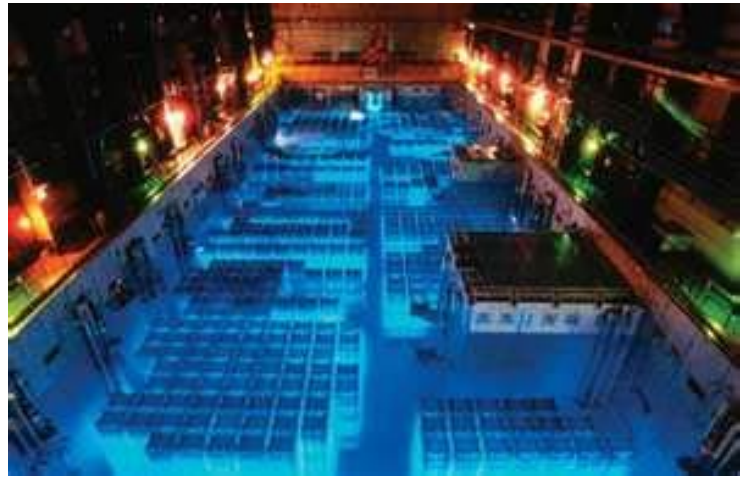


FUEL POOL TOOL

FPT-H3 Tritium Only (Air & Water) FPT-H3-ABG (Tritium & Alpha-Beta-Gamma - Water)

FEATURES:

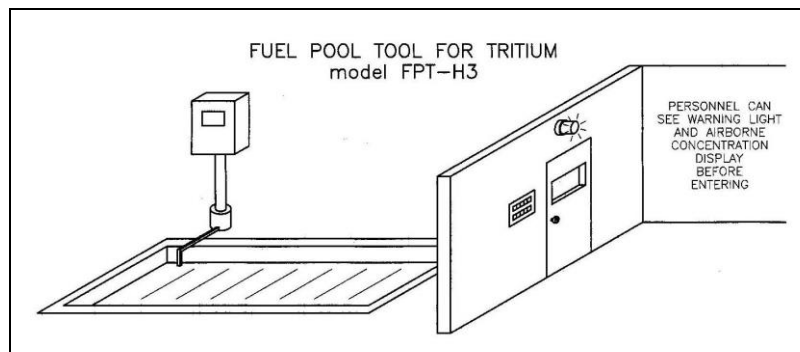
- DETECTS TRITIUM CONCENTRATION IN POOL WATER AND AIR
- REAL TIME CONTINUOUS IN-LINE INSTRUMENTATION
- NO WASTE STREAM
- EASY CALIBRATION
- FULL SCADA COMPATIBILITY & CONTROL ROOM INTEGRATION
- USER FRIENDLY CLEANING & DECONTAMINATION
- TA SMARTPEAK SOFTWARE
- DATA STORAGE / HISTORICAL RETRIEVAL SYSTEM
- OPTIONAL – ALPHA-BETA-GAMMA DETECTORS FOR WATER
- **DETECTORS: IP67**
- **ELECTRONICS: IP 64**



APPLICATION:

- Monitor nuclear power plant fuel pool: water, and air condensation for Tritium and other radioactive agents.
- Control room monitoring of spent fuel pool conditions: water level, temperature, radiation.
- Real time data enables command and control to limit exposure or release on and off site.

PROBLEM: New NRC rules will require close real-time monitoring of spent fuel pool status and parameters including control and active inventory of on site material including Tritium oxide.



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FUEL POOL TOOL

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Alpha Detector: Anthracene scintillator; a light-tight detector assembly interfaces with the sample via quick disconnect coax cables and medical grade hoses. A matched pair of 5" diameter photo-multiplier tubes display the sample.

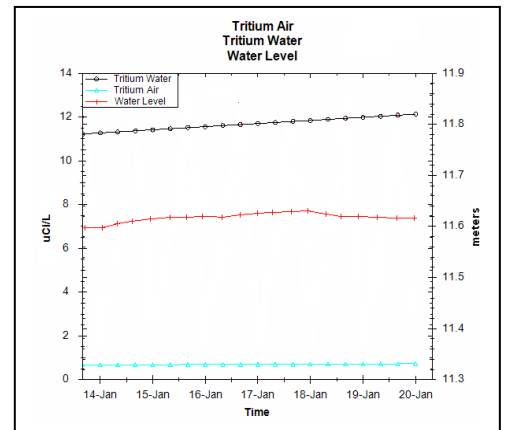
Beta Scintillation detector with 1,100cm² sensitive area. **The alpha, beta pulse analysis portion** of this system conditions and analyzes the output from the photo-multiplier tubes by pulse height, duration and coincidence; eliminating most background and noise counts. Sensitivity is enhanced by the use of stochastic resonance plus high gain, low noise PM tubes and pre-amps.

Gamma Detector: Gamma emitter content is measured using an MCA analyzer with greater than 1,000 channels with a user settable energy range. For example the MCA can be set for Gamma energy of 10 KeV to 3 MeV.

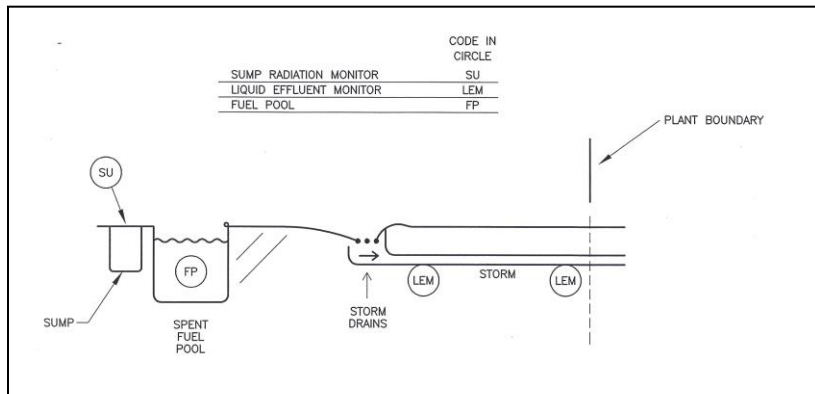
OPTIONAL: Isotope Identification System –TA SMART-PEAK™ Software detects even low gamma concentrations. The isotope identifier specifies and displays radioactive nuclides in water. Radon rejection is standard for airborne measurement and optional for water.

MEASUREMENT CHARTS

Measurements/Displays	Water	Air
Tritium Concentration	uCi/L	uCi/
Gamma Ion Chamber Surface Detector	Suspended above Reactor or Fuel Pools	
Temperature	°F / °C	°F / °C
Humidity		RH%
Dew Point		Optional
Water Level	Optional	NA
Alpha-Beta-Gamma Content	Optional	Optional
Turbidity	Optional	NA
PH	Optional	NA
Conductivity	Optional	NA
Warning/Alarm Settings	Yes	Yes
Remote Readouts	Optional	Optional



FPT Detector Placement



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Data:-Analysis-Display-Hard-Copy-DVD-ROM Archive

In each peak or area of interest, the net counts are automatically converted to concentration units, of picoCuries/liter (using the detector efficiencies automatically measured and stored previously by **FPT-H3** semi-automatic self-calibration procedure).

The concentration and total activity released and MDA levels are continuously calculated and recorded. This real time information will alert the notification system. All data is saved to the hard drive in spreadsheet format. Historical data is easily displayed on-screen (and/or printed out on the included graphics printer) in tabular or graphical format, showing quantitative information as well as trends. Data is recorded frequently so time-resolution is excellent.

DVD drive, Ethernet and USB ports (with security) make it easy to archive and further analyze data.

Continuous, Reliable Data – YES, False Alarms – NO

Our newest systems have multiple layers of protections and redundancy in both the software and the physical act of reporting an alarm, prevent false alarms. This includes an alarm voting system so that alarms will come on only if all the data is consistent and conclusive. Data is continuously recorded to allow human interpretation.

Each alarm activates fail-safe relays. Relay contacts are available to user.

Triggered Aliquot: This feature automatically collects and stores a small water sample for independent analysis whenever an alarm or event of interest occurs.

UV Lamp: Used on inlet as algae-cide.

3 GHZ COMPUTER INCLUDES:

- 3 GHz Processor, 600 G Hard Drive, 4 G Ram
- 15" LCD Monitor, Keyboard, Mouse
- DVD Drive creates DVD's for Data Archive
- 10 Channel Data Acquisition Board, All Cables
- Full Graphics Printer, color + B/W
- Ethernet for hook up to your LAN
- Win XP/Vista, Specific Software for Alpha, Beta, Gamma Counting.
- Software is easily customized by user for special needs.
- Data from the 1024 channel MCA- multi-channel analyzer is accessed via a USB or Ethernet Port.
- Full SCADA compatibility
- **Optional** MODBUS or DNP3 or other protocols.



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Detect	PAG Level	Lower Limit of Sensitivity	Top of Range	Sensor/Method Used		Maintenance
Standard FPT-H3					Time	Action
Tritium in Water		20,000 pCi/l	1 x 10 ⁶ pCi/l	Bed of Crushed Scintillation Crystals	3 mos	Replace Filter Cartridge
Tritium in Air		0.1mCi/m ³ 2,000 mCi/m ³	1 x 10 ⁶ pCi/l	Single 2L Wire Grid Ion Chamber	3 mos	Replace HEPA Filter
FPT-H3-ABG						
ALPHA	U-238 3,000 pCi/l			5" dia. Bed of Crushed Scintillation Crystals	3 mos	Replace Particulate Filter Cartridge
30 min. 24 hr		25,000 pCi/l 3,000 pCi/l	2 x 10 ⁷ pCi/l			
BETA	K-40 30,000 pCi/l			5" dia. Dual PM Tube 1,000 ml Chamber	3-6 mos	Replace Particulate Filter Cartridge
30 min. 24 hr		30,000 pCi/l 10,000 pCi/l	2 x 10 ⁷ pCi/l	1100 cm ² Beta Scintillator		
GAMMA	Co-58			MultiChannel Analyzer, Smart-Peak Detection Software	3-6 mos	Simple MCA Check
30 min. 24 hr		20,000 pCi/l 5,000 pCi/l	2 x 10 ⁷ pCi/l	75 75 mm NaI(Tl) Crystal		
GAMMA IC-25--HT						
0.5 – 3 Sec at 5 Decades	All Gammas	1 µG/h	0.1 G/h Optional 1 G/h	Ion Chamber mineral Insulated	6-12 mos	Clean Exterior if Necessary
RADON		100 pCi/l	2,000 pCi/l		1-3 mos	Clean or Replace Vapor Trap
Pre-Condition						
Expel Radon					1-3 mos	Clean or Replace Vapor Trap



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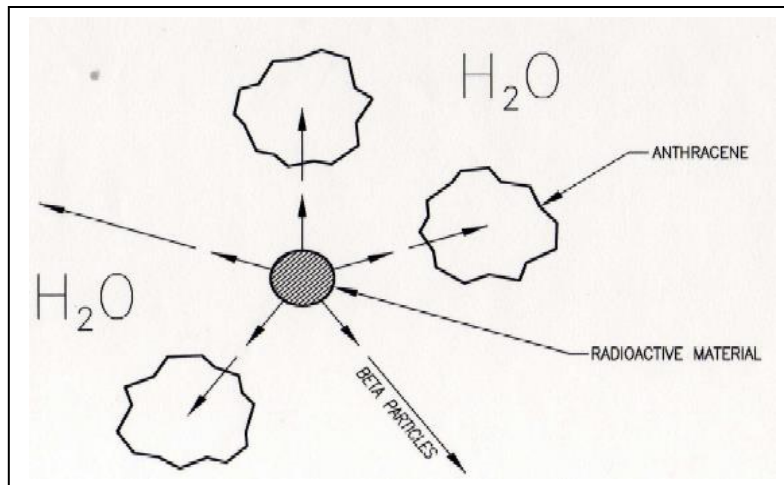
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FUEL POOL TOOL

FPT-H3 Tritium Only (Air & Water) FPT-H3-ABG (Tritium & Alpha-Beta-Gamma - Water)

FLOW PATH:

- Water Inlet Port
- Pressure Relief Valve
- ISCO Sampler
- Particulate Filter (With Gamma Detector)
- Ultra Violet Sterilizer
- Gamma Spec Shield
- Main Gamma Detector With MCA
- Gross Beta Detector
- Mass Flow Meter
- Metering Pump for Alpha Detector Loop.
- Alpha Detector Flow Cell (With Anthracene Crystals)
- Alpha Loop Flow Meter
- Tritium Beta Detector
- Ion Exchange with Gamma Detector
- Discharge Water is Clean and can be returned to Fuel Pool
- No Liquid Scintillant Or Reagents are Used
- No Toxic Or Radioactive Waste of any kind.



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WARNING LEVEL
SCREEN



SPECIFICATIONS:

SYSTEM FLOW RATE:

Standard: 100 to 1,000 ml/minute.
Optional: Wide range of flow rates available.

TEMPERATURE:

Sample Standard: up to 80° F
Ambient Temperature: 65° - 100° F

OPTIONAL:

Higher Temperature Sample Range
Wider Ambient Temperature Range
Cooler model COOL-33 for detector & sample used in situations of higher sample or ambient temperatures.

SIZE AND WEIGHT

One Cabinet: 34" wide X 31" deep X 72" high including wheels.
Wheels: 5" dia, high capacity, rugged wheels with lock & rubber tires.
Shipping Weight: Standard unit – 380 kg, **excluding shielding.**
(Lead Shot for shielding may be shipped separately. Overseas customers may want to purchase Lead Shot locally.)



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NRC Fuel Pool Monitoring Documents

REFERENCES: *Petition for Rulemaking to Revise* the following:

- **10 CFR 50:** Radionuclide Monitoring;
- **10 CFR 20** and other applicable regulations as well as
- Regulatory Guides **1.21**
- **(2008), 4.16 (2010), 4.21 (2008), 8.25 (1992),**
- **NUREG-1400 (1993)** and other applicable Regulatory Guides.

REFERENCES QUOTED:

NRC, -- The Near-Term Task Force Review Of Insights From The Fukushima Dai-Ichi Accident, **RECOMMENDATIONS FOR ENHANCING REACTOR SAFETY IN THE 21ST CENTURY**, July 12, 2011

2011-0137scy, NRC, -- **Staff Assessment and Prioritization of NTF Recommendations**, October 3, 2011

NRC, -- **Liquid Radioactive Release Lessons Learned Task Force Final Report**, September 1, 2006

ML091170109-Regulatory Guide 1.21 -- **Measuring Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste**, October 2008

EPRI Final Technical Report #1021106 -- **Estimate of Carbon-14 in Nuclear Power Plants Gaseous Effluents**, EPRI Project Manager Karen Kim, December 2010

ML091310141-Regulatory Guide 4.1 -- **Radiological Environmental Monitoring for Nuclear Power Plants**, November 2008

Radioactive Tritium Leaks Found At 48 Nuke Sites -- AP, Jeff Donn, 6/21/2011

10 CFR 20 Subpart B -- Radiation Protection Programs, § 20.1101 (c) Radiation Protection Programs. Source: 56 FR 23396, May 21, 1991, amended 63 FR 39482, July 23, 1998.

10 CFR 50.109 -- Backfitting, amended Jan. 1, 2003

10 CFR Appendix A to Part 50 -- General Design Criteria for Nuclear Power Plants, amended 72 FR 49505, Aug. 28, 2007

10 CFR Appendix I to Part 50 -- Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, amended 72 FR 49507, Aug. 28, 2007



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