SURVEILLANCE PLAN FOR THE LONDON ROAD FACILITY

Submitted to:

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INTRODUCTION

On November 2, 1979, Advanced Medical Systems, Inc. (AMS) was issued a license (No. 34-19089-01) by the U. S. Nuclear Regulatory Commission (USNRC) authorizing possession of Cobalt-60 (^{60}Co) in the form of both loose material and sealed sources. Beginning on this date, AMS 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, 1989, AMS ceased generating any liquid radioactive waste, and discontinued the disposal of licensed material into the sanitary sewerage system.

In 1994, the NEORSD isolated AMS from the sewage treatment system.[1] This action rendered the facility 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 made timely notification to the USNRC about the deteriorating conditions and implemented remedial actions.[2]

Pursuant to USNRC authorization, the remedial activities included "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.[3] The remedial action selected by AMS was to fill the inside of the sewer discharge line, the manhole and the lateral connection to the interceptor with grout.[4] This existing system was then abandoned, and a new connection to the interceptor will be installed elsewhere on the property.

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1 Since that time, AMS has installed portable toilets for employees, and is collecting all other liquids in above-ground storage tanks.

2 Integrated Environmental Management, Inc. Report No. 94009/G-2110, "Report of Water Treatment and Sewer Remediation", (in press).

3 Letter from W. L. Axelson, U. S. Nuclear Regulatory Commission to David Cesar, Advanced Medical Systems, Inc., December 15, 1994.

4 Integrated Environmental Management, Inc., "ALARA Analysis for Remediation of the AMS Lateral Connection to the Sewer System", Report No. 94009/G-115, January 26, 1995.

To demonstrate that the radioactivity secured within the abandoned piping remains in place until such time as AMS undertakes facility decommissioning, a long-term surveillance program is being implemented. This report contains a general description of radiological conditions at the London Road facility, a plan for monitoring radiological conditions in order to identify any migration of radioactivity that might occur, the means by which the quality of the surveillance program will be ensured, and a description of the records and reports that will be maintained as part of this effort.

CHARACTERISTICS OF THE SITE

Background

AMS (and its predecessor) manufactured and fabricated sealed sources of ^{60}Co for teletherapy and radiography machines. Under their USNRC license, AMS may possess up to 285,000 curies of ^{60}Co, in any form, for manufacture, installation and servicing of sealed sources. Table 1 shows the current inventory of radioactive materials at the site.

AMS is located in an industrial/residential neighborhood. The AMS facility, which occupies approximately 25% of a large warehouse/manufacturing building, is comprised of 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 ventilation system equipment room. The basement contains a source storage area (Source Garden), a former dry waste storage area, a liquid waste handling room, additional unoccupied space, and a liquid waste holdup tank room (WHUT room).[5] The majority of the 6.3-acre property is covered with asphalt or concrete. Figure 1 shows the layout of the AMS facility.

Findings from Previous Surveys

During October, 1985, a site survey was performed by Oak Ridge Associated Universities (ORAU) in response to a USNRC request. In the final report from that survey, it was noted that facility contamination levels appeared somewhat excessive.[6] As follow-up to that report, AMS initiated decontamination efforts on August 31, 1987.

In 1989, after decontamination efforts were complete, ORAU was asked by the USNRC to re-survey the AMS site and facilities in order to determine its current radiological status. The results of that survey indicated that the decontamination efforts implemented by AMS were "successful in reducing levels of contamination and direct radiation".[7] Outside of the facility, ORAU noted

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5 In 1989 AMS ceased discharging liquid radioactive waste to the sewer system. Shortly thereafter, a survey of the WHUT room indicated that exposure rates were in excess of 1,000 R per hour. Consequently, and after authorization by the USNRC, the WHUT Room was sealed to permit the residual radioactivity to decay prior to implementing additional remedial actions.

6 Oak Ridge Associated Universities, "Evaluation of the Operational Radiation Safety and Fire Protection Programs of the Advanced Medial Systems, Inc., London Road Facility, Cleveland, Ohio", December, 1985.

7 Cotten, P. R. And G. L. Murphy, "Radiation Survey of the Advanced Medical Systems, Inc. London Road Facility, Cleveland, Ohio", Oak Ridge Associated Universities Report No. ORAU 89/B-145, April, 1989.

that radiological conditions were generally indistinguishable from background, with elevated exposure rates noted at locations that were adjacent to source and waste storage areas. Furthermore, the following information was provided:

> "Soil and sediment from storm drains contained above background Co-60 levels but not at sufficient concentrations to pose an environmental concern. Levels of Co-60 in the sanitary drain have been reduced, but the direct radiation level is still significant, relative to NRC limits for unrestricted areas. Access to the sanitary sewer manhole at the front of the AMS facility should be controlled."[8]

ORAU noted that ambient gamma exposure rates, at a height of one meter above the manhole at the front of the property, were a maximum of 10 microR per hour. The ^{60}Co concentrations in surface soil samples collected in this area ranged from nondetectable to 2.2 $\pm$ 0.1 picocuries per gram. A water sample collected from the manhole indicated the presence of 150 $\pm$ 10 picocuries of ^{60}Co per liter. A sediment sample collected from this same location contained 640 $\pm$ 10 picocuries per gram.

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.[9] 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.[10] However, there was no 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.[11] Furthermore, there was no evidence that the ^{60}Co activity in water samples collected from this location was insoluble pursuant

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8 In response to ORAU's recommendations, the manhole at the front of the property was designated a restricted area and sealed to prevent inadvertent personnel access.

9 The connection is comprised of a sewer line, a manhole, and a lateral.

10 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.

11 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.

to American Public Health Association's Method 7110 "Gross Alpha and Gross Beta Radioactivity (Total, Suspended, and Dissolved)" from Standard Methods for Examination of Water and Wastewater.

Site Conditions after Sewer Remediation Activities

During the 1995 sewer remediation activities that were implemented in order to recover from the NEORSD's installation of a compression plug into the lateral, 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. This finding confirms that contaminant migration did not occur. In fact, no Co-60 was identified other than directly below the drain tile. RTM 9-24-95

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. Therefore, this portion is scheduled to be grouted in, and new foundation drains were laid outside of those that were abandoned. A concrete slurry wall was installed between the abandoned drains and the new drains. After back-filling, the ground surface between the building and the new drainage system was sloped from the building toward the new system and covered with an impermeable liner to minimize the potential for water infiltration into the abandoned drains.

Prior to abandoning the lateral connection 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.[12] In advance of this action, the length of the lateral connection was visually surveyed using a video camera. The ambient exposure rates within the lateral, measured with a microR meter, ranged from one (1) to four (4) milliR per hour. 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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[12] A new manhole was installed elsewhere on the property and a new lateral connection will be installed at a future date.

SURVEILLANCE PLAN

General Approach

Residual radioactivity identified during the sewer remediation effort exists in the abandoned lateral connection on the east side of the building and in the abandoned foundation drainage system on the south side of the building. There is no evidence to date that migration of the radioactivity that has been present in these locations has occurred. Therefore, surface surveys coupled with a well water sampling methodology will be used to monitor the abandoned lateral location until site-wide decommissioning occurs.

Surveillance for the abandoned foundation drainage system is not necessary since the placement of a slurry wall and liner precludes water intrusion into this area. ~~If intrusion should occur, it would escape into the new drain tile system and would be detected during routine discharge monitoring.~~ RTM 8-24-95

Sampling Frequency

In general, the frequency of surveillance activities depends on the site environment and the likelihood of changes along the pathways for transport. Pathways or receptors affected by seasonal variations or weather patterns generally require multiple sampling at different times of the year. For the abandoned systems at the AMS facility, there are no known environmental variations or tidal influences which might affect the concentration of radioactive materials contained therein, and there is no evidence that migration through the shale layer is likely. Therefore, a once per year surveillance effort is deemed sufficient.

Collection Locations

A "necessary and sufficient" number of ambient exposure rate measurements and samples collected from the areas in question will be obtained in order to meet the objectives of this program. Figure 2 shows the "affected area" of the abandoned lateral and Figure 3 shows the affected area of the abandoned footer drains. There shall be two (2) sampling locations selected from the abandoned lateral affected area.[13]

Preparation for Surveillance

The following program elements, which may affect field operations, safety, sample validity, and analytical results, shall be prepared in advance of the surveillance effort:

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[13] In regard to specific instructions contained in this Plan, the term "shall" indicates a requirement, "should" indicates a recommendation, and "may" indicates that the decision is left to the discretion of the individual.

- The effort shall be scheduled with the radioanalytical laboratory to assure timely delivery of results, proper analytical capabilities, and timing of sample arrival.

- Ambient gamma surveys shall be performed using a microR meter (or equivalent).

- Two monitoring wells shall be installed to detect any migration of radioactive materials from the abandoned manhole and lateral. One well will be positioned in the vicinity of the manhole and one will be located at the point of greatest depth for that portion of the lateral that is on the AMS property (i.e., adjacent to the sidewalk). Soil removed during well installation will be collected and analyzed for the presence of ^{60}Co. Once wells are installed, water samples will be collected on an annual basis using a baler or equivalent equipment.

- All surveillance equipment shall be checked for serviceability prior to deployment.

- All instrumentation intended for use shall be checked and calibrated, if necessary. The instrumentation shall be response-checked prior to and after the surveillance effort to ensure consistent operability.

- Labels, shipping forms, chain-of-custody forms, and request for analysis forms shall be prepared.

- Sufficient packing materials, shipping containers, and shipping labels shall be available on-site prior to initiating the sampling effort.

Surveillance Team

The surveillance team should consist of a team leader and a team member. The team leader should select the team, brief the team, record the results of the walk-over survey, assist with sample collection, and generate deliverables and reports. The team member should perform the walk-over survey, collect the samples, analyze samples, and oversee packaging and shipping of samples sent for confirmatory analysis.

Methodology

A walk-over survey, using a microR meter (or equivalent) shall be performed over the affected areas shown on Figures 2 and 3. Ambient exposure rates (e.g., exposure rates with the sensitive volume of the survey instrument at a distance of approximately one meter above the ground) shall be measured and recorded pursuant to ISP-2, "Area Survey Procedure".

Soil samples collected for radiological analysis during well installation shall be taken as a continuous core. After each filled coring tube is extracted from the sampling location, the sample shall be removed and separated into one-foot segments. A composite sample of each segment shall be placed into a marinelli beaker. Each sample shall be analyzed by the method of gamma

spectroscopy pursuant to ISP-34, "Operation of the Gamma Spectrometer". Samples with detectable ^{60}Co shall be forwarded to a commercial analytical laboratory for confirmatory analysis.

Water samples collected for radiological analysis shall be taken from each monitoring well using a sample baler or equivalent means of retrieving samples. Samples will be placed into a marinelli beaker for on-site analysis. Each sample shall be analyzed by gamma spectroscopy in accordance with ISP-34 and ISP-38, "Assessment of Radioactivity in Water Samples". Water samples containing detectable ^{60}Co shall be forwarded to a commercial analytical laboratory for confirmatory analysis.

Decontamination

All sampling equipment and tools used for this effort shall be decontaminated prior to collection of the first sample, and between successive samples thereafter. Decontamination activities should be performed by scrubbing off visible dirt and debris, rinsing in potable water (obtained from an on-site potable water source) and wiping the item dry with a clean towel. Decontaminated sampling equipment shall be monitored for radioactive contamination.

Disposal

If ^{60}Co is positively identified in any soil sample, the potable water used for decontamination shall be collected and an aliquot shall be analyzed by ISP-34 and ISP-38. Water or soil samples with no detectable ^{60}Co may be disposed of by conventional means. Water containing detectable insoluble ^{60}Co or more than 200 pCi/l of soluble ^{60}Co shall be stored on-site. The solubility of the radioactivity in the water shall be determined as described in ISP-38.

Sample Identification

Samples collected for radiological analysis shall be marked for identification at the time of collection. Sample labeling shall consist of a tag or label attached to the sample container, and shall include, as a minimum a unique sample number, the sampling location, the sampling date, and the individual(s) performing the sampling. All samples shall be contained in one-liter marinelli beakers with lids. Following collection, as much standing water as possible should be removed prior to compositing the cores into sample collection containers. Samples sent to commercial analytical laboratories will be contained in sample containers provided or recommended by the laboratory.

Sample Shipping

Samples sent to the commercial analytical laboratory for confirmatory analyses shall be shipped via next-day delivery (e.g., Federal Express) at the end of each day of sample collection. The

samples shall be shipped in accordance with Department of Transportation (DOT) Title 49 CFR, Parts 171 through 177. Included with the sample shipment shall be the chain-of-custody and request-for-analysis forms. The laboratory shall be notified in advance to expect a sample shipment.

QUALITY ASSURANCE PLAN

This surveillance effort shall be performed to assure that the results are accurate and that uncertainties have been adequately considered. The quality assurance (QA) plan shall define the data quality objectives of the program and shall operate throughout all stages of the surveillance program, including final validation of the data. The consensus nuclear industry standard for quality assurance is ASME NQA-1 (ASME 1989). The USNRC has also issued guidance for an acceptable QA plan (NRC 1979). The QA plan for this effort shall be consistent with the information contained in these documents, and with the following specific instructions.

QA Coordination

The AMS Radiation Safety Officer (RSO) shall serve as the QA officer for this effort. Therefore, the RSO should not be involved in activities that generate data. The QA officer shall be responsible for ensuring that all quality assurance objectives are met, reviewing selected field and analytical data to ensure adherence to procedures, approving the quality of data before they are used, serving as the focal point for quality assurance activities to ensure that they are conducted in accordance with established policies and procedures and overseeing sampling activities.

Documentation

All aspects of this surveillance program shall be documented. For field or analytical activities, the procedures contained in the ISP Manual shall be either adopted in whole or adapted to meet the requirements of this plan. Changes or exceptions to established procedures, if required, shall be documented, signed, and dated.

Training of the Sampling Team

All members of the sampling team shall receive training in the procedures to be performed. The extent of training and qualifications shall be commensurate with the education, experience, and proficiency of the individual and the scope, complexity, and nature of the specific task. Training shall be designed to achieve initial proficiency for the duration of the surveillance effort.

Equipment Maintenance and Calibration

Measuring equipment shall be maintained, calibrated, and tested to assure the validity of the sampling/survey/analysis data. Further, the procedures, responsibilities, and schedules for calibrating and testing and measuring equipment shall be documented. All equipment shall be tested before initial use and shall be recalibrated if maintenance or modifications could invalidate earlier calibrations. Field and laboratory instrumentation shall be calibrated with standards traceable to the National Institute of Standards and Technology (NIST).

Survey instruments should be tested for operability at least once for every day the equipment is used. Test results should be recorded in tabular or graphic form and compared to predetermined, acceptable performance ranges. Equipment that does not fall within the acceptable performance range shall be immediately removed from service.

Data Management

A consistent method of data generation, handling, evaluation, and reporting shall be developed and documented as part of this surveillance program. Information and data shall be recorded in logs or on standardized field and laboratory record forms. Data shall not be obliterated by erasing or through the use of "whiteout". Incorrect entries shall be corrected by striking a single line across the entry and entering new data. The correction or change shall be initialed and dated by the person making the entry.

A system of data review and validation should be instituted to ensure consistency, thoroughness, and acceptability. This should include regular reviews of field data and final reports by the QA officer. All reviews shall be signed and dated. Any questionable or invalid data shall be identified in the final report. Active records shall remain under the direct control of the team leader. Final reports shall be maintained by the RSO.

Sample Chain-of-Custody

To ensure the integrity of each sample collected as part of this program, and to ensure that there is an accurate record of sample collection, transport, analysis, and disposal, a sample chain-of-custody form shall be maintained for each sample collected. A chain-of custody form shall be completed by the team leader at the time of sample collection. This form shall accompany the sample at all times and shall become a part of the records after final sample disposition.

Sample custody shall be assigned to one individual at a time. All transfers of custody shall be documented on the chain-of-custody form. Samples are considered to be in an individual's custody if the samples are in his physical possession, the samples are within view after being in possession, or the samples are sealed and placed in a secure area by the last individual with custody of the samples. When a shipping container is ready for shipment to the analytical laboratory, a tamper-evident seal should be affixed to the container in such a way that the container cannot be opened without breaking the seal. A copy of the chain-of-custody form shall accompany the samples throughout transportation and analysis. Any break in custody or evidence of tampering shall be documented.

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TABLES

Table 1 - Current Inventory of Radioactive Materials at AMS

Item	Form	Material Description	Estimated Activity (Ci)
Licensed Material	Solid	Bulk Metal	23,000
Licensed Material	Solid	Sealed Sources	75,000
Packaged waste	Solid	Materials contained in high-level waste storage, LSA boxes and drums in the basement of the facility.	29
Packaged waste	Solid	Solid waste generated during the water treatment project.	0.4
Unpackaged waste	Solid/sludge	Materials contained in WHUT Room	53
Surface contamination	Solid	Uncharacterized surface activity in the restricted areas of the facility	11
		TOTAL	98,093.4

FIGURES

Figure 1 - Site Layout

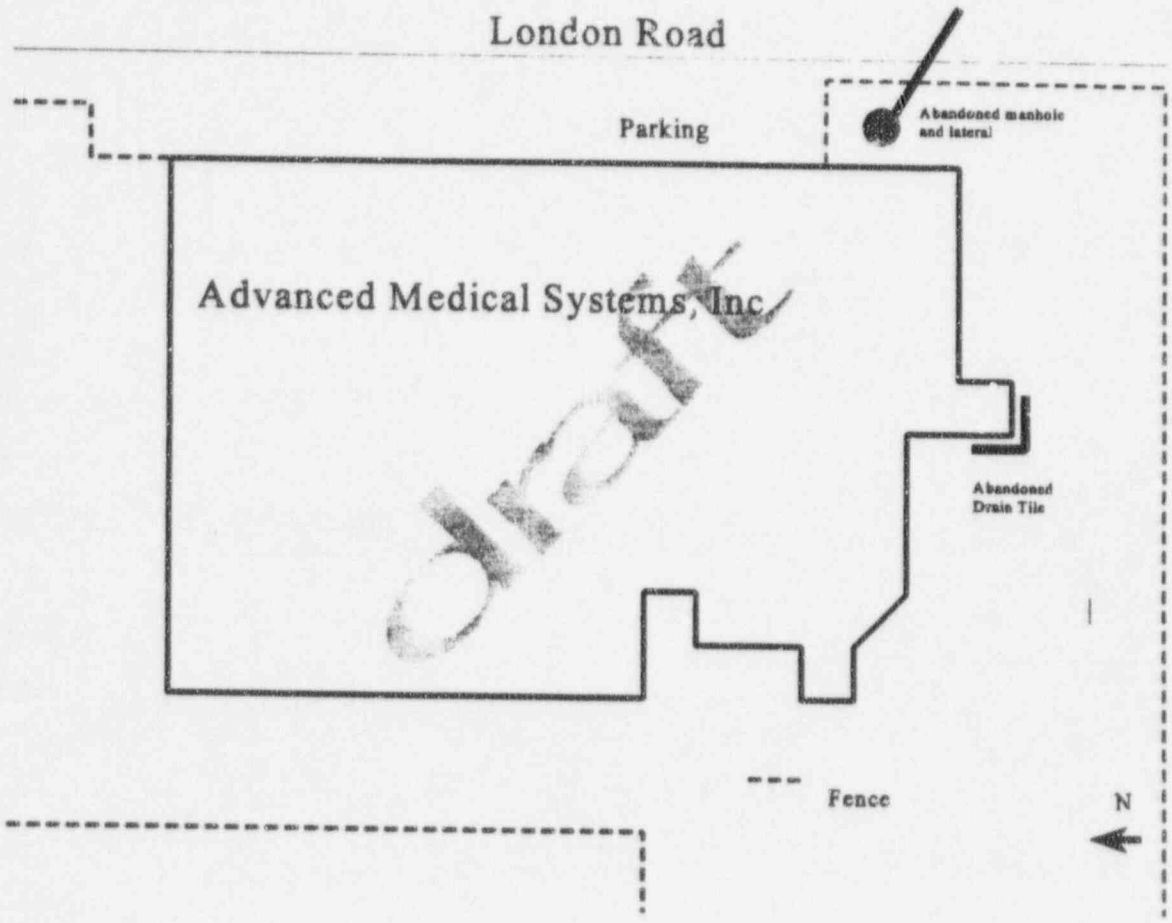
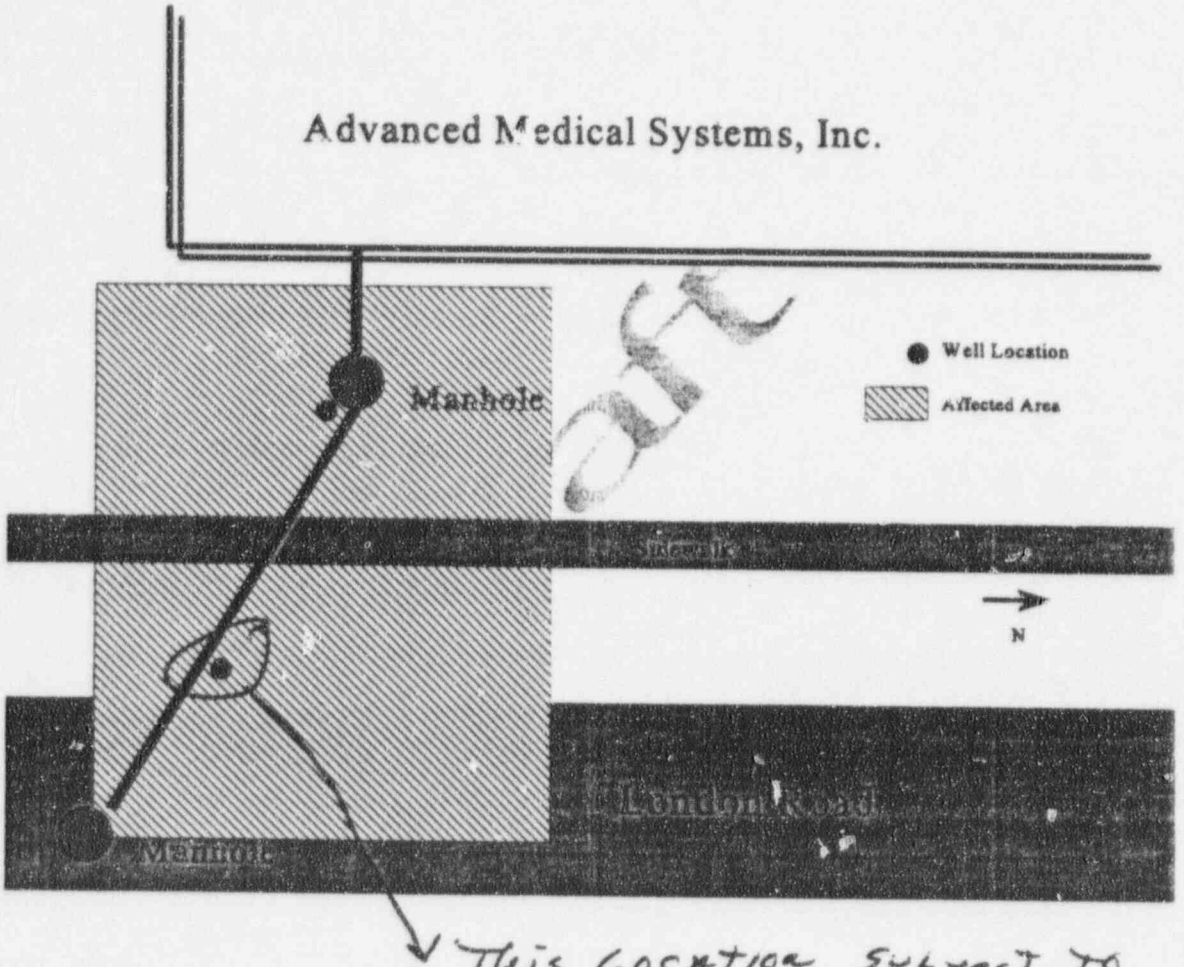


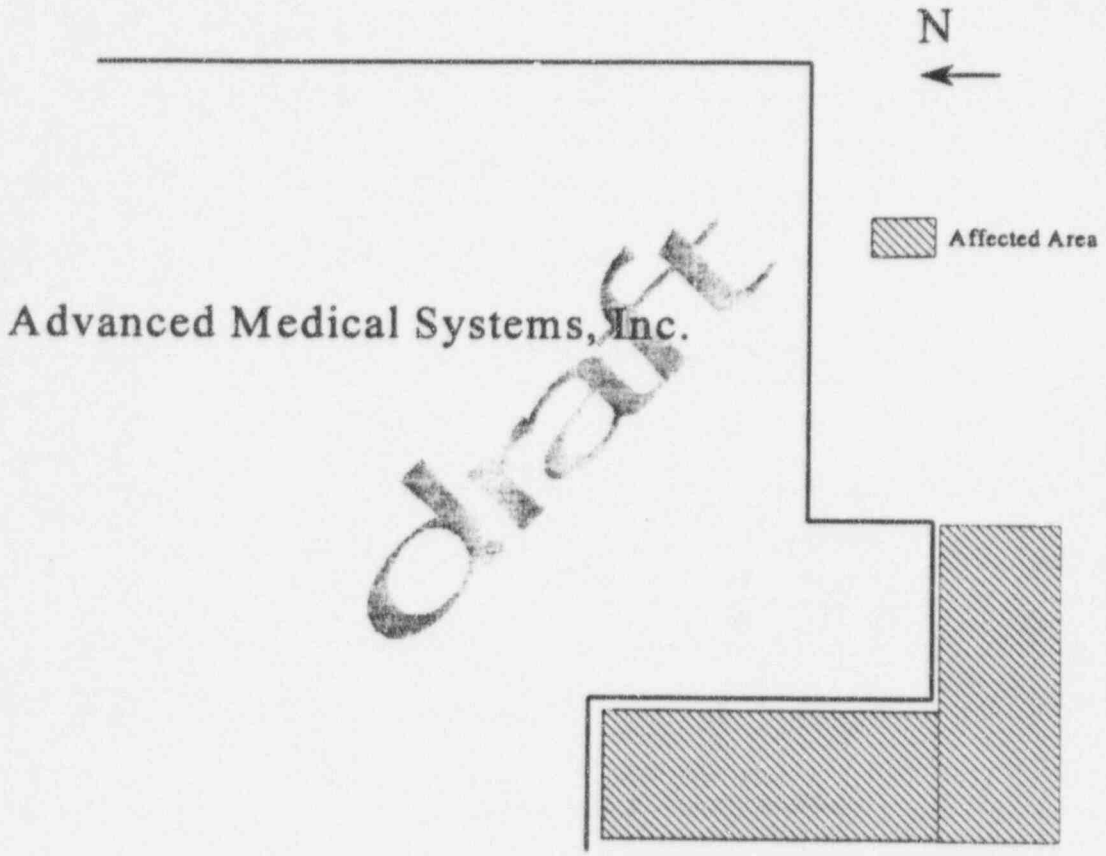
Figure 2 - Survey/Sampling Locations for Abandoned Lateral



This location subject to change. If permission to drill in the public Right of way cannot be obtained, an alternate well point will need to be determined (This location is in the "tree lawn")

RTM 8-24-95.

Figure 3 - Survey Locations for Abandoned Footer Drains



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