BERTHOLD TECHNOLOGIES

operating worldwide

detect and identify

IEC 62303 Tritium Standard

Dr. Alfred Klett

Berthold Technologies, Bad Wildbad, Germany

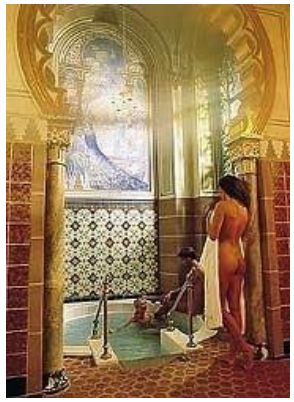
21st Annual Air Monitoring Users Group (AMUG) Meeting
Palace Station Hotel, Las Vegas, Nevada, USA, 5th May 2009

Berthold Technologies in Bad Wildbad

- German Manufacturer of instruments for
  - Industrial Process Control
  - Bioanalytics
  - Radiation Protection
- Nicely located in the Black Forest (close to Karlsruhe)
- Since more than 60 years reliable products **MADE IN GERMANY**







Berthold Technologies

- 1949 Founded by Prof. R. Berthold
- 1960 Continued by Dr. F. Berthold
- 1989 Acquisition by EG&G Inc. USA (later PerkinElmer Inc.)
- 2000 Re-acquisition
- 2008 Sales approx. 60 Mio. €
- Worldwide 335 Employees
- Subsidiaries in Belgium, France, Italy, Austria, Switzerland, UK and USA
- Quality Management System ISO 9001, ISO 14001, KTA 1401

We offer

Instruments with excellence in quality and reliability

Service and advice for the customer´s special needs

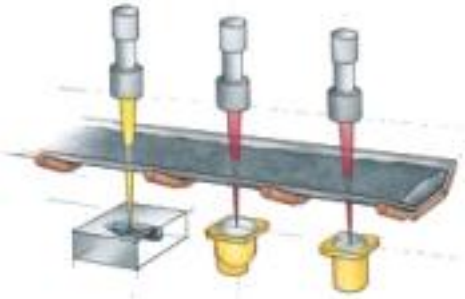
Process Control

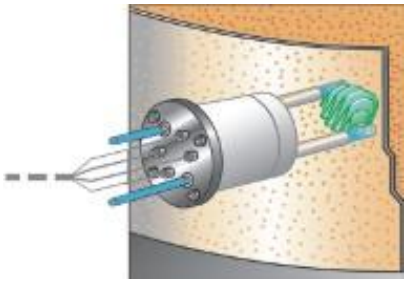
Bioanalytic

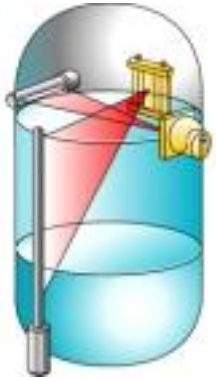
Radiation Protection

Products in Process Control

- Level
- Density
- Moisture
- Bulk flow
- Basis weight
- Concentration
- Sulphur content
- Process analysis







Our Customers in Radiation Protection

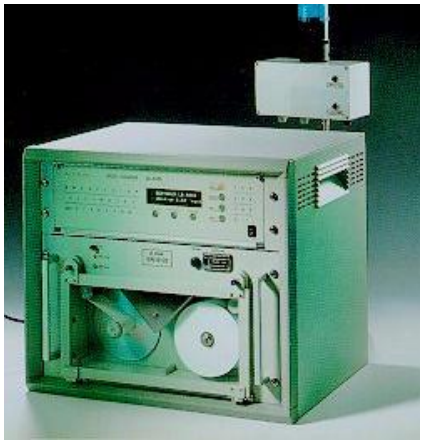
- Radionuclide Laboratories
- Nuclear Medicine
- Research
- Nuclear Power Plants
- Nuclear Industry
- Other Industries
- Authorities
- Nuclear Waste and Decommissioning

EWN , Lubmin, former East German reactors

ZWILAG Intermediate Storage Facility, Switzerland

Product Lines in Radiation Protection

- Contamination Monitoring
- Dose and Dose Rate Monitoring
- Measurement of Activity and Low-Level-α/β-Counting
- Air Monitoring, Particulates, Iodine, Noble Gas, Tritium
- Customized Systems



New Tritium Standard IEC 62303

- **Radiation Protection Instrumentation – Equipment for monitoring airborne Tritium** (Instrumentation pour la radioprotection – Matériel pour la surveillance du tritium atmosphérique)
- New Standard issued December 2008
- IEC Technical Committee TC 45
  - SC45A Nuclear Reactor Instrumentation
  - SC45B Radiation Protection Instrumentation
    - Working Group 13 Monitoring of Airborne Radioactivity
    - Convenor: Daniel BOULITROP (FR)
    - Members WG13: Morgan Cox, Mark D. HOOVER , Céline MONSANGLANT-LOUVET, Max POTTINGER, Erich BERGER Gerhardt Langmüller, Alfred Klett and several more

History Standard IEC 62303

- Sister to IEC 62302 Noble Gas (project leader Morgan Cox)
- 45B/327/NP New Project Proposal 2001-06-08
- 45B/378/CD Committee Draft 2002-07-05
- 45B/408/CD Committee Draft 2003-05-09
- 45B/458/CD Committee Draft 2004-11-05
- Change project leader 2005-06
  - from Dr. Gerhardt Langmüller
  - to Dr. Alfred Klett
- 45B/520/NP New Work Item Proposal 2006-09-08
- 45B/521/CDV Committee Draft for Vote 2006-09-08
- 45B/593/FDIS Final Draft 2008-09-26
- Standard IEC 62303 isssued 2008-12

Scope

- While IEC 670761-5 covers sampling and monitoring only in gaseous effluents
- IEC 62303 expands coverage to all possible locations where tritium could present a radiological hazard
- Sampling & continuos monitoring of airborne Tritium in
  - the workplace
  - gaseous effluents discharged into the environment
  - the environment

Scope

- with the following equipment
  - installed
  - portable
  - transportable
- conditions
  - normal operation conditions
  - Emergency conditions

Measurement & Functions

- Sampling & Analysis of air/gas containing tritium
- Measurement of volumetric activity and its variation in time
- Actuation of alarm if exceeding predetermined alarm levels for
  - Activity
  - Activity concentration
  - Total activity of released tritium
- Determination of the total tritium activity discharged over a given time

Specifications

- Equipment‘s characteristics
  - General
  - Mechanical
  - Electrical
  - Radiological
  - Safety
  - Environmental
- Requirements
- Test procedures
- Proper identification & certification of equipment

Definitions & References

- IEC 60050-393:2003, International Electrotechnical Vocabulary (IEV) – Part 393: Nucl. Instrumentation – Physical Phenomena & basic concepts
- IEC 60050-394:2007, International Electrotechnical Vocabulary (IEV) – Part 394: Nucl. Instr. – Instruments, systems, equipment & detectors
- ISO 2889 general principles for sampling airborne radioactive materials
- Guide to the expression of uncertainty in measurement (GUM) – ISO: 1995

Definitions

- **Tritium**: this standard covers tritium in gaseous or in vapor forms, whether chemically combined or not
- **Tritium Monitor**: equipment designed for the monitoring of airborne tritium in gaseous effluent discharged to the environment, in the environ-ment and in the atmosphere of a workplace
- **Tritium Sampler**: equipment designed to collect a sample of tritium in any form for subsequent analysis

Classification monitoring equipment

- Selectivity for chemical form of tritium
  - Gross tritium monitors: respond to all gaseous or vapour forms
  - Selective tritium monitors: detection of special chemical form (for example tritiaded water vapor)
- Method of sampling & analysis
  - Flow-through
  - Batch
- Measurement range
  - Low range < 10 MBq/m³
  - High range > 10 MBq/m³

Classification monitoring equipment

- Working conditions
  - normal operation conditions
  - Emergency conditions
- System interface
  - Local readout and alarm only
  - Interfaced with a central system
- Type of installation / power supply
  - Installed or transportable (primarily using mains)
  - Portable (primarily using batteries)

General Design Considerations

- Detector type not specified
- Measurement characteristics
  - Measured quantity
  - Decision threshold / detection limit
  - Measuring range
- Reliability
  - Operational lifetime of critical components
  - Adjustment & maintenance facilities
  - Frequency routine maintenance

General Design Considerations

- Capability of operational testing
- Ease of decontamination
- Electromagnetic Interference
- Corrosion resistance
- Mechanical shock
- Acoustic noise level
- Explosive atmospheres

Equipment components

- Sampling assembly
  - Sampling & exhaust pipes
  - Collection medium
  - Air pump
  - Flow Measurement & Control
  - Pressure Measurement & Control
  - Inlet Filter
- Detection assembly
  - Radiation detector
  - Protection against condensation
  - Compensation detectors

Equipment components

- Control assembly
- Indication facilities
- Alarm facilities
  - Alarm types
  - Alarm indication
  - Alarm test
- Check source
- Ambient background shielding / compensation
- Batteries

Test conditions

- Test procedures
- Standard test conditions
- Tests with variation of influence quantities
- Electrical & mechanical tests
- Warmup-time
- Environmental tests

Radiation detection tests

- Reference Response
- Test with gaseous & solid sources
- Linearity
- Response to other activities
  - other chemical forms of tritium
  - radioactive gases other than tritium
  - ambient gamma and / or neutron radiation

Annex A: General Conditions of Operation

- Effluent Monitoring
  - Normal operation conditions
  - Emergency conditions
- Environment Monitoring
  - Normal operation conditions
  - Emergency conditions
- Working Place
  - Normal operation conditions
  - Emergency conditions

Annex B: Preparation of tritiated ref. sources

- Use of pressurized bottles of tritiated gas
- Use of tritium ampoules
- Production of tritiated water vapour by oxidation of tritium gas
- Production of tritiated water vapors by bubbling tritiated water