



# Advanced Medical Systems, Inc.

1020 London Rd.  
Cleveland, Ohio 44110  
216-692-3270

February 13, 1996

Kevin G. Null  
Nuclear Materials Licensing Branch  
U. S. Nuclear Regulatory Commission  
801 Warrenville Road  
Lisle, Illinois 60532-4351

**Re: Radiation Safety Procedures for USNRC License No. 34-19089**

Dear Mr. Null:

In response to your letter dated December 5, 1995 wherein you requested the opportunity to review the Radiation Safety Procedures (RSPs) that were referenced in our license renewal application dated October 30, 1995, enclosed are the following additional RSPs:<sup>1</sup>

- RSP-008, "Instrumentation and Surveillance"
- RSP-010", Exposure Control"
- RSP-018, "Operation of the Gamma Spectrometer"
- RSP-019, "Assessment of Radioactivity in Water Samples"

These procedures are being submitted to the USNRC as supplemental information only to assist in your review of our application. They are not to be considered part of the application package or incorporated as license conditions. However, your comments on these RSPs, which have been reviewed and approved by the AMS Radiation Safety Committee, are welcome.

Because our renewal application was originally submitted more than thirty (30) days prior to the expiration date of License No. 34-19089-01, AMS assumes the license will remain in effect, under its existing provisions, until final action is taken on this revised application. Since AMS wishes to institute significant changes in our radiation protection program in order to improve its applicability and auditability, your prompt consideration of our revised

<sup>1</sup> RSP-001 and RSP-003 were transmitted as part of our October 30, 1995 license renewal application. RSP-002, RSP-003, RSP-005, RSP-007, RSP-009, RSP-011, RSP-012, RSP-013, RSP-014, RSP-015, RSP-016, and RSP-017 were forwarded to you under separate cover. RSP-006 is currently undergoing technical and administrative review. As soon as the reviews are complete, the final versions of this RSP will be immediately forwarded to the USNRC.

RECEIVED

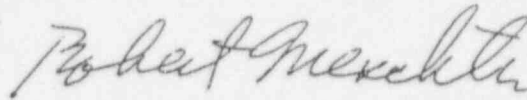
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application would be greatly appreciated. If you have any questions, please contact me at (216) 692-3270.

Sincerely

A handwritten signature in cursive script, appearing to read "Robert Meschter".

Robert Meschter, R.S.O.

cc: D. Cesar (w/o attach.)  
D. Miller, Esq. - Stavole & Miller (w/o attach.)  
C. D. Berger, C.H.P. - IEM (w/o attach.)  
M. Weber - USNRC Region III (w/o RSP-008 & RSP-010)

# Advanced Medical Systems, Inc.

OPERATION OF THE GAMMA SPECTROMETER	Procedure: RSP-018	Revision No.: 000
	Page: 1 of 15	Date: February 9, 1996
	Approved by (Vice President):	
	Approved by (RSQ):	
	Approved by (RSC Chair):	

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# RADIATION SAFETY PROCEDURE

Minor Change  
Number:  
By:  
Date: / /

## OPERATION OF THE GAMMA SPECTROMETER

No. RSP-018  
Rev. No. 000  
Date: 02/09/96  
Page: 2 of 15

### 1 PURPOSE

The purpose of this procedure is to provide instruction on the operation of the sodium-iodide-based gamma spectroscopy system at Advanced Medical Systems, Inc. (AMS).

### 2 SCOPE

This procedure applies to the routine operation of the gamma spectroscopy system in use at the London Road facility. Analysis of other than water or soil samples are exempt from the requirements of this RSP.

### 3 REFERENCES

- 3.1 U. S. Nuclear Regulatory Commission Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment".
- 3.2 American Society of Mechanical Engineers, ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities"
- 3.3 U. S. Nuclear Regulatory Commission License No. 34-19089-01 (as amended).

### 4 DEFINITIONS

The definition of terms used in this RSP that may not be commonly understood shall be included in RSP-002, "Definitions".

### 5 PROCEDURE

#### 5.1 Determine Energy Response and Regions of Interest

- 5.1.1 Energy response and regions of interest shall be determined daily, immediately prior to acquisition of background data.
- 5.1.2 Place either  $^{60}\text{Co}$  calibration source over the detector.
- 5.1.3 Adjust amplifier gain and/or high voltage so that the two primary photopeaks fall in channels 155 (1.17 MeV peak) and 176 (1.33 MeV).
- 5.1.4 Acquire data until approximately 4,000 counts appear in Channel 176, then stop data acquisition.

# RADIATION SAFETY PROCEDURE

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## OPERATION OF THE GAMMA SPECTROMETER

No. RSP-018

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5.1.5 Determine the regions of interest.

5.1.5.1 Place the left cursor to the left of channel 155 at the location where the peak tail reaches the continuum.

5.1.5.2 Place the right cursor to the right of channel 176 at the location where the peak tail reaches the continuum.

5.1.6 Record the left and right channel numbers on Attachment 1

### 5.2 Determination of Water Background

5.2.1 Background count rates in the regions of interest shall be determined daily, at the end of each shift.

5.2.2 Place a Marinelli Beaker containing deionized water over the detector.

5.2.3 Acquire data for a minimum of 28,800 seconds (eight hours).

5.2.4 Determine the number of counts in the Region (from Attachment 1).

5.2.5 Record the counts in the Region on Attachment 2

5.2.6 Determine  $R_b$  and  $\sigma_b$  as shown on Attachment 2.

### 5.3 Determination of Soil Background

5.3.1 Background count rates in the regions of interest shall be determined daily, at the end of each shift.

5.3.2 Place a Marinelli Beaker containing dry, cobalt-free soil collected from the AMS property over the detector.

5.3.3 Acquire data for a minimum of 28,800 seconds (eight hours).

5.3.4 Determine the number of counts in the Region (from Attachment 1).

5.3.5 Record the counts in the Region on Attachment 3

5.3.6 Determine  $R_b$  and  $\sigma_b$  as shown on Attachment 3.

### 5.4 Determine Efficiency for Water

5.4.1 Detection efficiency for water shall be determined daily, at the start of each shift.

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## OPERATION OF THE GAMMA SPECTROMETER

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5.4.2 Place the water-equivalent calibration source (Source No. A3082) over the detector.

5.4.3 Perform decay correction on source activity by:

$$A_{\text{today}} (nCi) = 526.3 e^{\frac{-0.693 \times t (\text{days since March 1, 1995})}{1923.92}}$$

5.4.4 Record corrected activity on Attachment 4 (Item A).

5.4.5 Acquire data for 600 seconds.

5.4.6 Determine the number of counts in the Region (from Attachment 1).

5.4.7 Record counts on Attachment 5.

5.4.8 Determine  $\epsilon_{\text{water}}$

5.5 Determine Efficiency for Soil

5.5.1 Detection efficiencies for soil shall be determined daily, at the start of each shift.

5.5.2 Place the soil-equivalent calibration source (Source No. A3083) over the detector.

5.5.3 Perform decay correction on source activity by:

$$A_{\text{today}} (nCi) = 587.6 e^{\frac{-0.693 \times t (\text{days since March 1, 1995})}{1923.92}}$$

5.5.4 Record corrected activity on Attachment 5 (Item A).

5.5.5 Acquire data for 600 seconds.

5.5.6 Determine the number of counts in the Region (from Attachment 1).

5.5.7 Record counts on Attachment 5.

5.5.8 Determine  $\epsilon_{\text{soil}}$

5.6 Data Acquisition and Analysis

5.6.1 Collect a full Marinelli beaker of sample.

5.6.2 Label the sample by S-xxxxxx-yy or W-xxxxxx-yy, where S = Soil, W = Water, xxxxxx = today's date (e.g., 030195 for March 1, 1995), and yy = a unique sequential identifier that repeats at the start of each day (e.g., 01, 02, etc.).

5.6.3 Seal the sample container

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5.6.4 If the sample is a soil sample, determine the sample mass in grams.

5.6.4.1 Weigh the empty Marinelli beaker (E)

5.6.4.2 Weigh the full Marinelli beaker (F)

5.6.4.3 Calculate the sample mass by F minus E

5.6.5 If the sample is a water sample, the volume is assumed to be "one liter"

5.6.6 Confirm that the outside of the sample container is free of contamination by smearing the outside of the container and ensuring that the smear count is less than "2x background". (If contaminated, place the container in a thin-walled plastic bag prior to placement on the detector.)

5.6.7 Place the sample over the detector

5.6.8 Acquire data for a minimum of 14,400 seconds (four hours) for water samples and 7,200 seconds (two hours) for soil samples.

5.6.9 Determine the number of counts in the Region (from Attachment 1).

5.6.10 Record counts on Attachment 6 if the sample is water or Attachment 7 if the sample is soil.

5.6.11 Determine  $R_s$  using the most recent value of  $R_b$  from Attachment 2 (for water) or 3 (for soil), and record on Attachment 6 or 7, as applicable.

5.6.12 Determine the Concentration and Minimum Detectable Activity and record on Attachment 6 or 7, as applicable.

5.6.13 Remove and archive the sample.

5.6.14 Confirm that the detector casing is free of contamination by smearing the outside of the casing and ensuring that the smear count is less than "2x background".

### 5.7 Confirmatory Analysis

5.7.1 Enclose the sealed Marinelli beaker inside of two zip-lock baggies.



# RADIATION SAFETY PROCEDURE

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- 5.7.2 Log the sample number and other pertinent information onto a Chain of Custody form (example follows Attachment 6).
  - 5.7.2.1 The analysis to be requested for water samples is "gamma spectroscopy for Cobalt-60, with a nominal LLD of no greater than 30 pCi/l"
  - 5.7.2.2 The analysis to be requested for soil samples is "gamma spectroscopy for Cobalt-60, with a nominal LLD of no greater than 5 pCi/g"
- 5.7.3 Forward the sample and the Chain of Custody form to a pre-selected analytical laboratory by overnight mail carrier (Federal Express or equivalent)
- 5.7.4 Maintain a copy of the Chain of Custody form and the airbill as the chain of custody record.
- 5.7.5 When results for water samples are received, record them on Attachment 6 and retain the Certificates of Analysis.
- 5.7.6 When the results for soil samples are received, record them on Attachment 7 and retain the Certificates of Analysis.

## 6 EXEMPTION PROVISIONS

Variances and exceptions to the requirements of this procedure shall be permitted pursuant to the written authorization of the RSO and the Radiation Safety Committee.

## 7 DOCUMENTATION

Records shall be maintained pursuant to RSP-004, "Radiation Protection Records"

## 8 ATTACHMENTS

- 8.1 Attachment 1 - Daily Energy Response and Regions of Interest
- 8.2 Attachment 2 - Daily Water Background Data
- 8.3 Attachment 3 - Daily Soil Background Data
- 8.4 Attachment 4 - Efficiency Determination for Water Samples
- 8.5 Attachment 5 - Efficiency Determination for Soil Samples
- 8.6 Attachment 6 - Analysis of Water Samples
- 8.7 Attachment 7 - Analysis of Soil Samples



[illegible]

1998

ENT 2

[illegible]

10

AT  
DAILY SOIL  
ENT 3  
GROUND DATA

[illegible]

Source Number A3082. Activity of 526.3 nCi at 0300 March 1, 1995

[illegible]

Instrument Num'

AT  
EFFICIENCY DETERMINATION - SOIL SAMPLES

Source Number A3083, Activity of 587.6 nCi at 0300 March 1, 1995

[illegible]

[illegible]

[illegible]



**ADVANCED MEDICAL SYSTEMS, INC.**  
**ANALYSIS REQUEST AND**  
**CHAIN OF CUSTODY RECORD**

Reference I. \_\_\_\_\_

Page 1 of \_\_\_\_\_

(1) Client Name	(7) Samples Shipment Date	(5) Bill to:
(2) Sample Team Leader	(8) Lab Destination	
(3) Task No.	(9) Lab Contact	
(4) Project Manager	(12) Technical Contact/Phone	(10) Report to:
(6) Purchase Order No.	(13) Carrier/Waybill No.	
(11) Required Report Date		

**ONE CONTAINER PER LINE**

(14) Sample Number	(15) Sample Description/Type	(16) Date/Time Collected	(17) Container Type	(18) Sample Volume	(19) Preservative	(20) Requested Testing Program

(23) Special Instructions	
(24) Possible Hazard Identification Non-hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input type="checkbox"/>	(25) Sample Disposal Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive _____ months
(26) Turnaround Time Required: Normal <input type="checkbox"/> Rush <input type="checkbox"/>	(27) QC Level: I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> Project Specific _____
(28) Relinquished by: (signature, date, time):	Received by: (signature, date, time)
Relinquished by: (signature, date, time):	Received by: (signature, date, time)
Relinquished by: (signature, date, time):	Received by: (signature, date, time)

(See Reverse for Instructions)

## INSTRUCTIONS FOR COMPLETING THIS FORM

1. **Client Name:** Record the name of the client (AMS)
2. **Sample Team Leader:** List the name of the team taking these samples.  
(      **sk No.:** Indicate the AMS task number, if applicable.
4. **Project Manager:** Record the project manager's name.
6. **Purchase Order No.:** Non-AMS personnel should use this space to record the purchase order number authorizing the analysis of these samples. AMS and AMS subcontractors should leave this space blank if a project number has been given for billing.
7. **Samples Shipment Date:** Indicate the date these samples are shipped to the laboratory.
8. **Lab Destination:** Indicate the laboratory designated for sample shipment. Do not list more than one lab on this form. Be certain before sending samples that the laboratory you are designating is aware of the shipment and is capable of accepting these sample types and has available capacity.
9. **Lab Contact:** Give the name of the laboratory contact (typically the lab's project manager).
10. **Report to:** Give the name, address and phone number of the person to receive the data report for these samples.
11. **Required Report Date:** Record the date which you and the laboratory contact have determined the results will be reported (include verbal or final report as appropriate).
12. **Technical Contact/Phone:** Indicate the name of the person to be contacted in case of any questions regarding these samples and the phone number where the contact may be reached the day the samples arrive in the laboratory.
13. **Carrier/Waybill Number:** If you are sending the samples by a commercial carrier such as Airborne or Federal Express, record the courier company name and the waybill or airbill number under which these samples will be shipped (Example - Fed-Ex/#513631771).
14. **Sample Number:** List the complete, unique identification number of each sample. These numbers must correspond with the identification numbers on the sample containers and the field sample collection document(s).
15. **Sample Description/Type:** Provide a short physical description of the sample and the sample type such as soil, sediment, sludge, water, wipe, air, concentrated waste or bulk.
16. **Date/Time Collected:** Record date and exact time each sample was collected. Use a 24-hour clock; i.e., 1645 not 4:45 p.m.
17. **Container Type:** Indicate the volume, color and type of the sample container used (Example - 1 gallon amber glass, 1 liter clear plastic, 40 milliliter clear glass).
18. **Sample Volume:** Estimate the amount of sample in the container. For air samples, indicate the volume of air sampled.
19. **Preservative:** Indicate what type of preservative, if any, has been used for the samples (Example - ice to 4°C nitric acid, hydrochloric acid).
20. **Requested Testing Program:** List the analyses to be performed on each sample by method number or quotation number.
23. **Special Instructions:** Use this space to record any special instructions to the lab regarding the processing of these samples.
24. **Possible Hazard Identification:** Indicate all hazard classes associated with the sample(s).
25. **Sample Disposal:** Indicate how the samples should be disposed of following analysis. The lab may charge for packing, additional archiving and disposal.
26. **Turnaround Time Required:** Check "Normal" or "Rush" as determined by the Technical Contact and the Lab Contact. Rush samples are subject to a surcharge.
27. **QC Level:** These should be specific to the analytical laboratory and should not be confused with USEPA Analytical Levels. Project specific should reference a quotation number or other specifications that have been submitted to the laboratory before beginning work.
28. **Signatures:** When releasing custody of these samples, use the "Relinquished By" space to sign your full legal name, date and time of release. After verifying that all samples are present, the person receiving the samples must sign the "Received By" space to take custody of the samples.

# Advanced Medical Systems, Inc.

## ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

Procedure: RSP-019

Revision No.: 000

Page: 1 of 7

Date: February 8, 1996

Approved by (Vice President):

Approved by (RSO):

Approved by (RSC Chair):

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By:

Date: / /

## ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

No. RSP-019

Rev. No. 000

Date: 02/08/96

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## 1 PURPOSE

The purpose of this procedure is to provide instruction on analyzing water samples for the presence of  $^{60}\text{Co}$ , and the criteria for discharge of water into the sanitary sewer system.

## 2 SCOPE

This procedure applies to the routine analysis of water samples at the London Road facility of Advanced Medical Systems, Inc. (AMS).

## 3 REFERENCES

- 3.1 U. S. Nuclear Regulatory Commission Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment".
- 3.2 American Society of Mechanical Engineers, ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities"
- 3.3 U. S. Nuclear Regulatory Commission License No. 34-19089-01 (as amended).
- 3.4 American Public Health Association, Method 7110, "Gross Alpha and Gross Beta Radioactivity (Total, Suspended, and Dissolved)", Standard Methods for the Examination of Water and Wastewater.
- 3.5 U. S. Environmental Protection Agency, Gamma Emitting Radionuclides in Drinking Water, Method 901.1, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA 600/4-30-032.
- 3.6 U. S. Department of Energy, Gamma, Section 4.5.2.3, EML Procedures Manual, HASL-300, Environmental Measurements Laboratory.
- 3.7 U. S. Nuclear Regulatory Commission, NRC Information Notice 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage Under the Revised 10 CFR Part 20".
- 3.8 U. S. Nuclear Regulatory Commission, Communication from J. A. Grobe (Chief, Nuclear Materials Inspection Section 2) to D. Cesar (Treasurer, Advanced Medical Systems), February 1, 1995.
- 3.9 Advanced Medical Systems, Inc., RSP-018, "Operation of the Gamma Spectrometer".

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ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

No. RSP-019

Rev. No. 000

Date: 02/08/96

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#### 4 DEFINITIONS

The definition of terms used in this RSP that may not be commonly understood shall be included in RSP-002, "Definitions".

#### 5 PROCEDURE

##### 5.1 Responsibilities

5.1.1 Sample collection and analysis pursuant to RSP-018 shall be performed by a radiation surveyor.

5.1.2 The RSO should select and pre-qualify the commercial analytical laboratory used to perform confirmatory analyses.

5.1.3 Water shall be discharged only upon authorization by the RSO.

##### 5.2 Data Acquisition

5.2.1 Water samples shall be placed into a one-liter Marinelli beaker.

5.2.2 Samples shall be analyzed pursuant to RSP-018.

5.2.3 Samples may be forwarded to a commercial analytical laboratory for confirmatory analysis.

##### 5.3 Solubility Determination

5.3.1 Samples that contain detectable  $^{60}\text{Co}$  shall be drawn (by vacuum pump) through a 0.45 micrometer filter.

5.3.2 The filtered sample shall be re-analyzed pursuant to RSP-018.

##### 5.4 Confirmatory Analysis

5.4.1 The sample container shall be enclosed inside of two zip-lock baggies, labeled, and a Chain of Custody Form shall be completed as described in RSP-018.

5.4.2 The sample, with its Chain of Custody form, shall be shipped to the commercial analytical laboratory.

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## ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

No. RSP-019  
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- 5.4.3 The samples shall be analyzed by gamma spectroscopy for Cobalt-60 pursuant to EPA Method 901.1 or HASL-300, with a nominal LLD of no greater than 30 pCi/l.
- 5.4.3.1 Analytical results that are less than the MDA or greater than 200 pCi/liter shall be forwarded to the RSO and no additional analyses are necessary.
- 5.4.3.2 Analytical results that are greater than the MDA but less than 200 pCi/liter shall be analyzed for suspended gross alpha and gross beta radioactivity pursuant to American Public Health Association Method 7110.
- 5.4.4 When results from the analytical laboratory are received, they shall be recorded and retained as described in RSP-018.
- 5.5 Discharge of Water (See Attachment 1)
- 5.5.1 Discharges of sampled water shall not exceed 40,000 liters (10,000 gallons) in a 24-hour period.
- 5.5.2 Water that contains greater than 200 pCi/l of  $^{60}\text{Co}$  as determined from the sampling and analysis effort described herein shall not be discharged.
- 5.5.3 Water that contains no detectable  $^{60}\text{Co}$  (e.g., less than the MDA) as determined from the sampling and analysis effort described herein may be discharged.
- 5.5.4 Water that exhibits both of the following may be discharged:
- 5.5.4.1 Less than 200 pCi/l of  $^{60}\text{Co}$  and
- 5.5.4.2 From 5.3, the count rate of the filtered water is statistically similar to the count rate of the unfiltered water pursuant to

$$\frac{C_f}{t_f} \pm \frac{2\sqrt{C_f}}{t_f} = \frac{C_u}{t_u} \pm \frac{2\sqrt{C_u}}{t_u},$$

where  $C_f$  = the net counts in the spectral region(s) of interest for the filtered water,  $C_u$  = the net counts in the spectral region(s) of interest for the unfiltered water,  $t_f$  = the count time for the filtered water and  $t_u$  = the count time for the unfiltered water.

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ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

No. RSP-019

Rev. No. 000

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## 6 EXEMPTION PROVISIONS

Variances and exceptions to the requirements of this procedure shall be permitted pursuant to the written authorization of the RSO and the RSC.

## 7 DOCUMENTATION

7.1 Records to be maintained shall include:

7.1.1 Forms generated pursuant to RSP-018.

7.1.2 Chain of Custody documentation (forms, airbills, etc.)

7.1.3 Requests for analysis

7.1.4 Certificates of Analysis

7.1.5 Discharge logs/records

## ATTACHMENTS

Attachment 1 - Technical Basis for Water Discharge Criteria



# RADIATION SAFETY PROCEDURE

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## ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

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### ATTACHMENT 1 TECHNICAL BASIS FOR WATER DISCHARGE CRITERIA

The objective of the water sampling and discharge program at Advanced Medical Systems, Inc. (AMS) is to ensure compliance with applicable regulations, as well as the radiological health and safety of employees and members of the general public. To ensure that these objectives are met, there must be clear instruction on how to interpret the results of sampling and analysis. These instructions are that a maximum of 10,000 gallons of water may be discharged over a single day. In addition, that water must be sampled and confirmed to contain less than 200 pCi/l of  $^{60}\text{Co}$ . However, any detectable  $^{60}\text{Co}$  in the sample must be deemed "soluble" in water.

These instructions were not selected arbitrarily. Instead, they were based upon regulatory and technical constraints and requirements. The following is a listing of the pertinent requirement and constraints:

- In Title 10, Code of Federal Regulations, Part 20, the USNRC authorizes discharge of licensed material into the sanitary sewage provided the material is readily soluble (or is readily dispersible biological material) in water, and the concentration of licensed material does not exceed that listed in Table 3 of Appendix B to 10 CFR 20.1001-20.2401. For  $^{60}\text{Co}$ , that concentration is 30,000 pCi/l. Therefore, AMS discharge concentrations must be less than 30,000 pCi/l of soluble  $^{60}\text{Co}$ .
- The USNRC has set a release limit for  $^{60}\text{Co}$  in soils of 8 pCi/g. Therefore, in order to ensure that the waste ash produced at the sewage treatment plant that services AMS remains exempt from regulation, AMS must not discharge insoluble  $^{60}\text{Co}$  in concentrations that exceed 1,362 pCi/liter. This number was derived from the assumption that every atom of  $^{60}\text{Co}$  discharged from AMS is transported to the ash, that 10,000 gallons of cobalt-bearing waste are discharged per day, and that the sewage treatment plant produces 7.5 tons of ash per day. The following is the calculation that was performed:

$$10000 \frac{\text{gal}}{\text{day}} \times 4 \frac{\text{t}}{\text{gallon}} \times X \frac{\text{pCi}}{\text{t}} \times \frac{\text{day}}{7.5 \text{ tons}} \times \frac{\text{ton}}{2000 \text{ lb}} \times \frac{\text{lb}}{454 \text{ grams}} = 8 \frac{\text{pCi}}{\text{gram}}$$

$$X = 1362 \frac{\text{pCi}}{\text{t}}$$

Therefore, to ensure that there are no adverse radiological impacts on the local sewage treatment plant, and remain consistent with the USNRC's requirements, the discharge concentration from AMS must be less than 1392 pCi/l of  $^{60}\text{Co}$ .

- The USEPA, in Title 40, Code of Federal Regulations, Part 141.16, establishes maximum contaminant levels for radionuclides in drinking water. For  $^{60}\text{Co}$ , that level is based upon assuring that the contaminant does not produce an annual dose equivalent to the total body or any internal organ of more than 4 millirem in a year. This dose limit is equivalent to a concentration of about 280 pCi/liter. However, no solubility criteria are given in 40 CFR 141.16. Therefore, in order to demonstrate compliance with the drinking water standards, the USNRC's requirements and ensure no adverse impacts on the local sewage treatment plant, the discharge concentration from AMS must be less than 280 pCi/l of soluble  $^{60}\text{Co}$ , even though the discharge will not enter a drinking water supply directly.
- In a letter to AMS,<sup>1</sup> the USNRC specified that discharges to the sanitary sewage system of soluble  $^{60}\text{Co}$  in concentrations less than 200 pCi/liter were acceptable. The USNRC felt, upon issue of this letter,

<sup>1</sup> Grobe, J. A. USNRC, written communication to D. Cesar, AMS, February 1, 1995.

# RADIATION SAFETY PROCEDURE

Minor Change

Number:

By:

Date: / /

## ASSESSMENT OF RADIOACTIVITY IN WATER SAMPLES

No. RSP-019

Rev. No. 000

Date: 02/09/96

Page: 7 of 7

that the nominal concentration of 200 pCi/liter provides a comfortable margin of safety with respect to sewage sludge concentrations in relation to the USNRC release criteria.

- The USNRC's criteria for solubility are defined in USNRC Information Notice 94-07, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage Under the Revised 10 CFR Part 20". This document lists the acceptable methods for demonstrating compliance with the solubility requirements. One of these is the American Public Health Association (APHA), Method 7110, "Gross Alpha and Gross Beta Radioactivity (Total, Suspended, and Dissolved)", Standard Methods for the Examination of Water and Wastewater.
- APHA Method 7110 contains an analytical procedure for determining the quantity of suspended gross beta activity in water samples. However, water typically contains significant gross beta activity from isotopes such as uranium and daughters, radium and daughters, thorium and daughters, and  $^{40}\text{K}$ . The standard does not provide guidance on how much suspended gross beta activity indicates an insoluble material.
- The USEPA recognizes the presence of naturally-occurring radioactivity in water. Consequently, 40 CFR 141 indicates that if the average annual concentration of gross beta activity in water is less than 50 pCi/liter, no further analyses are required. Concentrations greater than 50 pCi/l may still be acceptable for a drinking water supply, but isotope-specific analyses are required before the decision is made.
- A nominal detection sensitivity for  $^{60}\text{Co}$  in water by the methodology of gamma spectroscopy, when performed at a commercial analytical laboratory, ranges from 20 to 30 pCi/liter in a one-hour count time, depending upon the quantity of naturally-occurring radionuclides present in the sample. At AMS, the nominal detection sensitivity for a four-hour count time ranges from 20 to 50 pCi/l, again depending upon the quantity of naturally-occurring radionuclides that are present in the sample.

In light of the aforementioned requirements and constraints, the maximum concentration of  $^{60}\text{Co}$  that can be released into the sewer system or drinking water supplies is 200 pCi/liter. In addition, any detectable (e.g., greater than MDA) activity must meet the USNRC's criteria for solubility pursuant to APHA Method 7110.

Since naturally-occurring beta activity is readily detected by these methods, the maximum concentration of suspended (i.e., insoluble) gross beta activity that might be released into the sewer system based upon the results obtained from a commercial analytical laboratory is 50 pCi/liter. For samples analyzed at AMS pursuant to RSP-018, "Operation of the Gamma Spectrometer" and RSP-019, "Assessment of Radioactivity in Water Samples", the maximum concentration of suspended  $^{60}\text{Co}$  activity that might be released into the sewer system, yet remain unquantifiable, is approximately 35 pCi/liter. In either case, there no adverse radiological impact on the public water supply or the local sewage treatment plan will result.

February 16, 1996

Dwight A. Miller  
Stavole & Miller  
Attorneys and Counsellors at Law  
55 Public Square  
1604 Illuminating Building  
Cleveland, OH 44113

Dear Mr. Miller:

This is to restate the message conveyed during the telephone conversation between you, as attorney for Advanced Medical Systems, Inc. (AMS), and Messrs. John Madera and Michael Weber of my staff, on Friday, February 16, 1996. As explained during the telephone call, we again inform AMS that: (1) NRC detected insoluble cobalt-60 in a water sample from AMS tank 880, (2) a discharge of tank 880 would be, therefore, a potential violation of 10 CFR 20.2003, and (3) if tank 880 were discharged after our telephone notification, the discharge could be considered a willful violation.

Sincerely,

Original signed by Cynthia D. Pederson

Cynthia D. Pederson, Director  
Division of Nuclear Materials Safety

License No. 34-19089-01  
Docket No. 030-16055

See Attached Distribution

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D. Serig

*c/20*

February 22, 1996

Robert Meschter  
Radiation Safety Officer  
Advanced Medical Systems, Inc.  
1020 London Road  
Cleveland, OH 44110

Dear Mr. Meschter:

I am writing in response to your recent request to Mr. Michael F. Weber of my staff for information concerning RIII's sampling and analysis of AMS Tank 880.

On February 13, 1995, an NRC inspector went to AMS and took seven water samples from Tank 880. Four samples were obtained from the top of the tank while the water was being recirculated. (The water in the tank had been recirculating for approximately 24 hours.) Three samples were obtained from the bottom outlet valve of the tank. These bottom samples were taken one hour after the recirculation pump had been turned off. Prior to taking the samples, approximately two liters of water was drained from the bottom outlet valve and returned to the tank.

The analysis of the samples from Tank 880 is still in progress. To date, two samples from the top and two samples from the bottom of the tank have been filtered. No Co-60 was detected on the filters from the top samples, but Co-60 was detected on the filters from the bottom samples. (The analysis results are summarized in the enclosure.) Based on these results, we are reviewing the adequacy of your sampling and analysis procedures.

On February 16, 1996, because of the Co-60 detected on the filters, we informed AMS that insoluble cobalt-60 was detected in the water from Tank 880, and therefore, a discharge of Tank 880 would be an apparent violation of 10 CFR 20.2003.

Once our analysis of samples from Tank 880 is complete, you will be provided the complete results. In the meantime, please do not hesitate to contact me should you have any further questions.

Sincerely,

Original signed by

Geoffrey C. Wright, Acting Deputy Director  
Division of Nuclear Materials Safety

Docket No. 030-16055  
License No. 34-19089-01

Enclosure: As stated

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