WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary
Gloria L. McCutcheon, Regional Director

Southeast Region
Milwaukee Service Center
2300 N. Dr. ML King Drive, PO Box 12436
Milwaukee, Wisconsin 53212-0436
Telephone 414-263-8500
FAX 414-263-8716
TDD 414-263-8713

June 24, 2004

Sunrise Milwaukee, LP
c/o Great Lakes Companies, Inc.
Attn: Mr. Marc Vaccaro
Tenth Floor
122 West Washington Avenue
Madison, Wisconsin 53703

SUBJECT: Clarification of May 20, 1998 closure letter. FID#241828620; BRRTS#02-41-001158 and 03-41-099853.

Dear Mr. Vaccaro:

At the request of your environmental consultant, Natural Resources Technology, we have revisited the our May 20, 1998, closure letter for the Sunrise Plaza West property located at 1009 Marquette Avenue. In that closure letter, it states that the department closed the former underground storage tank located on the property. However, in this letter we failed to mention the status of the aboveground storage tank (AST).

Based on our review, we have determined that the contamination association with former AST has been investigated and remediated to the extent practicable under site conditions. Therefore, we consider the investigation and remediation of this area closed under s. NR 726.05, Wisconsin Administrative Code (WAC). As always, the department reserves the right to reopen this case pursuant to s. NR 726.09, WAC, should additional information regarding site conditions indicate that contamination on or from the site poses a threat to public health, safety or welfare or the environment.

We appreciate the efforts you have taken to restore the environment at this site, and apologize for any inconvenience our over-sight may have caused you. If you have any questions regarding this letter, you may contact me at the above address or at (414) 263-8589.

Sincerely,

Gina Keenan
Hydrogeologist

cc: NRT
SER case file

MilW Co. ERP 241 828 620

Thompson, Michael C

From: Ferguson, Scott J
Sent: Tuesday, June 01, 1999 10:06 AM
To: Schultz, Frank C; Ebersohl, Walter A; Thompson, Michael C
Cc: Ferguson, Scott J
Subject: "Buried drums" complaint, South Milwaukee

On Thursday, May 27, 1999, Frank Schultz received a complaint that excavators who were working adjacent to the Sunrise Shopping Center located in South Milwaukee were excavating buried drums. Frank asked me to respond to the complaint. I called the complaintant, Chuck Neuman (ph. 414-571-9537), and he said he was contacted by a friend who observed excavators uncovering buried drums and moving around contaminated soil which smelled petroleum-like. Mr. Neuman said his friend called Neuman because Neuman is a known environmentalist in the area.

The site is located between the Sunrise Shopping Center (1009 Marquette Ave.) and the South Milwaukee Fire Department Building. When I arrived at the site, no workers were present. I noted that the area was being excavated for development and that concrete building foundation footers had already been poured. I walked the entire site and entered areas which had been excavated for future foundation footers. I noted that there was no visible evidence of waste being excavated or soil contamination (e.g., the excavated sidewalls and base consisted of soil, not fill, not waste).

I observed one construction truck at the site. The truck had license plate number DG 16055 and was labeled as "Donovan Construction, Fond du Lac, phone 920-929-6464).

Along the northwest corner of the construction site, I observed an area of stockpiled soil and two 55-gallon drums. The stockpiled pile soil appeared to be mostly muck which had an organic (swampy) smell. The two 55-gallon drums were empty and labeled with the following information: DNR SER RR Program, 29 Jan. 1999, ~ 2400 S. 10th Ave., So. Milw., Empty. [See photos, below].

Conclusion
Mike Thompson labeled these two empty drums on January 29, 1999. Mr. Neuman's friend saw the excavators, saw the drums, smelled the muck soils, and assumed that the excavators uncovered the drums and stockpiled the contaminated soil. Someone transported the drums from 2400 South 10th Ave. to 1009 Marquette Ave. site (a distance of about 2 blocks). I called Donovan Construction and spoke the foreman (Pat) for the site. Pat told me that the drums "just appeared" at the site one day and that the excavator (Naus) did not excavate the drums.


Photo000.jpg


Photo001.jpg


Photo002.jpg


Photo003.jpg


Photo004.jpg

NEVAC, INC.

COMMERCIAL REAL ESTATE ACQUISITION, DEVELOPMENT, LEASING & BROKERAGE

August 3, 1995

Ms. Margaret Graefe
c/o ERR/ERP
Wisconsin Department of Natural Resources
P O Box 12436
Milwaukee, WI 53212

Re: File Ref: FID #241828620
ERR/ERP

Dear Margaret:

Per our conversation today, I am requesting an extension on the August 11, 1995 deadline noted in the correspondence from Julie Hanrahan dated July 11, 1995 regarding consultant selection and plan submission. We are still in the process of selecting a consultant and will be unable to meet the aforementioned deadline. We will expedite matters and submit the necessary information promptly.

Thank you for your cooperation with this matter. Please contact me with any further questions or directions.

Very truly yours,

Nevac, Inc.

Barrie L. Springhetti
Vice President
Property Management

c: Katherine Juno, Natural Resource Technology

Corporate Offices
700 Regent Street, Suite 300
Madison, Wisconsin 53715
(608) 251-6400 FAX: (608) 251-6800

Property Management (Milwaukee Properties)
4455 West Bradley Road, Suite 204
Brown Deer, Wisconsin 53233
(414) 365-9056 FAX: (414) 365-9057

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Southeast District - Annex Building
Post Office Box 12436
4041 N. Richards Street
Milwaukee, Wisconsin 53212
TELEPHONE: 414-229-0800
TELEFAX #: 414-229-0810

July 11, 1995

File Ref: FID #241828620
ERR/ERP

Ms. Barrie Springhetti
NEVAC, Inc.
4455 West Bradley Road
Milwaukee, WI 53223

SUBJECT: Reported Contamination at Sunrise Plaza West, 2410-2424 10th Avenue, South Milwaukee

Dear Ms. Springhetti:

The Wisconsin Department of Natural Resources (WDNR) was notified on June 26, 1995 that soil contamination was discovered at the subject property during an environmental assessment conducted in 1988. The *Phase II Environmental Site Reconnaissance*, dated October 10, 1988, prepared by STS Consultants, documents Total Petroleum Hydrocarbons (TPH) and benzene in the soils at levels that exceed State Ch. NR 720 soil cleanup standards.

Based on the information received by the Department of Natural Resources, we believe NEVAC, Inc. is responsible for restoring the environment at this site under Section 144.76, Wisconsin Stats., known as the hazardous substances spills law. Utilizing information submitted to the Department, this case has been assigned to a lower priority ranking group.

WDNR SE District Review Prioritization Policy

Due to the WDNR workload, it is necessary to rank all contamination cases for review priority. The highest priority sites have assigned WDNR project managers who are actively reviewing and approving investigation and remediation plans. Lower priority cases do not always have assigned WDNR project managers, however, responsible parties are required to proceed with investigation and clean-up efforts. Based on the information currently known about this site, the WDNR has assigned it a lower priority status. Although your case will not likely receive direct WDNR oversight, you should proceed to submit all reports, as well as quarterly status updates, to this office. The WDNR will notify you if active oversight is to be given to your site.

Your responsibilities include investigating the extent of the contamination and then selecting and implementing the most appropriate remedial action. Enclosed is information to help you understand what you need to do to ensure your compliance with the spills law.

The purpose of this letter is threefold: 1) to describe your legal responsibilities, 2) to explain what you need to do to investigate and clean up the contamination, and 3) to provide you with information about cleanups, environmental consultants, possible financial assistance, and working cooperatively with the Department of Natural Resources.

Legal Responsibilities:
Your legal responsibilities are defined both in statute and in administrative codes. The hazardous substances spill law, Section 144.76 (3) Wisconsin Statutes, states:

* RESPONSIBILITY. A person who possesses or controls a hazardous substance which is discharged or who causes the discharge of a hazardous substance shall take the actions necessary to restore the environment to the extent practicable and minimize the harmful effects from the discharge to the air, lands, or waters of the state.

Wisconsin Administrative Codes chapters NR 700 through NR 728 establish requirements for emergency and interim actions, public information, site investigations, design and operation of remedial action systems, and case closure. Chapter NR 708 includes provisions for immediate actions in response to limited contamination. Wisconsin Administrative Code chapter NR 140 establishes groundwater standards for contaminants that reach groundwater.

Steps to Take:
The longer contamination is left in the environment the farther it can spread and the more it may cost to clean up. Quick action may lessen damage to your property and to neighboring properties and reduce your costs in investigating and cleaning up the contamination. To ensure that your cleanup complies with Wisconsin's laws and administrative codes, you should hire a professional environmental consultant who understands what needs to be done. These are the first three steps to take:

1. By August 11, 1995, your consultant must submit a workplan and a schedule for conducting the investigation. The consultant must follow the Department's administrative codes and our technical guidance documents. Please include with your workplan a copy of any previous information that has been completed (such as an underground tank removal report or a preliminary soil excavation report).

2. Please keep us informed of what is being done at your site. You or your consultant must provide us with a brief report at least every 90 days, starting after your workplan is submitted. These quarterly reports should summarize the work completed since the last report. Quarterly reports need only include one or two pages of text, plus any relevant maps and tables. However, please note that should conditions at your site warrant, you may receive a letter requiring more frequent contacts with the Department.

3. When the site investigation is complete, your consultant must submit a full report on the extent and degree of soil and groundwater contamination and a proposal for cleaning up the contamination.

Due to the number of contaminated sites and our staffing levels, we will be unable to respond to each report. To maintain your compliance with the spills law and chs. NR 700 through NR 728, do not delay the investigation and cleanup of your site by waiting for DNR responses. We have provided detailed technical guidance to environmental consultants. Your consultant is expected to be familiar with our technical procedures and administrative codes and should be able to answer your questions on meeting Wisconsin's cleanup requirements.

Your correspondence and reports regarding this site should be sent to the Department at the following address:

Ms. Margaret Graefe, c/o ERR/ERP, Wisconsin Department of Natural Resources,
4041 North Richards Street, P.O. Box 12436, Milwaukee, Wisconsin 53212

Unless otherwise requested, please send only one copy of all plans and reports. Correspondence should be identified with the assigned DNR facility identification number (FID#, ERR/ERP) which is listed at the top of this letter.

Information for Site Owners:
Enclosed is a list of environmental consultants and some important tips on selecting a consultant. If you are eligible for reimbursement of costs under Wisconsin's PECFA program (see last paragraph) you will need to compare at least three consultants' proposals before hiring a consultant. Consultants and laboratories working in the PECFA program are required to carry errors and omissions insurance to help protect you against unsuitable work. Also enclosed are materials on controlling costs, understanding the cleanup process, and choosing a site cleanup method. This information has been prepared to help you understand your responsibilities and what your environmental consultant needs to do. Please read this information carefully.

If you are interested in obtaining the protection of limited liability under s. 144.765, Stats., please contact Mark Giesfeldt at (608) 267-7562 or Darsi Foss at (608) 267-6713, in the Department of Natural Resources' Madison office for more information. The liability exemption under s. 144.765. Stats., is available to persons who meet the definition of "purchaser" in s. 144.765(1)(c) and receive Department approval for the response actions taken at the property undergoing cleanup. The Department will determine eligibility for this program on a case-by-case basis, prior to the "purchaser" developing a scope of work for conducting a ch. NR 716 site investigation at the property.

Financial Information:
Reimbursement from the Petroleum Environmental Cleanup Fund (PECFA) is available for the costs of cleaning up contamination from eligible petroleum storage tanks. The fund is administered by the Department of Industry, Labor, and Human Relations (DILHR). Please contact DILHR at (608) 266-2424 for more information on eligibility and regulations for this program.

If you have any questions about this letter or your responsibilities, please call me at (414) 229-0801.

Thank you for your cooperation.

Sincerely,

Julie Hanrahan

Julie Hanrahan
Program Assistant

Enclosures: Selecting an Environmental Consultant
Environmental Services Contractors List
Cleanup Process for the Emergency and Remedial Response Program
Quarterly Updates for Cleanup of Contaminated Properties
Cleanup Methods for Petroleum-Contaminated Soil and Groundwater
Wisconsin Administrative Code NR 700 Outline

c: SED Casefile
Ms. Katherine Juno, Natural Resource Technology, Inc., 21005 West Watertown Road, P.O. Box 623, Brookfield, WI 53008-0623

FILE NOTE

Facility/Company Name	Location (Address or 1/4 1/4)	City, State, Zip Code
SUNRISE PLAZA	2410 - 2424 10TH AVE	SOUTH MILWAUKEE

Facility Type	District	County	Contact Method	Date	Time (24-Hour Clock)
		41	☒ Telephone ☐ In-Person	07 (M M) 11 (D D) 95 (Y Y)	1000

Facility Representative Contacted	Title or Position of Representative	Telephone Number (include area code)
KATHERINE JUNO	CONSULTANT	414 - 798-9696

At the consultants request, called Ms. Juno to let her know that this is a lower priority site for the WDNR. Also requested the RPs address to send RP letter, w/ copy to her.

RP Ltr to: Ms Barrie Springhetti
NEUAC, INC
4455 W Bradley Rd
Milwaukee, WI 53223

Check if additional sheets attached ☐

By Linda Mitchell

SUNRISE PLAZA WEST
2410-2424 10TH AVE
SOUTH MILWAUKEE

Site Screening Worksheet

Answering yes to any of the questions below indicates the site has a high potential of causing or threatening to cause environmental pollution (mark yes in Box V. on form 4430-4).

1. Evidence (attributable to site) of groundwater within 1200 feet exceeding a preventive action limit (PAL) for any substance of public health concern or public welfare concern listed in ss. NR 140.10 and 140.12. — Yes [] No [X]

2. Evidence (attributable to site) of surface water within 1200 feet exceeding water quality standards contained in chs. NR 102, 103 and 104. — Yes [] No []

3. Evidence (attributable to site) of air within 1200 feet exceeding air quality standards contained in chs. NR 400 to 499. — Yes [] No []

1988 REPORT:
Former coal storage fac.
Former bulk ASTs

4. Qualitative analysis of: Size of site, depth to groundwater, surface and underlying soils, distance to nearest private or public water supply, population within ½ mile, type or characteristics and volume of waste, proximity to protected natural resources or environments, or any other appropriate factors. Some examples:

Highest PIDs in B-5

TPH 2199 ppm B-3 (1-2')
7830 ppm B-4 (.5-2')
467 ppm B-5 (2.5-4')

Ba 8.1 ppb B-4 (.05-2')
+ PAHs

GW estimated at 5-10' bgs

   a. Waste disposal area is less than 5 acres and nearest water supply used for human consumption is within 600 feet.

   b. Waste disposal area is between 5 and 10 acres and nearest water supply used for human consumption is within 1200 feet.

   c. There is insufficient (less than 5 feet) confining layer of silt or clay separating the bottom of the site from bedrock or groundwater table.

   d. There is a significant amount of hazardous material at the site.

   e. There is a protected natural resource or environment nearby.

Based on the above, is there a reason to believe the environment and/or public health is at risk of contamination at this site? — Yes [] No [X] Unknown []

If Yes, then site shall be classified High Potential under ss.144.442 or ss.144.76. Unanticipated environmental consequences at a landfill fall under ss.144.442. Most other significant releases of hazardous materials fall under 144.76. — ss.144.442 [] ss.144.76 []

7/7/95

Natural
Resource
Technology, Inc.

N R T

June 21, 1995
(1098)

JUN 26 1995

Ms. Giselle Red
Wisconsin Department of Natural Resources
4041 N. Richards Street
P.O. Box 12436
Milwaukee, WI 53212

RE: Sunrise Plaza West, 2410 to 2424 10th Avenue, City of South Milwaukee, Wisconsin

Dear Ms. Red:

Please find attached a copy of a Phase II Environmental Site Reconnaissance conducted by STS Consultants, Ltd. (STS) at the referenced facility in October 1988 on behalf of Republic Savings. The subject property was owned by Frank and Joseph Crivello at the time the investigation was conducted. It is apparent that the impacts identified by STS were not previously reported to WDNR by either Republic Savings or the Crivellos'. This report is being transmitted to the Wisconsin Department of Natural Resources (WDNR) on behalf of the current property owner, NEVAC, Inc. in accordance with Ch. 144.76 W.A.C., as formal notification of evidence of a petroleum release on the subject property.

The attached report indicates that total petroleum hydrocarbons (TPH) were detected at a concentration of 467 parts per million in the area of former aboveground storage tanks. TPH levels as high as 7,830 ppm were detected in another area of the site. Measurable levels of VOCs and PAHs were also detected in soil samples collected by STS. NEVAC, Inc. wishes to initiate investigation of the observed impacts upon confirmation of eligibility for PECFA reimbursement by the Department of Industry, Labor and Human Relations (DILHR). We request that WDNR advise us of the priority ranking of this site so that NEVAC, Inc. may proceed with further evaluation of this property.

21005 W. Watertown Road, P.O. Box 623 • Brookfield, WI 53008-0623 • (414) 798-9696 • Fax (414) 798-9595

Your attention to this matter would be most appreciated. Please do not hesitate to contact us if questions arise on the above or if we can be of further assistance in any way.

Sincerely,

NATURAL RESOURCE TECHNOLOGY, INC.

Katherine M. Juno, P.G.
Senior Geologist

Robert J. Karnauskas, P.G., P.HG.
Principal Hydrogeologist

Enc.

cc: Ms. Barrie Springhetti, NEVAC, Inc. (w/o enc.)
Mr. Marc Vaccaro, NEVAC, Inc. (w/o enc.)
Mr. David Crass, Michael Best & Friedrich, S.C. (w/o enc.)

W:\1098DNR.LTR

STS Consultants Ltd.
Consulting Engineers

Phase II Environmental Reconnaissance

Sunrise Shopping Center
South Milwaukee, Wisconsin

Republic Savings

REPORT

STS Consultants Ltd.
Consulting Engineers

11425 West Lake Park Drive
Milwaukee, Wisconsin 53224
(414) 359-3030

October 6, 1988

Ms. Dana Endlich
Republic Savings
500 West Brown Deer Road
Milwaukee, Wisconsin 53217

RE: Phase II Environmental Reconnaissance, Sunrise Shopping Center, South Milwaukee, Wisconsin -- STS Project No. 82666XF

Dear Ms. Endlich:

We have completed the field and laboratory work as well as the engineering analysis for the above-referenced project. Our services were outlined in our proposal (STS Proposal No. 01563MP) dated July 7, 1988. The attached report presents the results of the field and laboratory testing, as well as our procedures and a discussion of the results.

We have appreciated this opportunity to provide engineering and testing services for you. If you have any questions with regard to the attached report, or if we can be of further assistance in any way, please feel free to contact us.

Respectfully,

STS CONSULTANTS, LTD.

Michael D. Frede, P.E.
Project Engineer

Thomas W. Wolf, P.E.
Principal Engineer

MDF/kw
Attachments

Report

Project

PHASE II ENVIRONMENTAL RECONNAISSANCE
SUNRISE SHOPPING CENTER
SOUTH MILWAUKEE, WISCONSIN

Client

MS. DANA ENDLICH
REPUBLIC SAVINGS
500 WEST BROWN DEER ROAD
MILWAUKEE, WI 53217

Project # 82666XF

Date October 6, 1988

STS Consultants Ltd.
Consulting Engineers

11425 W. Lake Park Drive
Milwaukee, Wisconsin 53224

(414) 259-7030

TABLE OF CONTENTS

REPORT SUMMARY

A Phase II Environmental Reconnaissance was conducted on the Sunrise Shopping Center property in South Milwaukee, Wisconsin. A Phase I environmental reconnaissance was previously conducted on this property and concluded that there is the potential for contamination to exist from past site uses. The purpose of this Phase II study was to detect the presence of contamination, if it exists, in the areas most likely impaired. The scope of our services consisted of drilling five (5) test borings on the site. The recovered soil samples were subjected to visual and olfactory analysis, and were screened with a photoionization detector (PID) to detect the presence of chemical contamination. Analytical tests to verify the presence of selected contaminants were also conducted on several soil samples.

The results of the field and laboratory testing indicated that there is some contamination of the near surface soils by polynuclear aromatic hydrocarbons (PNA's) in the area where coal was formerly stored. In addition, some near surface contamination by what appeared to be gasoline was also noted in the vicinity of Boring B-4. Finally, in the area of Boring B-5, apparent fuel oil contamination of the soils was detected to a depth of about 7 feet.

Although contamination was detected, it is our opinion that the significance of the impairment is not sufficient to warrant remediation. However, all the data collected during the Phase I and Phase II studies will need to be submitted to the DNR for review to receive final approval.

The attached report presents detailed discussions of our services, as well as the conclusions and recommendations derived from our services.

Project Overview

PHASE II ENVIRONMENTAL RECONNAISSANCE
SUNRISE SHOPPING CENTER
SOUTH MILWAUKEE, WISCONSIN

PROJECT OVERVIEW

Project Description

The property where the environmental reconnaissance services have been conducted is approximately 8.2 acres in size, located on the south side of Marquette Avenue in South Milwaukee, Wisconsin. The property is presently developed with three (3) individual retail shopping structures and two (2) restaurants. The existing site features are indicated on Figure 1, included in the Appendix.

STS previously conducted a Phase I environmental reconnaissance on this site (STS Project No. 82611XF, dated July 7, 1988). Phase I consisted of development of the site history and a reconnaissance of the property and adjacent developments. The purpose of Phase I was to evaluate the potential for environmental impairment on the site. As indicated in the conclusion of the Phase I report, there is a potential for subsurface contamination. The site history indicated that the portion of the property located on the southwest corner of Marquette Avenue and Tenth Avenue previously contained a coal storage facility. In addition, large above-ground fuel oil storage tanks were previously located on this portion of the property. Therefore, we recommended a Phase II environmental reconnaissance, which includes subsurface exploration, soil sampling, and chemical analysis of selected samples be conducted.

Scope of Work

To evaluate the subgrade conditions on this property, five (5) test borings were drilled to collect soil samples from potentially impaired areas. The locations of the test borings were selected by STS to provide an overview of the soil conditions.

After completion of the field services, a vapor analysis using a HNU Photoionization Detector (PID), as well as visual and olfactory observations were conducted on the recovered soil samples. When environmental impairment was observed in the recovered soil samples, selected samples were submitted to an analytical laboratory to verify the presence and preliminarily quantify the contaminants which would most likely exist.

Finally, an engineering review of the field and laboratory data was completed to determine if contamination was detected in our reconnaissance. Conclusions of the reconnaissance and recommendations for further action are also provided in this report.

Procedures

PROCEDURES

Subsurface Exploration Procedures

The subsurface exploration program consisted of drilling five (5) soil borings, denoted B-1 through B-5. Based on the results of the Phase I study, it was determined that there is a potential for subsurface contamination from coal derivatives and petroleum products to exist in various areas of the site. Borings B-1, B-3, and B-4 were drilled in the areas of former coal storage. Boring B-2 was drilled in the far northeastern corner of the property to detect the presence of any contamination from the migration from adjacent properties. Boring B-5 was drilled in the vicinity of two (2) former above-ground fuel oil tanks. The borings were drilled to termination depths of 15 feet below the existing site grade using hollow-stem continuous flight augers. Soil samples were obtained in the borings at 2.5 foot intervals to 10 feet and at 15 feet. The samples were obtained in general accordance with ASTM Specification D-1586, "Standard Method for Penetration Test and Split-Barrel Sampling of Soil". A brief description of this sampling method is included in the Appendix. The boring logs, which contain detailed descriptions of the materials encountered at each boring location are included in the Appendix of this report. The locations of the soil borings are illustrated on Figure 1, which is included in the Appendix.

Because soil samples were to be analyzed for chemical constituents, special decontamination procedures were used during sampling. These procedures consisted of steam-cleaning all equipment prior to conducting each test boring and also hand washing the samplers between sample recovery.

The drill crew maintained a record of the field exploration activities which documented, among other information, the general soil types and groundwater conditions observed in the borings. This information was later used by the engineer to develop the final boring logs.

Republic Savings
STS Project No. 82666XF
October 6, 1988

Laboratory Testing Procedures

Soil stratification was performed by a geo-environmental engineer on the basis of laboratory testing, field logs, and sample observations. Therefore, the stratification lines shown on the boring logs, which represent the various layers, are estimated and the transition between soil types in situ may be gradual in both the horizontal and vertical directions.

Each soil sample was visually examined by the engineer and classified on the basis of texture and plasticity in general accordance with the Unified Soil Classification system (USCS). A brief description of the USCS is included in the Appendix. The estimated group symbols according to this system of classification are indicated in parentheses following the soil description on the boring logs. Additional information regarding the preparation of the final boring logs from field logs and laboratory data is described on the sheet entitled "Field and Laboratory Procedures" which is included in the Appendix.

In addition, olfactory and visual observations of the recovered soil samples were conducted by the engineer to detect the presence of obvious chemical products in the soil samples. A vapor analysis was also conducted on the recovered soil samples. This analysis consisted of utilizing a PID equipped with a 10.2 eV lamp calibrated to Benzene to detect concentrations of Volatile Organic Compounds (VOC's) in the "head space" of each sample container. This type of analysis was used for preliminary verification of the presence of volatile petroleum products (such as fuel oil) and solvents in soil.

Based on indications of soil contamination, selected samples were submitted to an independent analytical laboratory (Radian Corporation). The analytical testing was focused on the most probable contaminants expected, such as petroleum products and derivatives of coal. The purpose of the analytical testing was to confirm and quantify the chemicals present in the soils.

All samples recovered from the borings will be retained in our Milwaukee, Wisconsin laboratory for a period of sixty (60) days after which they will be discarded unless other instructions as to their disposition are received.

Results

RESULTS

Soil Conditions

Surface materials at the five (5) test boring locations consisted of 3 to 6 inches of bituminous concrete overlying 2 to 18 inches of crushed limestone base course. Directly beneath the pavement materials, fill soils were encountered in Borings B-1, B-3, and B-4 to depths of 2 to 4 feet. This fill consisted of silty clay including occasional wood, coal, and slag fragments. At Boring B-5, the soils directly beneath the pavement materials extending to a depth of about 5 feet were classified as possible fill. These materials were also silty clays but exhibited unusual visual characteristics. Underlying the aforementioned materials, natural soils were encountered. The natural soil profile typically consisted of silty clay soils with occasional clayey silt layers. A fine sand layer was encountered in Boring B-5 below about 15.5 feet.

Dark staining was noted in the existing soil samples collected above depths of about 2 to 4 feet. In addition, a greenish hue, which may be an indication of petroleum contamination, was observed in the soils to depths of about 5.7 feet at Boring B-5. Slight to strong chemical odors were noted in the soils at Boring B-4 to a depth of about 2 feet and at B-5 to a depth of about 7 feet.

The soil profile described above is general in nature. The specific conditions encountered at each of the boring locations are indicated on the enclosed soil boring logs.

Water Table Conditions

The drill crew noted wet or near saturated soil samples during drilling and sampling at depths of 3.0 feet at Boring B-2 and 14.0 feet at Borings B-4 and B-5. These observations coincide with the existence of more granular soils and therefore, may

represent a perched groundwater condition. After the augers were removed, free water was observed at 3.5 feet at Boring B-2. Borings B-1 and B-3 were open and remained dry after completion of the drilling. Borings B-4 and B-5 also were dry, however, the soils had caved in at depths of 11.0 feet and 12.0 feet, respectively. Due to the short duration of the drilling program and the relative impermeability of the clay soils which are prominent in most borings, the borehole water levels, or lack thereof, are likely not a reliable indication of the groundwater table position.

After review of the recovered soil samples and based on the observations by the field crew, the groundwater table is believed to exist at a relatively shallow depth (5 to 10 feet) feet below the ground surface. However, fluctuations in the groundwater table are expected to occur, and the elevation of the groundwater table could rise at least seasonally. In addition, perched water is also believed to exist at shallower depths, as indicated by the drillers notations at Boring B-2.

Vapor Analysis Results

VOC's were detected in the "head space" analysis of several recovered soil samples. The following table presents the results of the vapor analysis, which are also indicated on the boring logs.

Boring No.	Sample Depth (ft)	PID (ppm)
1	0.5 to 2	0
	2.5 to 4	0
	5 to 6.5	0
	7.5 to 9	0
	10 to 11.5	0
	15 to 16.5	0
2	0 to 1.5	0
	2.5 to 4	0
	5 to 5.5	0
	5.5 to 6.5	0
	7.5 to 9	0
	10 to 11.5	0
	15 to 15.3	0
	15.3 to 16.5	0

Republic Savings
STS Project No. 82666XF
October 6, 1988

Boring No.	Sample Depth (ft)	PID (ppm)
3	0.5 to 1	0
	1 to 2	0
	2.5 to 4	0
	5 to 6.5	0
	7.5 to 9	0
	10 to 11.5	0
	15 to 16.5	0
4	0.5 to 2	6
	2.5 to 4	0
	5 to 6.5	0
	7.5 to 9	1
	10 to 11.5	0
	15 to 16.5	0
5	0.5 to 2	0
	2.5 to 4	49
	5 to 5.2	8
	5.2 to 5.7	25
	5.7 to 6.5	30
	7.5 to 9	0
	10 to 11.5	0
	15 to 15.5	2
	15.5 to 16.5	0

The Wisconsin Department of Natural Resources (DNR) in the past has utilized a threshold guideline level of 10 ppm (using a PID) when considering further testing or remediation.

The HNU Model 101 photoionization detector yields general qualitative results expressed as total parts per million for VOC's including those present in petroleum products and on the Priority Pollutant list. The results can be used to compare relative concentrations of total VOC's from one sample location to another but it does not produce a quantitative breakdown of specific VOC's present or their individual concentrations.

Republic Savings
STS Project No. 82666XF
October 6, 1988

Analytical Test Results

Because of the staining and odors noted in several samples and the detectable VOC concentrations from the soil vapor analysis, selected samples were submitted to an independent laboratory for analysis. The following table presents the results of the analytical tests. The results are also submitted on the laboratory's letterhead in the Appendix.

Parameter	B-3 @ 1 to 2 ft.	B-4 @ 0.5 to 2 ft.	B-5 @ 2.5 to 4 ft.
TPH	2199 ppm	7830 ppm	467 ppm
Benzene	N/A	8.1 ppb	ND
Toluene	N/A	5.3 ppb	ND
Ethylbenzene	N/A	15.6 ppb	ND
Xylene	N/A	25.5 ppb	1390 ppb
Athracene	206 ppb	N/A	N/A
Benzo (a) athracene	1020 ppb	N/A	N/A
Benzo (a) pyrene	770 ppb	N/A	N/A
Benzo (b) fluoranthene	815 ppb	N/A	N/A
Benzo (k) fluoranthene	224 ppb	N/A	N/A
Chyrsene	531 ppb	N/A	N/A
Fluoranthene	582 ppb	N/A	N/A
Fluorene	345 ppb	N/A	N/A
Napthalene	1080 ppb	N/A	N/A
Pyrene	943 ppb	N/A	N/A

NA - not analyzed
ND - below detection limit of 5 ppb

Only detected parameters are presented in this table.

The parameter TPH was selected because it is a general indication of the presence of hydrocarbons, such as petroleum products, oil, and greases. The laboratory noted that typical background values for TPH range from 50 to 100 ppm. The DNR commonly accepts a guideline TPH concentration of 10 ppm above background when determining the severity of the detected level. The excessive concentrations in the samples from Borings B-3 and B-4 are considered due to the presence of coal fragments in the samples, while the high level in the sample from Boring B-5 may be due to fuel oil concentration.

Analysis for the presence of VOC's was selected because of the positive detects during the vapor analysis, and also because of past storage of petroleum products on-site. The VOC analysis consisted of analyzing for the presence of 33 different compounds that are on the USEPA Priority Pollutant list in accordance with EPA method 601/602. There are, however, many VOC's not included in the analysis. The DNR does not utilize any formal or informal guideline levels when evaluating specific concentrations of VOC's in soils. These parameters were selected for analysis in order to characterize the contaminants. The presence of benzene, toluene, ethylbenzene, and xylene in the sample from Boring B-4 indicates that gasoline was probably the contaminant. The concentrations measured are considered relatively low and may be an indication that small amounts of gasoline derived from surface spills could have been the source. The presence of Xylene alone at Boring B-5 indicates fuel oil rather than gasoline. The concentration measured is considered relatively high and probably originated from the above-ground fuel oil tanks formerly located in the area.

The PNA's were selected for analysis because they can be derived from coal products and can leach from coal piles. The PNA analysis consisted of analyzing for the presence of 16 different compounds in accordance with EPA method 8310. Again, the DNR does not utilize any guideline levels for either total or individual PNA's in soils. The total PNA concentration is considered moderate when compared to possible source concentrations and other instances of contaminated soil encountered by STS personnel.

Analysis and Recommendations

Republic Savings
STS Project No. 82666XF
October 6, 1988

ANALYSIS AND RECOMMENDATIONS

The results of the laboratory testing accomplished on the recovered soil samples indicates that some impairment exists on-site from past site usage. Therefore, the DNR was contacted informally to develop an opinion regarding the significance of the measured concentrations. The DNR was provided with the general parameters and concentrations, as well as other "site specific" information, such as the approximate location of the property and soil conditions. However, no information was given to reveal the exact location or the present property owner. Their general response indicated that the TPH, VOC and PNA concentrations are significant, but the necessity for remediation would have to be determined after review of all pertinent data.

In our opinion, remediation of the contaminated soils is not warranted even though some of the soil concentrations are relatively high. The following points were considered in evaluating the site conditions.

1. The soils on-site are typically silty and clayey and are therefore, relatively impermeable. Therefore, contaminant migration is not expected to be substantial.

2. The property is developed as a shopping center, with the majority of the sites surface covered with pavements. Consequently, infiltration of surface water will be minimal, thus reducing a driving force for contaminant migration.

3. PNA's and oils are not mobile, especially in fine grained soils, and are not expected to move to significant distances.

Therefore, it is our opinion that the contaminants, as detected, will be highly attenuated to the soils and natural biodegradation will continue to reduce the contamination with time. Consequently, the impairment is not expected to influence any of the existing developments in the area. In addition, we do not believe that evaluation of the local groundwater quality or remediation is necessary. This conclusion is based on the following points.

1. The site and surrounding developments are serviced by public utilities. Therefore, the local groundwater is not utilized as a potable water source.

2. The contaminants detected have low water solubility and will not be as mobile as the groundwater.

3. It was concluded that the contaminants are not expected to migrate to significant distances. Therefore, because the past sources were in the central portion of the property, impairment of the groundwater off-site is considered unlikely.

4. The sources of the existing impairment have been removed. Consequently, natural biodegradation and dilution /flushing will continually reduce any on-site impairment of the groundwater.

We do, however, recommend that the data collected for this site be submitted to the DNR for final approval. It should be recognized that the DNR may require further evaluation of the site especially if future development on-site is proposed in the areas impaired.

STS would be pleased to assist Republic Savings & Loan or the property owner in presenting the data and our conclusions to the DNR, if requested.

General Qualifications

The conclusions presented in this report are based upon a limited scope of field and laboratory testing. The scope of our services were tailored toward only detecting the presence of petroleum products, VOC's and PNA's. In addition, the field procedures did not include monitoring or testing the groundwater for the presence of contaminants.

The results of the vapor analysis should not be construed as positive proof for the absence of petroleum products within the soils. Some petroleum products contain relatively low concentrations of VOC's, and therefore, low concentrations of some products within soil samples may not result in measurable concentrations of VOC's from a vapor analysis using a photoionization detector. The vapor analysis results are utilized as an indicator in detecting gross concentrations of petroleum products and VOC's.

Due to the limited scope of services conducted, the conclusions presented in this report should not be considered a guarantee that contamination does or does not exist within the subsoils or groundwater on this property. The conclusions are also based upon the subsurface conditions at the test boring locations relative to the geologic conditions present at the date of the field exploration. The results and conclusions submitted in this report are based upon the data obtained from these specific boring locations at the times under the conditions stated in this report. Variations in soil and groundwater conditions typically exist at moist sites between soil borings.

Appendix

APPENDIX

1. STS Changed Conditions Clause
2. Location Map
3. Soil Boring Location Diagram
4. STS General Notes
5. STS Standard Boring Log Procedures
6. Boring Logs
7. Analytical Test Results
8. STS Field and Laboratory Procedures
   - Subsurface Exploration Procedures
   - Sampling Procedures
   - Laboratory Procedures
9. STS Sampling Procedures
   - ASTM Specifications D-1586
10. STS Soil Classification System

STS Changed Conditions Clause

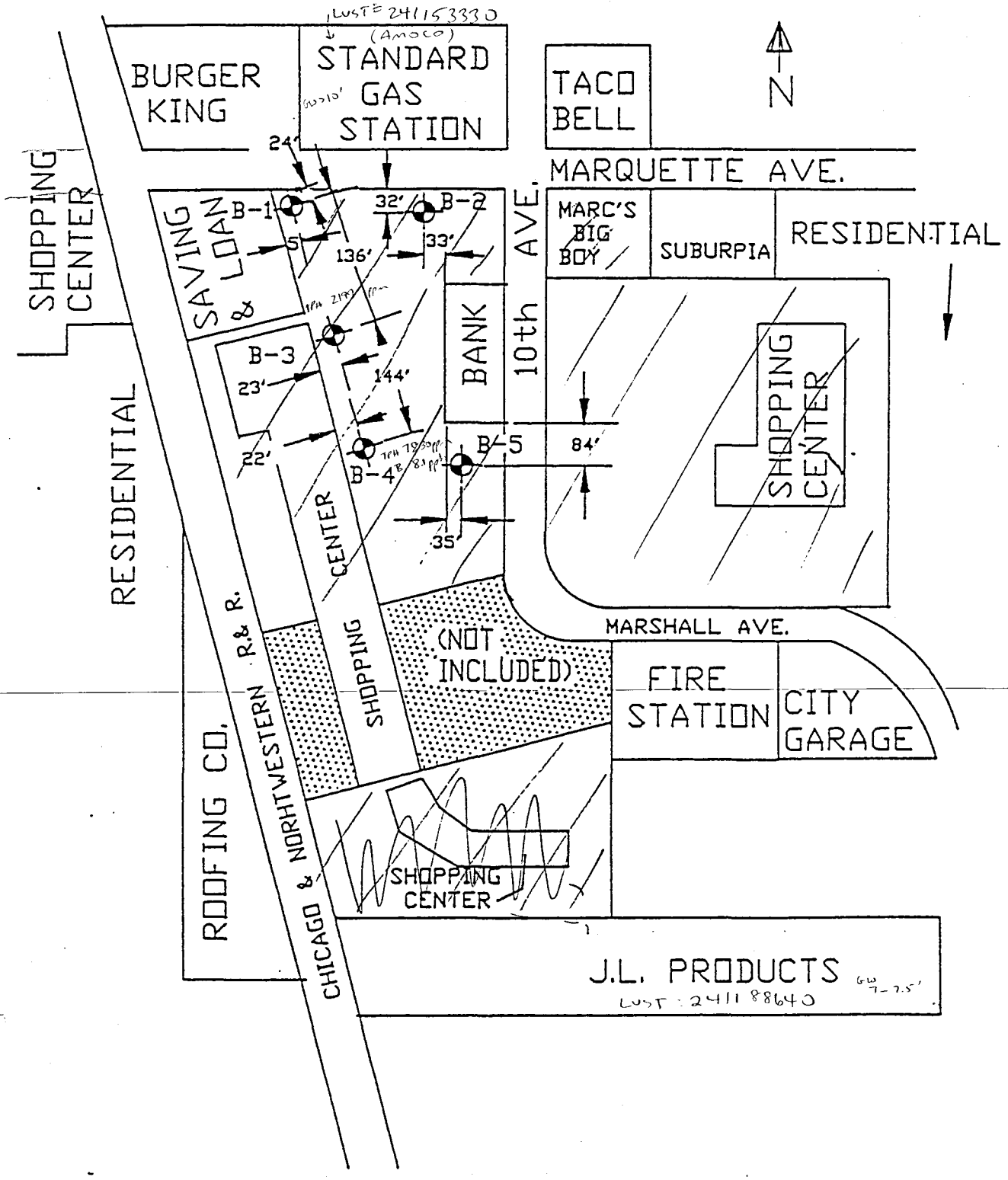
STS CONSULTANTS, LTD.

The following is a suggested standard clause for unanticipated subsurface conditions:

"The owner has had a subsurface exploration performed by a foundation consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions, as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during earthwork, paving and foundation construction operations that the contractor encounters conditions that are different than those anticipated by the foundation consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the foundation consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contractor agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and material basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.



STS Consultants Ltd.	SUNRISE SHOPPING CENTER			FIG. 1
	SOIL BORING LOCATION DIAGRAM			82666XF
	8-8-88	C.R.H.	M.D.F.	SCALE N.T.S.

STS General Notes

STS CONSULTANTS, LTD.

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon-1 3/8" I.D., 2" O.D. Unless otherwise noted
ST : Shelby Tube-2" O.D., Unless otherwise noted
PA : Power Auger
DB : Diamond Bit-NX, BX, AX
AS : Auger Sample
JS : Jar Sample
VS : Vane Shear
OS : Osterberg Sampler-3" Shelby Tube
HS : Hollow Stem Auger
WS : Wash Sample
FT : Fish Tail
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter Test, In-Situ
CS : Giddings Sampler

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WS : While Sampling
WD : While Drilling
AB : After Boring
WCI : Wet Cave In
DCI : Dry Cave In
BCR : Before Casing Removal
ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY:

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component Of Sample	Size Range	Description Of Components Also Present in Sample	Percent Of Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20-34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35-50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

CONSISTENCY OF COHESIVE SOILS:

Unconfined Compressive Strength, Qu, tsf	Consistency
0.25	Very Soft
0.25-0.49	Soft
0.50-0.99	Medium (Firm)
1.00-1.99	Stiff
2.00-3.99	Very Stiff
4.00-8.00	Hard
>8.00	Very Hard

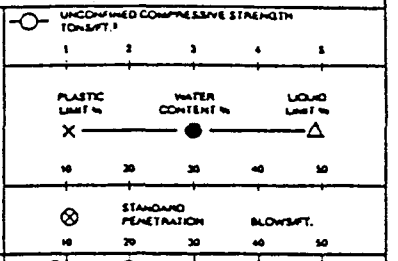
RELATIVE DENSITY OF GRANULAR SOILS:

N-Blows per ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
>80	Extremely Dense

STS Consultants Ltd.

OWNER: Republic Savings and Loan	LOG OF BORING NUMBER: B-2
PROJECT NAME: Sunrise Center - Phase II	ARCHITECT-ENGINEER
SITE LOCATION: 10th Street and Marquette, South Milwaukee	

DEPTH (FT) / ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	P.I.D. Results (ppm)
					SURFACE ELEVATION 97.1	
		HS			4" asphalt concrete over 2" crushed limestone base course	
	1	SS			Silty clay, trace fine to coarse sand, coal fragments-black-moist-stiff (CL)	0
2.5		HS				
	2	SS			Silty fine to coarse sand, trace gravel-brown-wet-medium dense (SM)	0
		HS				
5.0					Silty fine sand, trace medium to coarse sand-brown-moist-medium dense (SM)	0
	3	SS				0
	3A	SS			Clayey silt, trace fine to medium sand-gray brown-moist-stiff-medium dense (CL-ML)	
		HS				
7.5					Silty clay, trace fine to coarse sand, trace gravel-gray-moist-very stiff (CL)	0
	4	SS				
		HS				
10.0						0
	5	SS				
12.5					Clayey silt, trace fine to coarse sand, occasional fine sand seams-gray brown-moist-very stiff-medium dense (CL-ML)	
		HS				
15.0	6	SS				0
16.5	6A	SS			Fine sand, trace silt-gray-moist-dense (SP-SM)	0
					END OF BORING	
					Boring advanced 15 feet by hollow stem auger.	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 3.0'	WS OR WD	BORING STARTED 7-22-88	STS OFFICE Milwaukee		
WL	BCR ACR	BORING COMPLETED 7-22-88	DRAWN BY CH	SHEET NO. 1	OF 1
WL 3.5' AB		RIG FOREMAN CME 55/DK	APP'D BY MF	STS JOB NO. 8266XF	

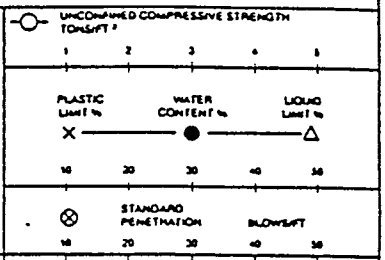
BL:J-0687

STS Consultants Ltd.

OWNER: Republic Savings and Loan	LOG OF BORING NUMBER: B-3
PROJECT NAME: Sunrise Center - Phase II	ARCHITECT-ENGINEER:
SITE LOCATION: 10th Street and Marquette, South Milwaukee	

SURFACE ELEVATION 99.2

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	P.I.D. Results (ppm)
			HS				
		1	SS			6" asphalt concrete over 1.5 feet crushed limestone base course	0
		1A	SS			Fill: silty clay, trace fine to coarse sand, trace gravel, wood, coal, and slag fragments-gray and brown and black mix-moist-stiff (CL)	0
2.5			HS				0
		2	SS				
			HS			Silty clay, trace fine to coarse sand, trace gravel-light brown slightly gray mottled-moist-very stiff (CL)	
5.0		3	SS				0
7.5			HS			Silty clay, trace fine to coarse sand, trace gravel-gray-moist-very stiff to hard (CL)	
		4	SS				0
10.0			HS				
		5	SS				0
12.5			HS				
15.0		6	SS				0
16.5						END OF BORING Boring advanced to 15 feet by hollow stem auger.	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL Dry WS OR WD	BORING STARTED 7-22-88	STS OFFICE Milwaukee	
WL BCR ACR	BORING COMPLETED 7-22-88	DRAWN BY CH	SHEET NO. 1 OF 1
WL Dry AB	RIG FOREMAN CME 55/DK	APP'D BY MF	STS JOB NO. 8266XF

BL:3-0687

STS Consultants Ltd.

OWNER: Republic Savings and Loan	LOG OF BORING NUMBER: B-5
PROJECT NAME: Sunrise Center - Phase - II	ARCHITECT-ENGINEER:

SITE LOCATION: 10th Street and Marquette, South Milwaukee

DEPTH (FT)	ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	P.I.D. Results (ppm)
						SURFACE ELEVATION 97.8	
			HS			4" asphalt concrete over 1.5' crushed limestone base course	
		1	SS				0
2.5			HS			Possible fill: silty clay, trace fine to coarse sand, trace gravel-dark green and gray and brown mottled-moist-firm to stiff (CL) (Strong chemical odor)	
		2	SS				49
			HS				
5.0		3	SS				8
		3A	SS			"A"	25
		3B	SS			Clayey silt, trace fine sand occasional fine sand seams trace roots-gray-moist-soft-medium dense (CL-ML) (Moderate chemical odor)	30
7.5			HS			Silty clay, trace fine to coarse sand, trace gravel-gray-moist-soft (CL)	
		4	SS				0
10.0			HS				
		5	SS				0
12.5			HS				
15.0							2
		6	SS				0
16.5		6A	SS			Fine sand, trace silt-gray-wet-medium dense (SP-SM)	

END OF BORING

Boring advanced to 15 feet by hollow stem auger.

"A"--Silty clay, trace fine to coarse sand, trace gravel-light green and gray and brown mottled-moist-sitff (CL) (Moderate chemical odor)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 14.0' WS OR WD	BORING STARTED 7-22-88	STS OFFICE Milwaukee	
WL BCR ACR	BORING COMPLETED 7-22-88	DRAWN BY CH	SHEET NO. 1 OF 1
WL Caved and dry AB @ 12.0'	RIG FOREMAN CME 55/DK	APP'D BY MF	STS JOB NO 82666XF

BL:J-0687

 RADIAN CORP. REPORT Work Order # M8-07-053

Received: 07/28/88 08/30/88 14:59:47

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MILWAUKEE, WI 53224

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CLIENT STS SAMPLES 3
COMPANY STS CONSULTANTS, LTD.
FACILITY 11425 W. LAKE PARK DR.
MILWAUKEE, WI 53224

WORK ID 82666XF
TAKEN DON KNOX
TRANS MIKE FREDE
TYPE SOIL
P.O. # 82666XF
INVOICE under separate cover

PREPARED Radian Corporation
BY Milwaukee Office
5103 West Beloit Road
Milwaukee, WI 53214
ATTEN Charles S. Applegate
PHONE (414)643-2768

Charles S. Applegate
CERTIFIED BY

CONTACT C_APPLEGATE

State of Wisconsin - Certified Laboratory
No. 241293910

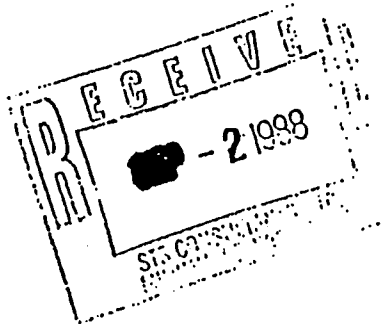
Radian Project No. 207-027-13-01

SAMPLE IDENTIFICATION

01 B-3: S-1A
02 B-4: S-1
03 B-5: S-2

TEST CODES and NAMES used on this report

EPA601 EPA601 COMPOUNDS
EPA602 EPA602 COMPOUNDS
O_G_HY OIL + GREASE, HYDROCARBON



Received: 07/28/88

Results By Test

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)
O_G_HY mg/L	2199 mg/kg	7830 mg/Kg	467 mg/kg

Received: 07/28/88
Results by Sample

SAMPLE ID B-4: S-1 FRACTION 02A TEST CODE EPA601 NAME EPA601 COMPOUNDS
Date & Time Collected 07/22/88 Category

ANALYST MM FILE # 02A
INSTRMT TRACOR INJECTD 08/02/88 FACTOR 1 UNITS ug/Kg

CAS#	COMPOUND	RESULT	DET LIMIT
74-87-3	Chloromethane	ND	5
74-83-9	Bromomethane	ND	5
75-71-8	Dichlorodifluoromethane	ND	5
75-01-4	Vinyl chloride	ND	5
75-00-3	Chloroethane	ND	5
75-09-2	Methylene chloride	ND	5
75-69-4	Trichlorofluoromethane	ND	5
75-35-4	1,1-Dichloroethene	ND	5
75-34-3	1,1-Dichloroethane	ND	5
156-60-5	trans-1,2-Dichloroethene	ND	5
67-66-3	Chloroform	ND	5
107-06-2	1,2-Dichloroethane	ND	5
71-55-6	1,1,1-Trichloroethane	ND	5
56-23-5	Carbon tetrachloride	ND	5
75-27-4	Bromodichloromethane	ND	5
78-87-5	1,2-Dichloropropane	ND	5
10061-02-6	trans-1,3-Dichloropropene	ND	5
79-01-6	Trichloroethene	ND	5
124-48-1	Dibromochloromethane	ND	5
79-00-5	1,1,2-Trichloroethane	ND	5
10061-01-5	cis-1,3-Dichloropropene	ND	5
100-75-8	2-Chloroethylvinyl ether	ND	5
75-25-2	Bromoform	ND	5
79-34-5	1,1,2,2-Tetrachloroethane	ND	5
127-18-4	Tetrachloroethene	ND	5

SAMPLE ID B-4: S-1 FRACTION 02A TEST CODE EPA601 NAME EPA601 COMPOUNDS
Date & Time Collected 07/22/88 Category

SURROGATES

74-97-5	Bromochloromethane	92	% Recovery
N\A	2-Bromo-1-chloropropane	NA	% Recovery

NOTES AND DEINITIONS FOR THIS REPORT.
DET LIMIT = DETECTION LIMIT
ND = not detected at detection limit
NA = not analyzed
* = less than 5 times the detection limit

Received: 07/28/88 Results by Sample

SAMPLE ID B-4: S-1 FRACTION 02A TEST CODE EPA602 NAME EPA602 COMPOUNDS
Date & Time Collected 07/22/88 Category

ANALYST MM FILE # 02A
INSTRMT TRACOR INJECTD 08/02/88 FACTOR 1 UNITS ug/Kg

CAS#	COMPOUND	RESULT	DET LIMIT
71-43-2	Benzene	8.1	5
108-88-3	Toluene	5.3	5
100-41-4	Ethylbenzene	15.6	5
108-90-7	Chlorobenzene	ND	5
106-46-7	1,4-Dichlorobenzene	ND	5
541-73-1	1,3-Dichlorobenzene	ND	5
95-50-1	1,2-Dichlorobenzene	ND	5
108-38-3	m-Xylene	14.5	5
Mixture	o,p-Xylene	11.0	5

SURROGATES

98-08-8	a,a,a-Trifluorotoluene	110.3% recovery

NOTES AND DEINITIONS FOR THIS REPORT.
DET LIMIT = DETECTION LIMIT
ND = not detected at detection limit
NA = not analyzed
* = less than 5 times the detection limit

SAMPLE ID B-5: S-2 FRACTION 03A TEST CODE EPA601 NAME EPA601 COMPOUNDS
Date & Time Collected 07/22/88 Category

ANALYST MM FILE # 03A
INSTRMT TRACOR INJECTD 08/02/88 FACTOR 1 UNITS ug/Kg

CAS#	COMPOUND	RESULT	DET LIMIT
74-87-3	Chloromethane	ND	20
74-83-9	Bromomethane	ND	20
75-71-8	Dichlorodifluoromethane	ND	20
75-01-4	Vinyl chloride	ND	20
75-00-3	Chloroethane	ND	20
75-09-2	Methylene chloride	ND	20
75-69-4	Trichlorofluoromethane	ND	20
75-35-4	1,1-Dichloroethene	ND	20
75-34-3	1,1-Dichloroethane	ND	20
156-60-5	trans-1,2-Dichloroethene	ND	20
67-66-3	Chloroform	ND	20
107-06-2	1,2-Dichloroethane	ND	20
71-55-6	1,1,1-Trichloroethane	ND	20
56-23-5	Carbon tetrachloride	ND	20
75-27-4	Bromodichloromethane	ND	20
78-87-5	1,2-Dichloropropane	ND	20
10061-02-6	trans-1,3-Dichloropropene	ND	20
79-01-6	Trichloroethene	ND	20
124-48-1	Dibromochloromethane	ND	20
79-00-5	1,1,2-Trichloroethane	ND	20
10061-01-5	cis-1,3-Dichloropropene	ND	20
100-75-8	2-Chloroethylvinyl ether	ND	20
75-25-2	Bromoform	ND	20
79-34-5	1,1,2,2-Tetrachloroethane	ND	20
127-18-4	Tetrachloroethene	ND	20

SAMPLE ID B-5: S-2 FRACTION 03A TEST CODE EPA601 NAME EPA601 COMPOUNDS
Date & Time Collected 07/22/88 Category

SURROGATES

74-97-5	Bromochloromethane	92	% Recovery
N\A	2-Bromo-1-chloropropane	NA	% Recovery

NOTES AND DEINITIONS FOR THIS REPORT.

DET LIMIT = DETECTION LIMIT
ND = not detected at detection limit
NA = not analyzed
* = less than 5 times the detection limit

RADIAN CORP. REPORT Work Order # M8-07-053
Received: 07/28/88
Results by Sample

SAMPLE ID B-3: S-2 FRACTION 03A TEST CODE EPA602 NAME EPA602 COMPOUNDS
Date & Time Collected 07/22/88 Category

ANALYST MM FILE # 03A
INSTRMT TRACOR INJECTD 08/02/88 FACTOR 1 UNITS ug/Kg

CAS#	COMPOUND	RESULT	DET LIMIT
71-43-2	Benzene	ND	20
108-88-3	Toluene	ND	20
100-41-4	Ethylbenzene	ND	20
108-90-7	Chlorobenzene	ND	20
106-46-7	1,4-Dichlorobenzene	ND	20
541-73-1	1,3-Dichlorobenzene	ND	20
95-50-1	1,2-Dichlorobenzene	ND	20
108-38-3	m-Xylene	2500	20
Mixture	o,p-Xylene	890	20

SURROGATES

98-08-8	a,a,a-Trifluorotoluene	MAX recovery

NOTES AND DEINITIONS FOR THIS REPORT.
DET LIMIT = DETECTION LIMIT
ND = not detected at detection limit
NA = not analyzed
* = less than 3 times the detection limit

STS CONSULTANTS, LTD.

COMMENTS: SAMPLE M8-07-053-03A HAD A STRONG GASOLINE SMELL. MANY UNCONFIRMED PEAKS WHERE PRESENT ON THE CHROMATOGRAM WHICH DO NOT MATCH WITH THE STANDARD EPA601 OR EPA602 ANALYTE LIST.

TEST CODE EPA601 NAME EPA601 COMPOUNDS

EPA method 601: Halogenated volatile organics by purge and trap GC

TEST CODE EPA602 NAME EPA602 COMPOUNDS

EPA method 602: Aromatic volatile organics by purge and trap GC

RADIAN CORPORATION

01A 82666XF B3:S1A
02A REAGENT BLANK

Client: RADIAN CORPORATION
RADIAN CORPORATION
5103 W. BELOIT ROAD
MILWAUKEE, WISCONSIN 53214

EPA METHOD 8310

Lab No: A8-08-010

RESULTS IN ug/Kg

CAS #	COMPOUND	01A	02A
208-96-8	Acenaphthalene	<8600	<8600
83-32-9	Acenaphthene	<170	<170
120-12-7	Anthracene	206*	<170
56-55-3	Benzo(a)anthracene	1020	<11
50-32-8	Benzo(a)pyrene	770	<21
205-99-2	Benzo(b)fluoranthene	815	<11
207-08-9	Benzo(k)fluoranthene	244	<8.6
191-24-2	Benzo(g,h,i)perylene	<21	<21
218-01-9	Chrysene	531	<8.6
53-70-3	Dibenzo(a,h)anthracene	<21	<21
206-44-0	Fluoranthene	582	<34
86-73-7	Fluorene	345*	<170
193-39-5	Indeno(1,2,3-c,d)pyrene	<43000	<43000
91-20-3	Naphthalene	1080	<170
85-01-8	Phenanthrene	<340	<340
129-00-0	Pyrene	943	<34

SURROGATE RECOVERIES (results in % recovery)

Decafluorobiphenyl	N/A	90

NOTES AND DEFINITIONS FOR THIS REPORT.
QC = OUTSIDE CONTROL LIMITS.
* = LESS THAN 5 TIMES THE DETECTION LIMIT.
B = DETECTED IN REAGENT BLANK; BACKGROUND SUBTRACTION NOT PERFORMED.
ND = NOT DETECTED AT DETECTION LIMIT.
NA = NOT ANALYZED.
N\A = NOT AVAILABLE.
NS = NOT SPIKED.

SUBSURFACE EXPLORATION PROCEDURES

Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the bore hole in preparation for obtaining the next sample.

Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the bore holes. They are turned and hydraulically advanced by a truck or track-mounted unit as site accessiblility dictates. In auger drilling, casing and drilling mud are not required to maintain open bore holes.

Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having an open stem are used to advance the bore holes. The open stem allows the sampling tool to be used without removing the augers from the bore hole. Hollow stem augers thus provide support to the sides of the bore hole during the sampling operations.

Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the bore holes. In this process, surface casing and/or drilling fluids are used to maintain open bore holes.

Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

STS Soil Classification System

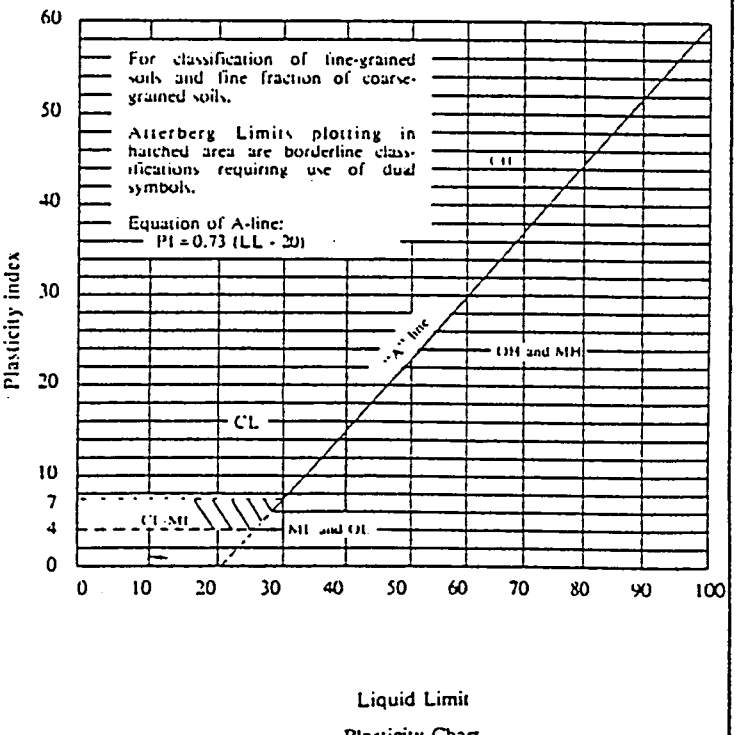
UNIFIED SOIL CLASSIFICATION

Major Divisions			Group symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 per cent ..... GW, GP, SW, SP
More than 12 per cent ..... GM, GC, SM, SC
5 to 12 per cent ..... *Borderline* cases requiring dual symbols

Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols

Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols



Plasticity Chart

so that the advance of the sampler under the impact of the hammer can be easily observed for each 6-in. (0.15-m) increment.

7.2 Drive the sampler with blows from the 140-lb (63.5-kg) hammer and count the number of blows applied in each 6-in. (0.15-m) increment until one of the following occurs:

7.2.1 A total of 50 blows have been applied during any one of the three 6-in. (0.15-m) increments described in 7.1.4.

7.2.2 A total of 100 blows have been applied.

7.2.3 There is no observed advance of the sampler during the applicaion of 10 successive blows of the hammer.

7.2.4 The sampler is advanced the complete 18 in. (0.45 m) without the limiting blow counts occurring as described in 7.2.1, 7.2.2, or 7.2.3.

7.3 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fraction thereof. The first 6 in. is considered to be a seating drive. The sum of the number of blows required for the second and third 6 in. of penetration is termed the "standard penetration resistance", or the "N-value". If the sampler is driven less than 18 in. (0.45 m), as permitted in 7.2.1, 7.2.2, or 7.2.3, the number of blows per each complete 6-in. (0.15-m) increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 in. (25 mm), in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.

7.4 The raising and dropping of the 140-lb (63.5-kg) hammer shall be accomplished using either of the following two methods:

7.4.1 By using a trip, automatic, or semi-automatic hammer drop system which lifts the 140-lb (63.5-kg) hammer and allows it to drop 30 ± 1.0 in. (0.76 m ± 25 mm) unimpeded.

7.4.2 By using a cathead to pull a rope attached to the hammer. When the cathead and rope method is used the system and operation shall conform to the following:

7.4.2.1 The cathead shall be essentially free of rust, oil, or grease and have a diameter in the range of 6 to 10 in. (160 to 250 mm).

7.4.2.2 The cathead should be operated at a minimum speed of rotation of 100 RPM, or the approximate speed of rotation shall be reported on the boring log.

7.4.2.3 No more than 2¼ rope turns on the cathead may be used during the performance of the penetration test, as shown in Fig. 1.

NOTE 4—The operator should generally use either 1¾ of 2¼ rope turns, depending upon whether or not the rope comes off the top (1¾ turns) or the bottom (2¼ turns) of the cathead. It is generally known and accepted that 2¼ or more rope turns considerably impedes the fall of the hammer and should not be used to perform the test. The cathead rope should be maintained in a relatively dry, clean, and unfrayed condition.

7.4.2.4 For each hammer blow, a 30-in. (0.76-m) lift and drop shall be employed by the operator. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.

7.5 Bring the sampler to the surface and open. Record the percent recovery or the length of sample recovered. Describe the soil samples recovered as to composition, color, stratification, and condition, then place one or more representative portions of the sample into sealable moisture-proof containers (jars) without ramming or distorting any apparent stratification. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, sample depth, and the blow count per 6-in. (0.15-m) increment. Protect the samples against extreme temperature changes. If there is a soil change within the sampler, make a jar for each stratum and note its location in the sampler barrel.

8. Report

8.1 Drilling information shall be recorded in the field and shall include the following:

8.1.1 Name and location of job,

8.1.2 Names of crew,

8.1.3 Type and make of drilling machine,

8.1.4 Weather conditions,

8.1.5 Date and time of start and finish of boring,

8.1.6 Boring number and location (station and coordinates, if available and applicable),

8.1.7 Surface elevation, if available,

8.1.8 Method of advancing and cleaning the boring,

8.1.9 Method of keeping boring open,

8.1.10 Depth of water surface and drilling depth at the time of a noted loss of drilling fluid, and time and date when reading or notation was made,

8.1.11 Location of strata changes,

8.1.12 Size of casing, depth of cased portion of boring,

8.1.13 Equipment and method of driving sampler,

8.1.14 Type of sampler and length and inside diameter of barrel (note use of liners),

8.1.15 Size, type, and section length of the sampling rods, and

8.1.16 Remarks.

8.2 Data obtained for each sample shall be recorded in the field and shall include the following:

8.2.1 Sample depth and, if utilized, the sample number,

8.2.2 Description of soil,

8.2.3 Strata changes within sample,

8.2.4 Sampler penetration and recovery lengths, and

8.2.5 Number of blows per 6-in. (0.15-m) or partial increment.

9. Precision and Bias

9.1 Variations in N-values of 100% or more have been observed when using different standard penetration test apparatus and drillers for adjacent borings in the same soil formation. Current opinion, based on field experience, indicates that when using the same apparatus and driller, N-values in the same soil can be reproduced with a coefficient of variation of about 10%.

9.2 The use of faulty equipment, such as an extremely massive or damaged anvil, a rusty cathead, a low speed cathead, an old, oily rope, or massive or poorly lubricated rope sheaves can significantly contribute to differences in N-values obtained between operator-drill rig systems.

9.3 The variability in N-values produced by different drill rigs and operators may be reduced by measuring that part of the hammer energy delivered into the drill rods from the sampler and adjustng N on the basis of comparative energies. A method for energy measurement and N-value adjustment is currently under development.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

Standard Method for

PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS[1]

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This method has been approved for use by agencies of the Department of Defense and for listing in the DOD Index of Specifications and Standards.

1. Scope

1.1 This method describes the procedure, generally known as the Standard Penetration Test (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

1.2 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For a specific precautionary statement, see 5.4.1

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Applicable Documents

2.1 ASTM Standards:

D2487 Test Method for Classification of Soils for Engineering Purposes[2]

D2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

D4220 Practices for Preserving and Transporting Soil Samples[2]

3. Descriptions of Terms Specific to This Standard

3.1 anvil—that portion of the drive-weight assembly which the hammer strikes and through which the hammer energy passses into the drill rods.

3.2 cathead—the rotating drum or windlass in the rope-cathead lift system around which the operator wraps a rope to lift and drop the hammer by successively tightening and loosening the rope turns around the drum.

3.3 drill rods—rods used to transmit downward force and torque to the drill bit while drilling a borehole.

3.4 drive-weight assembly—a device consisting of the hammer, hammer fall guide, the anvil, and any hammer drop system.

3.5 hammer—that portion of the drive-weight assembly consisting of the 140 ± 2 lb (63.5 ± 1 kg) impact weight which is successively lifted and dropped to provide the energy that accomplishes the sampling and penetration.

3.6 hammer drop system—that portion of the drive-weight assembly by which the operator accomplishes the lifting and dropping of the hammer to produce the blow.

3.7 hammer fall guide—that part of the drive-weight assembly used to guide the fall of the hammer.

3.8 N-value—the blowcount representation of the penetration resistance of the soil. The N-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 in. (150 to 450 mm) (see 7.3).

3.9 ΔN—the number of blows obtained from each of the 6-in. (150-mm) intervals of sampler penetration (see 7.3).

3.10 number of rope turns—the total contact angle between the rope and the cathead at the beginning of the operator's rope slackening to drop the hammer, divided by 360° (see Fig. 1).

3.11 sampling rods—rods that connect the drive-weight assembly to the sampler. Drill rods are often used for this purpose.

3.12 SPT—abbreviation for Standard Penetration Test, a term by which engineers commonly refer to this method.

4. Significance and Use

4.1 This method provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain disturbance in the sample.

4.2 This method is used extensively in a great variety of geotechnical exploration projects. Many local correlations and widely published correlations which relate SPT blowcount, or N-value, and the engineering behavior of earthworks and foundations are available.

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[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

Current edition approved Sept. 11, 1984. Published November 1984. Originally published as D1586—58T. Last previous edition D1586—67 (1974).

[2] Annual Book of ASTM Standards, Vol 04.08.

Fill or backfill required on the project should consist of a nonfrozen, nonorganic natural soil that is free of debris. The natural water content of the soil should be near the optimum water content determined by the proctor test. Difficulty in obtaining the desired degree of compaction could be expected for soil that is too dry or too wet. Adjustment in the water content by sprinkling or by scarifying and aerating may be necessary to facilitate compaction.

Fill or backfill as uniform as practical should be used on the project. Nonuniform materials or mixing two or more materials will reduce the degree of certainty in the test results.

Fill or backfill should be placed in horizontal loose lifts no thicker than 9 inches and compacted with a compactor well suited to the soil type. Normally vibratory drum or plate compactors are better suited for granular soils, while a sheepsfoot, a segmented foot or other "kneading" type compactor is often more effective in cohesive soils.

Fill or backfill that supports floor slabs loaded in excess of 500 psf, foundations and pavement subject to concentrated autombile traffic or occasional truck traffic should be compacted to a minimum of 95% of the maximum density determined by the modified proctor test (ASTM D-1557). Fill or backfill that supports lightly loaded floor slabs or pavement subject to dispersed automobile traffic should be compacted to a minimum of 90% of the maximum density determined by the modified proctor test.

It is difficult to impossible to compact soil on the edge of a slope. For this reason, we recommend that the fill or backfill extend laterally beyond the edge of buildings and foundations a minimum of 2 feet. Slopes should not exceed 1:1 for cohesive soils and 2 (horizontal) : 1 (vertical) for granular soils.

Specifications could consider compaction tests satisfactory if the average of any five consecutive tests exceeds the required compaction and no individual test is more than 2% below the required percentage of compaction.

LABORATORY PROCEDURES

Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf), by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

Dry Density (γ_D)

The dry density is the quantity used as a measure of the amount of solids in a unit volume of soil aggregate. Use of this value is often made when measuring the degree of compaction of a soil.

Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and classified on the basis of their texture and plasticity in accordance with the Unified Soil Classification System (USCS). The soil descriptions on the boring logs are in conformance with this system and the estimated group symbols according to this system are included in parentheses following the soil descriptions on the boring logs. Included on a separate sheet entitled "General Notes" is a brief explanation of this system of soil classification.