October 17, 1995

95-51

MEMORANDUM FOR: Donald A. Cool, Director
Division of Industrial and Medical
Nuclear Safety, NMSS

FROM: John R. Madera, Chief
Nuclear Materials Licensing Branch, RIII

SUBJECT: REQUEST FOR TECHNICAL ASSISTANCE IN THE REVIEW OF THE REVISED EMERGENCY PLAN FOR ADVANCED MEDICAL SYSTEMS, INC. (AMS)

Enclosed for your review is a copy of the revised Emergency Plan submitted by AMS in response to our June 7, 1995 deficiency letter. Since our review of the original submittal, the Region has received many comments from numerous agencies regarding the licensee's Emergency Plan. Attached for your information are copies of all the comments we received.

We are currently reviewing the revised Plan and will await your comments before we generate a second deficiency letter, if applicable. An expeditious review of the enclosed Plan would be greatly appreciated.

Attachments:
A. AMS revised Emergency Plan.
B. 6/7/95 letter from NRC and AMS 8/4/95 response.
C. 6/2/95 letter from State of Ohio Adjutant General's Department and AMS 8/2/95 response.
D. 5/31/95 letter from Ohio State Emergency Response Commission and AMS 8/2/95 response.
E. 6/2/95 letter from Cuyahoga Emergency Management Assistance Center and AMS 8/2/95 response.
F. 8/9/95 and 6/23/95 letters from the Northeast Ohio Regional Sewer District and AMS 9/22/95 response.

CONTACT: Kevin Null
(708) 829-9854

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Advanced Medical Systems, Inc.
1020 London Rd.
Cleveland, Ohio 44110
216-692-3270

October 17, 1995

Mr. James Caldwell
Nuclear Materials Inspection, Section 2
United States Nuclear Regulatory Commission
801 Warrenville Road
Lisle, Illinois 60523-4351

**Re: Addition of Grout to Abandoned Footer Drain and 4" Discharge Line at AMS (USNRC License No. 34-19089-01)**

Dear Mr. Caldwell:

In the letter dated July 19, 1995 from Advanced Medical Systems (AMS) to you, AMS stated its intention of using AV-118 Duriflex liquid grout to fill the abandoned section of the foundation drains at the AMS facility in order to immobilize contaminants that were present in the drain line. This type of grout was originally selected based on its properties (enters the system in a free-flowing liquid form, seals well, etc.).

After further review, AMS now intends to take no further action with regards to the grouting of the abandoned line. This decision was based on the fact that installation of this type of grout carries significant cost, involves the use of hazardous materials in the mixture (sodium persulfate catalyst), and requires a specialized delivery system. AMS maintains that the contaminated pipe is adequately isolated without the grout since there is a concrete isolation wall surrounding the drain and an impermeable liner covering the ground surface above the drains. Independent analysis of more than 30,000 gallons of water that has been collected from the newly installed footer drain system, which shows no detectable cobalt-60, further justifies this decision.

During a July 18, 1995 teleconference call between AMS and the USNRC, Mr. Jack Grobe also recommended that AMS grout in the entire length of the 4" discharge line that rests beneath the AMS basement. (Please recall that it was AMS's intent from the onset of the sewer remediation project to only grout in each end of the 4" line. This has been done). However, review of photographs of the AMS facility taken during building construction shows that a trench is in the vicinity of where the 4" line should currently lie. This implies that the line is imbedded in the cement foundation. AMS recently confirmed that the 4" discharge line is indeed located in the trench depicted in the photograph and is surrounded by concrete (i.e., the 4" line was laid in the trench and concrete was poured to fill the trench and completely surround the line). Therefore, it serves no purpose to grout in that section of the 4" line that traverses the building.

Should you have any questions or if I can provide any additional information, please call me at (216)

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Sincerely,

Robert Meschter

Robert Meschter, R.S.O.

cc: D. Cesar
D. A. Miller, Esq. - Stavole & Miller
C. D. Berger, C.H.P. - IEM

ATC medical group

# Advanced Medical Systems, Inc.

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

October 20, 1995

Mr. James Caldwell
Nuclear Materials Inspection, Section 2
United States Nuclear Regulatory Commission
801 Warrenville Rd.
Lisle, IL 60532-4351

**Re: Conceptual Decommissioning Plan - USNRC License No. 34-19089-01**

Dear Mr. Caldwell:

As committed to in the "Strategic Plan for the London Road Facility", which was forwarded to you on October 16, 1995, and pursuant to my September 1, 1995 letter to Mr. John Madera, enclosed is the "Conceptual Decommissioning Plan for the London Road Facility". This plan contains the decommissioning objective and its basis, a description of the items to be decommissioned, a description of the proposed decommissioning methodology, an ALARA analysis to support the proposed methodology, a cost estimate (1995 costs) for implementing the methodology, and a review schedule for ensuring the Plan's continued applicability for the duration of License No. 34-19089-01.

This plan is being submitted under Control Number 98507. Once approved, the plan will be funded by the corporation to the level shown therein. In the meantime, if you have any questions or if I can provide you with additional information, please call me at (216) 692-3270.

Sincerely,

Robert Meschter

Robert Meschter, R.S.O.

cc: D. Cesar
D.A. Miller, Esq. - Stavloe & Miller
C.D. Berger, C.H.P. - IEM

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REGION III

# CONCEPTUAL DECOMMISSIONING PLAN FOR THE LONDON ROAD FACILITY

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# *CONCEPTUAL DECOMMISSIONING PLAN FOR THE LONDON ROAD FACILITY*

Submitted to:


***Advanced Medical Systems, Inc.***
1020 London Road
Cleveland, Ohio 44110
(216) 692-3270


by:


**Integrated Environmental Management, Inc.**
1680 East Gude Drive, Suite 305
Rockville, Maryland 20850
(301) 762-0502



Report No. 94009/G-3114
October 20, 1995

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# INTRODUCTION

### Background

Advanced Medical Systems, Inc. (AMS) manufactured and fabricated sealed sources of $^{60}Co$ for teletherapy and radiography machines at its facility at 1020 London Road, Cleveland, Ohio. Under the provisions of U. S. Nuclear Regulatory Commission (USNRC) license No. 34-19089-01, AMS currently possesses 60,974 curies of $^{60}Co$, and 2,200 kilograms of depleted uranium (nickel plated) for use as shielding material. The types and quantities of all licensed materials in the AMS inventory are shown in Table 1.

### Purpose/Scope

Recently, AMS submitted an application to renew license No. 34-19089-01. As part of the renewal process, and pursuant to 10 CFR 40.36, a decommissioning funding plan is required. This report, which supplements the renewal application, describes the AMS plan to decommission the London Road facility after licensed activities are terminated. The extent of the decommissioning efforts described herein are intended to ensure that short- and long-term radiation exposures to workers and members of the general population after license termination are as low as reasonably achievable, and that the volume of radioactive waste to be disposed of is minimized. Included in this report is a description of the decommissioning objective for the AMS facility, the conceptual plan for decommissioning the site, an ALARA analysis to demonstrate that the preferred decommissioning methodology is consistent with the requirements of 10 CFR 20.1101, and a conservative estimate of the cost for achieving the decommissioning objective. The decommissioning funding plan for AMS, submitted under separate cover, is based upon the findings of this report.

## ITEMS TO BE DECOMMISSIONED

The AMS operation, which occupies approximately 25% of an 80,000 square foot warehouse and manufacturing building at the London Road address, is contained on three floors. The main floor includes an office area, the Isotope Shop area, a hot cell, a source storage area and irradiation facility, a shielded work room, and miscellaneous unoccupied areas. The second floor contains additional unoccupied office space, a mechanical equipment room, and the ventilation system equipment room. The basement contains a waste storage areas, additional unoccupied space, and a liquid waste holdup tank room (WHUT Room). The majority of the 6.3-acre property is covered with asphalt or concrete.

The AMS facility was built specifically for the manufacture and distribution of sealed sources. Licensed radioactive materials are located in specific areas within the AMS building. The following is a description of the various areas of the building, along with conservative estimates of the quantity of radioactive material that exists in each area as of the date of this report. This information is also summarized in Table 2.

### *Hot Cell*

The Hot Cell was designed and equipped to encapsulate sources of radioactive material used for medical therapy and industrial radiography. The cell is six (6) feet square and has 5.5-foot thick concrete walls and a four-foot thick floor and ceiling. There is a stainless steel floor pan in the cell, and 0.25-inch thick by 11 foot tall steel wall plates. The cell has a six foot wide, 42-ton hinged door at the rear. There is a 60-inch thick viewing window at the cell front.

Remote handling is accomplished with a pair of manipulators and a two-ton overhead crane. Every item of equipment in the cell and every item in the cell structure is removable. The location of the Hot Cell on the first floor of the AMS building.

The Hot Cell is a "Restricted Area". It currently contains approximately 4,000 curies of $^{60}Co$ and less than one (1) curie of residual surface contamination. Because of the structural integrity of the hot cell, this radioactivity is not readily dispersible in the event of a fire, flood or building damage.[1] The average ambient exposure rates within the cell are approximately 12 R per hour, with rates up to 200 R per hour on contact with certain surfaces.

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[1] Denega, J. W., Neff & Associates, letter to D. A. Miller, Stavole & Miller regarding "Structural Analysis of WHUT Room and Hot Cell", July 25, 1995.

### *Isotope Shop*

The Isotope Shop is located on the first floor next to the Hot Cell. This area has a concrete floor, ceiling, and interior walls. The exterior walls are of painted brick. Cobalt-60 sources are transported around this area in shielded containers.[2] The Isotope Shop also contains a table-mounted hood, a table, a sink, an old trash compactor, and three-ton overhead hoist with trolley, and a Tow Motor.[3] Within the Isotope Shop is the Source Garden.

The Isotope Shop is a "Restricted Area". However, with the exception of the Source Garden, it does not contain a significant inventory of licensed material. The radiation exposure rates in this area currently average between five (5) and 10 mR per hour, with a maximum of 80 mR per hour on the outside of the Decontamination Room doors.

The contamination levels in the Isotope Shop currently average about 50,000 disintegrations per minute (dpm) per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the Isotope Shop are uniformly contaminated at this level, and that the area consists of 85 $m^2$, there is a total of $1.91 \times 10^{-4}$ curies of residual contamination currently in this area.

### *Source Garden*

The Source Garden is located in the southwest corner of the building within the Isotope Shop area. This storage location houses 54 vertical tubes in a six-foot square well that extends from the first floor to the basement. An L-shaped shield around the well at the basement level is provided by two sand-filled compartments which are accessible through manholes in the first floor. The high-density concrete walls containing the sand shield are two-feet thick.

The 54 storage tubes in the Source Garden are arranged in a nine-by-seven rectangular array. The nine center spaces of the array are open and fitted with an irradiation plug which accommodates objects up to 8.5 inches square by 12 inches high. The source tubes terminate in a metal container through which cooling air is drawn from the room to the high-efficiency particulate air- (HEPA-) filtered exhaust system.

The Source Garden is in a "Restricted Area". It currently contains approximately 30,000 curies of $^{60}Co$ in a non-dispersible (sealed) form. Exposure rates over the Source Garden are approximately 200 mR per hour.

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[2] One such container is the "transfer monster", which is used to move sources in and out of the Hot Cell.

[3] The Tow Motor is an electric fork lift.

The contamination levels in the Source Garden currently average about 50,000 disintegrations per minute (dpm) per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the Source Garden are uniformly contaminated at this level, and that the area consists of 38 $m^2$, there is a total of $8.54 \times 10^{-5}$ curies of residual contamination currently in this area.

### *Decontamination Room*

The Decontamination Room is located behind the Hot Cell and at the side of the Isotope Shop. This area has a concrete floor and walls. The room provides space enough for opening the Hot Cell door into the ventilation controlled space of the Decontamination Room.

The room is equipped with water outlets and a floor drain which was used during previous decontamination operations. This drain has since been sealed. In this area is a vault that contains ancillary Hot Cell items and lead blankets, along with beam shields made of lead.

The Decontamination Room is a "Restricted Area" that contains approximately two (2) millicuries of activity. The average ambient exposure rates are approximately 80 to 100 mR per hour.

The contamination levels in this 12 ft. by 12 ft. room are approximately 3,000,000 dpm per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the Decontamination Room are uniformly contaminated at this level, and that the area consists of 18 $m^2$, there is a total of $2.43 \times 10^{-3}$ curies of residual contamination currently in this area.

### *High Level Waste Storage Room*

The High Level Waste Storage Room is located next to the Hot Cell on the first floor. This room has a concrete floor, walls and ceiling. There are drums of waste stored here, along with spent HEPA filters. The area in the front of the shield wall positioned in the room serves as storage.

The High Level Waste Storage Room is a "Restricted Area" that contains approximately 10 curies of activity. It currently has average ambient exposure rates of about 300 to 400 mR per hour. Contamination levels are insignificant (e.g., below the site release criteria).

### *Clean Equipment Room*

The Clean Equipment Room is located on the second floor. This room has a concrete floor, walls and ceiling. It contains all of the facility service equipment with the exception of the HEPA ventilation equipment.

The Clean Equipment Room is a "Restricted Area", however it does not contain any dispersible activity. It currently has average ambient exposure rates of less than one (1) mR per hour, with a maximum exposure rate of 30 mR per hour on the wall that adjoins the HEPA Equipment Room. Contamination levels are insignificant.

### *HEPA Equipment Room*

The HEPA Equipment Room is located on the second floor of the facility. This room has a concrete floor, walls and ceiling. It contains the facility HEPA ventilation equipment. There is one large HEPA exhaust blower that holds four two-foot by two-foot HEPA filters in a housing. This system services all of the isotope areas except the Hot Cell. There is also a small HEPA exhaust blower with only one HEPA filter in its housing. This system services the Hot Cell.

The HEPA Equipment Room is a "Restricted Area" that currently contains approximately two (2) curies of activity. It has average ambient exposure rates of about 80 mR per hour, with a maximum of 2,000 mR per hour on the exhaust duct from the Hot Cell.

Contamination levels in the area average 11,000 dpm per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the HEPA Equipment Room are uniformly contaminated at this level, and that the area consists of 20 $m^2$, there is a total of 9.91x10[illegible] curies of residual contamination currently in this area.

### *Back Basement*

The Back Basement is located in the basement. This room has a concrete floor and walls. There is a drum storage area along one wall, with temporary shielding erected between the storage area and the main part of the room. There are approximately 500 high-density concrete blocks in the room that are positioned to provide shielding from the WHUT Room.

The Back Basement is a "Restricted Area" that contains approximately 15 Ci of activity. It currently has average ambient exposure rates of about 10 mR per hour, with a maximum of 50 mR per hour. Drums located behind the storage shield have contact exposure rates that range from 100 to 1,000 R per hour.

Contamination levels in this area average 10,000 dpm per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the Back Basement are uniformly contaminated at this level, and that the area consists of 82 $m^2$, there is a total of 3.69x10[illegible] curies of residual contamination currently in this area.

### *WHUT Room*

The Waste Hold-Up Tank (WHUT) Room is located in the basement directly under the Hot Cell. This room has a concrete floor, walls and ceiling. The room walls are three feet thick to provide shielding from the room's contents.

The room contains a 100-gallon and a 500-gallon tank for liquid wastes. When the room was still in use, wastes were "held up" in the tanks until sampling/analysis confirmed that they could be discharged to the sewer system. However, in 1989 AMS ceased discharging liquid radioactive waste to the sewer system. Shortly thereafter, the WHUT Room was sealed.

The WHUT Room is a "Restricted Area" that contains approximately 53 curies of activity. The exposure rates in the room currently range from 50 to 240 R per hour.

### *Front Basement*

The Front Basement is located on the east side of the basement next to the WHUT Room. It consists of three rooms: the passageway between the front and back basement, the Chart Room, and the Blue Tank Room. The rooms have concrete floors, ceiling, and exterior walls. The interior walls are wood-framed with painted drywall surfaces. There are 45 high-density concrete blocks in the Blue Tank Room that are positioned to provide additional shielding from the WHUT room.

The Front Basement is a "Restricted Area", however it does not contain significant residual activity. It currently has average ambient exposure rates of about one (1) mR per hour, with a maximum exposure rate of 20 mR per hour in the Blue Tank Room.

Contamination levels average about 1,250 dpm per 100 $cm^2$. If it is conservatively assumed that the flat surfaces in the Front Basement are uniformly contaminated at this level, and that the area consists of 63 $m^2$, there is a total of $3.55 \times 10^{-6}$ curies of residual contamination currently in this area.

### *Miscellaneous Restricted Areas*

There are a number of miscellaneous areas within the AMS facility. These include the air lock, the Isotope Shop warehouse, portions of a caged storage area, and office areas on the second floor. These areas have been designated as "Restricted Areas". The average ambient exposure rates in these areas currently range from "background" to one (1) mR per hour (isotope warehouse and caged storage area).

Average contamination levels range from zero to 5,000 dpm per 100 $cm^2$ in the contaminated side of the air lock. If it is conservatively assumed that the flat surfaces in the miscellaneous restricted areas are uniformly contaminated at this level, and that the area consists of 1,184 $m^2$, there is a total of $2.67x10^{-4}$ curies of residual contamination currently in this area.

***Miscellaneous Unrestricted Areas***

There are a number of other miscellaneous areas within the AMS facility that are not restricted for purposes of radiological control. These are a former chemistry laboratory, the Hot Cell control office, the first floor office areas, portions of a caged storage area, and the counting room. The exposure rates and contamination levels in these areas are not distinguishable from background.

***Areas Outside of the Building***

AMS and its predecessor disposed of $^{60}Co$ into the sanitary sewer system under the provisions of Title 10, Code of Federal Regulations, Part 20.303. All discharges were accounted for and below permissible limits.

As part of a 1989 decommissioning effort, the lateral connection from the AMS facility to the sewer system interceptor owned by the Northeast Ohio Regional Sewer District (NEORSD) was partially decontaminated and covered with a layer of concrete in order to stabilize residual materials. In May of 1989, AMS ceased generating any liquid radioactive waste, and discontinued the disposal of licensed material into the sanitary sewerage system.

Between August 17 and October 14, 1994, the USNRC performed a special inspection of the London Road interceptor and the lateral connection from the AMS building to the interceptor.[4] During this inspection, samples of sewer debris, water effluent, and a series of wipes were collected and analyzed. The findings of the inspection were that residual radioactive materials in excess of the criteria contained in USNRC Regulatory Guide 1.86, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" were present in the interceptor in the immediate vicinity (outfall) of the AMS lateral connection.[5] However, there was no

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[4] The connection is comprised of a sewer line, a manhole, and a lateral.

[5] Removable activity in excess of 1,000 dpm per 100 $cm^2$ was found on the sewer interceptor brick directly below the AMS lateral. Other locations (e.g., the iron ladder below the lateral, the outer surfaces of the lateral, and at the 2:00 position of the lateral approximately one foot into the lateral from the interceptor) demonstrated measurable activity, but at levels well below the release criterion.

evidence of removable $^{60}Co$ activity above the release criteria in the outlet from the AMS processing drain, the sewer walls, or inside the lateral itself.[6]

Later in 1994, NEORSD intentionally isolated AMS from the sewage treatment system. This action rendered the facility storm- and ground-water drainage system non-functional, increased the hydrostatic pressure on the foundation structure, and caused groundwater to leak into the basement of the AMS facility. AMS instituted remedial actions for "isolation and remediation of the radioactively contaminated manhole and sewer line exiting the facility to the London Road Interceptor", and recovery of the facility drainage system.

During the remedial activities, it was discovered that the foundation drainage system (e.g., drain tile and gravel layer) was contaminated with $^{60}Co$. Removable activity as high as 100,000 dpm/100 $cm^2$ was noted in the drain tile during excavation and investigation efforts. However, the shale layer upon which the building is built and which forms the base of the footer drains, did not contain detectable $^{60}Co$. In fact, no $^{60}Co$ was identified other than between the drain tile and the shale. This finding confirms that contaminant migration did not occur.

The footer drains along the east (front) and south sides of the building were replaced and the area back-filled with clean gravel and soil. However, the footer drains in the vicinity of the Source Garden could not be replaced because of the presence of high ambient gamma exposure rates in the work area.[7] Also, prior to abandoning the lateral connection that runs from the west side of the AMS facility to the London Road interceptor, the four-inch discharge line from the AMS building, the AMS manhole and the 15-inch lateral connection were filled with grout. In advance of this action, the ambient exposure rates within the lateral were measured and found to be approximately one (1) milliR per hour. The exposure rate in the manhole prior to grouting ranged from 0.2 to 0.5 milliR per hour, with a maximum measured exposure rate of four (4) milliR per hour at the base. The contamination status of the lateral was determined using dry disk smears and a pancake GM detector. The results from this effort were negative for removable activity.

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[6] A site characterization study performed by ORISE in 1989 confirms the lack of significant residual activity in the AMS system. During this study, ambient gamma exposure rates in excess of background were not identified in the vicinity of the lateral. Furthermore, soil samples collected in this area were negative for the presence of $^{60}Co$.

[7] A concrete wall constructed between the abandoned drains and the new foundation drains, and the presence of an impermeable liner on the ground surface above the drainage systems serve to fully isolate the residual contamination in the abandoned drains from the new drainage system.

If it is assumed that 20 linear feet of foundation drains remain outside the Source Garden, and that this length is uniformly contaminated to levels of 100,000 dpm per 100 $cm^2$, approximately $8.76 \times 10^{-4}$ curies remain in this location.

If it is also assumed that the contamination inside the abandoned lateral and the manhole is evenly distributed, the Microshield code can be used to generate "dose rate-to-activity" conversion factors.[8] Applying these factor to the measured exposure rate of one (1) millirem per hour in the lateral and 0.5 milliR per hour in the manhole, translates into approximately $6.92 \times 10^{-4}$ and $4.02 \times 10^{-4}$ curies, respectively, of residual radioactivity at this locations.[9]

### *Depleted Uranium Inventory*

AMS currently possesses approximately 2200 kilograms of depleted uranium for use as shielding materials and in the form of parts for teletherapy machines. The form of this material is stable and easily sold/transferred to other licensees. Therefore, this material is not addressed further in this report.

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[8] Grove Engineering, Inc. Microshield 4.10, dated October, 1993.

[9] As of the date of this report, AMS is in the process of determining whether residual radioactive materials are present beneath the basement slab of the London Road building. When there is evidence to support the presence of sub-basement activity, this report will be modified accordingly.

## DECOMMISSIONING OBJECTIVE

A critical step in the decommissioning process is determining the objective of the action. The objective typically refers to the maximum acceptable dose limit that will be incurred by members of the general public after all action is complete and the USNRC license is terminated.

There are a number of dose limits promulgated by standards groups and regulatory agencies that are considered to present negligible risk, any one of which would constitute an acceptable objective for decommissioning of the London Road facility. The following are a few examples:

- The National Council on Radiation Protection and Measurements recommends a dose limit of 100 millirem per year from manmade sources for individual members of the public.[10] This limit is based on scientific recommendations developed through an impartial consensus process.

- The USNRC, in a 1991 Final Rule, adopted the recommendations of the NCRP as its basic dose limit applicable to any licensed facility.[11]

- The U. S. Environmental Protection Agency (USEPA) imposes a limit of 25 millirem per year to any member of the public from nuclear fuel cycle facilities.[12]

- In 1994, the USNRC issued proposed radiological criteria for decommissioning.[13] The goal of these criteria, which are based upon a dose objective of 15 millirem per year, is to ensure that residual radioactivity from decommissioned sites is "indistinguishable from background".

- In 1990, the USNRC issued a Policy Statement which established the framework within which the USNRC would make licensing decisions to exempt some or all

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[10] National Council on Radiation Protection and Measurements, "Ionizing Radiation Exposure of the Population of the United States", NCRP Report No. 93, September, 1987.

[11] Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation", January 1, 1994.

[12] Title 40, Code of Federal Regulations, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations", 1991.

[13] Title 10, Code of Federal Regulations, Part 20, Proposed Rule, "Radiological Criteria for Decommissioning", FR 59, No. 161, 43220, August 22, 1994.

regulatory controls over certain practices involving radioactive materials.[14] This Statement set a "below regulatory concern" dose criterion of 10 millirem per year, which was based upon what the USNRC considered to be an acceptable hypothetical lifetime risk of cancer of $3.5 \times 10^{-4}$ per rem of ionizing radiation dose. However, this policy statement was subsequently withdrawn.

- In addition to meeting the proposed decommissioning dose objective of 15 millirem, the USNRC's proposed decommissioning rule would also require the licensee to demonstrate that the dose from residual radioactivity at the decommissioned facility is ALARA.[15] However, to minimize the burden of documentation and analysis, the proposed rule would allow the licensee to comply with the ALARA requirement by showing that the TEDE to the average member of the population does not exceed three (3) millirem per year.

For this assessment, a dose objective of three millirem is deemed applicable and is used as the basis for the following calculations. The reasons for selecting this objective are threefold: It is the lowest of the values listed above and demonstrates a desire to implement conservative radiological protection practices; it provides a regulatory basis for development of release criteria; and the intent is consistent with federal requirements that licensed radioactive materials be handled and released in a manner that ensures that exposures are as low as is reasonably achievable (ALARA) taking into account economic and societal factors.[16]

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[14] U. S. Nuclear Regulatory Commission, "Below Regulatory Concern Policy Statement", 55 FR 27522 (July 3, 1990).

[15] Title 10, Code of Federal Regulations, Part 20, Proposed Rule, "Radiological Criteria for Decommissioning", FR 59, No. 161, 43220, August 22, 1994.

[16] The definition of ALARA is taken from Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

### Decommissioning Alternatives

Once a USNRC-licensed facility reaches the end of its useful operating life, it will be decommissioned. This typically means that the facility will be safely removed from service, and all radioactive materials in excess of levels which would permit unrestricted use of the facility will be disposed of. However, the USNRC has determined that several decommissioning alternatives will potentially satisfy this general requirement. These are "No Action", DECON, SAFSTOR and ENTOMB.[17] The following are brief descriptions of each of these alternatives:

- No Action - This implies that AMS would simply abandon or leave the facility after ceasing operations.

- DECON - This option is to remove all radioactive materials such that residual levels permit the property to be released for unrestricted use. DECON will lead to termination of the facility license and facility re-use shortly after cessation of facility operations. Since DECON is generally completed within a few months or years following facility shutdown, personnel radiation exposures are generally higher than for options that spread the decommissioning work over longer time periods to take advantage of radioactive decay. Similarly, larger commitments of money and waste disposal site space are also required for DECON.

- SAFSTOR - This alternative places and maintains the facility in a condition that ensures the risk to members of the general public is acceptable, that the facility can be safely maintained in a shutdown condition to allow for radioactive decay, and that it can be subsequently decontaminated and released for unrestricted use (deferred decontamination). SAFSTOR consists of a short period of preparation for safe storage, a variable safe storage period of continuing care consisting of security, surveillance, and maintenance, and a short period of deferred decontamination.

- ENTOMB - This alternative requires the encasement of the facility in concrete to protect the public from radiation exposure until its radioactivity has decayed to levels permitting unrestricted use of the facility.

[17] Terms and definitions taken from NUREG-0568 (U. S. Nuclear Regulatory Commission, Office of Standards Development, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities", NUREG-0568, January, 1981).

The "no action" alternative is clearly unacceptable to both AMS, regulatory agencies, and state/local officials. Given the short half-life of the radioactivity at AMS, ENTOMB is also not considered to be a viable alternative for the AMS facility. Therefore, at AMS, only DECON and SAFSTOR are considered to be potentially applicable decommissioning alternatives.

DECON is the more traditional approach to facility decommissioning. Its primary advantages are that it is relatively uncomplicated, eliminates the need for continued monitoring, and releases the facility for other uses within a relatively short time frame.[18] Activities under this option would include removal of contaminated equipment (hot cell contents, ventilation systems, packaged materials, sources), and decontamination of remaining room surfaces to eliminate residual radioactive materials above the release criteria, and performance of a final release survey. However, DECON would require a large initial commitment of money, maximize personnel radiation exposures, and result in a higher disposal volume than as would be required for SAFSTOR. Table 3 shows the manpower estimate for the DECON alternative.

SAFSTOR satisfies the requirements for protection of the public while minimizing initial commitments of time, labor, money, occupational radiation exposure, and waste disposal. Modifications to the facility would be limited to those which ensure the security of the building against intruders, and ensure containment of the licensed inventory. As a result of radioactive decay of this material, reductions in personnel exposure and simplifications in the complexity of operations can be achieved by deferring major decontamination efforts for 50 years. Also, because much of the residual radioactivity present in the facility will have decayed to background levels after the storage period, the volume of material that must be packaged for disposal, if any, will be significantly reduced.

The primary disadvantage of SAFSTOR is that personnel familiar with the facility at the time of deferred decontamination may not be available. Consequently, more time for training and orientation would be needed if the procedures for final license termination are extensive. Other disadvantages might include the fact that the site could be tied up in a non-useful purpose for an extended period, regulatory uncertainties in the future, possible interferences by state or local agencies, and the continuing need for maintenance, security and surveillance. Table 3 shows the manpower estimate for the SAFSTOR alternative.

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[18] Other advantages of DECON include the availability of a work force highly knowledgeable about the facility, and elimination of the need for long-term security, maintenance and surveillance.

***Short-term Risks***

Both DECON and SAFSTOR were evaluated with respect to their potential for increasing health and safety risks for members of the general public and workers involved in implementing the alternative. For this assessment, it was assumed that the general public will be protected from exposures by administrative and procedural controls. Therefore, the short-term impacts on this population group are considered to be negligible. It was also assumed that workers will follow ALARA procedures and all OSHA regulations, and that internal exposures will be prevented.

For the DECON option, the goal will be to maintain radiation exposures to decommissioning workers to below regulatory limits. At AMS, the critical exposure time will be during source packaging and shipment, the removal/dismantling of the hoods, ventilation system, hot cell, source garden, and high-level waste disposition. For the work durations and exposure rates shown in Table 4, the total worker dose for the DECON alternative is estimated to be 1037 person-rem.

For the SAFSTOR option, only minimal personnel exposures are anticipated as the facility is placed into a safe storage mode. Assuming that these activities are on-going for the person-days shown in Table 4, the total worker dose from external radiation is estimated to be 0.4 person-rem.

***Long-Term Risks***

The primary long-term risk incurred by humans after decommissioning is complete is exposure to the radioactive materials at the location of final deposition. For the DECON option, the long-term risks to members of the general public will be negligible. Also, for the $^{60}Co$ that is maintained inside of the building under SAFSTOR, the long-term risks to members of the general public will also be negligible. A previous assessment of the impact of the residual radioactivity that exists in the abandoned lateral and footer drains on members of the general public confirmed this conclusion.[19] Therefore, the relative long-term risks of DECON and SAFSTOR are equivalent and will result in individual doses of members of the general population that are well-below the decommissioning objective.

***Waste Disposal***

Both of the decommissioning options entail disposal of radioactive materials at an off-site disposal location. For DECON, a total of 3,600 cubic feet and 70 curies will be disposed of as radioactive

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[19] Integrated Environmental Management, Inc., "ALARA Analysis for Remediation of the AMS Lateral Connection to the Sewer System", Report No. 94009/G-115, January 10, 1995.

waste. For SAFSTOR, a total of 100 cubic feet and 0.22 curies will be disposed of as radioactive waste.

### *Decommissioning Cost Estimates*

The following assumptions were used for developing the decommissioning cost estimates for the DECON and SAFSTOR options as shown in Table 3:

- The AMS building will not be demolished during the decommissioning (i.e., the building structure will remain intact).

- There is no evidence that the soil underneath the building is contaminated. Any residual radioactivity that may exist in this area is clearly not mobile and will remain in place until eventual demolition of the building. Because the soil activity will have decayed to negligible levels by this time, no removal action is required.

- The inventory of Co-60 sources and depleted uranium at the facility will be shipped off site to another licensee.

- To ensure pricing consistency, all radioactive materials sent for disposal will be assumed to disposed of at the radioactive burial facility located in Barnwell, South Carolina, and asbestos waste will be disposed of at the facility in Clive, Utah.

- The final release surveys will be performed pursuant to the guidance contained in NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", USNRC Division of Regulatory Applications, Washington D.C., 1990.

- The following unit costs were assumed: Local technician labor at $30/hour; local supervisory labor and licensing/regulatory support at a mean rate of at $60 per hour; B-25 box cost at $500 per box; personnel protective equipment at $20 per day per person; waste transport at $2.75 per mile; radioactive waste disposal costs at $340 per cubic foot; and asbestos waste disposal costs at $150 per cubic foot.

For the SAFSTOR option, it is assumed that the WHUT Room, the HEPA equipment room, and the hot cell will be placed in a safe storage condition for 50 years to allow decay of the radioactive materials present in those rooms. It is also assumed that radioactive waste materials will be stored on site for the entire 50 year SAFSTOR period, and that four hours per week (labor) are required for facility maintenance/surveillance during this period. It is also assumed that additional security systems and facility alarms will be installed to detect intrusion into the facility, water leakage, the presence of smoke/fire, and other incursions. Finally, since the lateral connection to the sewer,

old manhole, and abandoned drain tile are adequately isolated, it is assumed they will remain in place until the end of the 50 year SAFSTOR period.

For the DECON option, it is assumed that all radioactive wastes generated during the decommissioning and all the waste in the inventory, excluding WHUT Room materials and the sealed sources, will be sent for disposal. It is also assumed that 3,000 cubic feet of the 9,000 cubic feet of soil generated during the sewer remediation project is contaminated such that off-site disposal is required. All contaminated areas of the facility are assumed to be decommissioned in the DECON option.

Table 3 shows the decommissioning cost estimates for DECON and SAFSTOR. These are based on a variety of cost-estimating data, including curves, generic unit costs, vendor information, conventional cost estimating guides, and prior similar estimates as modified by site-specific information. Both capital and operation and maintenance (O&M) costs were considered, where appropriate, along with O&M costs that may continue beyond implementation of the decommissioning action. Present-worth analysis was used.[20] Using the above assumptions, and assuming a 25% contingency, the estimates are $3,304,474 and $912,860, respectively.

### *Cost/Benefit Analysis*

According to the International Commission on Radiological Protection (ICRP), most decisions about human activities are based on an implicit form of balancing the costs and benefits leading to the conclusion that the conduct of a chosen practice is "worthwhile".[21] Thus the ICRP - as well as the USNRC - recommends that:

- No practice shall be adopted unless its introduction produces a positive net benefit;
- All exposures to ionizing radiation shall be kept as low as reasonably achievable, economic and societal factors being taken into account; and
- The dose equivalent to individuals shall not exceed applicable regulatory dose limits.

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[20] Since AMS will set aside cash to fund decommissioning in an interest-bearing account, the effects of inflation on the present-day costs are negated.

[21] International Commission on Radiological Protection, ICRP Publication 55, "Optimization and Decision-Making in Radiological Protection", Pergamon Press, 1989.

With respect to radiological impacts only, a simple cost-benefit analysis can be performed by evaluating the following:

$$X + \alpha S = Minimum$$

where X = the cost of achieving the decommissioning objective, S = the collective dose associated with the decommissioning activities, and α = a constant expressing the cost assigned to the unit collective dose.[22] Table 5, which is a summary of the cost-benefit analysis for the two decommissioning options, clearly demonstrates that the SAFSTOR option provides the greatest benefit at the lowest cost when radiological impacts are considered.

### *Description of the Methodology*

When ready to decommission, the residual radioactivity of interest at AMS will consist primarily of residual materials generated as a result of source manufacturing, sealed sources, and bulk $^{60}Co$. In its current state, the hazards to the general population from this licensable inventory are negligible. Furthermore, the short half-life of the materials demands consideration for delayed decommissioning in order to take advantage of radioactive decay.

Consistent with the ALARA concept, SAFSTOR presents the lowest overall radiological risk, results in the smallest volume of solid waste to be disposed of, and ensures that radiation exposures will be maintained as low as reasonably achievable with economic benefits taken into account. Therefore, SAFSTOR is the preferred decommissioning methodology for the AMS facility.

There are several subcategories of SAFSTOR. These are custodial SAFSTOR,[23] passive SAFSTOR,[24] and hardened SAFSTOR.[25] The following are brief descriptions of each:

- Custodial SAFSTOR - requires a minimum cleanup and decontamination effort initially, followed by a period of continuing care with the active protection systems kept in service throughout the storage period. Full-time onsite surveillance by

[22] A value of $1,000 per person-rem for α from Title 10, Code of Federal Regulations, Part 50, Appendix I, Section II.D is assumed to be valid for this assessment.

[23] Nomenclature taken from Schneider, K. J. And C. E. Jenkins, Technology, Safety and Costs of Decommissioning a Reference Nuclear Fuel Reprocessing Plant, NUREG-0278, October, 1977.

[24] Nomenclature taken from U. S. Nuclear Regulatory Commission, Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors", June, 1974.

[25] Nomenclature taken from Manion, W. J. And T. S. LaGuardia, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives", AIF/NESP-009, Atomic Industrial Forum, November, 1976.

operating and security forces is required to carry out radiation monitoring, to maintain the equipment, and to prevent accidental or deliberate intrusion into the facility and the subsequent exposure to radiation or the dispersal of radioactivity beyond the confines of the facility.

- Passive SAFSTOR - requires a more comprehensive cleanup and decontamination effort initially, sufficient to permit deactivation of the active protective (ventilation) systems during the safe storage period. All structures are secured and electronic surveillance is provided to detect accidental or deliberate intrusion. Periodic monitoring and maintenance of the integrity of the structure is also required.

- Hardened SAFSTOR (temporary entombment) - requires comprehensive cleanup and decontamination, and the construction of barriers around areas containing significant quantities of radioactivity. These barriers should be of sufficient strength to make accidental intrusion impossible and deliberate intrusion extremely difficult. Surveillance requirements are limited to detection of attack upon the barriers, maintenance of the integrity of the structures, and infrequent monitoring.

All three categories of safe storage require some positive action at the conclusion of the period of continuing care to release the property for unrestricted use and terminate the license for radioactive materials. Depending on the amount of residual radioactivity, these actions may range from completion of the final termination survey only, to dismantlement and removal of residual radioactive materials prior to the termination survey. Maintenance of the facility's structures and an ongoing program of environmental surveillance are also necessary for all categories of SAFSTOR.

Custodial SAFSTOR was deemed to be inappropriate for the AMS facility because of the need for ventilation systems and other support systems to remain operational to support AMS source exchange operations. Hardened SAFSTOR was deleted as an alternative because the existing AMS physical layout and security structure is sufficient to preclude intrusion into the facility.

The methodology of passive SAFSTOR is deemed appropriate because AMS intends to maintain a qualified staff on site to handle teletherapy source exchanges. This will require some of the systems at AMS to remain operational, such as the ventilation system, fire, security, and alarm system, and other equipment, to allow for source exchanges to take place. The on-site staff will conduct radiation monitoring, maintain equipment, prevent intrusion into the facility and deter release of materials from the facility.

### *Duration of Safe Storage Period*

The duration of the storage and surveillance period under SAFSTOR can vary from a few years to approximately 100 years, depending on the type of facility. For the London Road facility, a safe storage period of 50 years is deemed appropriate. This period is based on consideration of such factors as desirability of terminating the license, radiation dose reductions, and cost. It is also consistent with the USEPA policy on institutional control reliance for radioactivity containment. Since the value of the property is small, even if released for unrestricted use, there is little incentive to decontaminate the facility earlier than would otherwise be dictated by the decay of radioactivity within the facility.[26]

### *Procedures*

The AMS facility will be placed in a passive SAFSTOR mode by taking the following actions:

- With the exception of the WHUT Room, the basement of the AMS facility will have a gross decontamination performed.[27] This will require the removal and containerization of all unusable contaminated materials and equipment, removal of the removable surface contamination on floors and walls by strip coating or wiping, and performance of a contamination survey for the decontaminated areas. The basement will remain a restricted area.

- First floor areas (isotope shop, isotope shop warehouse, airlock, decontamination room) will undergo a gross decontamination. This will require the removal and containerization of all contaminated materials and equipment, removal of removable surface contamination from wall and floor surfaces, and the performance of a contamination survey of the decontaminated areas. These areas will remain restricted areas.

- Contaminated HEPA filters will be removed, containerized, and replaced with new filters. A gross decontamination will be performed in the HEPA equipment room with strip coat or by wiping and the room will be surveyed upon completion. The HEPA equipment room will remain a restricted area.

- The WHUT Room will be completely isolated from the basement by sealing all openings with concrete patch. No entry will be made into the WHUT Room during preparations for SAFSTOR.

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[26] U. S. Nuclear Regulatory Commission, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities", NUREG-0586, January, 1981.

[27] The USNRC recommends, in NUREG-0586, that gross decontamination be performed prior to placing a facility into a safe-storage mode. While these actions may result in personnel exposure in the short-term, they will reduce or eliminate the potential for future exposures and/or spread of contamination to other areas.

- Prior to sealing rooms in the basement, alarming level devices will be installed to indicate water incursion.

- The Hot Cell will be surveyed for contamination and radiation levels, sealed shut, and placed out of service. The manipulators will be rendered inoperable and placed out of service as well. All water and electric utilities to the Hot Cell will be removed from service.[28]

- All waste materials will be containerized and stored either in the high level waste storage room or in other areas for lower activity materials, as appropriate.

***Final Release Survey***

A final release survey will be performed upon completion of the safety storage period and prior to any area restoration. In general, the survey methodology will be designed in accordance with the recommendations of NUREG/CR-5849.[29] The objective of the survey will be to demonstrate that the radiological conditions at the AMS site meet the decommissioning objective, that surface radioactivity in the building is less than the site-specific release criteria, and that radiation doses to members of the general population will not exceed 15 millirem per year. These conditions will be demonstrated at the 95% confidence level. The survey data will also be used to calculate the total inventory of residual radioactivity at the London Road facility.

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[28] The only lighting for inspection of the area will be through the Hot Cell window.

[29] Berger, J. D., "Manual for Conducting Radiological Surveys in Support of License Termination", Draft Report for Comment, NUREG/CR-5849, ORAU-92/C57, 1992.

## REVIEW SCHEDULE

This conceptual decommissioning plan will be reviewed at least annually by the AMS Radiation Safety Officer (RSO) to determine if it requires revision due to any changes in the status of the AMS facility. This review will also include a review of the Decommissioning Funding Plan if changes have taken place that might impact the cost estimates presented herein. This plan may be reviewed more frequently if significant events take place, such as a reduction in the inventory of sources at the facility, decontamination of an area specifically addressed in this plan, or an incident involving the spread of contamination to previously uncontaminated areas of the facility occurs.

Should events at the AMS facility warrant a revision to this plan or the Decommissioning Funding Plan, the RSO will present the proposed changes to the Radiation Safety Committee for their review and approval. Revised plans will be submitted to the USNRC shortly thereafter.

# *TABLES*

# TABLE 1 - RADIOACTIVE MATERIALS INVENTORY

| Item | Form | Material Description | Estimated Activity (Ci) |
|---|---|---|---|
| Licensed Material | Solid | Bulk $^{60}$Co Metal | 11747 |
| Licensed Material | Solid | Sealed $^{60}$Co Sources | 49133 |
| Licensed Material | Solid | Depleted Uranium Inventory | 2175.52 kg |
| Packaged waste | Solid | $^{60}$Co-contaminated materials contained in high-level waste storage, boxes in the Isotope Shop and drums in the basement of the facility. | 29 |
| Packaged waste | Solid | $^{60}$Co in solid waste generated during the water treatment project. | 0.4 |
| Unpackaged waste | Solid/sludge | $^{60}$Co- contaminated materials contained in WHUT Room | 53 |
| Surface contamination | Solid | Estimate of uncharacterized surface $^{60}$Co activity in the restricted areas of the facility | $<11$ |
| | | TOTALS (excluding uranium) | 61033 |

# TABLE 2 - AREAS TO BE DECOMMISSIONED [30]

| Area | Current Activity (Ci) | | Projected (50 years) Activity (Ci) Assuming No Removal Action | |
|---|---|---|---|---|
| | Solids or Sources | Other Residual Activity | Solids or Sources | Other Residual Activity |
| Hot Cell | 4000.00 | 1.00e+00 | 5.80 | 1.45e-03 |
| Isotope Shop | 0.00 | 1.91e-04 | 0.00 | 2.77e-07 |
| Isotope Shop Warehouse | 22648.00 | 0.00e+00 | 32.84 | 0.00e+00 |
| Source Garden | 34232.00 | 8.54e-05 | 49.64 | 1.24e-07 |
| Decontamination Room | 2.00 | 2.43e-03 | 0.00 | 3.52e-06 |
| High Level Waste Storage Room | 15.00 | 0.00e+00 | 0.02 | 0.00e+00 |
| Clean Equipment Room | 0.00 | 0.00e+00 | 0.00 | 0.00e+00 |
| HEPA Equipment Room | 2.00 | 9.91e-06 | 0.00 | 1.44e-08 |
| Back Basement | 15.00 | 3.69e-05 | 0.02 | 5.35e-08 |
| WHUT Room | 0.00 | 5.30e+01 | 0.00 | 7.69e-02 |
| Front Basement | 0.00 | 3.55e-06 | 0.00 | 5.15e-09 |
| Miscellaneous Restricted Areas | 0.00 | 2.67e-04 | 0.00 | 3.87e-07 |
| Miscellaneous Unrestricted Areas | 0.00 | 0.00e+00 | 0.00 | 0.00e+00 |
| Areas Outside Building | 0.00 | 1.97e-03 | 0.00 | 2.86e-06 |
| Totals | 60914.00 | 5.40e+01 | 88.33 | 7.83e-02 |

[30] Excludes depleted uranium inventory.

# TABLE 3 - MANPOWER AND COST ESTIMATES

| Action | Person-days Required | Labor Costs ($) | Other Costs ($) | Total Cost ($) |
|---|---|---|---|---|
| **DECON Option** | | | | |
| Hot Cell | 180 | 43200 | 54600 | 97800 |
| Isotope Shop and Source Garden | 160 | 38400 | 34600 | 73000 |
| Decontamination Room | 90 | 21600 | 17300 | 38900 |
| Clean Equipment Room | 5 | 1200 | 5000 | 6200 |
| HEPA Equipment Room | 90 | 21600 | 19800 | 41400 |
| Basement | 360 | 86400 | 65200 | 151600 |
| WHUT Room | 180 | 43200 | 114600 | 157800 |
| Excavate Outside Areas | 60 | 14400 | 56300 | 70700 |
| All Other Areas | 200 | 48000 | 24000 | 72000 |
| Ship Sources Offsite | 60 | 14400 | 30000 | 44400 |
| Building Release Survey | 180 | 43200 | 11000 | 54200 |
| Outdoor Release Survey | 60 | 14400 | 7000 | 21400 |
| Planning, Training, Mobilization | 400 | 160000 | 2000 | 162000 |
| Supervision | 400 | 192000 | 4000 | 196000 |
| Waste Disposal | | 10000 | 1446179 | 1456179 |
| | **Subtotal** | 752000 | 1891579 | 2643579 |
| | | | **25%Contingency** | 660895 |
| | | | **Total** | 3304474 |

TABLE 3 - CONTINUED

| Action | Person-days Required | Labor Costs ($) | Other Costs ($) | Total Cost ($) |
|---|---|---|---|---|
| **SAFSTOR Option** | | | | |
| Hot Cell | 5 | 1200 | 1000 | 2200 |
| WHUT Room | 60 | 14400 | 8000 | 22400 |
| HEPA Equipment Room | 35 | 8400 | 4000 | 12400 |
| Gross Decon. Of other areas | 240 | 57600 | 5000 | 62600 |
| Decon. Surveys | 40 | 9600 | 2000 | 11600 |
| On-going building maintenance and surveys | (50 yr) | 312000 | 50000 | 362000 |
| Decontamination at end of SAFSTOR | 70 | 16800 | 25000 | 41800 |
| Outdoor Release Survey | 180 | 43200 | 11000 | 54200 |
| Building Release Survey | 60 | 14400 | 7000 | 21400 |
| Waste Disposal | 5 | 2000 | 38544 | 40544 |
| Planning, training, mobilize | 150 | 60000 | 1000 | 61000 |
| Supervision | 75 | 36000 | 2000 | 38000 |
| | Subtotal | 575600 | 154544 | 730144 |
| | | | 25% Contingency | 182536 |
| | | | Total | 912680 |

## TABLE 4 - COLLECTIVE DOSE ESTIMATE FOR DECON AND SAFSTOR

| Action | Person-days Required | Average Exposure Rate (decay-corrected where necessary) per Task (mR/hr) | Collective Dose (person-rem) |
|---|---|---|---|
| **DECON Option** | | | |
| Hot Cell | 180 | 12000 | 864 [31] |
| Isotope Shop and Source Garden | 160 | 10 | 12.8 |
| Decontamination Room | 90 | 100 | 72 |
| Clean Equipment Room | 5 | 1 | 0.04 |
| HEPA Equipment Room | 90 | 80 | 57.6 |
| Basement | 360 | 10 | 28.8 |
| WHUT Room | 180 | 145000 | 0 [32] |
| Excavate Outside Areas | 60 | 0 | 0 |
| All Other Areas | 200 | 0 | 0 |
| Ship Sources Offsite | 60 | 1 | 0.48 |
| Building Release Surveys | 180 | 0 | 0 |
| Outdoor Release Surveys | 60 | 0 | 0 |
| Planning, Training, Mobilization | 400 | 0 | 0 |
| Supervision | 500 | 0 | 0 |
| Waste Disposal | 30 | 5 | 1.2 |
| | | Total | 1036.92 |

[31] Assumes that five (5) percent of the person-days required to perform the work required in DECON are spent in the hot cell.

[32] There will be no entries into the WHUT Room during DECON.

TABLE 4 - CONTINUED

| Action | Person-days Required | Average Exposure Rate (decay-corrected where necessary) per Task (mR/hr) | Collective Dose (person-rem) |
|---|---|---|---|
| SAFSTOR Option | | | |
| Hot Cell | 5 | 17.4 | 0.0348 [33] |
| WHUT Room | 60 | 0.5 | 0.012 [34] |
| HEPA Equipment Room | 35 | 0.1 | 0.028 |
| Gross Decon. Of other areas | 240 | 0.1 | 0.192 |
| Decon. Surveys | 40 | 1.4e-3 | 0.000448 |
| On-going building maintenance and surveys | 2000 | 1.4e-3 | 0.0224 |
| Decontamination at end of SAFSTOR | 70 | 0.1 | 0.056 |
| Final Release Survey | 240 | 0 | 0 |
| Waste Disposal | 5 | 0.01 | 0.0004 |
| Planning, training, mobilize | 150 | 0 | 0 |
| Supervision | 75 | 0 | 0 |
| | | Total | 0.35 |

[33] Assumes that five (5) percent of the person-days required to perform the work required in SAFSTOR are spent in the hot cell.

[34] Assumes that five (5) percent of the person-days required to perform the work required in SAFSTOR are spent in the WHUT Room.

# TABLE 5 - COST-BENEFIT ANALYSIS

| **Option** | **X ($)** | **S (Person-Rem)** | **$\alpha$ ($ per Person-Rem)** | **Solution ($)** |
|---|---|---|---|---|
| DECON | 3304474 | 1036.92 | $1,000 | 4341394 |
| SAFSTOR | 912680 | 0.35 | $1,000 | 913030 |

This report was prepared under the direction of
Advanced Medical Systems, Inc.

by

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October 30, 1995

Mr. James Caldwell
Nuclear Materials Inspection, Section 2
United States Nuclear Regulatory Commission
801 Warrenville Road
Lisle, Illinois 60523-4351

**Re: USNRC License No. 34-19089-01**

Dear Mr. Caldwell:

Enclosed is the original and one copy of the Advanced Medical Systems, Inc. (AMS) application for renewal of the referenced materials license. This application supersedes the applications dated November 29, 1994 and January 26, 1995.

A renewal fee of $2,200 was submitted previously under Control No. 397891. Therefore, no additional fees are enclosed. The AMS Emergency Plan, Conceptual Decommissioning Plan and Decommissioning Funding Plan are being submitted under separate cover. If you have any questions, please contact me at (216) 692-3270.

Sincerely,

Robert Meschter

Robert Meschter
Radiation Safety Officer

cc: D. Cesar
D. Miller, Esq. - Stavole & Miller
AMS Radiation Safety Committee

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# ADVANCED MEDICAL SYSTEMS, INC.

## Application for Renewal of USNRC License No. 34-19089-01

**Advanced Medical Systems, Inc.**
1020 London Road
Cleveland, Ohio 44110

October 30, 1995

NRC FORM 313
(9-81)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION

# APPLICATION FOR MATERIAL LICENSE

APPROVED BY OMB NO. 3150-0120
EXPIRES 6-30-83

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 1.75 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR (Check appropriate item)

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER ____
- [x] C. RENEWAL OF LICENSE NUMBER 34-19089-01

2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)

Advanced Medical Systems, Inc.
1020 London Road
Cleveland, OH 44110

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

1020 London Road
Cleveland, OH 44110

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION: Robert Meschter

TELEPHONE NUMBER: (216) 692-3270

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time. See Attachment 1

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED: See Attachment 1

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE: See Attachment 2

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS: See Attachment 3

9. FACILITIES AND EQUIPMENT: See Attachment 4

10. RADIATION SAFETY PROGRAM: See Attachment 3 & 5

11. WASTE MANAGEMENT: See Attachment 3

12. LICENSEE FEES (See 10 CFR 170 and Section 170.31)
FEE CATEGORY: 2B, 3P
AMOUNT ENCLOSED: $ 2,200.00

13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

| SIGNATURE—CERTIFYING OFFICER | TYPED/PRINTED NAME | TITLE | DATE |
|---|---|---|---|
| D. Cesar | David Cesar | Vice President | 10-27-95 |

FOR NRC USE ONLY

| TYPE OF FEE | FEE LOG | FEE CATEGORY | COMMENTS |
|---|---|---|---|
| | | | |

| AMOUNT RECEIVED | CHECK NUMBER | | DATE |
|---|---|---|---|
| | | | |

APPROVED BY

NRC FORM 313 (9-81)

9702070492 56pp

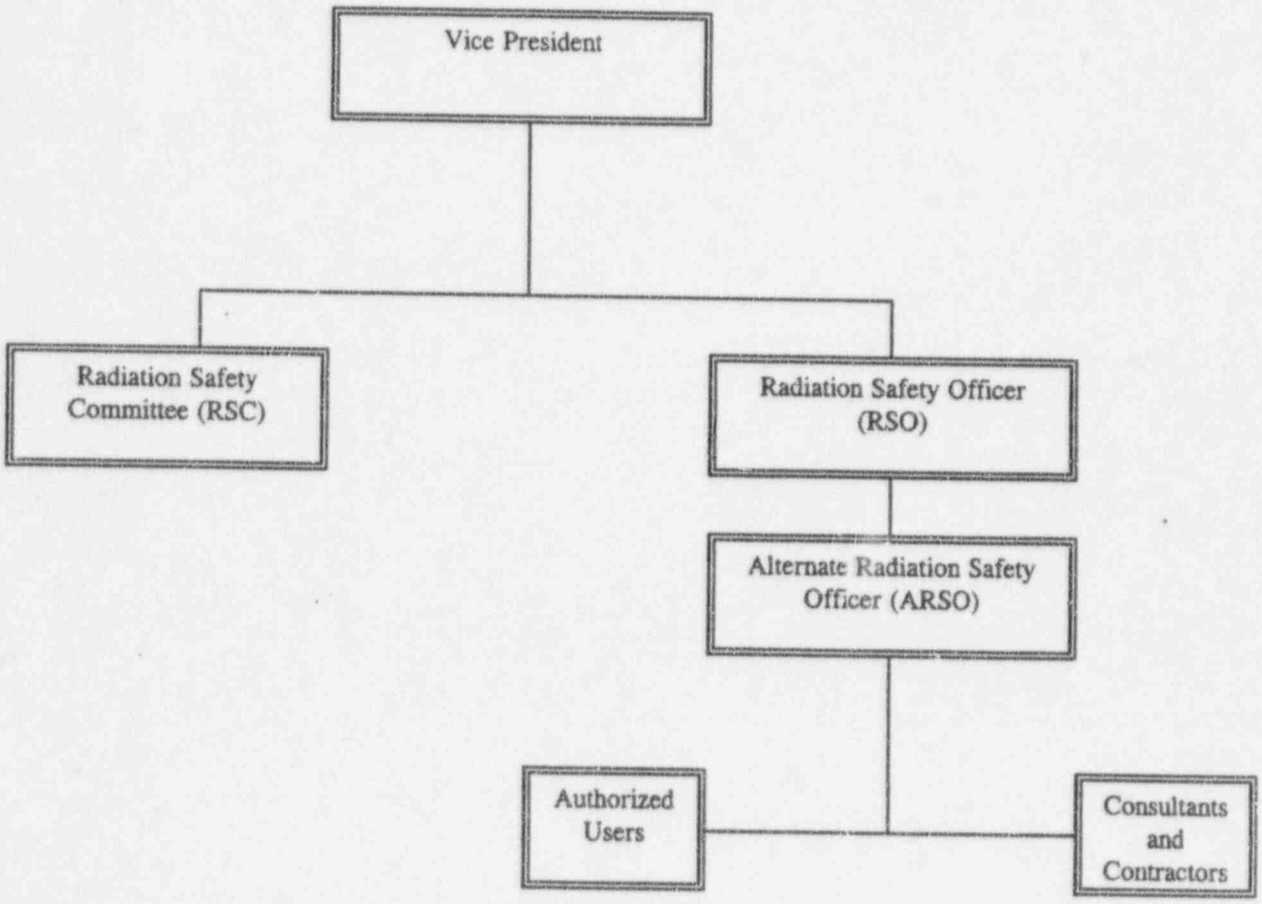
**ATTACHMENT 1**
**Authorized Uses of Licensed Materials**

**Radioactive Material (Type, Form and Use):**

| Radionuclide | Chemical/Physical Form | Site Limit (Ci) | Intended Use |
|---|---|---|---|
| Cobalt-60 | Solid metal (bulk) | 23000 | Storage incident to sale or transfer to authorized third party |
| Cobalt-60 | Sealed sources | 70000 | Storage incident to sale or transfer to authorized third party |
| Cesium-137 | Sealed sources | 665 | Use in devices, and storage incident to disposal, discharge and/or decommissioning. |
| Uranium (depleted) | Nickel-plated solid | 4,404 (kg) | Shielding for AMS and Picker teletherapy and radiography units. |
| Cobalt-60 | Sealed sources | 0.015 | Use for survey instrument response checks. |
| Cobalt-60 in Packaged waste | Solid | 35 | Materials contained in waste storage, LSA boxes and drums in the basement and waste storage room of the facility. |
| Cobalt-60 in Unpackaged waste | Solid/sludge | 60 | Materials contained in WHUT Room |
| Cobalt-60 in the form of Surface Contamination | Solid | 15 | Un-characterized surface activity in restricted areas of the facility |

**ATTACHMENT 2**
**Individuals Responsible for Radiation Safety Program**
**and their Experience**

# RADIATION SAFETY ORGANIZATION



## RADIATION SAFETY OFFICER

**Robert Meschter**

### *Education*

A.S. (Radiological Health Technology), Central Florida Community College (1975, with honors).

Training course, "ALARA Engineering", General Dynamics, 1982.

Training course, "Microshield Use", Grove Engineering, 1992.

Training course, "Radioactive Material Shipping", IEM, 1995.

Various employer-sponsored courses (i.e., Revised 10 CFR 20, supervision and management training)

### *Experience and Background*

Advanced Medical Systems, Inc. (1994 to present) - Radiation Safety Officer. Authority and responsibility for the Isotope facility at 1020 London Road. Responsible for radiation safety, regulatory compliance, maintenance of ISP Manual, personnel training, radiation dosimetry, and emergency response. Member of the Management Committee and Safety Committee.

Cleveland Electric Illuminating Company (1984 to 1993) - Senior Engineering Technician. Health Physics and other related duties during the past nine years included, but was not limited to, engineering analysis and evaluations, project economic and cost benefit analysis, preparation of procurement specifications, bid proposal evaluations, procedure writing, correspondence preparation, emergency planning, regulatory issues review, technical and program reviews, and work crew supervision.

Commercial Nuclear Power Industry (1975 to 1984) - Health and safety technician, chemistry technician, consultant and engineering technician for a variety of commercial nuclear installations.

## ALTERNATE RADIATION SAFETY OFFICER

**Stephen J. Haddock**

***Education***

B. A. (Health), Baldwin-Wallace College, (1986)
Training course, "Radioactive Material Shipping", IEM, 1995.

***Experience and Background***

Advanced Medical Systems, Inc. (1991 to present) - Isotope Handler and Technician. Provided health physics support in all aspects of the facility's operation, including in high radiation areas with accessible dose rates in excess of three (3) R per hour, transfer and handling of radiation sources, equipment maintenance and calibration, packaging and shipping of radioactive materials, radioactive materials inventory, and procedure implementation.

Coyne-Kangesser - Facility Coordinator. Managed 15 employees, which involved hiring, payroll, termination and scheduling of personnel as well as marketing functions. Responsible for customer complaints, billing and deposits. Position included customer contact.

Baldwin-Wallace College - Athletic Trainer. Part-time student athletic trainer with the Athletics Department. Duties included all facets of injury assessment including emergency procedures, first-aid including physical therapy and preventative procedures. Assisted doctors with field emergencies and physicals.

## CHAIR, RADIATION SAFETY COMMITTEE

**David Cesar**
Vice President

*Education*

Bachelor of Business Administration (Accounting), Cleveland State University.

*Registrations/Certifications*

Certified Public Accountant

*Professional Affiliations*

American Institute of Certified Public Accountants
Ohio Society of Certified Public Accountants

*Experience and Background*

Five years of public accounting experience specializing in auditing and tax.

Nine years of industry management experience as treasurer and member of board of directors for seven (7) corporations.

Trustee of two retirement plans.

## SECRETARY, RADIATION SAFETY COMMITTEE

**Robert Meschter**
Radiation Safety Officer

### *Education*

A.S. (Radiological Health Technology), Central Florida Community College (1975, with honors).
Training course, "ALARA Engineering", General Dynamics, 1982.
Training course, "Microshield Use", Grove Engineering, 1992.
Training course, "Radioactive Material Shipping", IEM, 1995.
Various employer-sponsored courses (i.e., Revised 10 CFR 20, supervision and management training)

### *Experience and Background*

Advanced Medical Systems, Inc. (1994 to present) - Radiation Safety Officer. Authority and responsibility for the Isotope facility at 1020 London Road. Responsible for radiation safety, regulatory compliance, maintenance of ISP Manual, personnel training, radiation dosimetry, and emergency response. Member of the Management Committee and Safety Committee.

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Commercial Nuclear Power Industry (1975 to 1984) - Health and safety technician, chemistry technician, consultant and engineering technician for a variety of commercial nuclear installations.

## MEMBER, RADIATION SAFETY COMMITTEE

**Stephen J. Haddock**
Licensed Isotope Handler

### *Education*

B. A. (Health), Baldwin-Wallace College, (1986)
Training course, "Radioactive Material Shipping", IEM, 1995.

### *Experience and Background*

Advanced Medical Systems, Inc. (1991 to present) - Isotope Handler and Technician. Provided health physics support in all aspects of the facility's operation, including in high radiation areas with accessible dose rates in excess of three (3) R per hour, transfer and handling of radiation sources, equipment maintenance and calibration, packaging and shipping of radioactive materials, radioactive materials inventory, and procedure implementation.

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Baldwin-Wallace College - Athletic Trainer. Part-time student athletic trainer with the Athletics Department. Duties included all facets of injury assessment including emergency procedures, first-aid including physical therapy and preventative procedures. Assisted doctors with field emergencies and physicals.

## MEMBER, RADIATION SAFETY COMMITTEE

**Edward L. Svigel**
Engineering Manager

***Education***

Bachelor of Mechanical Engineering (BME), Gannon College (1970)
Communication/Electronics Staff Officers School (1971)
SPC/QC Training, Lakeland Community College (1988)
Training Course: "Users of Radioactive Materials at AMS", RAD Services, 1987.
Training Course: "Safe Handling, Packaging, and Shipment of Depleted Uranium", 1983.

***Professional Affiliations***

American Society of Mechanical Engineers (ASME)

***Experience and Background***

Advanced Medical Systems (1982 to present) - Engineering Manager
Gould/Engine Parts Division (1978-1982) - Machine Design Engineer
True-Temper Corporation (1976-1977) - Plant Engineer
U. S. Army Signal Corps (1971-1973) - Signal Officer
True-Temper Central Engineering (1970-1976) - Research Engineer
Diamond Shamrock (1963-1965) - Draftsman.

## MEMBER, RADIATION SAFETY COMMITTEE

**Carol D. Berger, C.H.P.**
Integrated Environmental Management, Inc.

### *Education*

M.S., Health Physics, San Diego State University, San Diego, California; 1979
M.S., Radiation Physics, San Diego State University, San Diego, California; 1977
B.S., Physics/Chemistry, San Diego State University, San Diego, California; 1972

### *Registrations/Certifications*

Certified Health Physicist (Comprehensive), American Board of Health Physics: 1983
Re-certified: 1987, 1991

### *Professional Affiliations*

American Academy of Health Physics (President, 1995)
Health Physics Society
East Tennessee Chapter - Health Physics Society (President, 1986; President-Elect, 1985; Secretary, 1981-1982)
San Diego Chapter - Health Physics Society (Charter member)
Baltimore-Washington Chapter - Health Physics Society (Treasurer, 1993-1994)
Sigma Xi - Scientific Research Society
American Board of Health Physics, Comprehensive Panel of Examiners, 1989-1993.
ASTM Task Group E-10.04.27 "Transuranic Wound Analysis"; 1986 to present
ANSI Standards Committee (ANSI N13.41) on Multiple Badging; 1986 to present (Chairman, PlanCo-59 Working Group, 1990 to present)
ANSI Standards Committee (ANSI N13.39) on Internal Dosimetry Programs; 1994 to present
NCRP Scientific Committee 46-10, "Assessment of Occupational Exposures from Internal Emitters", 1989 to present.
Member of the Health Sciences Advisory Council for the School of Health Sciences, Purdue University, 1995 to 1998.
DOE/IAEA Whole Body Counter Intercalibration Committee (1980-1986)
Consultant to Knoxville Academy of Medicine, Mass Casualty Simulation (1984-1985)
Consultant to the National Cancer Institute to Evaluate Devices and Techniques to Determine Previous Radiation Exposure under Public Law 98-54 (Award for participation presented by Oak Ridge Associated Universities, April, 1988.)
Steering Committee Member, U. S. Department of Energy Task Group on the Education of Future Health Physicists - 1989 to 1991.
Technical reviewer and referee for *Health Physics*, *Nuclear Technology*, and *Radiation Protection Management*
IT Corporation *Distinguished Technical Associate* - June, 1992.

*Experience and Background*

Integrated Environmental Management, Inc. (1994 to present) - President. Provides strategic environmental management services and consulting to commercial and government clients on internal and external dosimetry, applied health physics, regulations and compliance, environmental monitoring, instrumentation, emergency response, laser safety, site decommissioning, waste management, risk assessment, training, long-range business planning and cost forecasting.

IT Corporation, Nuclear Sciences Department (1086 to 1994) - Senior Technical Consultant. Performed health physics consulting for government and commercial facilities in Internal and External Dosimetry; Radiation Monitoring; Environmental Monitoring; Instrumentation; Emergency Response and Preparedness; Site Decommissioning; Radioactive Waste Management; Radiation Risk Assessment; Training; Licensing and Regulatory Negotiations; and Non-ionizing Radiation

Martin Marietta Energy Systems, Oak Ridge National Laboratory (1983 to 1986) - Radiation Dosimetry Group Leader. Responsible for internal and external dose assessment and programs for ORNL employees, visitors and contractors. Experience included Internal and External Dose Assessment; Monitoring Program Design and Implementation; Instrumentation Development; Site Characterizations; Personnel Management; and Training.

Union Carbide Corporation, Oak Ridge National Laboratory (1978 to 1983) - Internal Dose Group Leader. Responsible for development of the ORNL Whole Body Counter Facility for detection and quantification of the actinides in-vivo. Experience included: Internal Dose Assessment; Monitoring Program Design and Implementation; Instrumentation Development; Special Studies; Personnel Management; and Training.

Oak Ridge Associated Universities (1978 to 1986) - Teaching Staff. Provided professional training courses and general classes in the following health physics and radiation protection areas: Internal Dose Assessment; In-vivo Monitoring and Bioassay Methodologies; and Instrumentation.

President's Commission on the Accident at Three Mile Island (1979 to 1980) - Health Physics and Dosimetry Task Group Member. Tasks included: Internal Dose Assessment from Whole Body Counting Results; Estimates of Source Term from in-plant Monitoring Systems; Atmospheric Dispersion Modeling and Population Dose Assessment; and Development of Health Physics Sequence of Events.

**ATTACHMENT 3**
**Radiation Protection Program Plan**

# Advanced Medical Systems, Inc.

| RADIATION PROTECTION PROGRAM PLAN | Procedure: RSP-001 | Revision No.: 000 |
|---|---|---|
| | Page: 1 of 15 | Date: October 26, 1995 |
| | Approved by (Vice President): | |
| | Approved by (RSO): | |
| | Approved by (RSC Chair): | |

## TABLE OF CONTENTS



**CONTROLLED COPY NO. : _____**

## 1 PURPOSE

The goals of the Advanced Medical Systems, Inc. (AMS) policy on radiological protection are to minimize the total risk of harm or injury incurred by employees, contractors, or visitors as a result of work-related activities at sites that are licensed to possess radioactive materials, and to demonstrate compliance with applicable laws and regulations on control of radioactive materials. This Radiation Protection Program Plan (Plan) has been developed to guide generation and implementation of AMS Radiation Safety Procedures (RSPs) as they pertain to licensing and radiation protection issues. The following sections contain a description of the programmatic elements of the AMS radiation protection program.

## 2 SCOPE

This procedure applies to all AMS facilities, equipment and operations at the London Road facility that are licensed by the USNRC to possess radioactive materials. Facilities, equipment and operations that do not require a license are exempt from the requirements of this Radiation Safety Procedure.

## REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports for Workers; Inspection and Investigations"

3.2 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

3.3 Title 10, Code of Federal Regulations, Part 30, "Domestic Licensing of By-product Material".

3.4 Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material".

3.5 U. S. Nuclear Regulatory Commission Radioactive Material License Number 34-19089-01

## 4 DEFINITIONS

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

## 5 PROCEDURE

### 5.1 Radiation Protection Organization and Administration

#### 5.1.1 Vice President

5.1.1.1 Overall control and authority for radiation protection at the London Road facility shall rest with the Vice President.

5.1.1.2 The responsibility of the Vice President shall include, but is not limited to, the following:

5.1.1.2.1 Establish AMS policy and prepare/amend this Plan accordingly;

5.1.1.2.2 Appoint and empower the AMS Radiation Safety Committee (RSC); and

5.1.1.2.3 Assure that the capability of AMS radiation protection services are sufficient to meet the requirements of this Plan and USNRC license requirements.

#### 5.1.2 Radiation Safety Officer (RSO)

5.1.2.1 The Vice President has designated the authority for implementing the radiation protection program described herein to the RSO.

5.1.2.2 The RSO shall be responsible for recommending the type and quantity of staff and resources necessary for full implementation of the Radiation Protection Program Pan.

5.1.2.3 The RSO shall have the responsibility and authority to terminate any work activities that do or may violate regulatory or AMS requirements for radiological protection.

5.1.2.3.1 Specific work activities shall be permitted to proceed to a safe condition after issuance of the stop-work order.

5.1.2.3.2 Stop-work orders shall be lifted after the initiating conditions have been alleviated.

5.1.2.4 The qualifications of the RSO shall be as described in RSP-006, "Training and Qualifications of Radiation Safety Personnel".

5.1.3 In the absence or unavailability of the RSO, the authority for implementing the radiation protection program described herein shall be delegated to the Alternate Radiation Safety Officer (ARSO).

5.1.4 Radiation Safety Committee (RSC)

5.1.4.1 The AMS Radiation Safety Committee shall provide oversight for the radiation protection program.

5.1.4.2 The permanent members of the AMS Radiation Safety Committee (RSC) shall include the RSO, the ARSO, the Vice President, the Engineering Manager, and a Certified Health Physicist.

5.1.4.3 The RSO shall serve as the Secretary of the RSC.

5.1.4.4 Depending upon the topic(s) to be addressed, the composition of the RSC may be expanded to include other individuals deemed appropriate by the Vice President or the RSO.

5.1.4.5 The RSC is responsible for the review and approval of all elements of the radiation protection program and for assessing compliance with USNRC license requirements.

5.1.4.6 The RSC is responsible for confirming that activities are performed safely and in a manner that will protect health and minimize hazards to life, property, and the environment.

5.1.4.7 Other responsibilities of the RSC shall include the following:

5.1.4.7.1 Monitoring compliance with Radiation Safety Procedures;

5.1.4.7.2 Reviewing and approving Radiation Safety Procedures for currency and adequacy, recommending revisions as appropriate;

5.1.4.7.3 Reviewing unusual incidents involving radioactive materials or radiation-producing machines and provide recommendations on how their recurrence shall be prevented; and

5.1.4.7.4 Initiating safety evaluations of all proposed uses of radioactive material or radiation-producing machines.

5.1.5 Authorized Users

5.1.5.1 The RSO may designate authority for implementing certain aspects of the radiation protection program to Authorized Users.

5.1.5.2 The responsibilities and authority of Authorized Users may include the following:

5.1.5.2.1 Monitoring and maintaining equipment associated with the use, storage, and disposal of licensed radioactive material under their control.

5.1.5.2.2 Preparing products for shipment;

5.1.5.2.3 Performing product testing;

5.1.5.2.4 Performing non-domestic (outside of the United States) field services;

5.1.5.2.5 Performing decontamination activities; and

5.1.5.2.6 Ensuring that personnel under their supervision comply with the requirements of this Plan.

5.1.6 Radiation Protection Technicians

5.1.6.1 The RSO may designate authority for implementing certain aspects of the radiation protection program to AMS or contract Radiation Protection Technicians.

5.1.6.2 The responsibilities and authority of Radiation Protection Technicians may include the following:

5.1.6.2.1 Ascertain compliance with rules and regulations, license conditions, and the guidelines approved and specified by the AMS Radiation Safety Committee (RSC);

5.1.6.2.2 Provide technical support for some or all aspects of radiation protection, including field operations;

5.1.6.2.3 Monitor and maintain equipment associated with the use, storage, and disposal of radioactive material and radiation-producing machines;

5.1.6.2.4 Provide consultation on all aspects of radiation protection to personnel at all levels of responsibility;

5.1.6.2.5 Administer and coordinate the distribution of personnel and area dosimeters on an as-needed basis;

5.1.6.2.6 Maintain personnel/area monitoring records, notify personnel and management of exposures approaching maximum permissible limits, recommend appropriate corrective action, and evaluate exposures reported by contract dosimetry services;

5.1.6.2.7 Perform an investigation in cases of apparent overexposure to radiation or radioactive materials;

5.1.6.2.8 Coordinate or conduct training programs and instruction in the acceptable methods for the use of radioactive materials and radiation-producing machines;

5.1.6.2.9 Provide refresher training as appropriate (e.g., changes in procedures, equipment, regulation);

5.1.6.2.10 Monitor the storage of all radioactive materials;

5.1.6.2.11 Monitor the shipping and receiving of all radioactive materials;

5.1.6.2.12 Maintain a radioactive materials inventory to assure continued compliance with the possession limits specified in the USNRC license.

5.1.6.2.13 Coordinate and conduct emergency response activities pursuant to RSP-016, "Emergency Response and Notifications".

5.1.6.2.14 Maintain stop-work authority pursuant to RSP-017, "Stop Work Authority".

5.1.6.2.15 Perform other monitoring/surveillance tasks as directed by the RSO.

5.2 Facilities and Equipment

5.2.1 Licensed radioactive materials shall be used/stored in restricted areas.

5.2.2 Temporary restricted areas may be instituted by the RSO, subject to the provisions of RSP-012, "Control of Work".

5.2.3 Laboratory facilities, remote handling equipment, storage containers, shielding, fume hoods, ventilation systems, and other items may be used for controlling exposures from licensed radioactive materials.

5.3 Training in Radiation Protection

5.3.1 All personnel permitted unescorted access to the controlled area shall be trained in radiation protection in accordance with RSP-007, "Training in Radiation Protection".

5.3.2 Training may consist of General Employee Training (GET), Radiation Worker Training, and/or special briefings, as determined by the RSO.

5.3.3 Other license-specific training may be substituted, at the discretion of the RSO.

5.4 Radiation Exposure Control

5.4.1 Radiation Dose Limits

5.4.1.1 Internal and external exposure limits for employees, visitors and contractors shall be consistent with those established by the USNRC in 10 CFR 20.1201.

5.4.1.2 The administrative exposure limits for monitored personnel shall be less than 4500 millirem TEDE.

5.4.1.3 The Vice President shall ensure that sufficient trained personnel are made available (to the RSO) to perform each operation such that administrative exposure limits are not reached.

5.4.1.4 Persons under 18 years of age are not permitted access to restricted areas at AMS.

5.4.1.5 Exposure limits for the unborn child shall not exceed 500 millirem for the entire gestation period.

5.4.1.5.1 Any employee, contractor or visitor that has the potential for occupational exposure shall be informed of the potential effects that may result to an embryo-fetus at low exposure levels.

5.4.1.5.2 Employees shall be encouraged to notify the RSO regarding declared pregnancies.

5.4.1.5.3 An evaluation shall be performed by the RSO to determine the potential for an employee to exceed the regulatory exposure limit during the nine month gestation period.

5.4.1.5.4 If the potential exists or if an employee's request for transfer is approved, the employee shall be transferred to a different job assignment.

5.4.1.5.5 Declared pregnant females with the potential to exceed 50 millirem CEDE during a calendar year shall be monitored for internal and external exposure.

5.4.1.6 All employees with the potential to exceed 500 millirem deep dose equivalent ($H_d$) shall be assigned a personnel dosimeter to wear while on site.

5.4.1.6.1 The personnel dosimetry program shall be accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.4.1.6.2 A formal investigation shall be performed by the RSO in the event that a personnel dosimeter shows an unexpected exposure or if a personnel dosimeter is lost.

5.4.1.6.3 A written report shall be submitted to the RSC within ten working days for review and approval of follow-up actions intended to prevent the exposure or loss from re-occurring.

5.4.1.7 All employees with the potential to exceed 500 millirem CEDE or 5,000 millirem CDE from internal sources shall participate in a routine internal radiation monitoring program.

5.4.1.7.1 The routine internal radiation monitoring program may consist of direct or indirect bioassay sampling at the beginning and end of employment, and on a planned and periodic basis thereafter as described in RSP-010, "Exposure Control".

5.4.1.7.2 Special monitoring may be performed whenever an administrative goal may have been exceeded, a nasal smear reveals the presence of detectable radioactivity, or whenever the RSO deems it appropriate.

5.4.1.7.3 Routine monitoring methodologies and frequencies shall be appropriate for detecting the types and quantities of radioactive materials in use by the employee, and shall be determined by the RSO.

5.4.1.7.4 A formal investigation shall be performed by the RSO in the event that a monitoring result is unexpected.

5.4.1.7.5 A written report shall be submitted to the RSC within ten working days for review and approval of follow-up actions intended to prevent the exposure from re-occurring.

5.4.2 Control of Work

5.4.2.1 Routine working conditions that subject an individual to exposures that are less than 100 millirem TEDE per calendar year shall require no specific controls.

5.4.2.2 Control of work that may subject an individual to exposures in excess of 100 millirem TEDE per calendar year shall be accomplished by:

5.4.2.2.1 Establishing radiological standards and responsibilities.

5.4.2.2.2 Using operations line management and the RSO to monitor performance of radiological work.

5.4.2.2.3 Training workers in recognition of radiation hazards and their responsibility to prevent their occurrence.

5.4.2.2.4 Providing personnel with RSPs and/or Radiation Work Permits that include the radiological protection measures and controls necessary for safe completion of the job.

5.4.2.3 Authorized Users shall not initiate work in areas that may subject members of the general population to exposures in excess of 100 millirem per year TEDE.

5.5 ALARA Program

5.5.1 While occupational radiation exposures incurred by employees or visitors of AMS historically are low, all exposures shall be assumed to entail some risk to the employee.

5.5.2 Line management shall adopt the following three principles to govern all work activities with the potential for exposure to radiation or radioactive materials:

5.5.2.1 Activities and operations shall produce a positive net benefit.

5.5.2.2 All radiation exposures shall be kept as low as reasonable achievable (ALARA) in light of economic and societal costs.

5.5.2.3 Radiation exposures received by individuals shall not exceed the radiation dose limits described above.

5.5.3 ALARA activities shall be performed as described in RSP-005, "ALARA Program".

5.6 Contamination Control

5.6.1 Loose and fixed radioactive contamination shall be maintained at concentrations that are as low as reasonably achievable (ALARA).

5.6.2 Equipment, components or surfaces where loose or total (loose plus fixed) contamination is detected shall be classified as described in RSP-009, Contamination Control.

5.6.3 Loose and total contamination shall be measured as described in RSP-008, "Instrumentation and Surveillance" and RSP-009, "Contamination Control".

5.6.4 Contaminated areas shall be clearly defined and posted.

5.7 Instrumentation

5.7.1 Instrumentation used by the RSO, ARSO, Radiation Protection Technicians, Authorized Users, and other Employees, visitors or contractors shall be of sufficient sensitivity and accuracy to assess radiation exposure levels found at AMS facilities, detect the presence of radioactivity on tools, equipment, clothing, and personnel at all levels found at AMS facilities, and shall be of sufficient quantity to support on-going or planned operations.

5.7.2 Instrumentation shall be purchased, tested, calibrated and used as described in RSP-008, "Instrumentation and Surveillance".

5.7.3 Calibration and repair records shall be maintained as described in RSP-004, "Radiation Protection Records".

5.7.4 Instrumentation used for other than radiation protection or license compliance purposes are exempt from these requirements.

5.8 Surveillance

5.8.1 Routine ambient exposure rate surveys and contamination surveys of restricted areas and certain unrestricted areas at the London Road facility shall be performed at a minimum frequency of once per calendar quarter.

5.8.2 Non-routine surveys may be performed at the discretion of the RSO or any time there is reason to suspect that radiation or contamination levels may have changed unexpectedly.

5.8.3 The methodology for performing surveillance activities shall be as described in RSP-008, "Instrumentation and Surveillance" and RSP-009, "Contamination Control".

5.9 Posting

Posting/labeling requirements shall be as described in RSP-011, "Radiological Areas and Posting".

5.10 Receipt and Control of Radioactive Material

5.10.1 Incoming packages, known or suspected to contain radioactivity at levels significantly higher than background, shall be monitored for exposure rate and removable external contamination, pursuant to RSP-014, "Receipt, Handling and Identification of Radioactive Material".

5.10.2 Radioactive material shall be marked as such to ensure proper handling and storage.

**Note: Markings may include tags or stickers (in yellow and magenta) indicating "Radioactive Materials".**

5.10.3 Items identified as radioactive materials shall be maintained in a radioactive material storage area that has been established within a restricted area specifically for this purpose.

5.10.4 Radioactive material received by AMS shall be entered in a radioactive material inventory log pursuant to RSP-014, "Receipt, Handling and Identification of Radioactive Material".

5.10.4.1 The log shall be maintained to assure compliance with maximum possession limits established in the USNRC license.

5.10.4.2 The radioactive material inventory shall be updated at least twice per calendar year to reflect new acquisitions.

5.11 Packaging and Transportation of Radioactive Materials

5.11.1 Licensed radioactive material shipped from AMS shall be packaged, surveyed, and labeled in accordance with RSP-015, "Packaging and Transportation of Radioactive Materials".

5.11.2 Prior to shipment of specifically-licensed materials, the RSO shall obtain confirmation that the receiver is licensed to receive the type, quantity and form of radioactive material present in the shipment.

5.11.3 The radioactive material inventory shall be updated at least twice per calendar year to reflect outgoing shipments.

5.12 Control of Radioactive Waste

5.12.1 Control of radioactive waste materials should be accomplished by the following:

5.12.1.1 Preventing materials from becoming unnecessarily and/or excessively contaminated;

5.12.1.2 Decontaminating and reusing radioactive materials such as tools and equipment;

5.12.1.3 Monitoring materials for radioactivity and removing non-radioactive materials prior to disposal; and

5.12.1.4 Using waste volume reduction techniques when practical.

5.12.2 Radioactive waste may be stored on site or disposed of by one of the following means:

5.12.2.1 Transfer to an authorized recipient as provided in 10 CFR 20.2001;

5.12.2.2 Release into the sanitary sewer in conformance with USNRC 10 CFR 20.2003; or

5.12.2.3 Any other means specifically approved in advance by the USNRC.

5.12.3 Manifests, Certificates of Disposal or other documentation to confirm transfer/disposal shall be maintained by the RSO pursuant to RSP-004, "Radiation Protection Records".

5.13 Radiation Protection Records

5.13.1 The RSO shall maintain records in order to document implementation of this Plan and to demonstrate compliance with applicable USNRC license requirements.

5.13.2 Records shall be maintained as described in RSP-004, "Radiation Protection Records".

5.14 Documentation

5.14.1 Radiation Safety Procedures shall be controlled and distributed pursuant to RSP-003, "Control of Radiation Safety Procedures".

5.14.2 The following Radiation Safety Procedures shall require amendment to USNRC License No. 34-19089-01 prior to revision or discontinuation:

5.14.2.1 RSP-001, "Radiation Protection Program Plan"

5.14.2.2 RSP-003, "Control of Radiation Safety Procedures"

5.15 Emergency Response and Notifications

5.15.1 For emergencies where radioactive materials may be involved, consideration shall be given to exposure to radioactive materials and ionizing radiation in addition to the other hazards present.

5.15.2 Emergency response actions shall be performed pursuant to RSP-016, "Emergency Response and Notifications".

5.15.3 If it is known or suspected that an internal or external dose limit has been exceeded or that contamination levels are not as expected:

5.15.3.1 The RSO shall be notified immediately.

5.15.3.2 The RSO shall evaluate the likelihood and magnitude of the exposure or contamination status, and shall implement appropriate follow-up actions as soon as possible after notification.

5.16 Quality Assurance in Radiological Protection

5.16.1 All activities conducted as part of this Plan shall be subject to quality assurance provisions.

5.16.2 These provisions should include the following:

5.16.2.1 Radiation Safety Procedures shall be developed to implement this Plan.

5.16.2.2 Limited-scope audits/assessments of the radiation protection program should be conducted by the RSO (or designee) to determine compliance with applicable federal/state regulations, applicable license requirements, and this Plan.

5.16.2.3 Audits/assessments of the provisions of this Plan should be performed by the Quality Assurance Department.

## 6 EXEMPTION PROVISIONS

Variances and exceptions to the requirements of this Radiation Safety Procedure shall be permitted pursuant to the written authorization of the RSO and the Vice President, and after approval by the USNRC.

## 7 DOCUMENTATION

None

## 8 ATTACHMENTS

None

ATTACHMENT 4
Facilities and Equipment

## Description of Facilities, Equipment at Advanced Medical Systems, Inc.

Advanced Medical Systems, Inc. (AMS) manufactured and fabricated sealed sources of $^{60}Co$ for teletherapy and radiography machines. The AMS operation, which occupies approximately 25% of an 80,000 square foot warehouse/manufacturing building at 1020 London Road (Cleveland, Ohio), is contained on three floors. The main floor includes an office area, the Isotope Shop area, a hot cell, a shielded work room, and miscellaneous unoccupied areas. The second floor contains additional unoccupied office space, a mechanical equipment room, and the HEPA ventilation system equipment room. The basement contains a source storage area and irradiation facility, waste storage areas, additional unoccupied space, and a liquid waste holdup tank room (WHUT room). The majority of the 6.3-acre property is covered with asphalt or concrete. Figures 1 through 3 show the layout of the three floors of the AMS building.

Licensed radioactive materials are located in specific areas within the AMS building. The following is a description of the various areas of the building.

### *Hot Cell*

The Hot Cell was designed and equipped to encapsulate large sources of radioactive material used for medical therapy and industrial radiography. The cell is six (6) feet square and has 5.5-foot thick concrete walls and a four-foot thick floor and ceiling. There is a stainless steel floor pan in the cell, and 0.25-inch thick by 11 foot tall steel wall plates. The cell has a six foot wide, 42-ton concrete hinged door at the rear. Two small access ports are located on the south wall of the cell.

There is a 60-inch thick viewing window at the cell front.[1] It is composed of an eight (8) inch inside cover plate of non-browning glass, two (2) inches of plate glass, 48 inches of zinc bromide solution, and a two (2) inch outside cover plate of laminated safety glass. This construction provides shielding that is equivalent to 66 inches of 150 lb/ft$^3$ concrete.

Remote handling in the Hot Cell is accomplished with a pair of manipulators and a two-ton overhead crane. Every item of equipment in the Hot Cell and every item within the cell structure are removable. The location of the Hot Cell on the first floor of the AMS building is shown in Figure 1. The Hot Cell is a "Restricted Area".

### *Isotope Shop*

The Isotope Shop is located on the first floor next to the Hot Cell as shown in Figure 2. This area has a concrete floor, ceiling, and interior walls. The exterior walls are of painted brick. Cobalt-

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[1] The window was designed and constructed in 1984 by Hot Cell Services Corporation, Kent, Washington.

60 sources are transported around this area in shielded containers.[2] The Isotope Shop also contains a table-mounted hood, a table, a sink, an old trash compactor, and three-ton overhead hoist with trolley, and a Tow Motor.[3] Within the Isotope Shop is the Source Garden. The Isotope Shop is a "Restricted Area".

### *Source Garden*

The Source Garden is located in the southwest corner of the Isotope Shop as shown on Figures 1 and 2. This area houses vertical tubes in a six-foot square well that extends from the first floor to the basement. An L-shaped shield around the well at the basement level is provided by two sand-filled shield vaults which are accessible through manholes in the first floor. The high-density concrete walls containing the sand shield are two-feet thick.

There are 54 storage tubes in the Source Garden's nine-by-seven rectangular array. The nine center spaces of the array are open and fitted with an irradiation plug which accommodates objects up to 8.5 inches square by 12 inches high. The source tubes terminate in a metal container through which cooling air is drawn from the room to the high-efficiency air- (HEPA-) filtered exhaust system. The Source Garden is in a "Restricted Area".

### *Decontamination Room*

The Decontamination Room is located behind the Hot Cell and at the side of the Isotope Shop as shown in Figure 2. This area has a concrete floor and walls. The room provides space enough for opening the Hot Cell door into the ventilation controlled space of the Decontamination Room.

The room is equipped with water outlets and a floor drain, which was used during previous decontamination operations. This drain has since been sealed. In this area is a vault that contains ancillary Hot Cell items and lead blankets, along with beam shields made of lead. The Decontamination Room is a "Restricted Area".

### *High Level Waste Storage Room and Shielded Work Room*

The High Level Waste Storage Room is located next to the Hot Cell on the first floor as shown in Figure 2. This room has a concrete floor, walls (three-foot thick) and ceiling, and a labyrinth entrance. There are drums of waste stored here, along with spent HEPA filters. The High Level Waste Storage Room is a "Restricted Area".

### *Clean Equipment Room*

The Clean Equipment Room is located on the second floor as shown on Figure 3. This room has a concrete floor, walls and ceiling. It contains all of the facility service equipment with the exception of the HEPA ventilation equipment. It also contains the emergency generator for use in the event of power failure. The Clean Equipment Room is a "Restricted Area".

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[2] One such container is the "transfer monster", which is used to move sources in and out of the Hot Cell.

[3] The Tow Motor is an electric fork lift.

### *HEPA Equipment Room*

The HEPA Equipment Room is located on the second floor of the facility as shown in Figure 3. This room has a concrete floor, walls and ceiling. It contains the facility HEPA ventilation equipment. There is one large HEPA exhaust blower that holds four two-foot by two-foot HEPA filters in a housing. This system services all of the isotope areas except the Hot Cell. There is also a small HEPA exhaust blower with only one HEPA filter in its housing. This system services the Hot Cell. The HEPA Equipment Room is a "Restricted Area".

### *Back Basement*

The Back Basement is located in the basement as shown in Figure 1. This room has a concrete floor and walls. There is a drum storage area along one wall, with temporary shielding erected between the storage area and the main part of the room. There are approximately 500 high-density concrete blocks in the room that are positioned to provide additional shielding from materials in the WHUT room. The Back Basement is a "Restricted Area".

### *WHUT Room*

The Waste Hold-Up Tank (WHUT) Room is located in the basement directly under the Hot Cell as shown on Figure 1. This room has a concrete floor, walls and ceiling. The room walls are three feet thick to provide shielding from the room's contents, with additional shielding as described above.

The room contains a 100-gallon and a 500-gallon tank for liquid wastes. When the room was still in use, wastes were "held up" in the tanks until sampling/analysis confirmed that they could be discharged to the sewer system. However, in 1989 AMS ceased discharging liquid radioactive waste to the sewer system. Shortly thereafter, the WHUT Room was sealed. The WHUT Room is a "Restricted Area".

### *Front Basement*

The Front Basement is located on the east side of the basement next to the WHUT room, as shown in Figure 1. It consists of three rooms: the passageway between the front and back basement, the Chart Room, and the Blue Tank Room. The rooms have concrete floors, ceiling, and exterior walls. The interior walls are wood-framed with painted drywall surfaces. There are 45 high-density concrete blocks in the Blue Tank Room that are positioned to provide additional shielding from the WHUT room. The Front Basement is a "Restricted Area".

### *Miscellaneous Restricted Areas*

There are a number of miscellaneous areas within the AMS facility. These include the air lock, the Isotope Shop warehouse, portions of a caged storage area, and office areas on the second floor. These areas have been designated as "Restricted Areas".

### *Other Areas*

There are other miscellaneous areas within the AMS facility that are not restricted for purposes of radiological control. These are a former chemistry laboratory, the Hot Cell control office, the first floor office areas, portions of a caged storage area, and the counting room.

### *Security and Fire System*

The AMS facility on London Road is equipped with a security system that is composed of fire detection and burglar alarm functions. Both facets of the system are remotely monitored by ADT Security Systems, Inc.

The burglar alarm system employs a variety of electronic techniques to detect intrusion. If intrusion occurs, the Cleveland Police Department is notified and ADT Security Systems, Inc. Personnel are dispatched to the facility. AMS personnel are also notified and respond to the facility.

The fire detection system consists of a combination of heat, smoke, and sprinkler system flow detectors. In the event that one of these detectors is activated after normal hours, ADT Security Systems, Inc. Notifies the Cleveland Fire Department and AMS personnel. During normal business hours, the system may be activated by a local fire alarm switch located at the main entrance to the facility on London Road, or by the installed detectors.

Fire alarm annunciator displays are located at the main entrance and at the alternate entrance. Also at these locations are facility layout diagrams denoting the radiologically restricted areas within the building.

The fire suppression capability in the building consists of a sprinkler system that covers all locations <u>outside</u> of the restricted areas. A variety of ABC-type fire extinguishers (hand-held) are placed throughout the building (restricted and unrestricted areas).

### *Air Handling Systems*

Air handling at the AMS facility is via four separate systems. These support the isotope area, the first floor office area, the second floor office area, and the lobby and reception area.

The isotope area system has once-through airflow, with a carefully balanced flow gradient to the Hot Cell as the low pressure point. Supply air is drawn through pre-filters before entering the building.[4] The supply air is distributed to the isotope areas by ventilating ducts containing manually-adjustable dampers. The airflow pattern is adjusted by balancing the supply and exhaust systems to obtain the desired flow pattern. Periodic checks of manometers are made to assure the desired pattern is maintained.

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[4] The heavy burden of industrial pollutants from neighboring plants and the railroad tracks is removed by the pre-filters in order to extend the useable lifetime of the HEPA filters.

The doors at either end of the change area are electrically interlocked to prevent simultaneous opening which might disturb the air flow pattern. The doors at either end of the air lock, used to move shipping containers in and out of the isotope areas, are similarly interlocked.

The exhaust system has two centrifugal blowers which are located on the second floor directly above the Hot Cell. Both blowers exhaust through separate filters and a common high-velocity stack. The larger blower removes air from all isotope areas except the Hot Cell, and routes it through an array of absolute (HEPA) filters. The exhaust fan for the Hot Cell is independently operated, and has a single absolute filter. The balanced air flow pattern is from the change areas, through the Isotope Shop area, to the Decontamination Room, and finally to the Hot Cell.

The Hot Cell exhaust fan is driven by a two-speed motor which is controlled by the position of the double doors connecting the Decontamination Room with the Isotope Shop area. With the doors closed, the fan operates at normal speed and the Decontamination Room receives its air supply through a duct at the south side of the doorway. When the door is opened, the supply air is diverted from inside to outside the Decontamination Room by means of a switch which also increases the Hot Cell exhaust fan capacity by about 50%. This prevents reverse flow of the potentially contaminated air of the Decontamination Room into the lower level Isotope Shop area.

The air from both exhaust systems exits the system from a stack with a height of 12.2 meters above ground. The system flow rate is 971 scfm. The filtration efficiency is 99.97% for particulates with a physical diameter of 0.3 micrometer or larger. An air sampling tube is mounted across a diameter of the exhaust stack at a height of eight (8) feet above the roof level. An air monitor located in the Hot Cell control area draws a continuous sample of 5 cfm (minimum) from the stack for analysis. The results are indicated on a chart recorder. The stack monitor is also connected to the security system.

The air handling system is under continuous control by a monitoring and safety system. Any increase of activity above a pre-set level immediately stops the exhaust fans and the supply fan. There is also automatic shutdown of either exhaust fan if a sudden pressure drop occurs across its absolute filters, indicating a possible rupture in the filter media.

### *Emergency Power and Lighting*
Continuous operation of the air handling equipment, the monitoring devices and other electrically-powered systems is maintained in the event of electrical power failure by a natural-gas-burning emergency generator with automatic rapid changeover. The facility emergency lighting system is also powered by this generator.

### *Alarm Systems*
All safety and monitoring devices are connected to a Master Alarm Panel in the Hot Cell control area of the AMS facility. Separate lights for each controlled item are always lit on the panel so that faulty operation of the panel itself is readily identified.

When a controlled item malfunctions, the alarm light increases in intensity and flashes on and off until an acknowledgment button is depressed. An audible alarm also sounds on the first and second floors until acknowledged. The alarm will continue to indicate the difficulty even though it may have corrected itself before the operator has checked the Master Alarm Panel since the alarm signal can only be terminated when the acknowledgment button has been depressed. The following are examples of conditions which will cause an alarm:

- Hot Cell Exhaust Fan: Shut down from lack of power or switch turned off; Sudden pressure drop across air filter indicating ruptured filter; Improper pressure across filter indicating broken belts, fan inoperative or plugged filter; and Excessive radiation on the air monitor.

- Isotope Shop Area Exhaust Fan: Shut down from lack of power or switch turned off; Sudden pressure drop across air filters indicating ruptured filter; Improper pressure across filter indicating broken belts, fan inoperative or plugged filters; and Excessive radiation on the air monitor.

- Air Monitor: Excessive radiation on filter paper in air monitor or electronic malfunction of monitoring equipment.

- Cell Temperature: Two thermostats, one located in Cell Control Area, and one located in Decontamination Room immediately behind the cell, are set to give an alarm signal for temperatures below $40^0$ F. or above $85^0$ F.

- Supply Fan: A thermostat in the intake system after the heaters will give an alarm signal for temperatures below $50^0$ F.

- Emergency Generator: Signal given on power failure when generator starts.

Alarms for fan shutdown, excessive heat, or excessive cold are also transmitted to the contracted security service. During non-working hours, the security service files a report with an AMS representative and the applicable response agency.

There are also a variety of alarm and interlock systems in specific locations of the restricted area. For the Hot Cell, there is a door interlock that secures the door in the closed position until two switches, one on the outside of the door and one on the cell face in the Cell Control Area, are depressed simultaneously. This safety feature makes it impossible for the cell door to be opened without the knowledge and consent of the cell operator, or for the door to be opened by a person working alone.

Also in the Hot Cell is a gamma alarm mounted opposite the cell face in the Cell Control Area. Since it is connected to a loud buzzer, it gives both an audible and a visible alarm (flashing red light) continuously when radiation levels are in excess of the preset level of approximately 2

mR/hr. The gamma alarm features fail-safe circuitry to provide a signal at all times. Failure of any element either turns on the red lamp or turns off the green (safe) lamp, signaling improper operation.

In the Isotope Shop area, there is a gamma alarm mounted on the west wall between the storage garden and the Decontamination Room adjacent to the source transfer operation. This will give a visible flashing red light when radiation exceeds the preset level of 5 mR/hr. Also, when the basement door is opened, a steady red light turns on above the door and on the Master Alarm Panel.

In the air locks, the doors at either end of the change area are electrically interlocked to prevent simultaneous opening which might disturb the air flow pattern. The entrance to the change area from the cell control area is an air lock by itself. The first door is interlocked with the door on the opposite side of the change area leading into the Isotope Shop area.

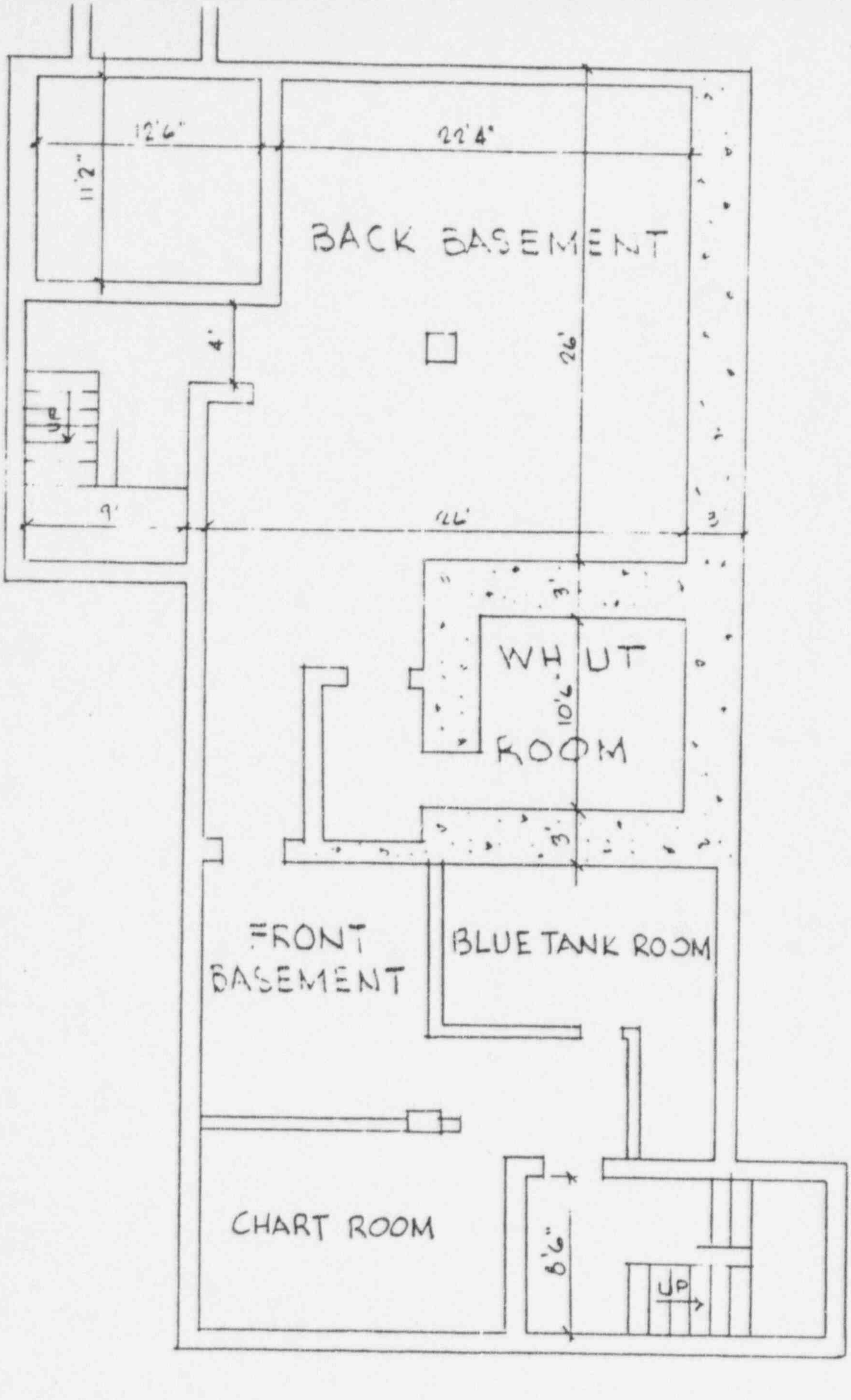
The air lock on the west side of the Isotope Shop area has three (3) electrically interlocked doors. One set of doors leads to the Isotope Shop area, one set leads to the warehouse and the last set, on the north side of the air lock, leads to the unrestricted area. When the Isotope Shop area doors are open, the other two doors cannot be opened. When one of the other two doors is open, the Isotope Shop area doors cannot be opened.

### *Instrumentation*

The AMS facility possesses a variety of portable and stationary radiation detection instruments. The following table shows the types of equipment and the minimum number available in the operating inventory at any point in time (with the exception of the Multichannel Analyzer and the Single Channel Analyzer):

| Purpose | Instrument Type | Detector Type | Minimum Number in Operating Inventory |
|---|---|---|---|
| Ambient gamma surveys | Portable GM Survey Meter | GM | 1 |
| Ambient gamma surveys | Portable Ion Chamber Survey Meter | Ion chamber | 1 |
| Ambient gamma surveys | Micro-R Meter | Sodium Iodide Detector | 1 |
| Personnel exposure monitoring | Pocket Ionization Chambers | Ion chamber | 5 |
| Air Monitoring | Breathing Zone Samplers | Filter cartridge and pump | 1 |
| Sample Analysis | Stationary Counter | GM | 1 |
| Sample Analysis | Multichannel Analyzer | Sodium Iodide Detector | 1 total |
| Sample Analysis | Single Channel Analyzer | Sodium Iodide Detector | 1 total |

**FIGURE 1 - BASEMENT OF AMS FACILITY**

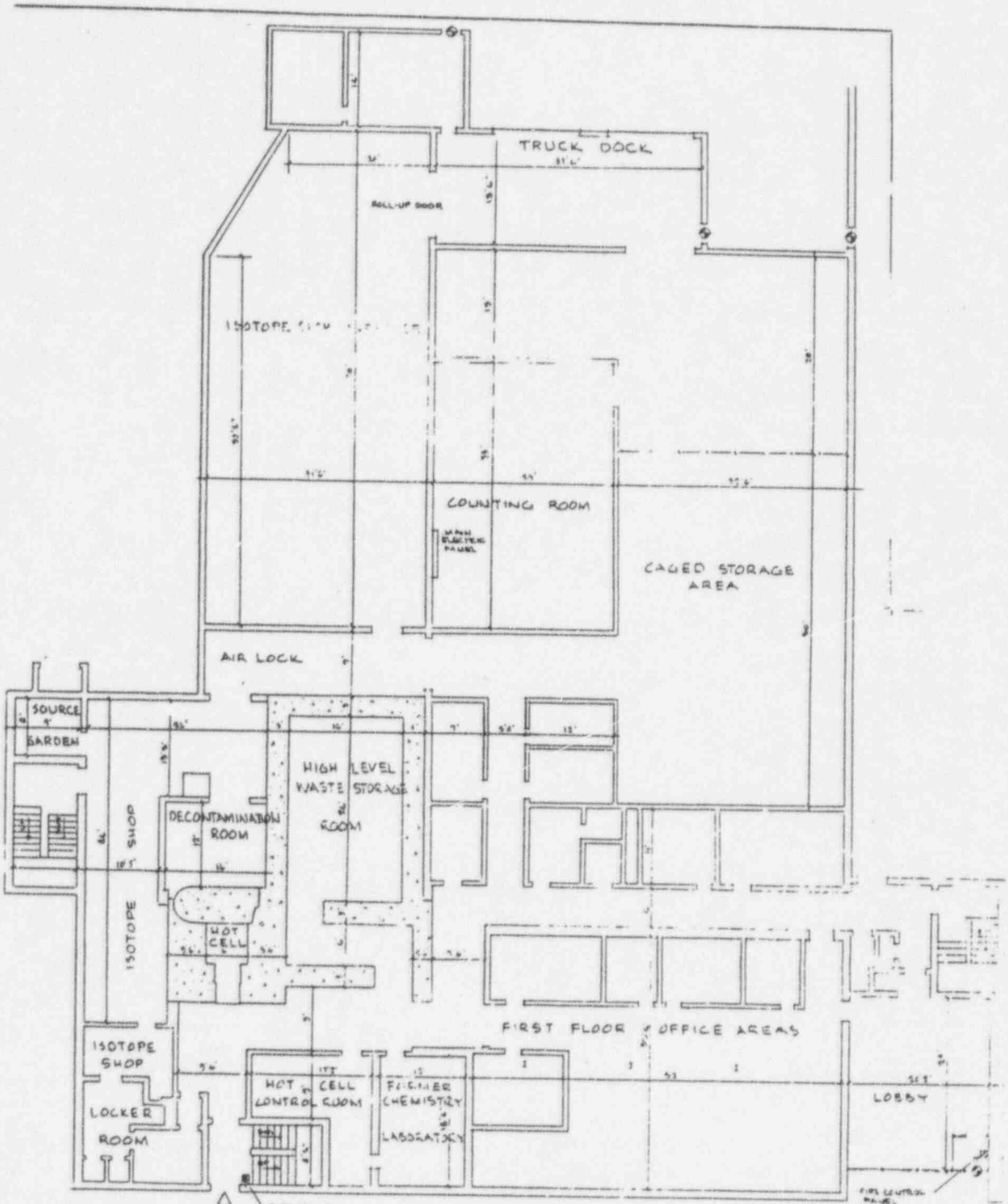



BASEMENT

1/8" = 1'0"

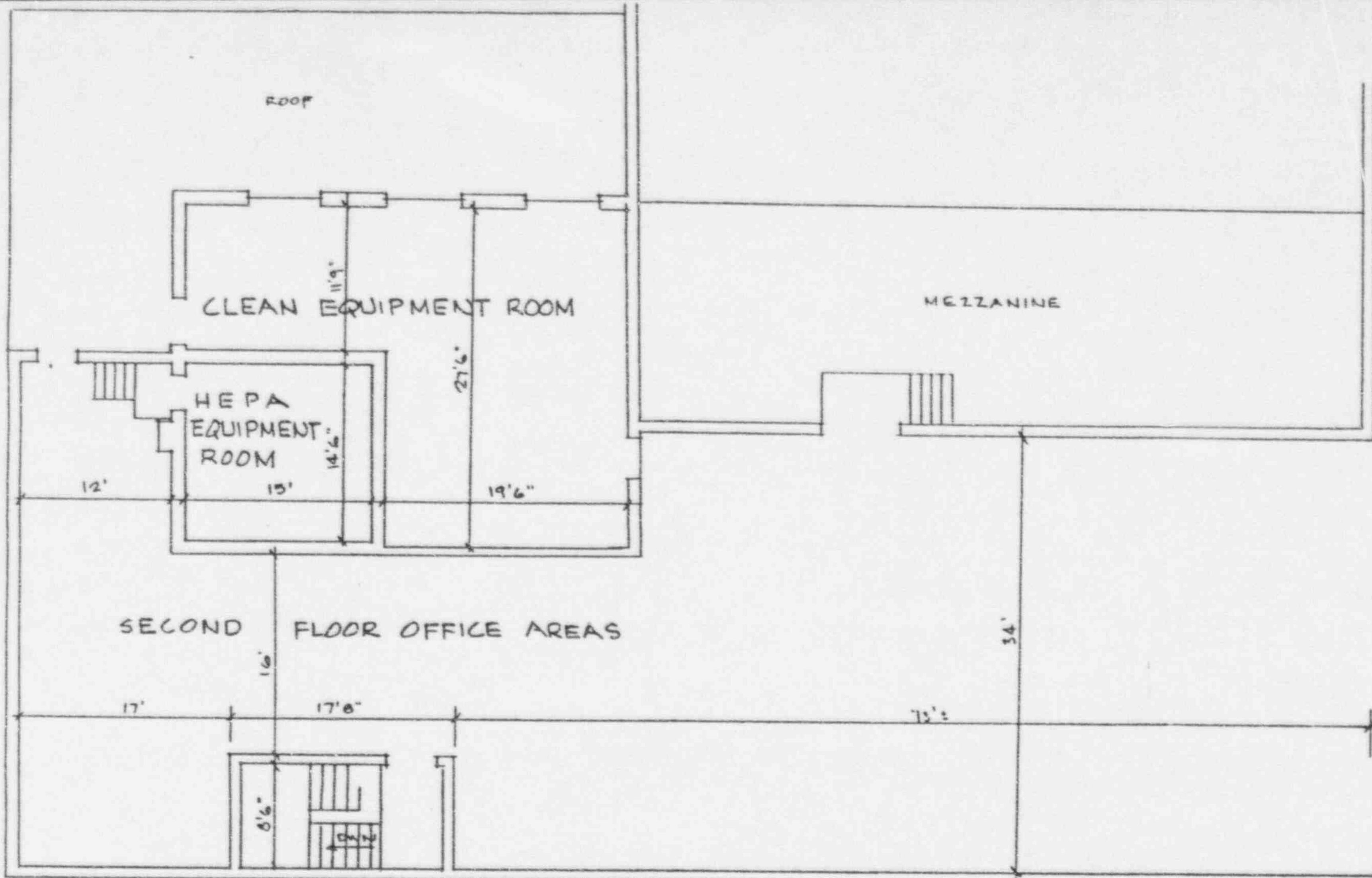
NOTE: DIMENSIONS SHOWN ARE IN PART FROM AVAILABLE PLANS, FIELD MEASURMENTS AND INFORMATION OBTAINED FROM PERSONEL ON SITE AND IS ACCURATE

FIGURE 2 - FIRST FLOOR OF AMS FACILITY


TRUCK DOCK
ROLL-UP DOOR
COUNTING ROOM
MAIN ELECTRIC PANEL
CAGED STORAGE AREA
AIR LOCK
SOURCE GARDEN
HIGH LEVEL WASTE STORAGE ROOM
DECONTAMINATION ROOM
SHOP
ISOTOPE
HOT CELL
ISOTOPE SHOP
LOCKER ROOM
HOT CELL CONTROL ROOM
FORMER CHEMISTRY LABORATORY
FIRST FLOOR / OFFICE AREAS
LOBBY
FIRE CONTROL PANEL
FIRE PULL BOX & CONTROL PANEL
ENTRY

FIRST FLOOR

**FIGURE 3 - SECOND FLOOR OF AMS FACILITY**




SECOND FLOOR

1/8" = 1'0"

NOTE: DIMENSIONS SHOWN ARE IN PART FROM AVAILABLE PLANS, FIELD MEASURMENTS AND INFORMATION OBTAINED FROM PERSONEL ON SITE AND IS ACCURATE FOR ITS INTENDED FUNCTION.

**ATTACHMENT 5**
**Methodology for Control, Issue and Distribution of Radiation Safety Procedures**

# Advanced Medical Systems, Inc.

| CONTROL OF RADIATION SAFETY PROCEDURES | Procedure: RSP-003 | Revision No.: 000 |
|---|---|---|
| | Page: 1 of 11 | Date: October 26, 1995 |
| | Approved by (Vice President): | |
| | Approved by (RSO): | |
| | Approved by (RSC Chair): | |

## TABLE OF CONTENTS



**CONTROLLED COPY NO. : ______**

## 1 PURPOSE

This procedure provides instructions for the preparation, issuance, and revision of Advanced Medical Systems, Inc. (AMS) Radiation Safety Procedures. Its purpose is to ensure that persons performing radiological activities are provided the most current approved procedures, and that all provisions of AMS's USNRC radioactive materials license and Radiation Protection Program Plan are met.

## 2 SCOPE

This procedure applies to control and distribution of Radiation Safety Procedures that address activities performed in support of the Radiation Protection Program Plan.

## 3 REFERENCES

3.1 U. S. Nuclear Regulatory Commission Radioactive Material License Number

3.2 Advanced Medical Systems, Inc., Radiation Safety Procedure No. RSP-001, "Radiation Protection Program Plan".

## 4 DEFINITIONS

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

## 5 PROCEDURE

5.1 Responsibilities

5.1.1 The Vice President shall:

5.1.1.1 Review and approve all RSPs prior to implementation.

5.1.1.2 Assure that the instructions contained in RSPs are followed.

5.1.2 The Radiation Safety Officer (RSO) shall:

5.1.2.1 Develop and administer RSPs.

5.1.2.2 Review and approve RSPs to assure compliance with USNRC regulations and license requirements.

5.1.2.3 Train personnel on RSP requirements prior to implementation.

5.1.2.4 Audit manual issuance and control requirements for compliance with the provisions of this RSP.

5.1.2.5 Ensure historical procedure files for RSPs are maintained.

5.1.2.6 Provide distribution coordination.

5.1.3 The Radiation Safety Committee (RSC) shall review and approve all RSPs to ensure compliance with corporate safety and operational requirements as well as with the AMS Radiation Protection Program Plan.

5.1.4 AMS personnel shall:

5.1.4.1 Comply with all applicable RSPs.

5.1.4.2 Notify the RSO or line management if an RSP is found to be inaccurate or lacking sufficient detail for the activity.

5.2 Procedure Format

5.2.1 Each page of each RSP shall utilize the header format as shown on this page.

5.2.1.1 The header shall specify the title of the procedure.

5.2.1.2 The procedure number and the approval date shall be specified in the header.

5.2.1.3 The page designation shall specify both the specific page and the total number of pages of the RSP.

5.2.2 The format for all RSPs shall include seven major sections: Purpose; Scope; References; Definitions; Procedure; Exemption Provisions; and Documentation.

5.2.2.1 The Purpose Section shall specify the reason for the RSP and if appropriate, shall denote why the activity is to be performed.

5.2.2.2 The Scope section shall specify the range of activities covered by the RSP and any limitations on the use of the RSP.

5.2.2.3 The References Section should include "Regulatory References" and "Technical References".

5.2.2.3.1 Regulatory References should include regulatory documents used during the preparation of the RSP.

5.2.2.3.2 Technical References should include all technical standards, related in-house procedures, and regulatory guides used in the preparation of the RSP or identified in the RSP.

5.2.2.4 The Definitions section shall include the definitions of terms that are used in the body of the document that may not be commonly understood, or it may reference the definitions contained in RSP-002, "Definitions".

5.2.2.5 The Procedures Section shall contain the information necessary for the successful execution of the task being described by the RSP.

5.2.2.5.1 One subsection shall identify those individuals who have responsibilities under the RSP. Responsibilities shall identify all groups and/or levels of individuals that are involved in any phase of any procedure. This includes execution of the RSP through management review of the completed task.

5.2.2.5.2 Each statement describing an action to be performed should be direct and to the point.

5.2.2.5.3 All instructions should be written in a manner that is clear and avoids ambiguity.

5.2.2.6 The Exemption Provisions Section shall specify the means by which variances and exceptions to the RSP are instituted.

5.2.2.7 The Documentation Section shall specify the records that shall be maintained and the length of time records shall be retained.

5.3 Listing of Required RSP Topics

5.3.1 RSP-001, "Radiation Protection Program Plan"

5.3.2 RSP-002, "Definitions"

5.3.3 RSP-003, "Control of Radiation Safety Procedures"

5.3.4 RSP-004, "Radiation Protection Records"

5.3.5 RSP-005, "ALARA Program"

5.3.6 RSP-006, "Training and Qualifications of Radiation Protection Personnel"

5.3.7 RSP-007, "Training in Radiation Protection"

5.3.8 RSP-008, "Instrumentation and Surveillance"

5.3.9 RSP-009, "Contamination Control"

5.3.10 RSP-010, "Exposure Control"

5.3.11 RSP-011, "Radiological Areas and Posting"

5.3.12 RSP-012, "Control of Work"

5.3.13 RSP-013, "Control of Radioactive Waste"

5.3.14 RSP-014, "Receipt, Handling, and Identification of Radioactive Materials"

5.3.15 RSP-015, "Packaging and Transportation of Radioactive Materials"

5.3.16 RSP-016, "Emergency Response and Notifications"

5.3.17 RSP-017, "Stop Work Authority"

5.4 Review of Procedures

5.4.1 Prior to submittal for approval, each RSP shall receive editorial and technical reviews.

5.4.2 An editorial review shall be performed by someone other than the author of the procedure and should address clarity, grammar, punctuation, spelling, and consistency in abbreviations.

5.4.3 A technical adequacy review shall be performed by a technically competent individual who is not directly responsible for the generation of the RSP.

5.5 Approval of Procedures

5.5.1 All RSPs shall be approved by the RSC and signed by the Vice President, the RSO, and the chair of the RSC prior to implementation.

5.5.2 Approval signatures shall signify that the RSP is adequate for its intended use, that it meets the requirements of the Radiation Protection Program Plan, and that all provisions of the USNRC license are met.

5.6 Revising Procedures

5.6.1 RSPs shall be revised by making needed changes and resubmitting the revised RSP for the same review and approval as the original RSP.

5.6.2 Signed approvals for the revised RSP shall be obtained prior to implementing any changes.

5.6.3 The following RSPs shall not be revised without amendment of USNRC License No. 34-19089-01:

5.6.3.1 RSP-001, "Radiation Protection Program Plan"

5.6.3.2 RSP-003, "Control of Radiation Safety Procedures"

5.7 Procedure Change Notices

5.7.1 When the need for a procedural change is identified and it is of such nature that an immediate change is required, a Procedure Change Notice (PCN) shall be used to implement the change to the RSP until the RSP can be revised and reissued.

5.7.2 The originator of the PCN shall perform the following:

5.7.2.1 Enter onto the standard PCN form (see Attachment 1) the needed changes, referencing by number the paragraph to be changed. Entries may be hand written or typed.

5.7.2.2 Submit the PCN to the Vice President, RSO, and RSC for review and approval.

5.7.2.3 Submit the signed form to the RSO for reproduction and distribution of RSPs.

5.7.3 The RSO shall assign a number to each PCN for a given RSP, numbered sequentially as each is submitted for production and distribution.

5.7.4 Copies of PCNs shall be distributed to all holders of controlled copies within one week of approval.

5.7.5 Temporary RSP changes shall be noted as such on the PCN, along with effective dates.

5.7.6 Revised RSPs with permanent changes shall be issued within six months of the procedure change approval.

5.8 Minor Changes

5.8.1 Minor changes in RSPs may be made if approved by the RSO.

5.8.2 Minor changes shall be written by hand on the affected page.

5.8.3 The date and originator shall be noted at the top of the affected page.

5.8.4 The RSO shall distribute the affected pages to all holders of controlled copies within one (1) week.

5.9 Procedure Manual Issuance and Control

5.9.1 All RSPs shall be maintained under a controlled distribution system.

5.9.2 Authorized recipients:

5.9.2.1 The RSO shall determine who is to be issued manuals to assure that all individuals needing the RSPs will have access to them in the area in which the work is to be performed..

5.9.2.2 If requested, and if a recipient name/address is provided, the USNRC shall be an authorized recipient of one copy of the manual and all RSPs.

5.9.3 A master list of procedure manuals and individual procedures issued shall be maintained by the RSO.

5.10 Procedure Cancellation

5.10.1 If it becomes necessary to cancel an RSP, a revision shall be issued consisting of only a PCN that states that the revision cancels the RSP.

5.10.2 The following RSPs shall not be canceled without prior amendment of USNRC License No. 34-19089-01:

5.10.2.1 RSP-001, "Radiation Protection Program Plan"

5.10.2.2 RSP-003, "Control of Radiation Safety Procedures"

## 6 EXEMPTION PROVISIONS

Variances and exceptions to the requirements of this Radiation Safety Procedure shall be permitted pursuant to the written authorization of the RSO and the Vice President, after approval by the USNRC.

## 7 DOCUMENTATION

7.1 A historical procedure file shall be maintained for each RSP by the RSO.

7.2 The historical file shall consist of the following:

7.2.1 The signed master copy of the RSP and each revision.

7.2.2 A copy of all PCNs associated with the RSP.

7.2.3 The signed original of each Minor Change.

## 8 ATTACHMENTS

8.1 Attachment 1 - "Procedure Change Notice"

2 Attachment 2 - "Procedure Manual Transmittal Form"

3 Attachment 3 - "Radiation Safety Procedure Transmittal Form"

## ATTACHMENT 1
## PROCEDURE CHANGE NOTICE

Modification to existing RSP ( ) or Supplement to exiting RSP ( )

RSP Number: ______________________________

RSP Title: ______________________________

Time Period from ____________ to ____________

Specific Activities affected: ______________________________

Description of changes including pages and paragraphs affected (attach additional sheets as needed):

______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

Justification for changes:

______________________________

______________________________

Approved by: ______________________________
Vice President

Approved by: ______________________________
Radiation Safety Committee (Chair)

Approved by: ______________________________
Radiation Safety Officer

## ATTACHMENT 2
## PROCEDURE MANUAL TRANSMITTAL FORM

To:

Date:

From: Radiation Safety Officer (RSO)

Subject: Radiation Safety Procedure Manual Issuance

Enclosed for your use is Controlled Copy No. ______ of the Advanced Medical Systems, Inc. (AMS) Radiation Safety Procedure Manual. Please note that as a controlled-copy holder, you will be issued all revisions to the enclosed procedures. If you feel you do not need this manual, now or in the future, or if you leave the employment of AMS, please return this manual to the Radiation Safety Officer (RSO). Upon receipt of this document, please sign and date this form and return it within five working days to the RSO.

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To: Radiation Safety Officer

Date:

From: ______________________________

Subject: Radiation Safety Procedure Manual Issuance

I verify by my signature that I have received the controlled manual numbered as indicated above.

______________________________ / ______________
Name/Date

## ATTACHMENT 3
## RADIATION SAFETY PROCEDURE TRANSMITTAL FORM

To: Date:

From: Radiation Safety Officer (RSO)

Subject: Radiation Safety Procedure Transmittal

Attached is a new or revised copy of the procedure(s) listed below for incorporation into your Radiation Safety Procedure Manual. Within ten working days, please place the attached document(s) into your manual and remove and return all superseded documents. Procedure Change Notices (PCNs) should be placed at the front of the existing procedure and all pages retained until the next revision. When you have updated your manual, please sign and date this form and return it to the RSO.

| Revision Number | Date | Pages Affected | Description of Change |
|---|---|---|---|
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I verify by my signature that the above item(s) have been placed in my controlled manual and superseded procedures/PCNs have been removed and returned.

_______________ / _______________
Name/Date