



APPLICATION REPORT Nuclear

Process instrumentation for a nuclear waste treatment plant

- Safe and sustainable treatment of nuclear liquid waste from Mo-99 radiopharmaceutical production
- Instrument supply for flow, level, pressure, and temperature measurement
- Including radioactive waste measurement, hot cell pressure control and chemical dosing
- Supplies of instruments for nuclear and non-nuclear environments



Australian Government



1. Background

Australia's Nuclear Science and Technology Organisation (ANSTO) is one of Australia's largest public research organisations. The institute is widely recognised as an international player in the field of nuclear science and technology.

ANSTO has developed the Synroc® technology which is regarded as global best practice in the safe treatment of complex nuclear waste, including actinide bearing materials, radioiodine, and molten salts from spent fuels. The benefit of this technology is demonstrated in an automated process plant (Synroc Waste Treatment Plant) that the organisation operates near Sydney. The objective of the plant is to treat the liquid by-product of Molybdenum-99 (Mo-99) nuclear medicine production.

2. Measurement requirements

The liquid waste from Mo-99 production is captured, stored, and characterised in tanks before it is processed within a hot cell by introducing the Synroc formulation. The tailored liquid additive undergoes mixing before it is converted into a granulated powder via a drying process. Subsequently, the powder is then dispensed to a specially designed canister which is then sealed and placed into a Hot Isostatic Press (HIP) where heat and pressure are applied for waste form consolidation. The final solid product is volume-reduced, durable and a disposal-ready waste form.

While the liquid Mo-99 production waste is radioactive, various manufactured components needed to be interrogated for material compatibility within the environment prior to commissioning. One of the main challenges was finding an instrument supplier with experience in radiation sensitive environments.



3. KROHNE solution

With a long track record in nuclear applications, offering a wide range of radiation hardened products and components, KROHNE was able to qualify as a preferred instrument supplier.

The instruments in contact with the Mo-99 waste were the first to be specified. This included the POWERFLUX 5300, an electromagnetic flowmeter designed for nuclear environments, which is used for the waste feed and feed control. The most critical installation involved the double remote POWERFLEX 2200 guided radar level transmitter used for waste tank level measurement. To maintain ventilation confinement, various OPTIBAR DP 7060 differential pressure transmitters are used for pressure control and monitoring of the hot cell.



OPTIFLUX 5300 flowmeter for the chemical dosing of the special Synroc agent for treatment of waste from Mo-99 production

In total, the instrument selections covered various applications incl. flow, level, pressure, and temperature measurement as well as different media – from liquid Mo-99 waste to chemicals and process condensate to clean water. KROHNE supplied among others:

- 5 POWERFLUX 5300, 3 OPTIFLUX 5300 and 4 OPTIFLUX 4300 electromagnetic flowmeters
- 2 POWERFLEX 2200 guided radar (TDR) level transmitters
- 25 OPTIBAR DP 7060 differential pressure (DP) transmitters
- 30 OPTIBAR PM 5060 pressure transmitters
- 4 OPTIMASS 6400 and OPTIMASS 7400 Coriolis mass flowmeters
- 2 OPTIWAVE 7500 80GHz FMCW radar level transmitters
- 1 BM26A-1000 magnetic level indicator with LT40 reed chain transmitter
- 3 H250 M40 variable area flowmeters

Most instruments have been provided in rugged stainless-steel housing. Critical instruments were proven and demonstrated on a smaller pilot plant to verify the concept before the customer selected the instrument supplied for the Synroc Waste Treatment Plant.



OPTIMASS 6400 measuring process condensate



Level measurement on tanks using the BM26A-1000 level indicator and the OPTIWAVE 7500 radar level transmitter

4. Customer benefits

Selecting KROHNE allowed ANSTO to have a supplier for radiation specific measurements as well as standard applications. Given its vast experience in nuclear applications, KROHNE was able to supply the instruments for a number of unique measurements in contact with nuclear waste.

KROHNE offers various devices designed to operate in nuclear applications inside and outside the nuclear power industry, many of which can also be qualified according to IEEE 323, IEEE 344 and RCC-E standards and designed as per nuclear construction codes such as ASME Section III or RCC-M.



Water measurement with the H250 M40 variable area flowmeter



OPTIBAR PM 5060 for gauge pressure measurement in a tank



OPTIBAR DP 7060 used for hot cell pressure control and monitoring

5. Products used

POWERFLEX 2200

- Guided radar (TDR) level transmitter for the nuclear industry
- Designed and tested for industrial nuclear environments
- Referenced for nuclear applications
- Conforms to nuclear standards (e.g. ASME Section III, RCC-M)

POWERFLUX 5300

- Electromagnetic flowmeter for nuclear applications
- Designed and tested for industrial nuclear environments
- With high-tech ceramic tube for very aggressive and abrasive fluids

OPTIBAR DP 7060

- High performance DP transmitter with integrated line pressure measurement
- Outstanding temperature and static pressure stability
- Unique 3D linearisation of transmitter: compensation for all influencing factors at virtually all possible combinations

OPTIBAR PM 5060

- Pressure transmitter for advanced process pressure and level applications
- Rugged design with fully welded metallic diaphragm suited to high pressure ranges

OPTIFLUX 5300

- Electromagnetic flowmeter for advanced process applications

OPTIFLUX 4100

- Electromagnetic flowmeter for standard applications with abrasive and aggressive liquids

OPTIMASS 6400

- Coriolis mass flowmeter for advanced liquid and gas applications
- High accuracy mass, density and volume flow measurement

H250 M40

- Variable area flowmeter for liquids and gases
- Nuclear qualification on request (e.g. IEEE, RCC-E)

OPTIMASS 7400

- Coriolis mass flowmeter for advanced process applications
- Single straight tube design for viscous, aggressive, or shear-sensitive media

OPTIWAVE 7500

- Radar (FMCW) level transmitter for liquids in narrow tanks with internal obstructions
- 80 GHz radar, flush-mounted Lens antenna

BM26A-1000

- Magnetic level indicator for basic liquid applications
- Available with reed chain transmitter

Contact

Would you like further information about these or other applications?
Do you require technical advice for your application?
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Please visit our website for a current list of all KROHNE contacts and addresses.

