JUL 17 1995

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

Dear Mr. Meschter:

Enclosed is Amendment No. 38 to your NRC Material License No. 34-19089-01 in accordance with your request.

License Condition Nos. 21 and 22.I. have been changed to authorize operation of the water evaporation device described in your March 22, 1995, June 8, 1995, and June 29, 1995 letters.

Note that we are still in the process of reviewing Item II. in your June 16, 1995 letter, regarding your proposed soil sampling program, and the grouting/remediation project. We anticipate that we will have additional questions on these issues and will forward them to you as soon as possible.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office so that we can provide appropriate corrections and answers.

Please be advised that your license expires at the end of the day, in the month, and year stated in the license. Unless your license has been terminated, you must conduct your program involving byproduct materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate in accordance with NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.

2. Notify NRC, in writing, within 30 days:

   a. When Radiation Safety Officer permanently discontinues performance of duties under the license or has a name change; or

   b. When the licensee's mailing address changes (no fee is required if the location of byproduct material remains the same).

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3. In accordance with 10 CFR 30.36(b) and/or license condition, notify NRC, promptly, in writing, and request termination of the license:

   a. When you decide to terminate all activities involving materials authorized under the license; or

   b. If you decide not to complete the facility, acquire equipment, or possess and use authorized material.

4. Request and obtain a license amendment before you:

   a. Change Radiation Safety Officers;

   b. Order byproduct material in excess of the amount, or radionuclide, or form different than authorized on the license;

   c. Add or change the areas of use or address or addresses of use identified in the license application or on the license; or

   d. Change ownership of your organization.

5. Submit a complete renewal application with proper fee or termination request at least 30 days before the expiration date of your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of byproduct material after your license expires is a violation of NRC regulations. A license will not normally be renewed, except on a case-by-case basis, in instances where licensed material has never been possessed or used.

In addition, please note that NRC Form 313 requires the applicant, by his/her signature, to verify that the applicant understands that all statements contained in the application are true and correct to the best of the applicant's knowledge. The signatory for the application should be the licensee or certifying official rather than a consultant.

You will be periodically inspected by NRC. Failure to conduct your program in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in enforcement action against you. This could include issuance of a notice of violation, or imposition of a civil penalty, or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions, 10 CFR Part 2, Appendix C. Since serious consequences to employees and the public can result from failure to comply with NRC requirements, prompt and vigorous enforcement action will be

taken when dealing with licensees who do not achieve the necessary meticulous attention to detail and the high standard of compliance which NRC expects of its licensees.

Sincerely,

Original Signed By
Cassandra Frazier
Nuclear Materials Licensing Section

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

Enclosure: Amendment No. 38

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NRC FORM 374
(7-94)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Amendment No. 38

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Advanced Medical Systems, Inc.	In accordance with letter dated March 22, 1995
2. 1020 London Road Cleveland, OH 44110	3. License Number 34-19089-01 is amended in its entirety to read as follows:
	4. Expiration Date December 31, 1994
	5. Docket or Reference No. 030-16055/040-08764/030-17154

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License
A. Cobalt-60	A. Solid Metal	A. 150,000 curies
B. Cobalt-60	B. Sealed sources (teletherapy/ radiography sealed sources which have been evaluated and approved for commercial distribution by the NRC or an Agreement State)	B. 135,000 curies (no single source to exceed 13,700 curies)
C. Cesium-137	C. Sealed sources (teletherapy/ radiography sealed sources which have been evaluated and approved for commercial distribution by the NRC or an Agreement State)	C. 40,000 curies (no single source to exceed 2,200 curies)
D. Depleted Uranium	D. Nickel Plated	D. 4,040 kilograms
E. Cobalt-60	E. Sealed Sources	E. 15,000 curies

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MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
34-19089-01

Docket or Reference number
030-16055/040-08764/030-17154

Amendment No. 38

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
F. Cobalt-60	F. Sealed Sources (any sealed source approved by the NRC or an Agreement State)	F. 15 millicuries

9. Authorized Use:

A. For storage only incident to waste disposal or transfer to an authorized recipient. This license does not authorize the manufacture of sealed sources.

B. For installation, maintenance of, dismantling and servicing of Picker Corporation and Advanced Medical Systems, Inc. teletherapy units and Picker Model 6145 radiography units possessed by licensees authorized to possess the radioactive material pursuant to a specific license issued by the Commission or an Agreement State. For installation and removal of sealed sources into Picker Corporation, Advanced Medical Systems, Inc. and Keleket Barnes teletherapy units of licensees authorized to possess the radioactive material pursuant to a specific license issued by the Commission or an Agreement State. For training Hospital or Clinic personnel for in-house service operations on teletherapy equipment, on unit model per course, in accordance with letter dated August 15, 1988 and September 29, 1988.

C. For installation, maintenance, dismantling and servicing of Picker Corporation and Advanced Medical Systems radiography and teletherapy units of licensees authorized to possess the radioactive material pursuant to a specific license issued by the Commission or an Agreement State.

D. Shielding material in Picker Corporation and Advanced Medical System, Inc., radiography and teletherapy devices.

E. For storage only, those non-NRC approved sources in the possession of the licensee prior to the issuance of this amendment.

F. For use in devices (including Tech OP Model 571 Calibrator described in application dated November 12, 1984) approved by the Nuclear Regulatory Commission or an Agreement State to calibrate radiation survey instruments.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
34-19089-01

Docket or Reference number
030-16055/040-08764/030-17154

Amendment No. 38

CONDITIONS

10. Licensed material in Items 6.A., 6.E. and 6.F. shall be used only at the licensee's facility at 1020 London Road, Cleveland, Ohio. Licensed material in Items 6.B. and 6.C. shall be used only at 1020 London Road, Cleveland, Ohio and at facilities of customers who possess a specific license from the NRC authorizing possession of the licensed material. Licensed material in Item 6.D. shall be used only at the licensee's facilities at 1020 London Road, Cleveland, Ohio or 121 North Eagle Street, Geneva, Ohio, and at facilities of customers who possess a specific license from the NRC authorizing possession of the licensed material.

11. A. The Radiation Protection Officer for service operations described in Subitems 9.B. and 9.C. and routine health physics activities is Robert Meschter.

The licensee shall not perform service operations described in Subitems 9.B. and 9.C. until Robert Meschter has completed the required training.

B. Licensed material shall be used by, or under the supervision of and in the physical presence of, users listed in the table below. The users are only authorized to perform the indicated services on the teletherapy or radiography units specified in the table below:

AMS/PICKER TELETHERAPY/RADIOGRAPHY UNITS MODELS

	CS 600	C 1000	C 2000	C 3000	C 5000	C 10,000	C4	C8	C9	C12	Cyclops
USER				★	★ ★	★	★				
Curtis Perry				3	1,2	1,2	1,2	1,2	1,2		1,2
Haddock	5	5	5	5	5	5	5	5	5	5	5

AMS/PICKER TELETHERAPY/RADIOGRAPHY UNITS MODELS

	V 1000	V 2000	V 3000	V 10,000	C V4	C V9					
USER											
Curtis Perry		1,2	1,2	1,2	1,2	1,2					
Haddock	5	5	5	5	5	5					

11. (Continued)

1. Authorizes the servicing of AMS/Picker units, excluding source exchange.
2. Authorizes sealed source exchange.
3. Authorizes removal of unit and head from customer sites only.
4. Authorizes the training of AMS personnel in the manufacture of AMS/Picker sealed sources.
5. Authorizes the handling of sealed sources only.

12. A. (1) Each sealed source acquired from another person and containing licensed material, other than hydrogen-3, with a half-life greater than 30 days and in any form other than gas shall be tested for contamination and/or leakage before use. In the absence of a certificate from a transfer or indicating that a test has been made within 6 months before the transfer, a sealed source received from another person shall not be put into use until tested.

(2) Notwithstanding the periodic leak test required by this condition, any licensed sealed source is exempt from such leak tests when the source contains 100 microcuries of less of beta and/or gamma emitting materials or 10 microcuries or less of alpha emitting material.

(3) Except for alpha sources, the periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources excepted from this test shall be tested for leakage before any use or transfer to another person unless they have been leak tested within 6 months before the date of use or transfer.

B. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to use or transfer as a sealed source. If the inspection or test reveals any construction defects or 0.005 microcurie or greater of contamination, the source shall not be used or transferred as a sealed source until it has been repaired, decontaminated and retested.

C. Each sealed source containing licensed material, other than hydrogen-3, with a half-life greater than 30 days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed 6 months except that each source designated for the purpose of emitting alpha particles shall be tested at intervals not to exceed 3 months.

D. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in what the sealed source is permanently or semi-permanently mounted or stored on which one might expect contamination to accumulate. Records o leak test results shall be kept in units of microcuries and maintained for inspection by the Commission. Records may be disposed of following Commission inspection.

12. (Continued)

E. If the test required by Subsection A. or C. of this condition reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, Illinois 60532-4351 / ATTN: Chief, Nuclear Materials Safety Branch, describing the equipment involved, the test results, and the corrective action.

13. The licensee may transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

14. Inventory Requirements:

A. An inventory system will be established that accounts for the receipt, movement, transfer and disposal of all radioactive material possessed under this license. Records of inventories will be maintained for 10 years from the date of each inventory.

B. A complete examination of records will be completed every six months to confirm the location of all radioactive materials and ensure that possession is within the limits specified in this license.

C. A physical inventory of all radioactive material possessed under this license will be conducted on or before June 1, 1993. Thereafter, a physical inventory of all radioactive material possessed under this license will be completed within 60 months of the previous physical inventory.

15. The licensee's field service audits (as described in the ATC Medical Group Management Plan, revised April 1, 1989, and submitted with letter dated April 17, 1989) shall be performed unannounced by the Radiation Protection Officer (i.e., Radiation Safety Officer).

16. The licensee shall follow the recommend survey frequencies outlined in Regulatory Guide 8.21, Revision 1, October 1979, in work areas where radioactive materials are handled or used.

17. The licensee shall maintain records of information important to safe and effective decommissioning at 1020 London Road, Cleveland, Ohio per the provisions of 10 CFR 30.35(g) until this license is terminated by the Commission.

18. The licensee shall maintain and execute the response measure of their Emergency Plan dated October 25, 1991 and revised January 1992, May 27, 1992 and April 26, 1993. The licensee shall make no change in the emergency plan submitted pursuant to 10 CFR [30.32(i), 40.31(j), 70.22(i)] that would decrease the effectiveness of the plan without prior Commission approval. The licensee may make changes to its Emergency Plan without prior Commission approval if the changes do not decrease the effectiveness of the plan. The licensee shall maintain records of changes that are made to the plan without prior approval for a period of three years from the date of the changes and shall furnish the Chief, Medical, Academic, and Commercial Use Safety Branch, Division of Industrial and Medical Nuclear Safety, NMSS, U.S. Nuclear Regulatory Commission, Washington, DC 20555, and the appropriate NRC Regional Office specified in Appendix D of 10 CFR 20, a report, within six months after the change is made, containing a description of each change.

19. The licensee is authorized to begin the following activities no sooner than March 17, 1995, and must complete them by the date specified in each item in accordance with letters dated January 27, February 2, 10, and 14, and March 1, 3, 8, and 10, 1995, wherein the licensee proposed and clarified its plans for: (1) dealing with the accumulation of ground water in and around its facility basement; (2) immobilizing and/or remediating contamination that has collected in below ground sewer piping and manholes; and (3) processing future ground water that builds up around the facility. These plans address the following actions the licensee will take.

    A. Process water that is currently stored outside its facility in above-ground tanks.

        i. Tanked water will be processed in-situ using a submersible water treatment system that includes filtration and ion-exchange demineralization as described in letters dated March 1, 3, 8, and 10, 1995.

        ii. Water will be treated until it contains no detectable non-soluble cobalt-60 and less than 1000 pCi/l of soluble cobalt-60 as determined by a contract analytical laboratory. The licensee may continue to pump treated water to the collapsible storage containers prior to receiving results of solubility tests from the contract laboratory. The treated water will subsequently be pumped to 25,000 gallon storage containers located in the facility warehouse, as described in letters dated March 3, 8 and 10, 1995.

    B. Simultaneously pump and process water currently residing in the sewer manhole and lateral, building sump pit and basement. This project shall be completed by June 30, 1995.

        i. Pumping will be sequenced as described in letter dated March 1, 1995, to ensure a positive hydrostatic pressure is maintained from outside to inside the facility's basement.

19. (Continued)

ii. Water in the sewer manhole, lateral, building sump pit, and basement will be pumped to a radiologically controlled area of the facility and processed using a skid mounted, multi-stage filtration and ion-exchange system as described in letters dated March 1, 3, 8 and 10, 1995. Spill procedures and radiological controls will be implemented as described in letter dated February 14, 1995, and Attachment 2 to letter dated March 1, 1995.

iii. Water removed from the sewer manhole, lateral, building sump pit, and basement will be treated to contain no detectable non-soluble cobalt-60 and less than 1000 pCi/l soluble cobalt-60 as determined by a contract analytical laboratory. The licensee may continue to pump treated water to the collapsible storage containers prior to receiving results of solubility tests from the contract laboratory. The treated water will subsequently be pumped to 25,000 gallon storage containers located in the facility warehouse, as described in letters dated March 3, 8, and 10, 1995.

C. Water sampling and analytical protocols will be as described in letter dated February 2, 1995, as clarified in letters dated February 14, and March 3, 1995. Solubility of cobalt-60 in samples containing detectable activity will be demonstrated in accordance with the reference in Supplement 2 to letter dated March 3, 1995. All solid radwaste generated from the water processing activities, including filter and demineralizer resin wastes, will be collected and stored at the London Road facility pending its ultimate disposal as radioactive waste.

D. Excavate areas around the facility to allow: (i) access to the radioactively contaminated four-inch waste discharge line; and (ii) the radiological evaluation of the facility's underdrain system and surrounding soils. This project shall be completed by July 7, 1995.

i. Excavate the soil in the vicinity of the building's four-inch waste discharge line and underdrains and disconnect these drains as described in letter dated March 1, 1995. Evaluate the radiological contamination status of the underdrain system and remediate or replace the system. Reconnect the underdrain system to the building sump pit and pump, test and process the underdrain system waters as described in letter dated March 1, 1995. The testing and processing of water pumped from the underdrain system will continue until sampling of the water consistently reveals no detectable non-soluble cobalt-60 and less than 200 pCi/l soluble cobalt-60.

ii. Evaluate the radiological status of the soil in the vicinity of the underdrain system and building sump pit as described in the letter dated March 1, 1995.

19. (Continued)

E. Immobilize the radioactive contamination present in the sewer manhole, lateral and four-inch discharge line. This project shall be completed by July 7, 1995.

i. Completely grout-in the radioactively contaminated four-inch sewer discharge line and the manhole and lateral up to the sewer interceptor as described in "Issue 4" of letter dated January 27 and letter dated March 1, 1995. The grouting will render the existing sewer discharge piping system inoperable, and immobilize (fix) the radioactive contamination that resides in the system.

ii. Develop and implement a sub-surface radiological monitoring program to assess contamination migration as described in letter dated February 10, 1995. The program must be submitted in writing and approved by the NRC.

F. Remediate the London Road interceptor in the vicinity of the abandoned lateral, as described in letter dated January 27, 1995. The remediation activities will be coordinated with the Northeast Ohio Regional Sewer District. This project shall begin no later than July 8, 1995.

G. i. The licensee shall notify the NRC Region III office no later than July 14, 1995, regarding the status of the completion of License Condition Numbers 19.B., 19.D. and 19.E.

ii. The licensee shall notify the NRC Region III office no later than July 14, 1995, to confirm initiation of the remediation project described in License Condition Number 19.F., and provide an estimated completion date.

20. The licensee is authorized to install a new manhole and lateral and re-connect this to the existing under drain system. The purpose of the new manhole is strictly to act as a means of collecting water from the under drain system which will be pumped to storage containers and subsequent analysis for cobalt-60 concentration.

21. The licensee is authorized to install and operate the water evaporation equipment described in letters dated March 22, 1995, June 8, 1995 and June 29, 1995.

22. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated November 12, 1984;

B. Letters dated November 12, 1984 (excluding Item 4), February 12, 1985, June 7, 1985 (excluding letter Item 4), September 6, 1985 (excluding change to Page 29 of ISP-1 manual);

22. (Continued)

C. Letters dated May 29, 1986 (Response to Enclosure A, Significant Licensing Deficiencies of NRC letter dated March 7, 1986);

D. Letter dated July 23, 1986 (Response to Enclosure B, Additional Licensing Issues for Renewal Applications of NRC letter dated March 7, 1986) excluding approval of the licensee's in-house training program;

E. Letters dated August 22, 1986, October 28, 1986, November 13, 1986, November 14, 1986 and December 4, 1986 (with Revised ISP-1 Manual, Appendices A and B attached), May 7, 1987, August 3, 1987, December 31, 1987, January 15, 1988 (Item V only), August 15, 1988 (with attached course manual), September 29, 1988 (with attachments) and November 21, 1988; and

F. Letters dated March 29, 1989 (except Section 3.4 "Hot Cell Entry and Action Levels"), April 7, 1989, August 25, 1989 (except Item B(4)), July 23, 1990 (except Sections 3.0 and 5.0 of ISP-14 procedure), March 1, 1991 (with attachments), March 27, 1991 (with attachments), May 9, 1991, May 14, 1991, February 27, 1992, February 28, 1992, March 2, 1992, and March 5, 1992.

G. Letters dated April 16, 1992 (with enclosures), June 15, 1992 (with attachments), August 10, 1992, September 18, 1992, December 29, 1992 (with enclosures), January 20, 1993, March 30, 1993, March 31, 1994 (with enclosure), April 11, 1994, and September 21, 1994.

H. Letters with attachments dated January 27, 1995, February 2, 10, and 14, 1995, and March 1, 3, 8, and 10, 1995.

Notwithstanding any reference to the specific activities in the above listed letters, the following activities are not addressed by this license.

i. The discharge of treated water to the sanitary sewer system.

ii. Installation of a composite sampler and flow gage.

iii. Conventional disposal of excavated soils exhibiting cobalt-60 concentrations greater than 8 pCi/g.

I. Letters dated May 3, 1995, May 17, 1995, June 6, 1995, June 13, 1995 and June 14, 1995 (received June 21, 1995) March 22, 1995 (Item 1 related to water evaporation use and associated attachments), June 8, 1995, June 14, 1995 (received June 19, 1995), and June 29, 1995.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date July 14, 1995

By Cynthia D. Pederson
Materials Licensing Section, Region III

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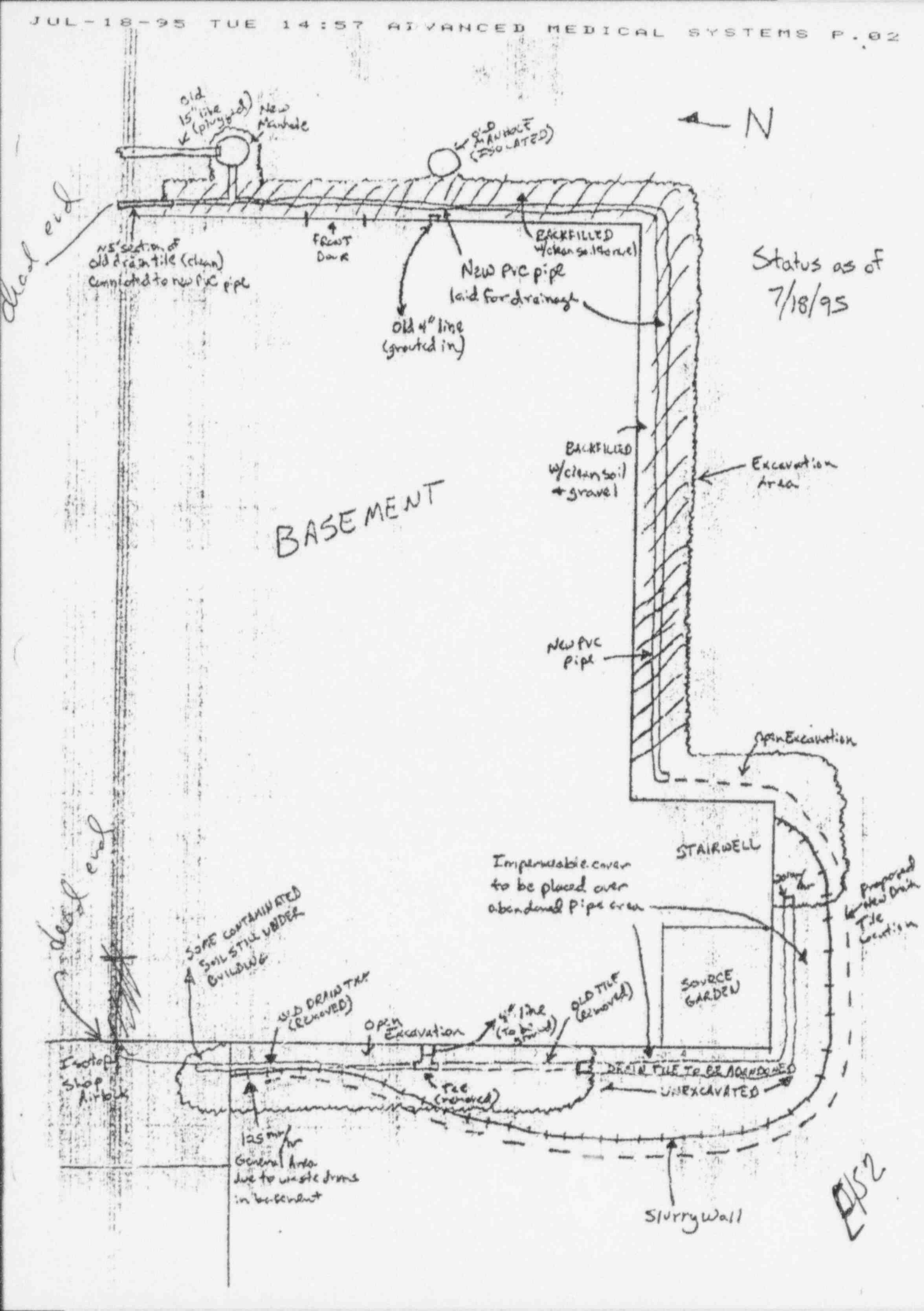
N
Old 15" line (plugged)
New Manhole
Old MANHOLE (ISOLATED)
dead end
N5' section of old drain tile (clean) connected to new PVC pipe
FRONT DOOR
BACKFILLED w/clean soil & gravel
New PVC pipe laid for drainage
Old 4" line (grouted in)
Status as of 7/18/95
BACKFILLED w/clean soil + gravel
Excavation Area
BASEMENT
New PVC pipe
Open Excavation
STAIRWELL
Impermeable cover to be placed over abandoned pipe area
Proposed new Drain Tile location
dead end
SOME CONTAMINATED SOIL STILL UNDER BUILDING
OLD DRAIN TILE (REMOVED)
OPEN Excavation
4" line (to be grouted)
OLD TILE (removed)
SOURCE GARDEN
Isotope Slop Airlock
DRAIN TILE TO BE ABANDONED
UNEXCAVATED
PVC (removed)
125 mr/hr General Area due to waste drums in basement
Slurry Wall
2 of 2

Hand delivered to Slawinski while @ AMS on 7/20/95

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

July 19, 1995

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

Re: Advanced Medical Systems, Inc. - License No. 34-19089-01

Dear Mr. Caldwell:

The purpose of this letter is to summarize the information relayed to you in the July 18, 1995 telephone conversation between the USNRC and representatives of Advanced Medical Systems, Inc. (AMS). In that conversation, and in reference to Item D of Amendment 38 to our materials license, we informed the USNRC that we successfully remediated the four-inch discharge line and the foundation drainage system at the front of the building in the vicinity of the old manhole. No detectable ^{60}Co exists in the soils in that area, and a new foundation drainage system has been installed.

In the process of completing this task, we discovered that the building drainage paths were not as depicted in the 1950-vintage drawings available to us. We expected the foundation drains to connect to the four-inch line in a wye connection at the east side of the building. However, the drains ran continuously over the four-inch line, and stopped about 10 feet to the north of the front door. At the location in the four-inch line where the wye connection should have been, a length of clay pipe was found to complete the connection between the line and the manhole.

AMS continued the excavation along the south and west sides of the building in order to determine where the connection exists. This effort revealed that the four-inch discharge line, which the drawings depict as coming to a stop well before reaching the back wall of the building, continues out the west side of the building to a tee connection with the foundation drainage system. Elevated contamination was identified in this portion of the four-inch line and in the foundation drains in the immediate vicinity. However, negligible contamination was found in the shale layer underneath the drains.

The foundation drains ran another 13 feet north past the tee connection, where they terminated. Approximately four (4) feet of this length ran beneath the isotope shop air lock. The sand and gravel that was used as fill for this area are contaminated. However, the shale layer in this vicinity was free of contamination.

Attempts to remove the contaminated drains at the back of the building were halted when excavation approached the Source Garden and when the west building wall was reached. Because of the existence of 20,000 curies of ^{60}Co in the Source Garden, exposure rates to excavators in this vicinity are calculated to be 30,000 mR per hour or more. At the west wall of the building, which houses a high-level waste storage area, exposure rates are currently in excess of 100 mr/hr and are rising as the excavation proceeds under the building. Since only hand-excavation of the drainage system under the building is possible, the risk of cave-ins is also of great concern.

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The current status of the site is shown in Attachment 1. The footer drains along the east (front) and south sides of the building have been replaced and the area has been back-filled with clean gravel and soil. AMS intends to grout in the entire length of the four-inch line that protrudes from the back of the building to ensure no migration of contamination. A grout material called "AV-118 Duriflex" will be used for this purpose. The specifications for AV-118 Duriflex are included as Attachment 2

The foundation drain that remains in the vicinity of the Source Garden will also be grouted in with AV-118 Duriflex as shown in Attachment 1 and Attachment 3. The excavation under the high-level waste storage area will be filled with Mearl Geocell. The specifications for Mearl Geocel are included as Attachment 4. New foundation drains will be laid outside of the abandoned systems and the cemented in area. These will connect to the new system that is already in place on the south wall (see Attachments 1 and 3). A slurry wall will be installed between the abandoned system and the new system. After back-filling is complete, the ground surface between the building and the new drainage system will be sloped from the building toward the new system and covered with an impermeable liner to minimize the potential for water infiltration into the abandoned area.

The new drainage system will then be connected to the new manhole that has been installed at the front of the building. Approximately 10,000 gallons of clean water will be used to flush this system to ensure complete isolation of the new system from the residual contamination. After the flush, the water that collects in the manhole will confirmed to meet the release criteria contained in the February 1, 1995 letter from J. Grobe to D. Cesar prior to discharge. A description of the monitoring methodology is being forwarded to you under separate cover. Until NEORSD approval to re-connect the building to the London Road Interceptor is given, water that meets the release criteria will be discharged through an alternate (temporary) path.

After all remediation activities are complete, AMS will institute a system of long-term surveillance over any residual radioactive materials that remain outside the building (e.g., in the lateral connection from the front of the building to the London Road Interceptor and in the abandoned drain lines at the back of the building). As required in Item E.ii of Amendment 38, the surveillance plan will be submitted to the USNRC for approval prior to its implementation.

Finally, please recall that on June 21, 1995 AMS was issued Amendment No. 36 to the referenced license number to permit treatment of contaminated water that currently exists in the basement of the London Road facility. In Item 19 of that amendment, AMS was directed to complete subitems "D" and "E" by July 7, 1995, and to begin item "F" by July 8, 1995. When we informed the USNRC that our ability to meet these deadlines was beyond our control, we were assured by Mr. John Madera and Mr. Wayne Slawinski that the dates were included in the Amendment for tracking purposes only and that a simple written notification of changes in the schedule is all that would be required of AMS.

As expected, AMS was unable to receive the necessary permits and authorizations in time to meet the July 7, 1995 deadline. Therefore, pursuant to the instructions of Mr. Madera and Mr. Slawinski, AMS forwarded amended milestone dates in a letter dated June 29, 1995. Once AMS discovered that the building drawings (circa 1950) did not accurately depict the true construction of the foundation drainage system we again forwarded amended milestones to account for the additional excavation that is required (see letter dated July 12, 1995).

AMS is still dependent upon the timely approval of the USNRC and the NEORSD to complete the remainder of this project. Therefore, AMS is now submitting the following amended milestone dates:

Item	Scheduled Start Date	Scheduled Completion Date	Current Status
Treat basement water	May 17, 1995	--	Complete
Install new manhole	July 3, 1995	--	Complete
Excavate in vicinity of 4" line, disconnect foundation drainage system, and remediate 4" line, 15" line and foundation drainage system.	July 3, 1995	July 28, 1995	The entire foundation drainage system has been removed.
Grout in existing lateral connection and existing manhole	July 3, 1995	August 11, 1995**	Awaiting NEORSD authorization to brace compression plug
Re-connect foundation drainage system to new manhole	July 3, 1995	August 11, 1995	Pending
Remediate ^{60}Co activity that exists at the outfall of the existing lateral system in the NEORSD Interceptor	July 8, 1995**	Revised start date is August 11, 1995**	Awaiting NEORSD authorization to access manhole.

** Actual start date subject to timely NEORSD approval to access the London Road Interceptor at the location of the outfall.

Again, these dates are subject to change based upon a variety of external factors. In the event that additional changes are necessary, I will immediately communicate the revised dates to the USNRC, along with the reason for the change.

AMS is looking forward to the USNRC's timely review of our plans for the final stages of this project. Work at the site is proceeding in advance of receiving you comments. If you need additional information or if I can answer any questions, please call me at (212) 692-3270.

Sincerely,

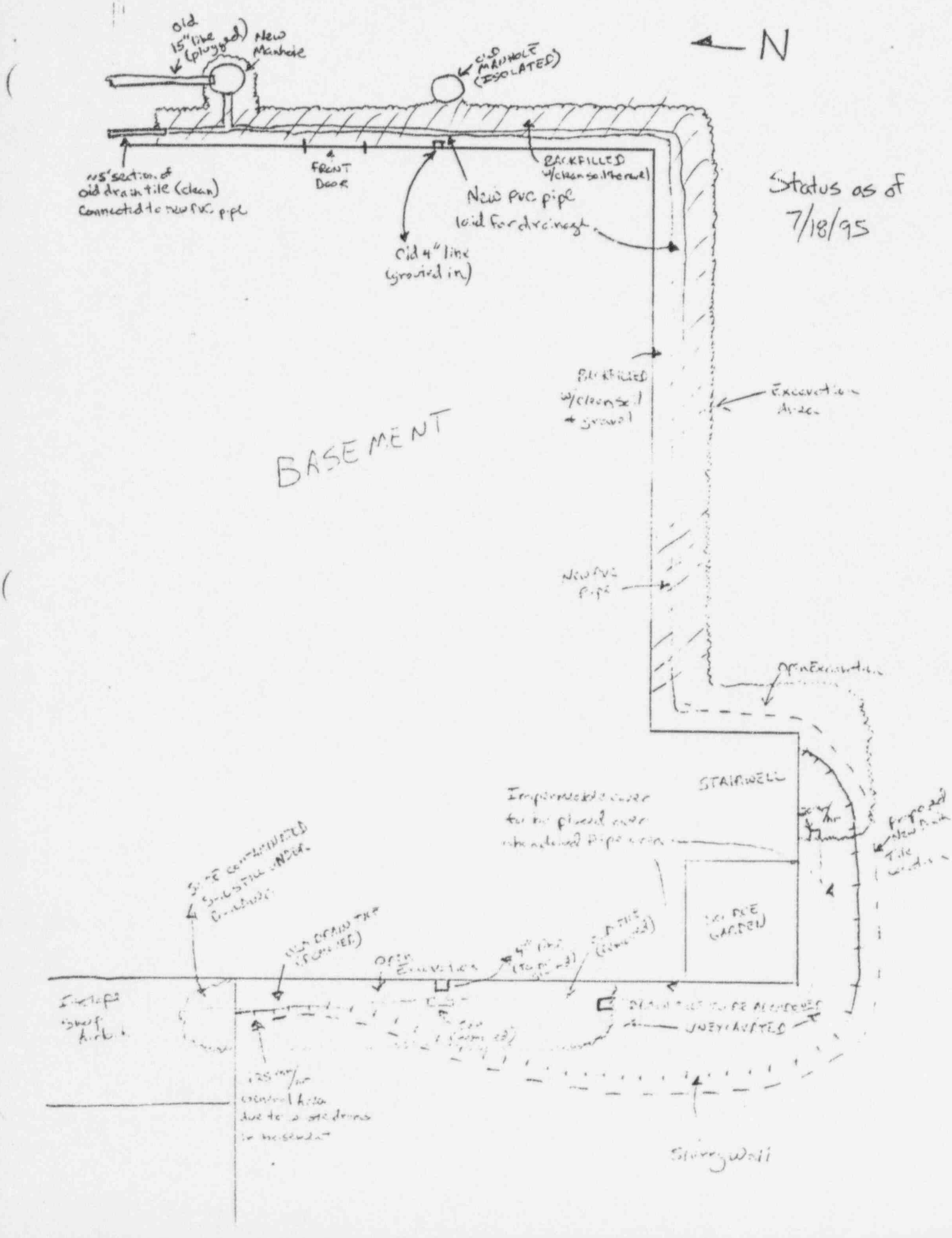
R Meschter 7-20-95

Robert Meschter, RSO

cc: D. Cesar
D. A. Miller, Esq., Stavole & Miller

Chris Reed Signing for R. Meschter

ATTACHMENT 1 - SKETCH OF CURRENT STATUS OF SITE



Old 15" line (plugged)
New Manhole
Old MANHOLE (ISOLATED)
N
15' section of old drain tile (clean) Connected to new PVC pipe
FRONT DOOR
BACKFILLED w/clean soil material
New PVC pipe laid for drainage
Status as of 7/18/95
Old 4" line (grouted in)
BACKFILLED w/clean soil + gravel
Excavation Area
BASEMENT
New PVC pipe
Open Excavation
STAIRWELL
Proposed New Drain Tile
GARDEN
Open Excavation
Stony Wall

ATTACHMENT 2 - SPECIFICATIONS FOR AV-118 DURIFLEX

Ray Bark
NE Regional mgr
800-771-1197

15 gallon
drum
metric 60 gallon
barrel
1:1 Gel time 1/2 hr

AVANTI
INTERNATIONAL

Don Roach
Technical Director

AV-118 DURIFLEX

TECHNICAL MANUAL

Acrylic Resin
Chemical Grout

AV-118 DURIFLEX
Acrylic Resin Chemical Grout

Chemical Grout for Sewer Joint Sealing and Soil, Rock and Concrete Waterproofing

1 - INTRODUCTION

AV-118 DURIFLEX is a water solution of acrylic resins. After admixture of catalysts, a cohesive gel is formed. The set time of this gel may be closely controlled from a few seconds to several hours even in flowing water.

Because the behavior of the materials can be closely controlled under these kinds of leak flow conditions, AV-118 DURIFLEX Chemical Grout is ideal for sealing leaks in sewer pipe joints and manholes. It also performs equally well when used to control water seepage in soil and rock or cracks and joints in subgrade concrete structures.

The AV-118 DURIFLEX grout solution has approximately the same viscosity as water (1 or 2 centipoises). Pumped into the cracks of rocks or voids of soils, it produces, after a controlled setting time, an elastic and cohesive gel which stops flowing water.

AV-118 DURIFLEX gel swells in the presence of water, allowing a long-lasting watertightening effect.

2 - PRESENTATION

The AV-118 DURIFLEX grouting solution is composed of:

1. AV-118 DURIFLEX
2. Gel initiator - AV-103 Sodium Persulfate
3. Gel activator - AV-101 Catalyst T+
4. Gel inhibitor - Potassium Ferricyanide (KFe)

2.1 AV-118 DURIFLEX (Liquid Form)

Appearance: slightly syrupy clear aqueous solution

Freezing point: .....–8°C (17.6°F)
Density: .....1.08 g/cm³ at 20°C (68°F)
Viscosity: .....4 centipoises at 20°C (68°F)
pH: .....about 7

2.2 AV-103 Sodium Persulfate (initiator) (PNa)

White granular oxidizing agent, highly soluble in water.

2.3 AV-101 Catalyst T+ (activator)

Appearance: .....viscous liquid
Density: .....1.12 g/cm³ at 20°C (68°F)
Solubility: .....complete in water
Flash point: .....140°C (284°F)
Melting point: .....–5°C (23°F)
Boiling point: .....198°C (388.4°F)

2.4 Potassium Ferricyanide (inhibitor) (KFe)

Appearance: .....reddish granular material
Solubility: .....33 1/3 fl. ozs. water at 40°C (104°F)

3 - PACKAGING - STORAGE

3.1 AV-118 DURIFLEX

Sold and shipped in 132-pound plastic barrels.

3.2 AV-103 Sodium Persulfate (initiator) (PNa)

Sold and shipped in 50-pound pail and/or 225-pound drum.

3.3 AV-101 Catalyst T+

3.4 Storage

The shelf life of AV-118 DURIFLEX will be 6 months at least, if stored out of sunlight at temperatures from 5°C to 30°C (41°F to 86°F).

AV-118 DURIFLEX will retain its properties if dry stored at temperatures below 30°C (86°F). AV-103 Sodium Persulfate must be kept dry (out of high humidity) and stored as a combustive material. AV-101 Catalyst T+ may be stored in the original unopened container for at least one year.

3.5 Mixing and handling equipment

Stainless steel, glass and plastic are satisfactory materials for wetted surfaces in contact with the grout solutions. Other materials should not be used. Aluminum, copper, brass and iron will promote polymerization of AV-118 DURIFLEX. Therefore, stirrers, pumps, pipes, tanks, and valves made of these materials should be avoided.

4 - FORMULATION OF GROUT SOLUTIONS

4.1 General grout formulation

Grouting solutions are ordinarily prepared by mixing AV-118 DURIFLEX with 1 to 3 parts of water by volume.

Higher concentrations of AV-118 DURIFLEX are recommended when the grout solution might become diluted by running water before gelation or when maximum strength and permanence of the treatment is required.

Generally, the two primary solutions are prepared separately before the final AV-118 DURIFLEX grouting solution is created through blending of all the separate components.

- **Solution 1:**
  - AV-118 DURIFLEX
  - a part of the dilution water
  - AV-101 CAT-T+
- **Solution 2:**
  - the other part of the dilution water
  - AV-103 Sodium Persulfate

The two primary solutions may be stored in the proper type of tank for 2 or 3 days as long as they are kept cool and out of sunlight. The grouting solution is prepared by mixing together Solution 1 and Solution 2.

4.2 Grout formulation examples: Common mixes

Usual Formulations

Dilution by 3 volumes of water.

1	Solution 1
DURIFLEX	:15 gals.
Water	:15 gals.
CAT-T+	:5± lbs.

Viscosity: 1 centipoise

2	Solution 2
Water	:30 gals.
PNa	:5± lbs.

PNa Sodium Persulfate AV-103

GS	Grouting Solution
Solution 1	:30 gals.
Solution 2	:30 gals.

AV-118 DURIFLEX MIXING INSTRUCTIONS

Technical Information

Most manufacturers of equipment used for placing AV-118 Chemical Grout have standardized on two thirty (30) gallon chemical tanks.

TANK A		TANK B	
15 gals. AV-118 15 gals. WATER 1% - 2% Cat-T+ (0.5-1 gal.) by weight (Do not exceed 2% or 1.3 gal. Cat-T+)	+	30 gals. WATER 1% - 3% SP (5-15 lbs.) by weight (Do not exceed 3% or 15 lbs.)	= 60 Gals. of AV-118 Grout Total Weight 500 lbs.

There are many catalysts and mixtures of catalysts which may be used to gel AV-118. For normal use, however, the catalyst system is composed of Cat-T+ (Triethanolamine) and SP (Sodium Persulfate).

CAT-T+ (TEA) AV-101

1. Cat-T+ is a heavy syrup-like liquid. It is the chemical which is most commonly used as the activator in the polymerization reaction of the chemical grout.

2. Cat-T+ is added to the tank containing the AV-118 chemical grout solution and is a catalyst element.

3. Cat-T+ is incompatible with oxidizing compounds, such as SP, and should be stored in a tightly closed container in an area isolated from other chemicals.

4. AV-101 Cat-T+ is blended with ethylene glycol to reduce its freezing temperature from 70°F to 0°F.

SODIUM PERSULFATE (SP) AV-103

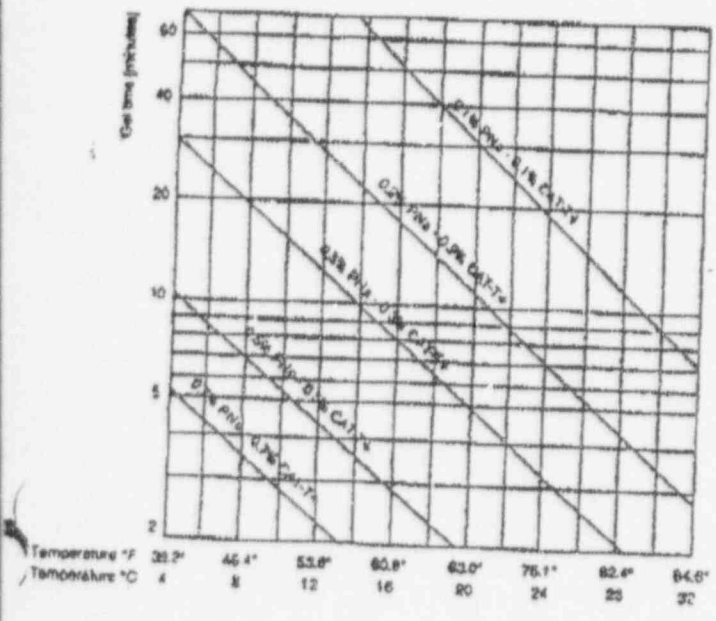
1. SP (AV-103) is a white granular material normally supplied in 225-lb. fiber drums or 50-lb. plastic pails. It is a very strong oxidizing agent. Exposure to moisture will reduce the effectiveness of the catalyst as an oxidizer.

2. AV-103 Sodium Persulfate is the initiator that triggers the polymerization reaction. It is added to the second chemical tank, pumped through its own hose, and mixed with the AV-118/ Cat-T+ solution in the mixing chamber of the sealing packer.

GEL TIME versus TEMPERATURE

Temperature °F							% of grouting solution by weight	
92°	81°	70°	59°	68°	77°	86°	PNs AV-103	CAT-T+ AV-101
–	–	–	–	60'	17'	9'	0.1	0.1
–	–	38'	20'	12'	6'	3'	0.2	0.2
–	27'	16'	9'	5'	3'	1.30'	0.3	0.3
17'	9'30"	5'30"	3'	2'	1'	1'	0.5	0.5
8'30"	5'	3'	1'30"	1'	1'	1'	0.7	0.7
4'	2'	1'30"	1'	1'	1'	1'	1	1

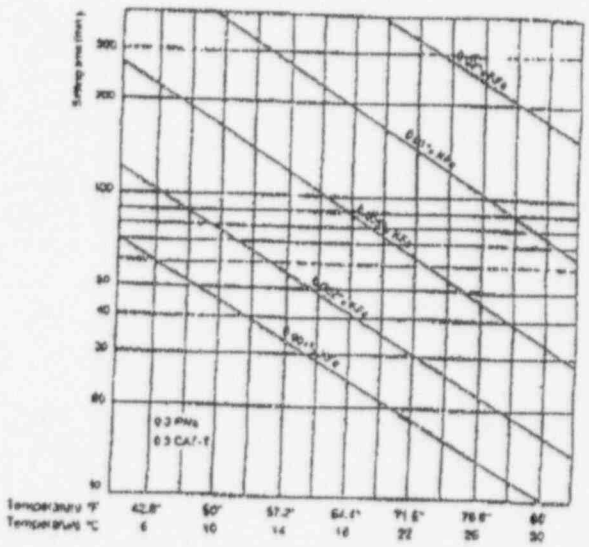
- Grouting solutions containing 25% to 50% of AV-118 DURIFLEX.
- As the density of the CAT-T+ is about 1, it is possible to assimilate the weight to the volume when preparing the solutions.



LONG GEL TIME versus TEMPERATURE

	Temperature °F						PFs
	41°	50°	59°	68°	77°	86°	% by weight
0.3 PNs	68'	46'	30'	22'	15'	10'	0.001
0.3 CAT-T	120'	75'	50'	35'	23'	15'	0.002
	260'	170'	120'	75'	50'	35'	0.005
	–	360'	250'	170'	120'	75'	0.010
	–	–	–	360'	260'	170'	0.020

- Grouting solutions containing by weight:
  - +25% to 50% of AV-118 DURIFLEX
  - -0.3% of AV-103 PNs
  - -0.3% of AV-101 CAT-T+
- As the density of the CAT-T+ is about 1, it is possible to assimilate the weight to the volume.



WARRANTY STATEMENT

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NO WARRANTY OF SUITABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS MADE.

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7.3 How to prepare the primary solutions

- **Solution 1:**

  Mix together AV-118 DURIFLEX and a part of the dilution water in a plastic or stainless steel tank. Add a suitable quantity of AV-101 Catalyst T+ (activator) and, if necessary, KFe (inhibitor for long set times) and mix again. (30 seconds is usually sufficient for mixing because the material mixes easily with water.)

- **Solution 2:**

  In a second plastic or stainless steel tank, dissolve the AV-103 PNa (initiator) in the other part of the solution water. This solution may safely be stored for some days without problems but will lose some strength over time. For this reason, it may require "sweetening" for gel time maintenance.

The grouting solution is obtained by mixing the two primary solutions together. This is the starting point of the time for the gelatin reaction.

8 - PRECAUTIONS FOR USE

Grouting with AV-118 DURIFLEX solutions should be performed only by specialists with the proper training and equipment.

8.1 Handling of AV-118 DURIFLEX

Prevent contact of the product with skin. Spills on the skin should be washed immediately with water. Additional information is located on the label and the Material Safety Data Sheet.

Empty drums should not be re-used for any purpose and should be buried when empty in an approved landfill.

8.2 Handling of the catalysts

AV-101 Catalyst T+ is not particularly dangerous but must not be ingested.

AV-103 PNa is a strong oxidizing agent and should be handled by operators wearing protective equipment.

KFe requires some special handling precautions and should not be ingested.

Catalysts must not be added directly to the non-diluted solution of AV-118 DURIFLEX. Catalysts also should never be allowed to come directly together outside of the grout mix, especially in their non-diluted forms.

8.3 Handling of AV-118 DURIFLEX grout solutions

Prevent the contact of the grouting solutions with skin or clothing. Should such contact occur, the skin should be washed with water and clothing changed.

8.4 Protective equipment

Operators preparing and injecting AV-118 DURIFLEX solution should wear waterproof trousers and coats, protective glasses, and rubber boots and gloves. Running water for washing should be available at the sites where AV-118 DURIFLEX grout solution is prepared and injected.

8.5 Toxicity

The single dose oral LD50* of AV-118 DURIFLEX for rats has been shown by unpublished internal studies to be

AV-118 DURIFLEX when properly catalyzed, produces a gel which is essentially nontoxic.

TOXICITY CLASSIFICATION OF PRODUCTS

a) Official Journal of the EEC (European) 10/15/79 P.L. 259/20

Very toxic	LD 50 =	0-	25 mg/kg
Toxic	LD 50 =	25-	200 mg/kg
Harmful	LD 50 =	200-	2,000 mg/kg

b) U.S.A.

Very toxic	LD 50 =	5-	50 mg/kg
Moderately toxic	LD 50 =	50-	500 mg/kg
Very slightly toxic	LD 50 =	500-	5,000 mg/kg

c) Swiss

Class of toxicity	1 LD 50 =	0-	5 mg/kg
Class of toxicity	2 LD 50 =	5-	50 mg/kg
Class of toxicity	3 LD 50 =	50-	500 mg/kg
Class of toxicity	4 LD 50 =	500-	5,000 mg/kg

*LD 50 means Lethal Dose Fifty and is a calculated dose (estimated) in mg of product/kg of animal

CL 50/24H: Inhibiting concentration for 50% of the Daphines put in experiment during 24 hours. (From AFNOR Norm 90301, a test of toxicity towards a crustation of soft water.)

CL 50/24H: AV-118 DURIFLEX - 0.13%

CHEMICAL RESISTANCE OF GELS

	AV-118 DURIFLEX
WATER	GOOD
SEA WATER	GOOD
NaCl SATURATED WATER	GOOD
$(NH_4)_2SO_4$ at 2% sol.	GOOD
KCl 0.3 5% sol.	GOOD
SOAP 5% sol.	GOOD
HCl 2% sol.	POOR
H_2SO_4 2% sol.	POOR
ACETIC ACID 2% sol.	GOOD
NaOH 1% sol.	GOOD
KOH 1% sol.	GOOD
NH_3 1% sol.	GOOD
ETHYLENE GLYCOL 100%	POOR
ISOPROPANOL 100%	POOR
METHYL ETHL CETONE 100%	POOR
HEPTANE 100%	GOOD
TOLUENE 100%	GOOD
PETROL 100%	GOOD
GAS OIL 100%	GOOD
TRICHLORETHYLENE 100%	GOOD
TRICHLORETHANE (BALTANE) 100%	GOOD

* Gel continuously immersed in the chemical solution not over one year.
* Chemical resistance is better with a higher

conditions of high humidity or reimmersed in water, but the fractures formed during drying will not heal.

In dry soils or above the frost line, the addition of AV-105 Ethylene Glycol to AV-118 chemical grout in lieu of water either tank (or both) will help in retarding dehydration. The maximum amount of AV-105 Ethylene Glycol to add is 4 gallons, or 6.8% of the total mixed volume (60 gals.). Use only Ethylene Glycol supplied in plastic or plastic lined metal pails. Contact with ferrous metal may cause undesirable catalization of chemical grout in the grout side tank or in the grout hose.

5.4 Corrosiveness

Because of the oxidizing property of the Sodium Persulfate catalyst, grouting solutions are corrosive to steel. The long term effect of the gel on mild steel plate is nearly the same as that of water.

Corrosiveness can be controlled if necessary by adding 5% of a 50/50 mixture of Sodium Phosphate di and tri basic into the grout. If this is done, the balance of catalysts in the mix solutions must be readjusted because the phosphate retards the set time.

5.5 Permanence - stability

AV-118 DURIFLEX gel is resistant to attacks by fungi, alkali, diluted acids, salts and gases which are normally present in soils, rock or concrete structures.

5.6 Compressive strength (on Fontainebleau Sand)

118 DURIFLEX with 3 parts water - 130 psi (0.7 PMa)

PROPERTIES OF THE GEL

AV-118 DURIFLEX		
Properties	Concentration 25/75	Concentration 50/50
Appearance	Transparent	Transparent
Consistency	Sticky-Firm	Firm
Solubility	Insoluable in water, diluents, hydrocarbons	
Adherence	Very good	Quite good
Swelling in water	+	++
Dessication in the air	Risks of fissuration-shrinkage	
Cycle swelling dessication	Reversible	Reversible

+ : About 80% of swelling

6 - ADDITIVES FOR SPECIAL GROUTS

6.1 Increasing the viscosity

Due to its excellent low viscosity (practically the same as water), AV-118 DURIFLEX grouting solution can generally be pumped into any soil or rock formations through which water will flow.

6.2 Increased density

If required, the density of AV-118 DURIFLEX can be increased by the addition of diatomaceous earth in quantities of approximately 5% of the weight of the total mixed batch weights. Not only will the density be increased, but the compressive strength of the grout (into such applications as crushed stone bedding) will be increased as well.

AV-257 Icoset may be added to the AV-118 DURIFLEX Chemical Grout tank in lieu of water. The minimum amount of Icoset to add to the grout side tank is 5% of the total mix volume (60 gals.) or 3 gallons. Additional quantities of Icoset may be added only if the valving mechanism on the inflatable packers will tolerate it. Never add AV-257 Icoset to the Sodium Persulfate tank.

6.3 Dye in the grout solution

To trace the path of an injected solution, it may be useful to color it. The recommended dye for this purpose is TADCO Tracer Water Soluble Dyes at a concentration of 2 (.07 oz.) to 10 g. (.35 oz.) per 26 gals. of solution. This solution can be stored only one day and must remain completely out of sunlight.

7 - PREPARATION OF GROUT SOLUTIONS

7.1 Field application

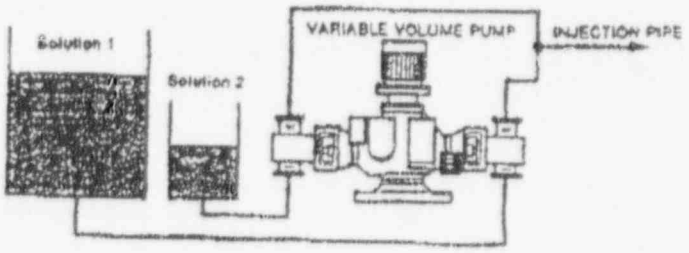
Water control with AV-118 DURIFLEX is initially accomplished through the complete filling of the pathway followed by the flowing water. It is also partly the result of the swelling of the ultimate gel in contact with water over a period of time.

For this reason, gels are not recommended for treatment of very dry grout zones or well-drained soil and rock formations. They are, however, quite good in treating zones in a wet environment or partly immersed structures such as dams, tunnels and shafts.

7.2 Method of preparation

Continuous (or twin-stream) method

A two-component positive-displacement pump should be used. The first pump feeds a defined quantity of Solution 1 in proportion to the flow of the Solution 2 being fed by the other pump. The two component streams of the product are mixed together under pressure as they are injected into the ground or the structure.



By changing the flow rate of the Solution 2 batch feeding the Sodium Persulfate solution, it is possible to vary the setting time over a wide range without changing the AV-118 DURIFLEX concentration of the grouting solution.

In these conditions the grout does not polymerize in the pump

Dilution by 1 volume of water.

1	Solution 1
DURIFLEX	:30 gals.
CAT-T+	:5± lbs.

2	Solution 2
Water	:30 gals.
PNa	:5± lbs.

Viscosity: 1 centipoise

GS	Grouting Solution
Solution 1	:30 gals.
Solution 2	:30 gals.
Total Gs	:60 gals.

4.3 Viscosity control

The DURIFLEX grout is characterized by its low viscosities (1 to 2 centipoises) which remain constant until gelation occurs. Because of this property, AV-118 DURIFLEX grout can be injected up to gelation in fine cracks or honeycombed concrete.

4.4 Gel time variables

The gel time is the period between the mixing of the two primary solutions together and gelation of the final solution. When gelation occurs, the viscosity of the grout instantly increases to yield a cohesive, transparent gel.

Gel time of the AV-118 DURIFLEX grout can be controlled by changing the catalyst ratios. The two catalysts AV-103 PNa and AV-101 Catalyst T+ are the additives which exert the primary influence on gel time. If long gel time is needed (especially when working with high temperatures) sufficient Potassium Ferricyanide inhibitor must also be added.

The gel time of AV-118 DURIFLEX grout can also be significantly influenced by the grout temperature, the pH of the grout solution, and the amount of oxygen dissolved in the grout solution.

Gel time can also be influenced by contact with particular metals, by exposure to ultraviolet rays from sunlight, or by the presence of certain mineral salts in the water used to make the grout solution.

Gel time may be closely estimated from gel time curves and tables, but final gel time which will be obtained from a given mix should be determined in the field. Tests of gel time under actual site conditions using the actual water which will be mixed with the grout are recommended.

4.4-1 Influence of temperature

Gel time for any given catalyst ratio will increase if the temperature of the grout solution decreases, and will decrease if the temperature of the solution increases. As a rough rule of thumb, the gel time is reduced by half if the temperature of the grout solution rises 10°F. This relationship is shown graphically by the charts of gel time versus temperature found at the end of this booklet.

Influence of pH

In general, as the pH of the grout solution drops, the gel time will become longer.

However, with most water supplies, the grout pH is buffered between 8 and 9 when using 0.2 to 1% AV-101 Catalyst T+ concentrations. As a practical matter, only the use of highly alkaline or acidic water will seriously influence the gel time. Under such conditions, the grout plant operator will find that gel time becomes erratic, then long and indefinite.

4.4-3 Presence of entrained oxygen in the solution

Oxygen which is entrained and dissolved during the vigorous mixing of the solutions will increase the gel time.

4.4-4 Contact with particular metals

Metals such as iron and copper have an accelerating effect on the set time of the AV-118 DURIFLEX grouting solution. The use of plastic or stainless steel tanks is recommended for mixing the grout solutions.

4.4-5 Influence of ultraviolet rays

Ultraviolet rays are strong initiators of the gelation reaction. For this reason, the AV-118 DURIFLEX solution must be kept out of direct sunlight. This would include all process equipment such as open drums, solution mixes, sight glass flow meters and pipes.

4.4-6 Presence of mineral salts

The presence of soluble salts in the grouting solution can increase or decrease gel time (sodium chloride, phosphates . . .).

4.5 Very short gel times

Gel times of a few seconds up to 1 minute can be obtained by using high ratios of PNa and AV-101 Catalyst T+.

Example of formulation:

Solution 1	
DURIFLEX	:30 gals.
CAT-T+	:2 to 10 lbs.

Solution 2	
Water	:30 gals.
PNa	:2 to 11 lbs.

If the grout solution is diluted by running water in the grout zone the gel time will be retarded, making the set time to solids formation longer. If this is undesirable, more catalyst must be added to the solution. The set time will be 2 to 4 times longer if the grout is diluted in the grout zone with an equal volume (100% dilution) of water.

5 - PROPERTIES OF THE GEL

5.1 Appearance

AV-118 DURIFLEX ..... firm and sticky

5.2 Solubility

The gel produced by AV-118 DURIFLEX is not soluble in water, solvents or hydrocarbons once it forms.

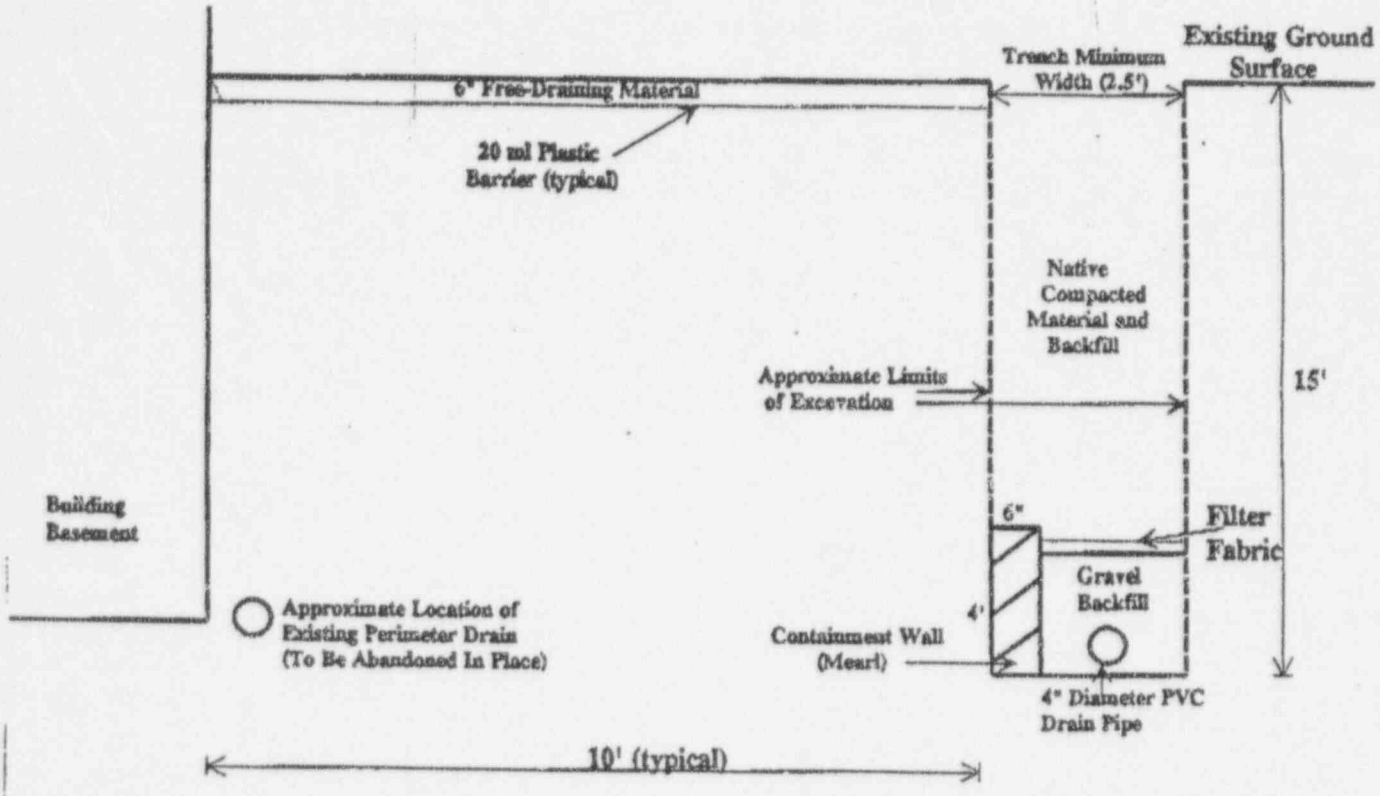
5.3 Swelling and shrinkage

The gels may swell in water up to 200% of their initial volume if unconfined. Swelling pressures are small, however, and do not exert undue pressure on the structure into which they are placed.

Inversely, if placed in areas where they may be exposed to dry conditions for an extended period, the gels may shrink due to dessication. They will swell again if returned to

ATTACHMENT 3 - SKETCH OF PLANNED CONSTRUCTION

Attach 3



CROSS-SECTION OF PROPOSED DRAIN SYSTEM

AMS LONDON ROAD FACILITY

JULY 19, 1995

Approximate Scale: 1"=5' Vertical and 1'=2.5' Horizontal

ENGINEERING • TESTING • INSPECTION
APPLIED CONSTRUCTION TECHNOLOGIES, INC.
BI-STATE • BUFFALO • CLEVELAND OHIO AREA • DETROIT

2-08-95
2-28-95 (28D)
3-28-95 (56D)

Laboratory 6534
Laboratory Report No. 18
File No. 9305.15
P.O. No.
Bldg. Permit No.
Field Report No. 454
Date of Inspection 30 January 1995
Date Cylinders in Lab 01 February 1995

GROUT INSPECTION & TESTING

CLIENT: NEORSD
PROJECT: BLUESTONE ROAD, CONTRACT NO. 1
ARCHITECT: J.D.J. AND ASSOCIATES, INC./DAWN ENGINEERING
DATA WAS REPORTED TO: (*) MR. M. CHEETHAM (NEORSD)
CONTRACTOR: SUB: PACIFIC INTERNATIONAL GROUT CO.
CONCRETE SUPPLIER: COLLINWOOD CONCRETE
FIELD CURE BOX: ☒ YES ☐ NO

CONCRETE CLASS 500 PSI NO. CU. YDS. 445 AMBIENT WEATHER: MOSTLY SUNNY 34-42°F

Indicated MIX PROPORTIONS		BRAND OR SOURCE	GENERAL POUR LOCATION
CEMENT	410/410 lbs.	MEDUSA TYPE I/FLY ASH CLASS "F"	
FINE AGG.	2254 lbs.	SAMCO SAND	
COARSE AGG.	lbs.		TUNNEL BACKFILL
ADDITIVE	oz.		A.S. NO. 7 TO A.S. NO. 8, BETWEEN STATIONS
ADDITIVE	oz.		158+94± TO 168+85± (991'±)
WATER	536 Lbs.	HEATED	
INTRUSION AID	36 Lbs.	MERLE BRAND FOAM	

* CYLINDERS CAST NOMINAL 3" DIAMETER BY 6" LENGTH

CK NO.	TIME BATCH ARRIVE DEPART	QTY. (YDS)	CYLINDER IDENTITY FIELD	CYLINDER IDENTITY LAB	SLUMP (IN.)*	AIR %	TEMP °F*	WATER ADDED (GAL.)	SPECIFIC LOCATION	(2)	COMPRESSIVE STRENGTH, PSI 28 DAYS	56 DAYS	DAYS
281	1110	8.5	1	153	---	---	81	0	UNIT WEIGHT (A.M.)		590		
			2	154					GROUT = 135.4 PCF		530		
			3	155					FOAMED = 94.4 PCF			570	
			4	156								560	
*EXTRA SET FROM A.M. SAMPLE													
281	1110	8.5	5	157	---	---	81	0	CYLINDERS 157 THROUGH 160				
			6	158					RETURNED TO NEORSD ON				
			7	159					02-08-95.				
			8	160									
208	1221	7	9	161	---	---	60	0	UNIT WEIGHT (P.M.)		570		
			10	162					GROUT = 134.6 PCF		450		
			11	163					FOAMED = 95.1 PCF			680	
			12	164								590	

(1) METHOD USED FOR AIR TEST (2) SPECIFIC LOCATION PRESSURE METER VOLUMETER AND OTHER (3) TYPE OF BREAK A-SPLIT B-SHEAR C-CRUSH D-CONE SHEAR

REMARKS: Grout arrived on site via ready-mix truck. Merle brand foam intrusion aid was added on site by a representative from P.I.G. Co. Sampling was performed by P.I.G. Co. The extra set, cylinders 5 through 8, will not be subject to oven dry conditions prior to compression testing per ASTM C-495.

Glenn Harrah, Field Technician
Andrew Wozniak, Field Technician
Rabih Wakim, Field Technician

cc: NEORSD, M. Cheetham ✓
NEORSD, Mr. Vasulka
Kassouf Co., R. DiPuccio
Dawn Engineering

GEORGE WORTHAM, ACT

THE MEARL CORPORATION

Pacific International Grout Company works closely with The Mearl Corporation, located in Roselle Park, New Jersey, to develop products for geotechnical applications. For over 40 years, The Mearl Corporation Foam and Chemicals Division has been of service to the cellular concrete industry and is recognized by the construction industry worldwide for its technical expertise and product performance. Division General Manager Harold Himansky heads a staff of highly qualified professionals who are actively engaged in establishing industry standards set by the industry's leading technical societies.

Mearl Geocell

Mearl Geocell is a rigid cellular structure composed of hydrated portland cement in which air voids are uniformly distributed as small, homogeneous, non-interconnected cells. It is a concrete where air is the aggregate. The air content may be varied to produce densities from 20 pcf to 120 pcf with compressive strengths from 20 psi to over 2,500 psi. The air cells are introduced into the cement slurry by means of a separately generated stable, microbubbled, aqueous foam. Simple, calibrated equipment combines water, compressed air and Mearl's Foam Liquid Concentrate in fixed proportions to produce up to 40 cfm of preformed foam.

Mearl Geocell is manufactured at the job site by mixing a portland cement slurry, with or without fine aggregate such as flyash or sand, with Mearl's pregenerated aqueous foam. When the cement paste surrounding each air void or cell hardens, the foam is stabilized and cellular concrete is created.

The high duality of Mearl's pre-generated foam enables Mearl Geocell to withstand vigorous mixing and pumping long distances to the point of placement.

Advantages of Mearl Geocell include:

- Low Cost
- Places easily by pump
- Flows a long way — high slump
- Positive Fill
- Lightweight
- Insulating
- May be designed for almost any compressive strength
- Environmentally Safe - Non-Hazardous & Non-Polluting
- Rapid Installation
- Non-Corrosive
- Excellent freeze/thaw resistance
- Excellent shock absorber
- Requires less burnishing

Technical data on Mearl Geocell is included for your information.

Properties of Cellular Concrete

Compressive Strength varies from 20psi to 2,000psi. In common with other types of concrete, at constant water/cement ratio the compressive strength of cellular concrete will vary with the cement factor so long as the density is held constant. Therefore, at a given final density, the strength can be increased simply by increasing the cement content prior to adding the foam. At any given proportion of cement, aggregate and water, the compressive strength varies directly with density or inversely with the foam content.

Thermal Conductivity or "k" factor, varies only with density. Data information which illustrates the quantitative relationship is included in this document.

Drying Shrinkage. As with all concretes, the drying shrinkage increases with the cement factor. For low density insulating concretes used in roof decks and lightweight fills, this is about 0.2 to 0.6%. The higher density concretes in the 100 pcf range have a drying shrinkage of about 0.06%, again depending somewhat on the cement factor, the fineness modulus of the sand, the type of aggregate and the water/cement ratio.

Modulus of Elasticity. The modulus of elasticity, E_c is the modulus at 0.5 f'_c that is at one half the compressive strength. In lieu of test data for any given mix it may be calculated by means of the formula (from ACI-318) $E_c = 33w^{1.5}\sqrt{f'_c}$ 0.5 in which w is the oven dry density of the concrete.

Thermal Expansion. The linear coefficient of thermal expansion is similar to that for steel, between 5 and 7 x 10^{-6}, so that it may be reinforced in the same manner as conventional concrete, using mesh, reinforcing bars or proprietary embossed galvanized steel forms.

Durability. In freeze/thaw stability, cellular concretes show markedly superior durability for either precast or cast-in-place wall construction. The low density material has also been tested at extremely low temperatures for cryogenic applications and will withstand thermal shock with liquid nitrogen. When used for light residential pavements or sidewalks, cellular concrete at densities of 100 pcf have proven far more resistant to the effect of salts than conventional sand and gravel concretes.

SPECIFICATIONS: Mearl Geofoam Liquid

Mearl Geofoam Liquid is an aqueous concentrate of a surface active Polypeptide-Alkylene polyol condensate, specially formulated to yield a tough, stable, voluminous microbubbled foam. The foam is used for producing cellular lightweight concrete and cement slurries used for replacement of unstable soils, density controlled load relief, void fills and similar geotechnical applications.

No harmful effect to the Mearl Geofoam Liquid is sustained by exposure to temperature extremes. It is completely stable to repeated freeze-thaw cycles and is readily restored to its original fluid condition by storing for a short period at ambient working temperatures.

Mearl Geofoam Liquid is compatible with many com-