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Rockwell Hanford Operations
Richland, WA 99352

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3. CANNOT BE REWORKED

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Concurring Approval

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Rockwell International

Rockwell Hanford Operations
Energy Systems Group

PROCUREMENT SPECIFICATION FOR
BETA-GAMMA PARTICULATE AIR MONITOR

HWS-10193

Date: March 8, 1978

APPROVED BY

J. H. [Signature]
Manager, Instrument Design and Development

7/5/78
Date

[Signature]
Manager, Radiological Engineering

Date

C. Schneider
Quality Assurance

6/28/78
Date

Spec. Doc. No.: HWS- 10201 10193	Revision: 0	Title: Beta-Gamma Continuous Air Monitor Unit	Amendment No.: C1
Prepared By: S. W. Woolfolk	Department: Environmental & Occupational Safety - Rad. Eng.		Date: 11/16/79
Approved - R&E: <i>[Signature]</i>	Approved - QA: 12-7-79 <i>[Signature]</i>	Approved: <i>[Signature]</i>	Page <u>1</u> Of <u>1</u>

This Amendment Forms A Part Of Specification/Document

~~10201~~, Revision 0, Dated 01/15/1979
HWS-10193

TEXT:

The maximum weight limit on these units shall be revised from 150 pounds to 170 pounds.

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PSK-17209
PROCUREMENT SPECIFICATION FOR
BETA-GAMMA PARTICULATE AIR MONITOR

1.0 SCOPE

This specification covers an air sampling and monitoring system for beta-emitting and gamma-emitting airborne particulates. The instrument shall use buyer's vacuum system to pull air through a sample filter. The instrument shall measure the beta-gamma emitted by the deposited radio-nuclides and indicate the net count rate on a logarithmic recorder and as a voltage or current output available on a rear mounted terminal strip.

2.0 GENERAL REQUIREMENTS

2.1 Description

Each air sampler and monitor shall consist of filter holder, sample detector, shield, detector bias supply, amplifiers, count rate circuit, high level alarm circuit, failure alarm circuit, and recorder.

2.2 Mechanical

2.2.1 Filter Holder

The filter holder shall accept a 47 millimeter diameter filter (millipore SM or equivalent) and shall allow for rapid filter change. Connectors shall be provided for remote sample and vacuum system lines.

2.2.2 Air Flowmeter

A front panel mounted air flowmeter with a control valve shall be provided, range 0.5 to 3.5 CFM or 10 to 100 LPM. This flowmeter shall read within ± 10 percent of the air through the filter.

2.2.3 Air Leakage

Leakage into the system shall not exceed $\pm 10\%$ of the air entering the system. The sample chamber design shall prevent leakage around the filter paper. There shall be no leakage out of the system.

2.2.4 Sample Chamber Intake

The air intake tubing shall be straight into the sample chamber, without elbows or bends, to minimize particle deposition.

2.2.5 Shielding

The sample chamber and detector shall be surrounded by shielding equivalent to 2 inches of lead (50.8 cm) or more.

2.2.6 Size

Overall dimensions shall be less than 28 inches high by 26 inches wide by 21 inches deep. Weight shall not exceed 150 pounds.

2.3 Electrical and Electronic

Circuitry shall use solid-state components (except detector) and be of modular design for high reliability and ease of maintenance. All adjustments, test points, and calibration controls shall be readily accessible. The system shall be operational from 20°F to 130°F with a total change in system gain less than $\pm 10\%$.

2.3.1 Detector, Sample

The detector shall be a 900 volt pancake-type geiger tube with an active diameter of approximately 1.75 inches and a density thickness of 1.4 to 2.0 mg/cm².

2.3.2 Detector, Background

A second detector shall be located inside the shield to detect gamma background for background subtraction use.

2.3.3 Amplifiers and Count Rate Circuit

The amplifiers shall match the detector output pulses to the count rate circuit. The count rate circuit shall include a discriminator to reject noise pulses. A subtraction circuit shall be provided along with an adjustment control for percent subtraction to permit subtraction of up to 100% of the counts per minute detected by the background detector from the counts per minute detected by the sample detector. A mode switch shall be provided to select gross counting or background subtraction. A logarithmic converter shall provide an output proportional to the logarithmic of the net counts per minute. This output shall be four decade, covering count rates from 10 to 100,000 counts per minute. The output shall drive the high level alarm circuit and the recorder.

2.3.4 High Level Alarm

The high level alarm circuit shall be adjustable over the entire range. An alarm delay circuit shall be provided such that the count rate must exceed the alarm point for a selected period of time before alarm indications are activated. This delay shall be adjustable from 1 to 30 seconds. The alarm shall be latching. The alarm indications shall be an audible alarm, a red light, and relay contacts for remote alarm use. The audible alarm shall be a bell meeting the following specifications: 120 VAC, 60Hz, 88 dB at 10 feet, approximately 5 inch diameter base, Edwards catalog #340 "Adaptable" or equivalent. (Edwards Company, Norwalk, Connecticut.) The bell shall be mounted on the side of the cabinet. The red light shall be a rotating beacon type meeting the following specifications: 120 VAC, base 5 inches O.D., height 5-3/4 inches, clear red plastic dome, metal clamp with screw holds plastic cap to base, Federal Signal model 121-S, series A-1, "Vitalite" or

equivalent. (Federal Signal Corporation, Blue Island, Illinois.) The red light shall be on top of the instrument. The relay contacts shall be single pole, double throw (SPDT) rated at least 3 amperes at 30 volts DC and 115 volts AC.

A push button acknowledge switch shall be provided which turns off the audible alarm but leaves the alarm light and external relay contacts activated.

2.3.5 Failure Alarm

A failure alarm shall be provided which is activated when no signal from the detector reaches the failure detection circuit after a 30 second time period. A failure alarm light shall be provided. A normally energized SPDT relay with contacts rated at least 3 amperes at 30 volts and 115 volts AC shall be provided for remote failure alarm capability.

2.3.6 Test Connectors

The unit shall have a BNC connector for monitoring the detector output or connecting an external signal generator. The connector shall be capacitively coupled to the detector output.

2.3.7 Recorder

A miniature, inkless strip-chart recorder compatible with the count rate circuit shall be provided as an integral part of the instrument. The recorder shall have a chart capacity for 20 days continuous. The recorder must be able to move one full roll of paper from supply to take-up reel without external adjustment. The recorder scale shall be calibrated and labeled for 10 to 100,000 counts per minute (four decade logarithmic).

2.3.8 Recorder Output

The unit shall have an output signal brought to a terminal strip on the back of the unit. The output signal shall be voltage (0 to 10 millivolts) or current (0 to 1 milliampere) directly proportional to the reading on the recorder. The output shall therefore be proportional to the log of the net count rate.

2.3.9 Power Requirements

The instrument shall operate from 105 to 125 volts AC, 60 Hz power. Electro-magnetic interference (EMI) filters shall be built-in for line noise rejection. Calibration shall change less than $\pm 5\%$ for line voltage variations of $\pm 10\%$. A power on lamp shall be provided.

3.0 OPERATION AND SERVICE MANUALS

One set of operating and service manuals per instrument shall be provided unless otherwise stated in the purchase order. Circuit drawings must be complete

and in agreement with the instruments supplied. If blocks or squares are used to indicate a portion of the circuit a complete drawing should be provided elsewhere in the manual. Information on normal voltages and waveforms at all important points of the circuit shall be included as a part of the circuit diagrams or manuals. The manual shall include complete parts list, including values, and where applicable manufacturer and manufacturer's part number. All parts are to be identified and values given either on the schematic drawings or on the parts list. Front panel and rear panel views of the instrument shall be included in the manual.

The theory of circuit operation and servicing and adjustment procedures should be complete. Explanations and procedures should require a level of understanding which could be expected of instrument technicians having two years of vocational-technical schooling in electronics and two years of related work experience.

4.0 PERFORMANCE TESTS

4.1 Conformance to Specifications

Each air sampler/monitor shall meet all the specifications listed above. Seller may make any tests he considers necessary to assure this requirement. A certificate of testing shall be provided for each instrument.

4.2 Basic Testing

The following tests shall be made for each instrument by the seller before shipment, and test results furnished to the buyer. Seller shall furnish all equipment required for tests. Test source, where called for, shall be a 47 mm diameter disc, distributed Strontium-Yttrium 90, 10,000 disintegrations per minute, known to $\pm 10\%$.

4.2.1 Burn-In

The monitor shall be plugged into a power source and operated for 120 hours prior to further testing. At least once during each 24 hours of this burn-in time, the monitor shall be checked using the test source as required to determine that all monitor functions are operable. If not, it shall be repaired and burn-in shall continue until 120 hours operation without fault have accumulated.

4.2.2 Counting Efficiency, Gross Counting Mode

Adjust instrument per instructions in the manual. Set controls in the gross counting mode. Put the test source in place. Record the count rate (source c/m). Remove the test source and record the background count rate (background c/m). Calculate the counting efficiency (CE).

$$CE = \frac{(\text{source c/m}) - (\text{background c/m})^*}{(\text{source d/m})} \times 100$$

CE shall be at least 20%.

* NOTE: The "background 4m" count will not exceed 50% of the "source c/m" in evaluating the counting efficiency.

4.2.3 Counting Efficiency, Subtraction Mode

Set controls in the background subtraction mode. Adjust the background subtraction circuit per instructions in the manual. Take an eight-hour background run; no source and no air flow. The net count rate shall not exceed 10 counts/minute maximum as read on the recorder.

4.2.4 Put the test source in place. Record the count rate (source c/m) with the mode set to background subtraction. Calculate the counting efficiency (CE). CE shall be at least 25%.

4.3 Special Testing

In addition to the basic tests, one of each batch of 10 instruments shall be tested as follows by the seller before shipment, and test results furnished to the buyer:

4.3.1 Temperature Tests

This test pertains to the circuitry and may be done without the bell and light. With the source in place and monitor in ambient temperatures of $75 \pm 3^\circ\text{F}$ for at least 30 minutes, record count rate. Change ambient temperature to $100^\circ\text{F} \pm 3^\circ\text{F}$ and hold that temperature for at least 30 minutes. Record the count rate. Change in count rate from that at 75°F shall not exceed $\pm 5\%$. The indication on the recorder shall not change more than $\pm 10\%$. Change ambient temperature to $50^\circ\text{F} \pm 3^\circ\text{F}$ and hold at that temperature for at least 30 minutes. Change in count rate from that at 75°F shall not exceed ± 5 percent. The indication on the recorder shall not change more than ± 10 percent.

4.3.2 Supply Voltage Tests

With source in place record reading with supply at 115 ± 2 volts. Vary supply down to 105 ± 2 volts and up to 125 ± 2 volts. Reading shall not vary from that at 115 volts by more than ± 5 percent. The indication on the recorder shall not change more than ± 10 percent.

4.3.3 Stability

Make a 24 hour test run with source in place. Deviation, exclusive of short transient peaks (<10 seconds), of average reading during half hour periods shall not exceed ± 20 percent as read on the recorder.

4.4 Acceptance Tests

Buyer may make any performance tests on instruments at buyer's facility to determine whether the instruments meet all the requirements of this specification.

QUALITY ASSURANCE

The Seller shall maintain and document a quality program that complies with contract requirements. The Seller's quality system is subject to review and approval at all times by Buyer or Buyer's Quality Assurance Department. Should the Seller be a Distributor furnishing material not of its own manufacture, the Manufacturer who's product is furnished shall be qualified by the Seller as stated above. The Seller shall identify the Manufacturer and supply this information to the Buyer with each shipment.

INFORMATION RELEASE REQUEST

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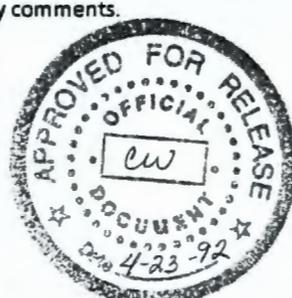
References:
WHC-CM-3-4

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Title <i>Procurement Specification for Beta-Gamma Particulate Air Monitor 03/08/78</i>			Unclassified Category UC-	Impact Level
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Review Required per WHC-CM-3-4	Yes	No	Reviewer Name (printed)	Signature	Date
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Information conforms to all applicable requirements. The above information is certified to be correct.

Author/Requestor (Printed/Signature) <i>Cindy Stout</i> C.M. STOUT	Date 4/8/92	<p>INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP</p> <p>Stamp is required before release. Release is contingent upon resolution of mandatory comments.</p>  <p>INFORMATION</p>
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