

HIGHLY SENSITIVE FOR NUCLEAR POWER PLANTS

核电站用高灵敏实时连续水监测器

Real-Time Continuous Water Monitor

Model ~ NPP-H₂O & NPP-H₂O-G

NPP-GAMMA ~ NPP-GAMMA-G ~ NPP-BETA ~ NPP-ALPHA

FEATURES:特点

- WORLD'S ONLY PAG-LEVEL $\alpha\beta\gamma$ WATER MONITOR
世界唯一符合PAG（保护行动纲领）标准的 $\alpha\beta\gamma$ 水监测器
- MEASURES AT OR BELOW EPA/DHS PAG LEVELS
(EPA's PROTECTIVE ACTION GUIDELINE LEVELS)
测量符合或低于环保/国土安全局保护行动纲领水平
- REAL TIME, IN-LINE, CONTINUOUS
实时，在线，连续
- DETECTS ALPHAS, BETAS AND GAMMAS
检测 α β γ
- GAMMA-MCA ISOTOPE IDENTIFIER
DETECTOR TYPE: NaI (TI) or HPGe
伽马多道核素甄别器，探测器类型NaI (TI) 或 HPGe
- TRITIUM AND C-14 OPTIONAL DETECTION
可选检测氚或C14
- NO REAGENT TANKS TO FILL
无需填充试剂箱
- NO WASTE STREAM
无废水排放
- EASY CALIBRATION
容易标定
- FULL SCADA COMPATIBILITY
全 SCADA 兼容



TECHNICAL ASSOCIATES OVERHOFF TECHNOLOGY

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PROBLEM: 问题

Most nuclear power stations have high range water monitors for monitoring coolant leaks, but low range water monitors for real-time, on-line use have not been available until now. Very few nuclear power plants have real-time radiation monitors in place to **protect the water and the public, to spot problems early, and to ensure compliance with current regulations.**

大多数核电站安装了高量程水监测器监测冷却剂泄露，但是低量程实时在线水监测器直到现在才问世，极少有核电站现场安装实时辐射监测器以**保护水源和公众，及早锁定问题，以确保符合当前规定。**

SOLUTION: 解决方案

For the first time in a **Continuous Real-Time Water Monitor** the Model **NPP-H₂O** solves this problem by continuously monitoring the water using Alpha, Beta and Gamma detectors and Gamma-MCA identifiers. Determines and identifies individual radionuclides.

首次**实时连续水监测器**，型号**NPP-H₂O**使用 α β γ 探头和伽马多道甄别器通过连续解决了这个问题，此仪器确定并识别单个辐射核素。

Sources of Radioactive Material

辐射物来源

- Coolant leaks into pipes or
管道冷却剂泄露
- Drains
排放
- Deposition of air borne materials
气溶胶物沉积
- Make-up water
补给水



Location of Contaminated Water

污染水位置

Onsite/"Inventory"

现场“库存”

- Pipes, drains, pools, surface water
管道，排水，燃料池，表面水

-Underground

地下

- Drainage pipe 排污管道
- Vado -zone/soil air 土壤层

-In the Aquifer

含水层

Crossing site boundaries 穿越现场边界

- Liquid waste stream 液体流出物排放
- Storm drains 雨水渠

-Off-site/environmental

非现场环境

- Surface Water 地表水
- Rivers 江河
- Local drinking water 当地饮用水



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DESCRIPTION: 描述:

Model **NPP-H₂O** is a multi detector water monitor /controller for simultaneous measuring of Alpha, Beta and Gamma-emitting radio nuclides. The electronics are microprocessor with color LCD display. The pre-amps are plug in modules allowing quick change, addition of functions, and rapid repair in the field.

型号**NPP-H₂O**是一款多探头水监测器/控制器,同时测量 α - β - γ 辐射核素。电子学为微处理器,带彩色LCD显示。前置放大器为插入式模块允许改变或日后拓展功能,现场快速维修。

The modular system is covered by TA's unique exchange warranty system in addition to the full one year warranty. On-site warrantees available in many areas.

此**模块系统**在TA公司特别包换保证范围内,外加一整年保修。许多地区提供现场维修

Detector shields are made of lead encased in welded housing for long useful life and easy decontamination. The Alpha and Beta flow cells are easily changed via disconnect fittings. The Gamma Spec shield can be opened for cleaning with little effort. All connections are sealed against leaks. The standard water moving system is based on a high precision pump with a 10 liter per minute capacity.

探头屏蔽铅制,装在焊接箱中以便延长使用寿命和去污。 α - β 流室通过断开装置容易更换, γ 规格屏可以轻易打开清理,所有连接部分都密封防泄漏。高精度泵保证了标准水动系统,每分钟流量10升。

A wide range of pump capacities are available to meet user's specific needs. The entire system is mounted in a wheeled, self-contained rugged cabinet. The **NPP-H₂O** comes complete with all cabling tubing and connectors in place and is ready to operate. 115 Volt 60Hz is standard; 220 Volt 50/60 Hz is optional.

宽程泵容量以满足用户具体需求。整个系统安装在一个坚固一体带轮的机箱里。**NPP-H₂O**自带电线套和连接件,一切准备就绪,标准115V 60Hz,选购220V 50/60 Hz

System Has Three Principal Detectors: 此系统有三个主要探测器:

1. Alpha Detectors: α 探测器

A special plastic Alpha scintillator that consists of 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.

专用塑料 α 闪烁体探测器包括一个不透光的探头组件,通过快速断开同轴电线和医用级软管与样品对接。样品被一对相匹配的直径5"光电倍增管显示

2. Beta Scintillation Detectors: β 闪烁探测器

Sensitive area: 1,100cm². 灵敏面积1,100cm²

3. Gamma Detectors: γ 探测器

Choice of NaI (Tl) Scintillation or HPGe Solid State: 可选NaI (Tl) 闪烁探头或HPGe探头

Description of Alpha, Beta Pulse Analysis: α β 脉冲分析描述

This system conditions and analyzes the output from the photo-multiplier tubes by pulse height, duration and coincidence. In this way the system eliminates counting most background and noise counts. Sensitivity is



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enhanced by the use of stochastic resonance plus high gain, low noise PM tubes and pre-amps.

此系统通过脉冲高度，持续时间和脉冲符合修整并分析来自光电倍增管输出，这样系统消除大部分本底计数和噪音计数。敏感度因使用随机共振加上高获得、低噪音 PM 管和前置放大器而提高。

Measurement of Gamma-Emitter Content: γ 发射物测量

An advanced high definition multi-channel analyzer (MCA) with drift free operation is utilized. The energy range is user settable. For example the MCA can be set for Gamma energy of 10 KeV to 3 MeV, (or 10 MeV).

使用先进的高分辨多道分析仪，零漂移功能；能量范围用户设定如 MCA 可设定 γ 能量为 10 KeV - 3 MeV, (或 10 MeV).

This system uses of the NaI (TI) Scintillation crystals, photomultiplier tube and provides pulse height and duration analysis. Noise counts are substantially reduced. Sensitivity is enhanced with high gain, low noise pre amp.

系统使用 NaI (TI) 闪烁晶体，光电倍增管分析脉冲高度和脉冲持续性，噪音计数基本扣除，灵敏度因高收益低噪音前置放大器而提高。

Use of the HPGe solid state consists of an intrinsic Germanium P-Type Coaxial detector. High count and excellent baseline are achieved.

P型同轴高纯锗固体探测器，高计数，良好的本底信号。

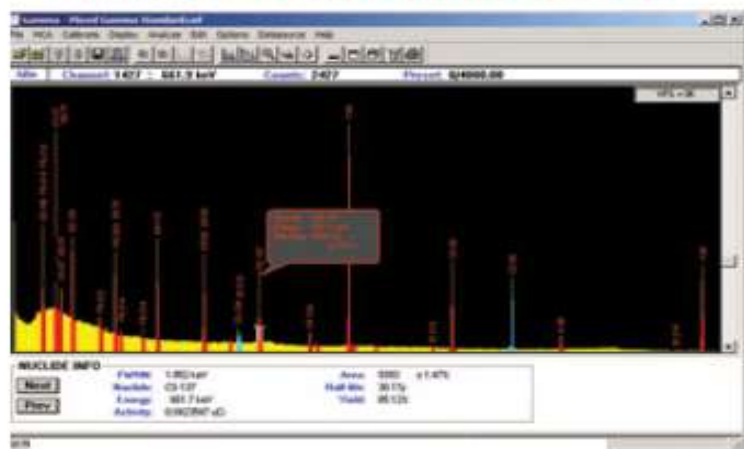
Peak Detection Isotope Identification System

峰检测核素识别系统

TA SMART-PEAK™ Software detects radiation peaks even at very low Gamma concentration. In the event of high activity and during system calibration the isotope identifier function takes over and displays the exact radioactive nuclides in the water.

TA 公司 SMART-PEAK™ 软件甚至在低 γ 浓度下检测辐射峰值，在高活性事件和系统校正期间，同位素识别器功能发挥作用并显示水中确切辐射核素。

GAMMA-MCA ISOTOPE IDENTIFIER



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DATA:-Analysis-Display-Hard-Copy-Archive 数据: 分析-显示-硬拷贝-DVD-ROM 文档

In each peak or area of interest, the net counts are automatically converted to user settable units, of picoCuries/liter or KBq/m³ (using the detector efficiencies automatically measured and stored previously by semi-automatic self-calibration procedure).

在每个峰值或兴趣区, 净计数自动转换为浓度单位 pCi/L 或 KBq/m³ (用先前由半自动半自标定程序测量并储存的效率)

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.

浓度,释放的总活性和 MDA 值持续计算并记录。这些实时信息将提醒通知系统。此外,所有的数据都以电子表格格式保存到硬盘驱动器中。

Historical data is easily displayed on-screen and may be printed out with optional graphics printer in tabular or graphical format, showing quantitative information as well as trends. Data is recorded frequently providing excellent time-resolution.

历史数据很容易地在屏幕上显示出来并可以以表格或图形格式用图形打印机打印出来,显示定量信息以及发展趋势。数据频繁记录因此时间分辨率高。

Ethernet and USB ports (with security) provides easy access for archiving and further data analysis.

以太网和USB接口(带保护)使得存档和进一步分析数据很容易。

Continuous, Reliable Data – YES, False Alarms – NO

连续可靠数据-是, 虚报-无

Our systems have multiple layers of protections and redundancy in both the software and the physical act of reporting an alarm which prevents false alarms. This can include an optional alarm voting system providing activation of alarms only if all the data is consistent and conclusive. Data is continuously recorded to allow user interpretation.

我们系统在软件 and 实际报警中带有层保护和多余度,防止假报警。包括报警表决系统,只有所有数据一致的和确凿的才报警,数据持续被录入以使用户解读。

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

每一次报警激活安全故障继电器。向提供用户继电器触片

Optional 选项

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

触发等分: 在报警事件发生时此功能自动收集和储存小部分水样以独立分析。



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SYSTEM INCLUDES: 系统包括

UV Lamp:	Used on inlet as algae-cide.
UV灯:	在入口处作为除藻剂
Flat Screen Monitor:	LCD High Color Graphics
平面显示器:	LCD高清晰彩色图像
Hard Drive:	1 Terabyte
硬盘:	1 TB
DATA Acquisition:	Board and All Cables
数据采集:	卡和数据线
High Speed Ethernet access:	LAN or SCADA hookup.
高速以太网:	LAN或SCADA接口
Specialized software:	Designed for Gamma Spectrum Detection; user friendly adaptability for your needs.
特制软件:	伽马能谱监测, 符合用户所需
Optional:	MODBUS or other protocols.
选择:	MODBUS或其他协议

System flow rate

系统流量

Optional:	Per Customer Requirement: Very wide range of flow rates is available
选择:	用户选择, 可提供宽范围流量
Sample temperature standard:	Up to 80° F liquid. (optional to higher temperatures)
样品温度标准:	液体80° F (可选更高温度)
Ambient temperature:	65° F - 100° F (wider temperatures ranges optional)
环境空气:	65° F - 100° F (可选更宽温度范围)
Optional:	Cooler model Cool-33 for detector & sample is used in case of higher sample or ambient temperatures AND/OR for increased precision measurements.

选择: 更高样品或环境温度探头和样品, 或者增加测量精度可使用冷却器Cool-33。

NOTE FOR SELECTION OF *INTRINSIC HPGe* DETECTOR ~ NPP-H₂O-G or NPP-GAMMA-G:

高纯锗 (HPGe) 探测器- NPP-H₂O-G or NPP-GAMMA-G:

NPP-H₂O-G or NPP-GAMMA-G Systems include an installed Dewar to maintain HPGe crystal at proper temperature range.

此系统包括一个杜瓦保温器以确保HPGe在正常温度内

OPTIONAL: An electronic cryo-cooler is available.

选择: 电子低温器



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A sample pre-Cooler-33-G includes an installed in the NPP-H₂O-G or NPP-GAMMA-G system.

此系统包含样品预冷器Cool-33-G

SIZE AND WEIGHT:

尺寸与重量

Dimensions:

One cabinet: 34" wide X 31" deep X 72" high including wheels

尺寸:

机柜34" 宽 X 31" 深 X 72"高, 含轮子

Wheels:

5" dia, high capacity, rugged wheels with lock & rubber tires.

轮子:

直径5", 带锁和橡胶胎高承重结实轮子

Shipping weight:

Standard unit: 380kg / 837 lbs - excluding shielding

邮寄重量:

标准: 380kg/837磅-不含屏蔽

NOTE:

Lead Shot for shielding can be shipped with instrument or shipped separately. Overseas customers may wish to buy locally.

注:

铅粒屏蔽可随仪器邮寄, 也可单独邮寄, 海外用户可就地购买

SPECIFICATIONS 规格	PARTICULATE DETECTOR 粒子探头	PRINCIPAL DETECTOR CHOICES 主要探头选择	
Monitoring 在监测	Pre-Filter 前置过滤器	Sample Flow 样品流	Sample Flow 样品流
Radiation Detected 辐射监测	GAMMA	GAMMA	GAMMA
Materials Monitored 被监测物	Particulates	Water Borne Radioactivity	Water Borne Radioactivity
Scintillator Shape 闪烁体	2" x 2"	3" x 3"	3" x 3"
Scintillating Crystal 闪烁晶体	NaI (TI) Spectroscopic Grade	NaI (TI) Spectroscopic Grade	Intrinsic HPGe
Shielding 屏蔽	None – Standard ½" Recommended	2" Standard	2" Standard



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DETECT 监测	PAG LEVEL PAG标准	LOWER LIMIT OF SENSITIVITY 下限灵敏度	TOP OF RANGE 上限	SENSOR/METHOD USED 传感器/方法	TIME 时间	MAINTENANCE ACTION FOR FINISHED WATER 维护
NPP-Alpha	U-238 3,000 pCi/l			5" dia. Dual PM Tube, crushed scintillation bed of crystals	3-6 mos 3-6月	Replace particulate filter cartridge 更换粒子过滤器
30 min 24 hr		25,000 pCi/l 3,000 pCi/l	2×10^7 pCi/l			
NPP-Beta	K-40 30,000 pci/l			5" dia. Dual PM Tube, 1,000 mi chamber	3-6 mos 3-6月	Replace particulate filter cartridge 更换粒子过滤器
30 min 24 hr		30,000 pCi/l 3,000 pCi/l	2×10^7 pCi/l	1100 cm ² Beta Scintillator		
OPTIONS						
NPP-Tritium		0.2 µCi/l	1×10^6 pCi/l	Crushed scintillation bed of crystals	As Needed 根据需要	Replace pre-filter 更换前置滤网
NPP C-14		20,000 pCi/l	1×10^6 pCi/l	Crushed scintillation bed of crystals	As Needed 根据需要	Replace pre-filter 更换前置过滤器
NPP-Radon		100 pCi/l	2,000 pCi/l		1-3 mos 1-3月	Clean or replace vapor trap 清洗或更换气体捕捉 器
PRE- CONDITION						
Expel Radon					As Needed 根据需要	Clean or replace vapor trap 清洗或更换气体捕捉 器



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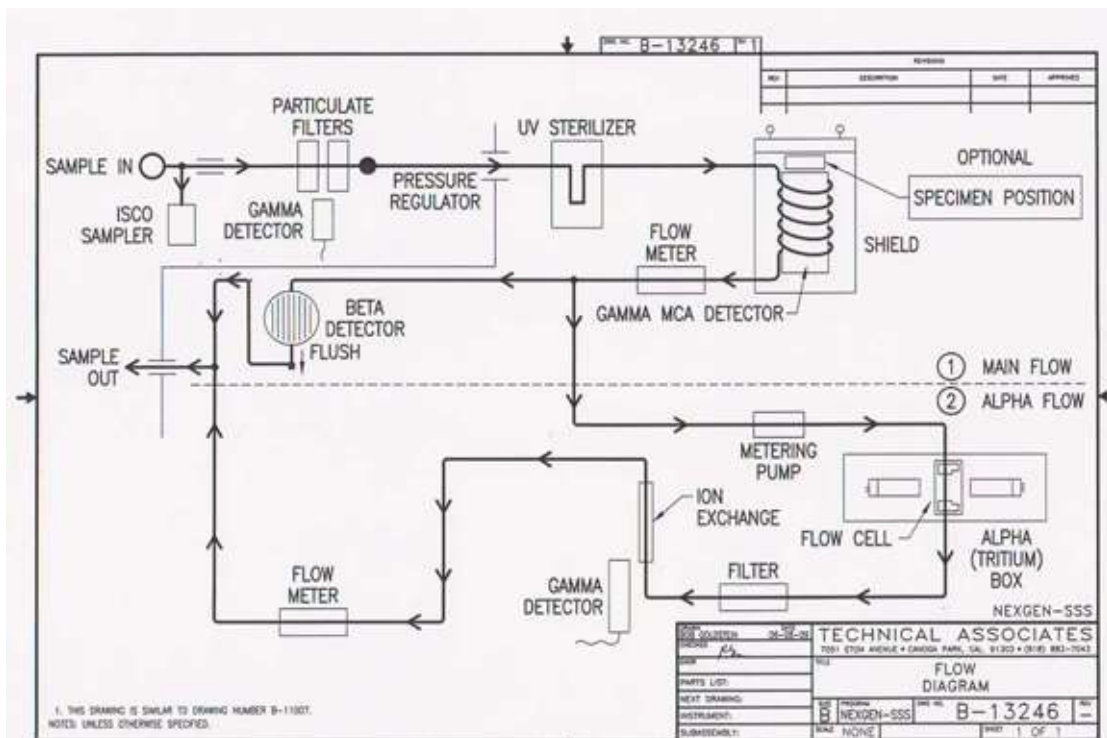
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SINGLE CHANNEL SYSTEMS ARE AVAILABLE: 可选择单道系统

NPP- GAMMA ~ NPP-BETA ~ NPP-ALPHA

GAMMA DETECTION LIMITS 伽马监测范围					
ISOTOPE	LOW 低	LOW 低	HIGH 高	SENSOR METHOD 探测器方法	
				RESPONSE RATE - SLOW	RESPONSE RATE - FAST
⁵⁸ Co	3.7×10^{-1} KBq/m ³	10 pCi/L	1×10^7	3" x 3" NaI (TI) Crystal	Intrinsic HPGe
⁶⁰ Co	1×10^0 KBq/m ³	27 pCi/L	1×10^7	3" x 3" NaI (TI) Crystal	Intrinsic HPGe
¹³¹ I	5×10^{-1} KBq/m ³	13.5 pCi/L	3×10^6	3" x 3" NaI (TI) Crystal	Intrinsic HPGe
¹³⁷ Cs	6×10^{-1} KBq/m ³	16.2 pCi/L	6×10^6	3" x 3" NaI (TI) Crystal	Intrinsic HPGe



NPP-H₂O FLOW CHART

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DESIGN CRITERIA

FLOW PATH流路			
1	Water Inlet port 进水口	11	Alpha Loop flow meter α 回路流量表
2	Pressure relief valve 压力释放阀	12	Ion Exchange with gamma detector 带伽马探头离子交换
3	ISCO Sampler ISCO 采样器	13	Discharge water is clean and can go back into drinking water line. 排放的干净水可以回到饮用水管线
4	Particulate Filter (with Gamma Detector) 粒子过滤器 (带伽马探头)	14	No liquid scintillate or reagents are added 无液体闪烁液或添加剂
5	Ultra Violet Sterilizer 紫外线杀菌	15	No toxic or radioactive waste of any kind. 无毒或辐射废物
6	Gamma spec shield 伽马专用屏蔽		
7	Main Gamma Detector with MCA 带多道分析仪主要伽马探头		
8	Mass Flow Meter 流量计		
9	Metering pump for Alpha detector loop. α 探头回路计量泵		
10	Alpha Detector flow cell (with Anthracene crystals) α 探测器流室 (带蒽晶体)		



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Real-Time Continuous Water Monitor

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NPP-GAMMA ~ NPP-GAMMA-G ~ NPP-BETA ~ NPP-ALPHA

MODEL	NPP-H ₂ O
MAJOR USE PROTECTIVE-ACTION GUIDELINE	NEXT GENERATION WATER MONITOR
Serve as Accident/Attack Alarm	
Serve as Alarm in case of major pollution event	
MEASURES AT OR BELOW	
Acute Health Effects Rad Level	Reads at Full Scale
Chronic RAD levels leading to severe health risk	Yes
Military Limits for Drinking Water	Yes
DHS Protective Action Guideline Levels	Yes
Public Drinking Water Limits	Send sample for lab analysis
DETECTS	
Detect alpha and beta as well as gamma	Has never been done before in real time, in liquids
False Alarm Protection	Yes
Action	Save water sample
Local and remote Alarms	Yes
Local and remote data availability and data archive	Yes
Response Time	Prompt response – 2 min & 1 hr warn or alarms
Efficient	Continuous, automatic, unattended operation
Maintenance interval	30 days or longer see "Maintenance Schedule"
Serviceable	Easy Maintenance, low cost
Durability	Rugged, dependable
Customer Support	Annual upgrades are available on request
Software upgrades	No Charge
Hardware upgrades	At Cost



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