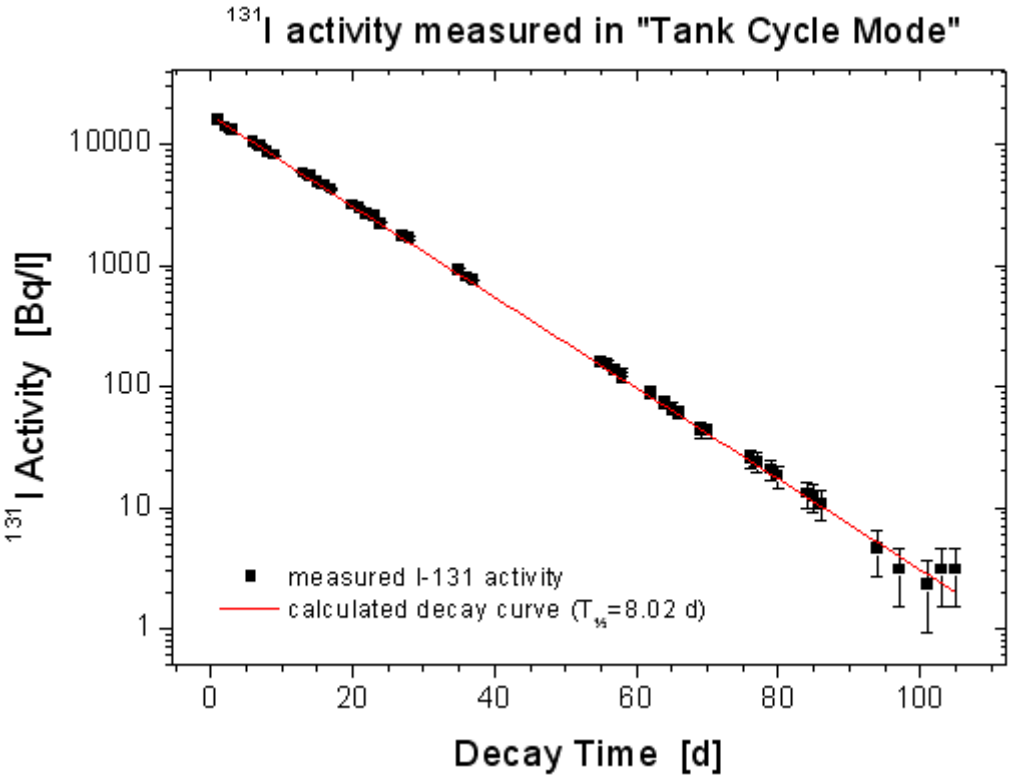
Dr. Westmeier GmbH
Möllner Weg 5
D-35085 Ebsdorfergrund-Mölln
Telephone +49 (0) 6424-923000 • Fax +49 (0) 6424-923002 • westmeier@westmeier.com

Automatic surveillance of decay - systems (e.g. in nuclear medicine)



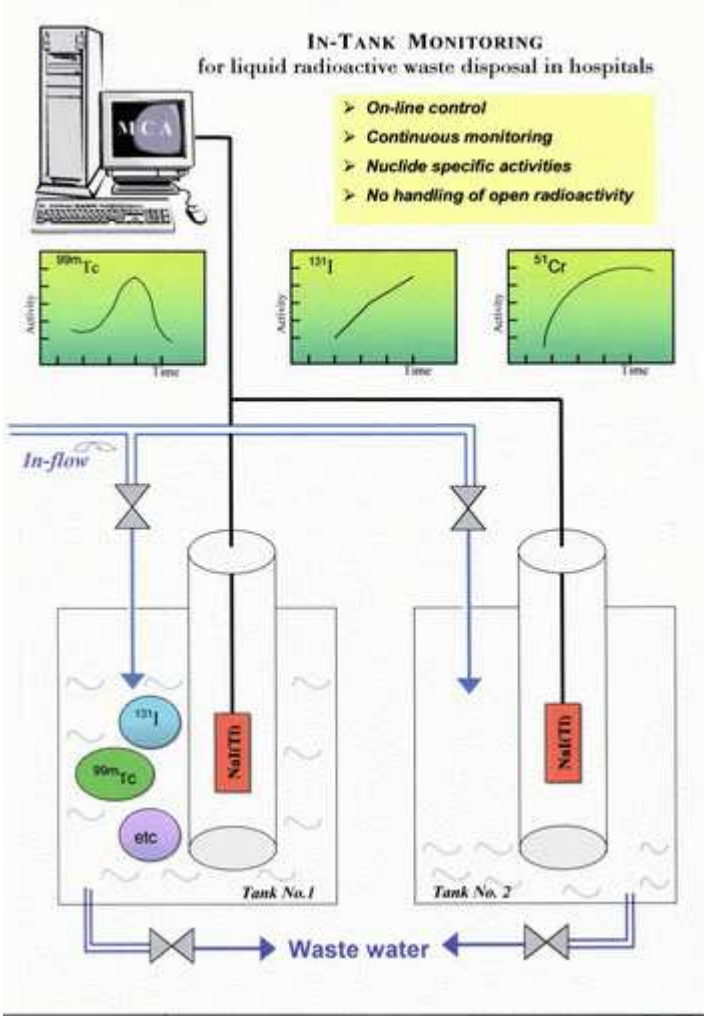
The automatic surveillance of several decay tanks in cyclic mode (see example below) will provide at least one data point per day for the decay curve as shown in the graph and per container. Spectra are analysed with SODIGAM yielding reliable activity results over many orders of magnitude, the lowest being fairly below the German “Freigabe-Grenzwert” (the legal limit of radioactivity for release to the sewage system) of <5 Bq/l.

When activity is low, a very precise, longer-lasting final measurement is made with the detector in the tank. Activities below 5 Bq/l are typically measured with uncertainties below ±5%.
Automatic analysis of nuclides other than I-131 is also possible with SODIGAM, depending on definitions in the start-up file and the software set-up parameters.
Significant advantages of in-tank measurements are:

- at no time does the user come in contact with open radioactivity,
- at any time the correct activity inventory in the tank is known,
- an illegal or erroneous release into a decaying tank is immediately detected, and
- at any point in time one can start a very precise measurement prior to release

An example of on-line monitoring: Decay system in nuclear medicine

Radioactive waste from diagnostic and therapeutic applications in nuclear medicine departments must be collected and isolated until short-lived activities have decayed to acceptable levels. Only when the activity levels are below regulation limits (which are State controlled), may the fluid waste be flushed into the public sewage system. In traditional waste disposal facilities, fluid samples were taken from time to time and assayed in well shielded setups with a large 3"x3" NaI(Tl) detector. The radioactive sample was then poured back into the system through an appropriate inlet.



In modern systems, handling of open radioactivity samples is no longer necessary. A medium size 2"x2" NaI(Tl) detector is mounted inside each of a facility´s sewage tanks in a submerged watertight tubing. The detector sits almost at the bottom of the tank. A multichannel analyser with SODIGAM software selects which tank/detector is to be measured and controls all data manipulations.

Software options are used for different measuring strategies:

a) Individual measurements

The user defines in the software all details of the next spectrum measurement such as:

- Tank to be surveyed
- Measuring time
- Spectrum name
- Post measurement procedure(s)

Starting time for the spectrum
Spectrum display options

and the measurement is performed under fully automatic system control.

b) Cyclic measurement of all tanks

The user defines in the software the relevant details for the measurement such as:

Measuring time for each tank
Total number of tanks
Calibration data for each detector,

and measurements are performed fully automatic from all tanks in a cyclic sequence.

A measurement is made for the defined time, and then a special spectrum handling routine is selected which will:

make a fast analysis of the spectrum and find the most prominent peak(s). An energy re-calibration test is made where the program tests if the energy of a defined reference peak is found and the calibration polynomial coefficients are updated if necessary. Two calibration reference peaks can be defined. Updated calibration data are stored for future analyses, thus insuring automatic re-calibration.

Then the whole spectrum or regions of the spectrum are analysed using high-precision peak-fit according to analysis definitions given in a dedicated batch file. According to selected options and existing hardware the results (activity in Bq/l) can be printed out, displayed on screen and transferred via 20 mA lines to a remote control station. Then the next detector is selected in a cyclic manner and the above sequence is repeated.

Typical measuring times in cyclic measurement systems are 3 to 4 hours per spectrum which yields very precise results for activity levels of e.g. I-131 well below 2 Bq/l and typically 1 or 2 data points per tank and per day. Such automatic supervision is perfect for all applications in nuclear medicine and radiology.

c) Fast release control

Using a special software mode the program will measure spectra from a detector mounted in the tubing that leads sewage out. One peak in the spectra is analysed every 1/30 second and the resulting activity for that nuclide is checked against a predefined reference value. If the released activity exceeds the limit value a digital I/O line or relay is actuated and the outgoing valve is immediately closed by the controlling board. This measuring mode is an effective and safe method to avoid erroneous operation where highly radioactive waste is pumped out from the wrong tank and yearly activity release margins may be exceeded.