STRAP-ON PIPE RADIATION MONITOR

Model Series~ PEMO-7

PEMO-7 ~ PEMO-7-MCA ~ PEMO-7-G

FEATURES:

- INSTALLS ANYTIME ANYWHERE
- DETECTOR TYPE CHOICE: NaI (Tl) or HPGe
- SENSITIVITY INDEPENDANT OF FLOW RATE
- NO PENETRATION, NO DOWNTIME
- SENSITIVITY: 1 x 10^{-7} µCi/cc ^{60}Co in 18" pipe

ELECTRONICS FM-9W

- REAL TIME ALARM
- RATE & INTEGRATED EXPOSURE
- USB & ETHERNET PORTS
- ON BOARD DATA ARCHIVE, TRANSMIT, & DISPLAY

THREE MODELS:

PEMO-7 – SINGLE CHANNEL – ANY DETECTOR

PEMO-7-MCA – MULTICHANNEL – ANY DETECTOR

PEMO-7-G - HPGe SOLID STATE DETECTOR

APPLICATION:

The ***PEMO-7* Series** Pipe Monitors assure accurate detection and quick alarm in case of waterborne radioactivity contamination flowing thru one or more pipes. A constant check with alarm and data record is accomplished by the onboard computer. Integrated exposure information is recorded and can provide a hard copy via external printer. It is a complete system and may be expanded per need with modules of the ***FM-9W*** series.

The ***PEMO-7* Series** is sensitive and versatile. It may be used to monitor water in pipes or effluent streams down to EPA levels.

DESCRIPTION:

The **PEMO-7 Series** uses standard NaI(Tl) Detector in T/A's unique Strap-On Style Shield to continuously measure any water or airborne gamma emitting Radioactive contaminants, onboard data logging. The water or air stream is under constant surveillance via a scintillation detector. The unit is completely self- contained.

The ***PEMO-7*** utilizes a NaI(Tl) scintillation crystal detector.

The ***PEMO-7-MCA*** utilizes a NaI(Tl) scintillation crystal detector.

The ***PEMO-7-G*** utilizes an intrinsic HPGe (Germanium) solid state detector.

NOTE FOR SELECTION OF *INTRINISIC HPGe* DETECTOR ~ *PEMO-7-G*:

The ***PEMO-7-G*** System includes an installed Dewar to maintain the Germanium HPGe crystal at proper temperature range.

OPTIONAL: An electronic cryo-cooler is available.

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STRAP-ON PIPE RADIATION MONITOR

Model Series~ PEMO-7

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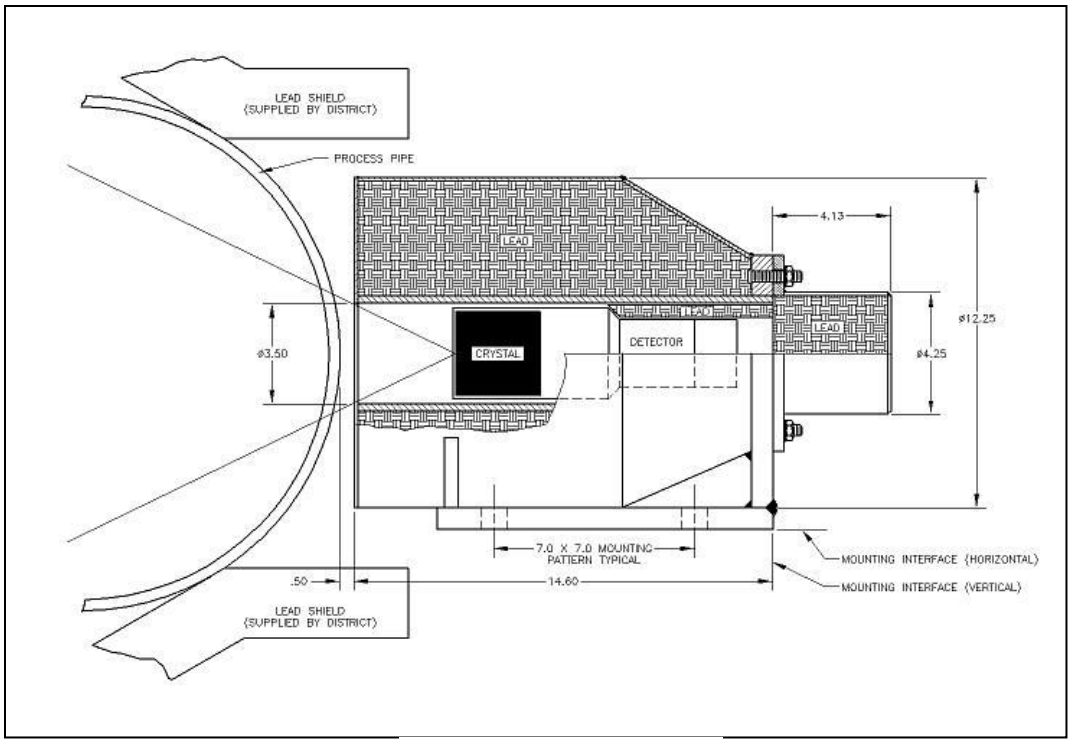
ELECTRONICS
Model *FM-9W*



***PEMO-7* Series**
Installation Diagram

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Model Series~ PEMO-7

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SPECIFICATIONS:

Sensitivity:

Sensitivity and response time depend on user's requirements and physical circumstances such as pipe diameter, wall thickness, and ambient background radiation level and energy (KeV) of major nuclides of interest.

Example: The standard system with 3" x 3" NaI detector and 2" of lead shielding has a limit of sensitivity better than 1 X 10^{-7} Ci/cc of ^{60}Co in an 18" diameter pipe with 0.02 mR/hr background in a one-hour measurement.

DETECTORS:

PEMO-7* & *PEMO-7-MCA	Model PGS-3-3 : 3" x 3" NaI(Tl) crystal scintillation detector probe, (typically one per pipe);sensitivity to all Gamma above 100 KeV.
PEMO-7-G:	Intrinsic HPGe Solid State Detector

ELECTRONICS:

Engineering Units:	User can input correct conversion factor and change to any units.
Controls: Front Panel:	On-Off, Alarm-mute, Rate, Integrate, Reset.
Recessed or Internal:	Discriminator level, high voltage. Other adjustable settings: See calibration.
Input Sensitivity:	Adjustable from less than 1 millivolt to 100 millivolt Anti-saturation and Dead-time Corrections are available.
Alarm:	2000 Hz audio tone with audio "mute" switch + RED LIGHT High current relay. 0-100% of full scale.
Alarm Set Point:	User settable to any point on detector range.
Serial Output:	Two-way USB standard, Ethernet optional.
Power:	105-125 volts, 50-60 Hz (220 V optional)
• **OPTIONAL:**	Software package for integration into facility computer & to link multiple detectors.

ELECTRONICS *FM-9W*:

Dimensions:	21" W X 11" H X 16" D
Weight:	20 pounds (9 kg)

MODEL	ENERGY ANALYZER	DETECTOR	SMART ELECTRONICS	ANALYSIS OUTPUT	TEMPERATURE OPERATION
PEMO-7	Single Channel Analyzer (SCA)	3" x 3" NaI(Tl) PGS-3-3	FM-9W	Wide or Narrow Window	No Dewar Ambient Temperature Operation
PEMO-7-MCA	Multi-Channel Analyzer (MCA)	3" x 3" NaI(Tl) PGS-3-3	Full Computer	Isotope Identification Enhanced Display	No Dewar Ambient Temperature Operation
PEMO-7-G	Multi-Channel Analyzer (MCA)	Germanium Solid State HPGe	Full Computer	Isotope Identification Enhanced Display	Manual Dewar or Electronic Cryo-Cooler Cryogenic Temperature Operation

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Shielding:	0.25" to 3" low- activity-lead around detector.
Range - *PEMO-7:*	**Example**: 1 x 10^{-7} to 1 x 10^{-4} µCi/cc **with** 3" x 3" NaI (Tl) & 18" Pipe.
Alarm:	User Settable. 2000 Hz beeper, red flasher and relay contacts for user.
Response Time:	Settable 1 second to 10 minutes.
Readout:	Color Monitor showing: concentration, total activity and programmed information.
Power:	115 V, 50-60 Hz (230 V optional).
Flow Rate:	Measurement is independent of Flow rate.
Sample Volume:	The pipe should be full of liquid for best sensitivity.
Case:	Electronics rack mounted or housed in enameled steel case.

WEIGHT & DIMENSIONS:

Detector Assembly Weight:	10 lbs for unshielded ***PEMO-7*** assembly, up to 350 lbs for 2" thick lead shielding.
Shipping Weight:	450 lbs. for complete 1 detector ***PEMO-7*** system, including detector light shielding. (weight will vary dependent on shield & detector selection)

NOTES FOR RADIATION MEASUREMENT WHEN DETECTOR IS OUTSIDE OF THE PIPE:

Obstacles In Obtaining Good Efficiency And High Sensitivity When Measuring Radioactive Activity From The Outside Of A Pipe.

1. Unknown volume if pipe is not always full.
2. Unknown list of nuclides & energies.
3. Pipe wall thickness and material, such as steel will absorb all Alphas & all Betas below 1 MeV, & Gammas below 100 KeV.
4. Geometry of measurement is poor because pipe presents only a small angle source to the probe crystal's view.

UNITS OF MEASUREMENT FOR PIPE MONITOR

The instrument can calculate & display any engineering units desired. But the user needs to input a valid calibration coefficient factor.

In the absence of a good calibration factor for the ***PEMO-7* Series**, read-out defaults to units in **cps** or can easily be set to read-out in **cpm** without calibration. Units of **mR/hr** can be set with minimum effort.

Instructions for Manual Input of Calibration Coefficient:

1. Fill the pipe full with a known concentration of the single nuclide of greatest interest or abundance.
2. Set energy window or area of interest to the major energy peak.
3. Record the count rate

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4. Calculate calibration coefficient factor.

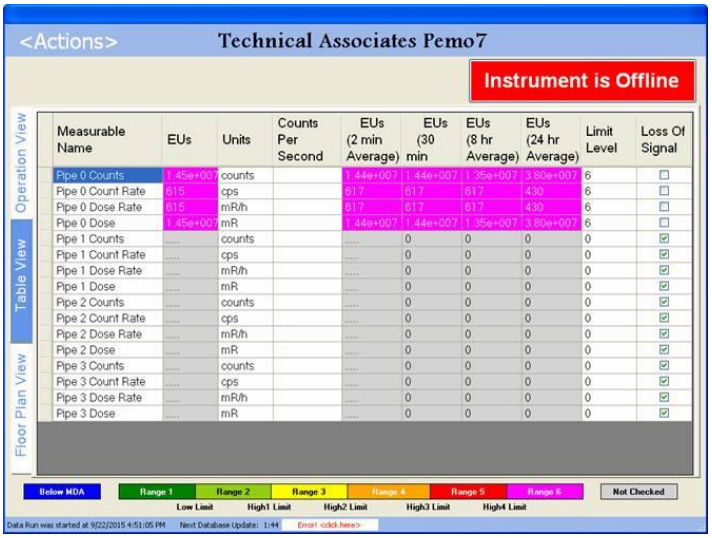
   Calculation Formula:

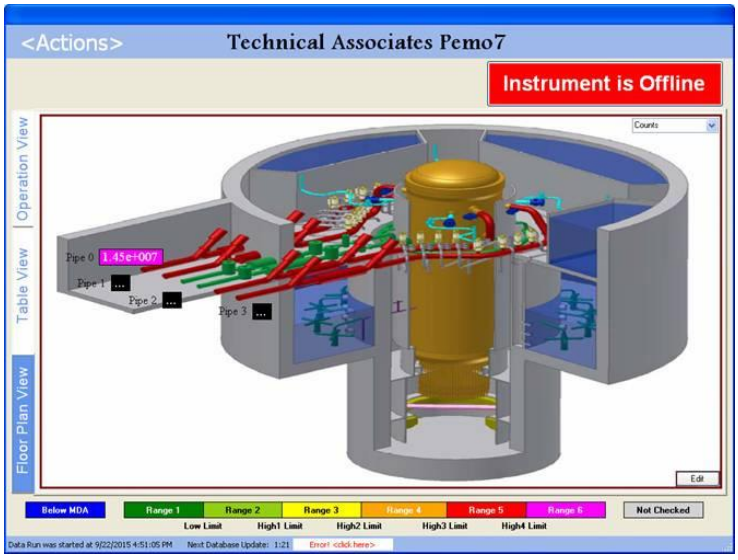
   Divide cps by Bq (Counts per second divided by disintegrations per second)

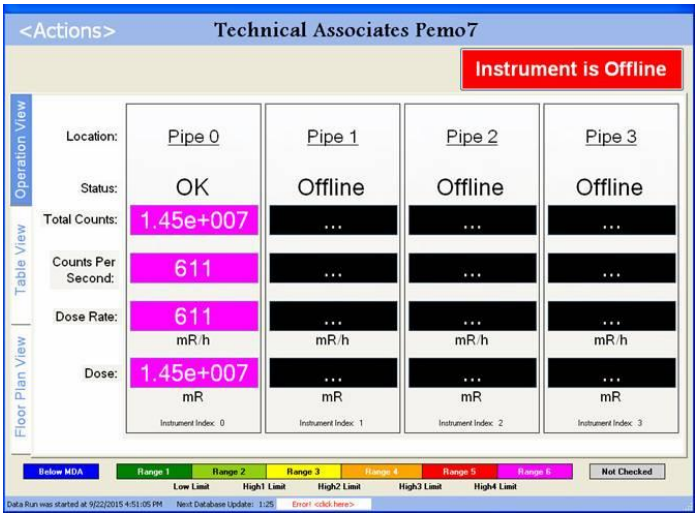
5. Repeat procedure for the second most abundant nuclide.
6. Use the factors that you have determined to calculate a weighted average factor which reflects the abundance of each important nuclide in the liquid mixture.
7. Input the calibration factor as you follow the on-screen calibration instructions.
8. The ***PEMO-7* Series** can then readout in concentration units such as µCi/L (microCuries per liter) or KBq/m^3 or as desired.

NOTE: Solid sources can be used to approximate the correct calibration factor for particular nuclides if pipe thickness is taken into account.

OPTIONAL SOFTWARE SCREEN SHOTS







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