THE JOHNSON COMPANY, INC.
*Environmental Sciences and Engineering*

AUG 28 1990

Mr. Richard Spiese
Petroleum Management Section
Department of Environmental Conservation
Agency of Natural Resources
103 South Main Street
Waterbury, Vermont 05676

Re: Westminster West, Vermont Petroleum Release Investigation: Proposal for Services

Dear Richard:

We are pleased to respond to the Petroleum Management Section's Request for Proposal (RFP) dated August 9, 1990 relating to the discovery of petroleum contaminated groundwater in Westminster West, Vermont.

Our proposal describes the methodologies for addressing each individual task listed in the RFP. We are confident that the methodologies are appropriate for this investigation and our ability to accurately and efficiently perform them.

We value our relationship with the Department of Environmental Conservation and look forward to working with you on this investigation. As always, we are willing to discuss and possibly modify any aspect of the proposal, and answer any questions you may have. Thank you for your time and consideration.

Best wishes,

THE JOHNSON COMPANY, INC.

By: Michael Pottinger
Michael H. Pottinger
Senior Scientist

MHP.cll
MIKE\WEST

Reviewed by: MHP



*Civil/Environmental Engineering Hydrogeology Water Supply & Wastewater Disposal Hazardous Waste Remediation Hydrology Contaminant Fate Analysis Soil & Water Science Geology & Geophysics Rivers and Dams Solid Waste Permitting*
*5 State Street Montpelier, VT 05602 ■ (802) 229-4600 Fax: (802) 229-5876*

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## 1.0 INTRODUCTION

This document represents The Johnson Company, Inc.'s response to a Request for Proposal (RFP) dated August 9, 1990 from Mr. Richard Spiese of the Vermont Department of Environmental Conservation (DEC) Petroleum Management Section. The RFP was a solicitation for bids for the initiation of a bedrock groundwater monitoring program at a petroleum contaminated site.

## 2.0 STATEMENT OF PROBLEM

Petroleum contamination, preliminarily identified as fuel oil, has been detected in a private water supply well finished in bedrock in the Town of Westminster West, Vermont. The source of the contamination is not known. In order to characterize the extent of contamination and identify the source, a better understanding of the bedrock hydrogeology is required. The purpose of this investigation is to locate, install and sample bedrock groundwater monitoring wells in the vicinity of the contaminated drinking water well.

## 3.0 SCOPE OF WORK

The following list of required tasks are structured parallel to those outlined in the DEC's RFP. Some tasks not specifically mentioned in the RFP but which are necessary (for example: development of a Health and Safety Plan) have been included in the appropriate location.

### 3.1 Background Data Review/Pre-field Work Meeting

All available background information concerning the site will be gathered prior to the initiation of any field work. Such background information includes but is not limited to the Petroleum Managements Section site file, logs for wells in the vicinity of the site, air photos and ortho photos. Based on the information gathered, a Health and Safety Plan (HASP) will be developed. A meeting will then be held with Petroleum Management Section personnel to discuss the history of the site, the HASP, and any modifications of the scope of work. During the meeting, the three existing water supplies that will be sampled will be chosen, and a date will be selected for the sampling.

### 3.2 Sample and Analysis of Three Existing Water Supplies

As requested in the RFP, three existing water supplies will be sampled and analyzed. We also suggest resampling the contaminated well for a better understanding of the contamination distribution at a given time. The selection of the wells will be based on finished depth and location relative to the contaminated well and potential sources. Samples will be collected from the tap as near to the well

head as possible, and before any water treatment system that may be present. The aerator at the tap will be removed prior to sampling. The pH, temperature, and specific conductance of the tap water will be recorded and allowed to stabilize before collecting the sample. A trip blank will be submitted to the laboratory as a quality assurance/quality control measure. Chain of Custody procedures outlined in SOP-JCO-007 (Attachment A) will be followed for all samples collected during this investigation.

The contaminated water supply well will be analyzed using EPA method 418.1 along with a FID/PID scan. The purpose of the FID/PID scan is to better characterize the nature of the petroleum contamination. This information in turn, may be useful in identifying the source. The other water supply samples will be analyzed using EPA 418.1 only.

The analytical results will be forwarded to the Petroleum Management Section as soon as they are available.

3.3 Bedrock Monitoring Well Installation

The results of the analyses of the existing water supply samples as well as drillers' log information will be used to locate three additional bedrock monitoring wells. In addition, a fracture trace analysis will be conducted to identify fractures that may be water bearing.

Monitoring wells will be installed with a forward air rotary rig in such a manner to ensure that representative groundwater samples can be collected and to preclude the introduction of contamination into the bedrock aquifer from the surface. Figure 1 shows a typical monitoring well construction in competent bedrock. It is similar to a water supply well construction. This type of construction has the advantage of creating a borehole large enough to accommodate a pump should one be desired. If highly weathered incompetent rock is encountered, PVC screen and riser will be inserted into the borehole and the well will be finished in a fashion similar to monitoring wells in overburden. This technique allows for access into boreholes that would otherwise collapse. Figure 2 is a schematic that shows typical monitoring well construction in incompetent bedrock. It is important to note that the annular space will be filled with grout from at least five feet below the top of bedrock to near the surface. On a frequency to be determined by site conditions, the borehole will be pumped free of drilling fluid and inspected to determine if groundwater has been encountered.

8/23/90 LBM MISCDWG\MWROCK

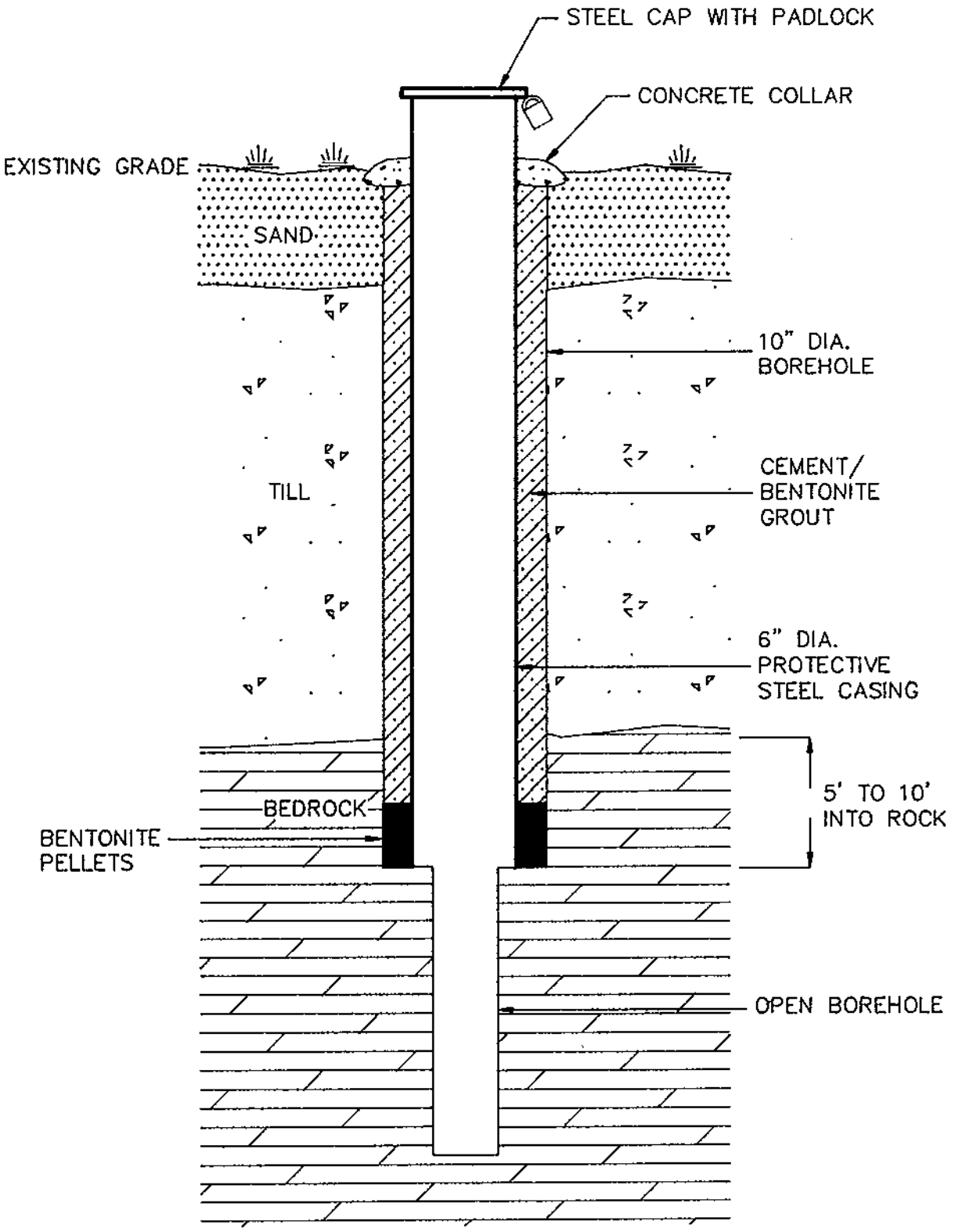


Figure 1

| | |
|---|---|
| TYPICAL MONITOR WELL CONSTRUCTION<br>IN COMPETENT BEDROCK<br>NOT TO SCALE | THE JOHNSON COMPANY, INC.<br>Environmental Sciences and Engineering<br>MONTPELIER, VERMONT |

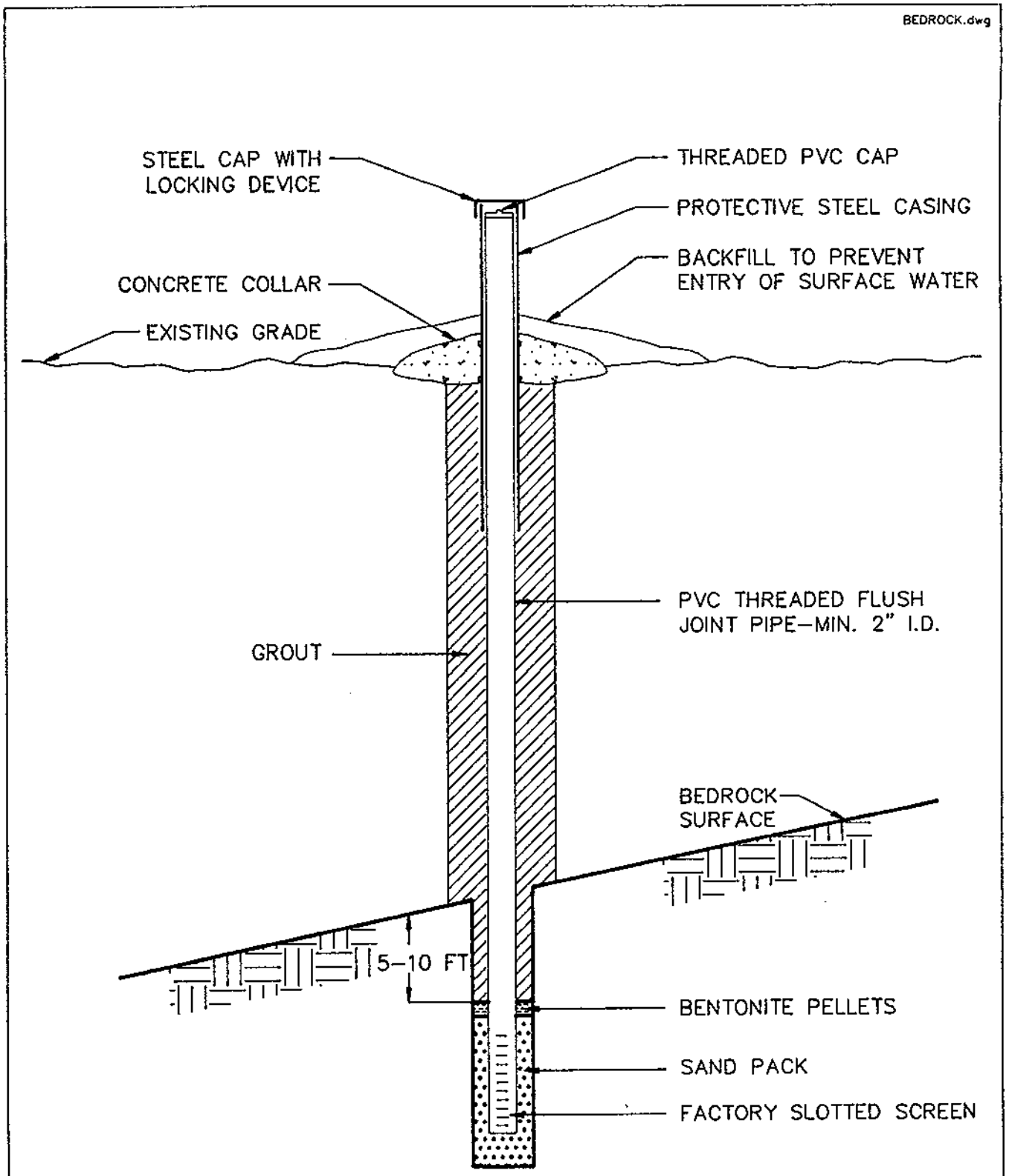


**Figure 2**

| | |
|---|---|
| TYPICAL MONITOR WELL CONSTRUCTION<br>IN INCOMPETENT BEDROCK<br>NOT TO SCALE | THE JOHNSON COMPANY, INC.<br>Environmental Sciences and Engineering<br>MONTPELIER, VERMONT |

A photo-ionization detector (PID) will be used to screen cuttings and ambient air during the drilling process.

All drilling equipment that comes in contact with the borehole will be cleaned with a high pressure, high temperature water wash before moving to the next borehole. Additionally, the drilling fluid(water) will be sampled and analyzed to ensure it is free of contamination. Well construction logs will be generated and submitted along with the final report.

3.4 Monitoring Well Sampling and Analysis

A minimum of one week after monitoring well installation, the bedrock monitoring wells will be sampled and analyzed. Sampling will be conducted as described in SOP-JCO-008 (Attachment B). Samples will be analyzed using EPA method 418.1.

On the same day that sampling of bedrock monitoring wells occurs, a survey of the site will be conducted. This survey will locate the three monitoring wells, the existing water supply wells, and other pertinent features. Relative elevations for the three monitoring wells will be obtained and to the degree possible, the relative elevations of the existing bedrock water supply wells will also be determined.

3.5 Groundwater Plume Delineation and Presentation

The analytical results of all samples collected will be plotted on a site map along with groundwater flow directions and water table gradients.

3.6 Report

A report will be prepared which will contain the detailed description of the methodologies, results, and conclusions of the investigations.

3.7 Alternative Water Supply Location Determination

Based on the hydrogeologic and chemical data investigation, an assessment of alternative water supply locations will conducted. This assessment will consider the location and construction of existing bedrock water supplies in the general area, the analytical results, and the results of the fracture trace analysis.

## 4.0 QUALIFICATIONS

### 4.1 Corporate Qualifications

The Johnson Company, Inc. was founded in 1978 by Martin L. Johnson, Ph.D, P.E., to provide quality civil engineering and an environmental consulting services. We have worked on numerous uncontrolled hazardous waste sites in Vermont and elsewhere. We have conducted numerous investigations for the Petroleum Management Section of the DEC. A complete statement of qualifications is included as Attachment C.

### 4.2 Project Team/Project Management

The Johnson Company will dedicate a skilled, experienced project team to this investigation. This team will include a corporate officer, project manager/senior scientist, a health and safety officer, and a senior environmental technician. The personnel who will fulfill these roles and their respective responsibilities and experience are summarized below. Complete resumes of the project team are included in the statement of qualifications in Attachment D.

*Corporate Officer: Chris Stone, Vice-President of Hydrology and Earth Sciences*

The corporate officer is responsible for negotiating and signing contracts, ensuring the integrity of all data collected, and for the final review of the report. As vice-president, Chris has developed the skills required to effectively and efficiently perform these duties.

*Project Manager: Michael Pottinger, Senior Scientist*

The project manager will be responsible for overseeing the execution of the tasks required for the successful completion of the project within the allotted budget. Michael will also be the principal investigator for the project, and will be on site during monitoring well installation. He will be responsible for knowing the project status, and will be available to the Petroleum Management Section for project updates. Michael received his M.S. in hydrogeology from the University of Montana and has lived and worked in Vermont as a hydrogeologist for four years. He has worked on numerous groundwater contamination investigations and has overseen the installation of bedrock monitoring wells at the old Poultney Landfill in Poultney, Vermont.

*Health and Safety Officer: Greg Johnson*

The Health and Safety Officer (HSO) is responsible for the development and execution of the HASP. He ensures that all persons involved with the investigation have met OSHA 1910.120 requirements. He is ultimately responsible for all health and safety issues. Greg, as The Johnson Company's Corporate Health and Safety Co-Officer, is experienced in developing HASPs and ensuring their execution.

*Senior Environmental Technician: Warren Davey*

The environmental technician is responsible for the day to day activities of the project, including sampling. Warren has over five years experience in environmental sampling, and conducts his responsibilities in an efficient and thorough manner, always giving close attention to details.

We will also be using the surfaces of several subcontractors on the project. These are as follows:

Drilling: Falcon Well Drilling, Lyndonville, Vermont
Laboratory: Scitest Laboratories, Randolph, Vermont
Survey: Little River Survey, Stowe, Vermont

We are familiar with all of these subcontractors and know that their capabilities match the requirements of the project.

## 5.0 SCHEDULE

Work on the project will begin no later than one week after the signing of the contract. We anticipate that the project will be completed approximately 45 days after project initiation.

## 6.0 COSTS

The Johnson Company strives to provide its clients with innovative and accurate solutions at a reasonable price. As such we have developed a following budget:

6.1 Johnson Company Costs

| Task | Probable Cost |
|---|---|
| Background Research/HASP Development/meeting | $ 550 |
| Site Visit/Sample Existing Wells | $ 900 |
| Monitoring Well Installation | $1,400 |
| Sample Monitoring Wells | $ 540 |
| Groundwater Map/Plume Delineation | $ 540 |
| Report | $1,100 |
| **Total Probable Johnson Company** | $5,100 |

6.2 Drilling Costs

| Task | Probable Cost |
|---|---|
| Mobe/Demobe | $ 400 |
| Drilling (assume 60 ft/well at $9/ft) | $1,620 |
| Casing (assume 10 ft/well at $8/ft) | $ 240 |
| Grouting(approximately 1 hr/well at $200/hr) | $ 600 |
| **Total Probable Drilling Costs** | $2,860 |

6.3 Laboratory Costs

| Task | Probable Cost |
|---|---|
| EPA Method 418.1 (assume 11 samples at $70) | $ 770 |
| FID/PID Scan (assume one sample at $85) | $ 85 |
| **Total Probable Laboratory Costs** | $ 855 |

6.4 Survey Costs

| Task | Probable Cost |
|---|---|
| Site Survey | $ 600 |
| **Total Probable Survey Costs** | $ 600 |
| **Total Project Probable Cost:** | $9,415 |

The above costs assume that the DEC will be billed directly by the subcontractors, thus saving the our 20 percent markup on subcontracting fees.

## 7.0 ACCEPTANCE

We would appreciate the opportunity to discuss any parts of this proposal should the DEC request any modifications. Should the DEC accept the costs and scope of this proposal, we will enter into negotiations of a contract at that time.

# Attachment A

## Standard Operating Procedure - SOP-JCO-007

## Chain of Custody

THE JOHNSON COMPANY, INC
5 State Street
Montpelier, Vermont 05602
(802) 229-4600



# *Standard Operating Procedure For Chain of Custody Records*

## INTRODUCTION

The Chain-of-Custody record allows for the tracking of possession and handling of individual samples from the time of field collection through laboratory analysis. All samples released from field operations shall be accompanied by a Chain-of-Custody form (Attachment JCO-007-1). This is done to insure the legal integrity of the sample materials collected. Every effort shall be made to keep as few people as possible in the chain of sample possession.

## PROCEDURE

1. The Chain-of-Custody record shall accompany each set of samples released from the study site. The Chain-of-Custody record for all samples shall include the following information:

   - o Signature of Sampler
   - o Client/Project name
   - o Project Location
   - o Field Logbook Number (e.g. page no. in field book)
   - o Sample Number, Identification
   - o Date and time of sample collection
   - o Type of Sample (Air, water, soil, etc.)
   - o Analysis requested
   - o Preservative Added (Remarks section)

- o Source of the Sample (Remarks section)
- o Chain-of-Custody Tape Number
- o Inclusive Dates of Possession
- o Signatures of Persons Involved in Chain of Possession
- o Name of person the analytical results are to the attention of (in lower right corner of the form).

2. The chain-of-custody record is designed in quadruplicate. Each of the individual four sheets is a different color. Along the bottom of each sheet are the instructions describing who gets which copy. These instructions are as follows:

| | |
|---|---|
| White Copy: | Original sheet to accompany sample to the lab and returned to The Johnson Company. |
| Yellow Copy: | Laboratory Copy |
| Pink Copy: | Transporter Copy (optional) |
| Orange Copy: | Sampler Copy |

Therefore, after the chain-of-custody sheet has been completely filled out, the sampler signs the initial "Relinquished by" along with date and time and obtains the signature of the next person (i.e. transporter) in the chain-of-custody (in the initial "Received by" box along with date and time. The sampler then tears off the back (orange) copy for his records. Then the transporter delivers the samples to the analytical lab, he signs the second "Relinquished by" box along with date and time, and a laboratory representative signs the second "Received by" box along with the date and time. At this point, the transporter has the option of retaining the Pink copy for his records.

Instructions shall be given to the laboratory regarding their responsibilities in returning the top sheet (white copy) to The Johnson Company with the lab results. This sheet

contains all sample information and original signatures. The lab should retain the yellow copy for their records.

If the sampler delivers the samples themselves to the laboratory, then they should make certain the receiving party at the lab signs in the proper space, i.e., "Received for Laboratory".

3. The form shall be completed in legible hand writing with indelible ink, with all the appropriate information completed. Once completed, the form is either:

   a. place in a plastic-wrap and included with the samples in the cooler, or;

   b. fixed in an envelope taped securely in top of the cooler or plastic packing slip container (if available). This method allows for signatures to be inclusive with each transfer of custody. This method is mandatory in the event a non-commercial courier is utilized to transport samples.

4. The sample container shall be sealed with Chain-of-Custody tape, containing the designation, date, and sampler's signature. The custody tape is especially important when shipping the container via overnight courier such as Federal Express and United Parcel Service.

ATTACHMENT JCO-007-1

Nº 139

# CHAIN OF CUSTODY RECORD

| Client/Project Name | Project Location | ANALYSES |
|---|---|---|
| Project No. | Field Logbook No. | |
| Sampler: (*Signature*) | Chain of Custody Tape No. | |

| Sample No./ Identification | Date | Time | Lab Sample Number | Type of Sample | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | | | | |
|---|---|---|---|---|---|
| Relinquished by: (*Signature*) | Date | Time | Received by: (*Signature*) | Date | Time |
| Relinquished by: (*Signature*) | Date | Time | Received by: (*Signature*) | Date | Time |
| Relinquished by: (*Signature*) | Date | Time | Received for Laboratory: (*Signature*) | Date | Time |
| Sample Disposal Method: | Disposed of by: (*Signature*) | | | Date | Time |

SAMPLE COLLECTOR

5 State Street
Montpelier, VT 05602
(802) 229-4600
Fax: (802) 229-5876

THE JOHNSON COMPANY, INC.
Environmental Sciences and Engineering

ANALYTICAL LABORATORY

1974-3-84

# Attachment B

## Standard Operating Procedure - SOP-JCO-008

## Groundwater Sampling

THE JOHNSON COMPANY, INC.
5 State Street
Montpelier, Vermont 05602
(802) 229-4600



# *Standard Operating Procedure for Groundwater Sampling of Monitoring Wells: Water Quality*

INTRODUCTION:

The goal of a groundwater sampling program is to accurately assess the quality of the groundwater that occurs under the study site. To accomplish this goal, specific measures must be taken during groundwater sampling to ensure that the sample from each well is representative of the aquifer water in that locality. Measures must also be taken so that the samples are not altered or contaminated during the sampling and handling procedures.

PROCEDURE:

A. Water Level Measurement

A water level measurement should be taken prior to well purging (refer to SOP-JCO-009 for procedure).

B. Well Purging

The column of water that is within each monitoring well constitutes stagnant, or non-representative groundwater that must be purged prior to sampling. The recommended length of time required to pump or bail a well before sampling is dependent on many factors including characteristics of the well, hydrogeological nature of the aquifer, the type of sampling equipment being used, and parameters being sampled for (Scalf et al, 1981).

Field parameters in groundwater that should be measured are: pH, temperature, conductivity, and where applicable, oxidation-reduction potential (ORP). If probe cables are of sufficient length to reach the water level in the well, then measurements can be taken for these parameters after the well is purged, or; if applicable, during the well purging process, within a flow-cell. One such flow-cell system is a YSI 3560™ Water Quality Monitoring System. This system allows for chemical parameters to be monitored during the well purging process, within the flow cell. Maintenance and operation of the YSI Water Quality Monitoring System are listed in Attachment JCO-

008-1. The parameters should be recorded until 3 successive readings indicate the same value. If a flow-cell monitoring system is unavailable, and cables on conventional meters are not of sufficient length to reach the groundwater, measurements can be taken within a clean sample container by placing the probes in the container and recording the measurements. The probes are rinsed at least 3 times with deionized water prior to measuring the next sample.

As a general rule, the well will be purged a minimum of 3 well volumes. Purged well water should be collected in a 5 gallon bucket (after passing through the flow cell) in order to quantify the volume of water that is evacuated. Care should be taken not to purge the well completely dry, as this may introduce sand and silt into the sampling train. If the well 'dries up' however, the sampler should proceed with other wells, and return to the well later for sample collection. If the well is still dry after some time (e.g. 2 hours minimum), it should be left overnight if at all possible - otherwise a note should be made referring as to why the sample was not collected.

C. Sample Collection

The sample is collected after the well has been purged. There are a variety of sample withdrawal mechanisms that can be used to take water samples. The type of system used is a function of the degree of detail the study requires, well construction, the water level, the type of pollutant, the analytical procedure and the presence or absence of permanent pumping fixtures within the well (Scalf, et al, 1981). Ideally, the sample mechanism should be completely inert to the parameters being analyzed.

1). Bailer. Bailers are constructed from a wide variety of materials compatible with the parameters to be analyzed, and provide a convenient method of sampling. Care should be taken however to avoid cross contamination between wells which can occur if the bailer is not adequately cleaned after each use (minimum of 3 rinses with deionized water).

2). Dedicated Pumps. There are numerous specialized sampling pumps available which, depending upon the scope of work and project duration, can be

dedicated and installed within each monitoring well. Some of the more common sampling pumps are: suction lift pumps; portable submersible pumps; air lift samplers; positive displacement ("Waterra" type) pumps; and air-operated bladder pumps. One type of bladder pump is the model with Teflon bladder pumps (Attachment JCO-008-2) installed at the bottom (or sump) of each well. A portable compressor and control box connected at the well head to the air line of the sampling pump provide the mechanism for well water evacuation. The pump operates by compressed air squeezing the bladder in the pump casing, thereby forcing the column of water in the Teflon water line up and out of the well.

The effectiveness of the bladder pump is based on the proper placement of the pump within the well. If the bladder is not entirely submerged within the water column, the possibility of air entering the sampling train is distinct. Therefore, when installing the pumps, care must be taken to insure that the bladder is entirely submerged. All material construction in the sampling train is either Teflon or stainless steel, thereby providing an inert environment for the well water sample.

D. Sampling Parameters

1. Major Ions For major ionic species, two 1-litre plastic bottles are used: a pale yellow primary (with $HNO_3$ preservative) for metals and; a secondary for the other inorganics (no preservative). The sample is collected by removing the cap or stopper carefully from the sample bottle, taking care not to touch the inside of the cap or bottle with the sampling spigot/bailer. The sample container is filled to approximately one-inch below the top of the one-liter plastic bottle, the bottle is capped tightly.

2. Volatile Organic Compounds (VOC) Samples shall be collected in 40 ml glass vials with screw-on caps equipped with Teflon lined septa. Ordinarily clear class is adequate, but if the parameters of concern are typified by a high photolysis potential, brown glass should be utilized. The sample should be

poured slowly and carefully into the vial. Care must be taken to minimize turbulence. The vial shall be filled to a positive meniscus and the cap screwed on firmly. This vial should be inverted and tapped gently with a finger to check for air bubbles. If bubbles are present a new sample must be collected.

3. Dissolved Metals For dissolved metals analyses, the sample should be filtered with a .45 micron filter. The filtering method entails: 1) pouring approximately 250 milliliters of the sample into a filter barrel manufactured by Geotech Environmental Equipment Inc. (Attachment JCO-008-3); 2) fixing the .45 micron filter to the screen portion of the filter barrel, as per the instructions listed in Attachment 4; 3) tightening the top of the filter assembly to the barrel; 4) turning the barrel over and; 5) collecting the sample by applying air pressure to the inside of the barrel.

4. Pesticides. The pesticide samples should be collected in clean 1 liter amber glass bottles with Teflon lined septa. The sample is collected by removing the cap carefully from the sample bottle, taking care not to touch the inside of the cap or bottle with the sampling spigot or any other apparatus. For some pesticides, a pre-rinse with isopropyl alcohol is recommended. The sample bottle is filled approximately half full and then rinsed with the well water. The sample bottle then filled entirely, taking care to slowly pump the well water into the bottles so as not to introduce air bubbles. The bottle is tightly capped, sealed with tape, and a sample label is fixed to the bottle.

E. Sample Size and Preservation

Specific data is given for preservation, sample size, holding time, and analytical methodology. The data is given in Attachment JCO-008-4.

F. Documentation of Sample

Documentation of the sampling event will consist of filling out a collection log form JCO-HYDRO-007. The form is presented in Attachment JCO-008-5.

G. Transportation/Packing

Upon collection, samples are packed in an insulated cooler with ice and delivered to the laboratory for analysis as soon as is reasonable, but no later than 24 hours after collection. A completed chain of custody form, (SOP-JCO-007) will accompany the sample set.

References

Scalf, M.R., McNabb, J.F., Dunlap, W.J., Cosby, R.L., and J.F. Fryberger, 1981. Manual of Ground Water Sampling Procedures, National Water Well Assn., Worthington, OH, 19821

Attachment JCO-008-1


si 3560
Water Quality
Monitoring System
Portable well-side system measures groundwater on-site.
Flow-through measurements of temperature, conductivity, pH and mV.
m 3500
YSI

## Rugged Flow-Through System Measures Groundwater On-Site

This rugged new system measures groundwater on-site as it's pumped from a well. As the water flows through the sample chamber, the system simultaneously measures:

- Temperature
- Conductivity or temperature-compensated conductivity
- pH or temperature-compensated pH
- Or millivolts for use with optional oxidation reduction potential (ORP) electrode

Now you can simultaneously measure all four at the well, which the U.S. Environmental Protection Agency (EPA) recommends to assure accuracy.*

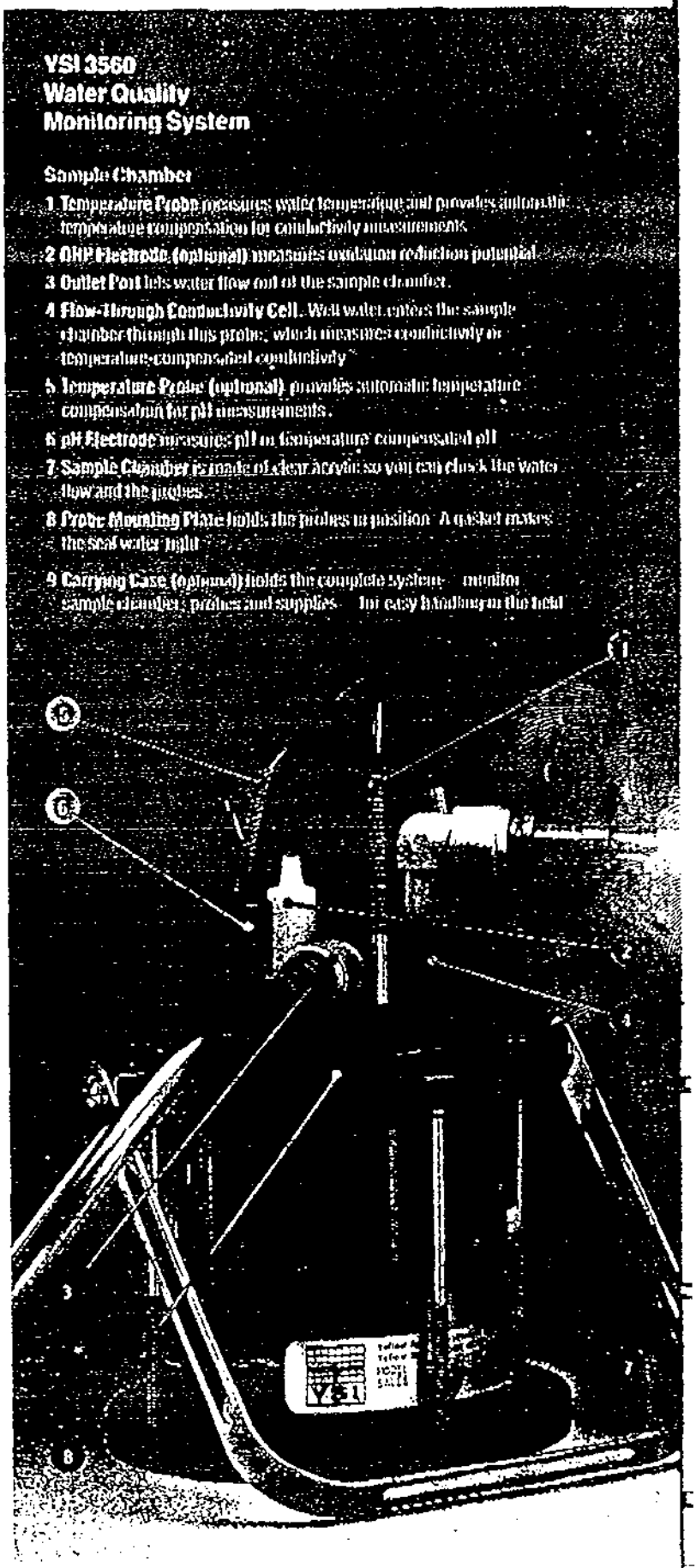
This also helps you obtain a *representative sample* without juggling several probes and meters while you wait for the readings to stabilize. Instead, just check the digital readouts on the monitor. You also may use the YSI 3560 System with a bailer, surface water pump or in the lab.

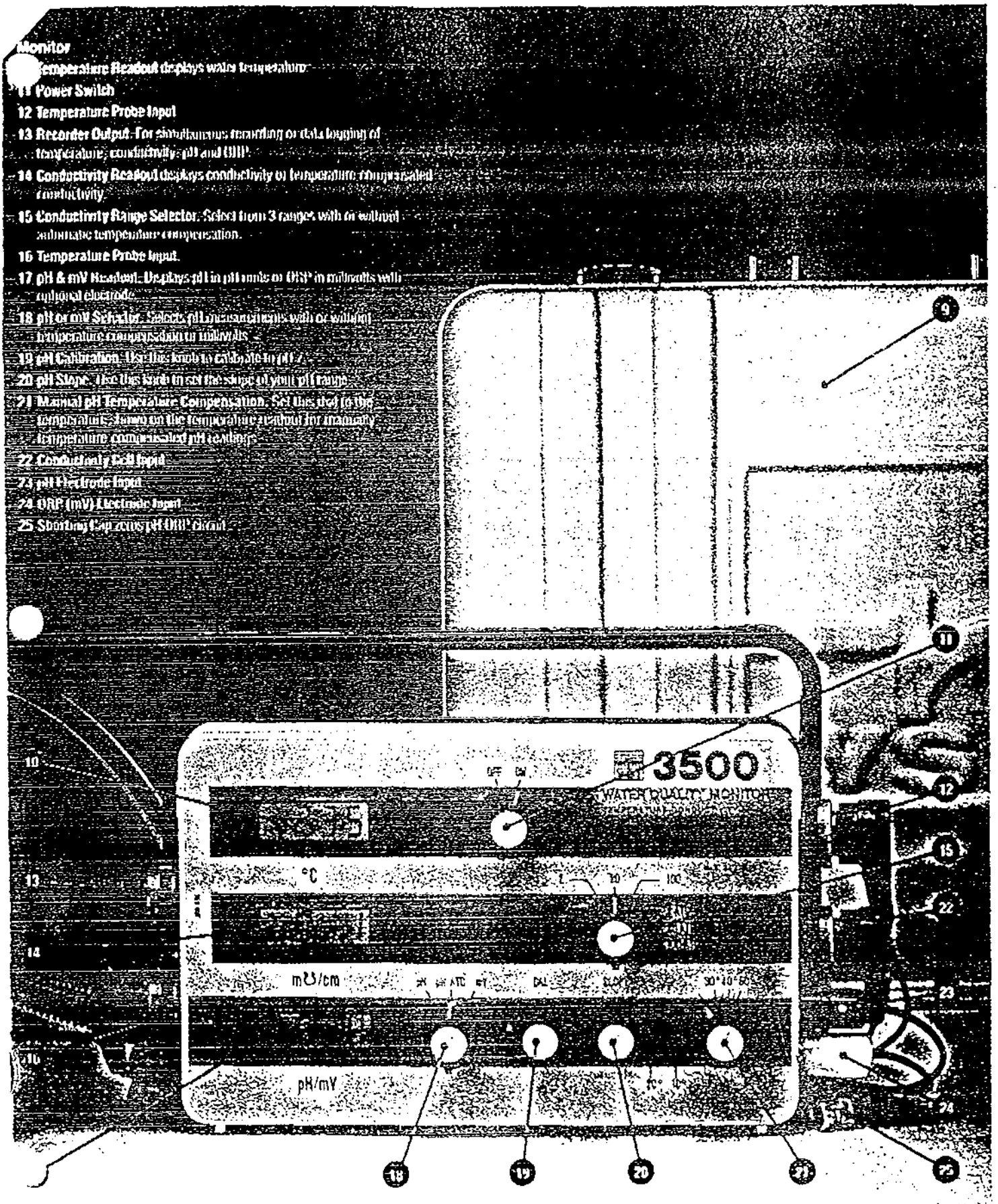
Results are displayed on 3½-digit readouts. A single port lets you send the results of all four measurements to a data logger or chart recorder. Alkaline cells provide 700 hours minimum operation (1,000 hours typical), and the low battery indicator tells you when to replace them. The optional case holds the monitor, sample chamber, probes and supplies for easy handling in the field.

Look over the features of our new Water Quality Monitoring System on the opposite page. Better yet, find out firsthand with a demonstration—call us toll-free at 800 343-HELP (in Ohio, 513 767-7241).

*Resource Conservation and Recovery Act, Ground-Water Monitoring Technical Enforcement Guidance Document. OSWER-9950.1. Washington, DC, September 1986.

YSI Incorporated
Yellow Springs, Ohio 45387 USA




Monitor
Temperature Readout displays water temperature.
11 Power Switch
12 Temperature Probe Input
13 Recorder Output. For simultaneous recording or data logging of temperature, conductivity, pH and ORP.
14 Conductivity Readout displays conductivity or temperature compensated conductivity.
15 Conductivity Range Selector. Select from 3 ranges with or without automatic temperature compensation.
16 Temperature Probe Input.
17 pH & mV Readout. Displays pH in pH units or ORP in millivolts with optional electrode.
18 pH or mV Selector. Selects pH measurements with or without temperature compensation or millivolts.
19 pH Calibration. Use this knob to calibrate to pH 7.
20 pH Slope. Use this knob to set the slope of your pH gauge.
21 Manual pH Temperature Compensation. Set this dial to the temperature shown on the temperature readout for manually temperature compensated pH readings.
22 Conductivity Cell Input
23 pH Electrode Input
24 ORP (mV) Electrode Input
25 Shorting Cap covers pH ORP circuit
3500
WATER QUALITY MONITOR
°C
mS/cm
pH/mV

## Specifications

**Temperature**

Ranges: −5.0 to +50.0°C

Accuracy: ±0.4°C

Response Time: 95% of reading in 10 seconds

**Conductivity & Temperature-Compensated Conductivity**
(Automatically compensated to 25°C with a 2%/°C coefficient)

Ranges: 0.00 to 2.000 millimhos/cm
0.00 to 20.00 millimhos/cm
0.00 to 100.0 millimhos/cm

Accuracy at 25°C: ±3% of full scale from 0 to 2.000 millimhos/cm and from 0 to 20.00 millimhos/cm; ±6% of full scale between 0.0 and 50.0 millimhos/cm. Accuracy of ±6% of full scale can be achieved from 50.0 to 100.0 millimhos/cm by platinizing the cell using the YSI 3575 Platinizing Adapter, the YSI 3045 Platinizing Instrument and YSI 3140 Platinizing Solution.

Response Time: 95% of reading in 10 seconds

**pH & Temperature-Compensated pH**

Range: 0.00 to 14.00 pH

Accuracy: Subject to calibration using available pH buffer solutions in measurement range.

Response Time: 95% of reading in 10 seconds

Temperature Compensation: 0 to 50°C (manual); −5 to +50°C (automatic).

Operating Temperature: −5 to +50°C

**Oxidation Reduction Potential (ORP)**

Range: −1500 to +1500 mV

Accuracy: ±2% of reading plus 1 count

Response Time: 95% of reading in 10 seconds

Operating Temperature: −5 to +50°C

**Instrument**

Ambient Temperature: −20 to +50°C

Humidity: 10 to 90% relative humidity, non-condensing at 25°C

Shock & Vibration: MIL-T-28800-C, Class 3, Style A

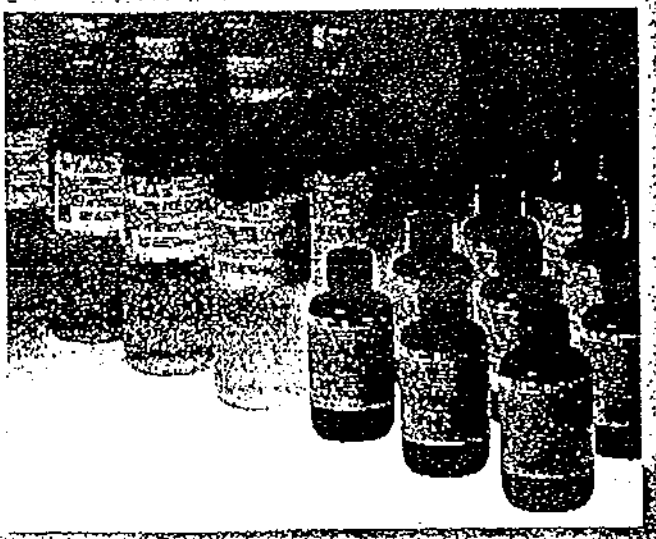
EMI: Complies with FCC emanation rules (47CFR Part 15, Subpart J) for Class A and Class B environments.

Recorder Output: Provides 4 simultaneous outputs for recording temperature, conductivity (not temperature-compensated), pH and mV. 50K ohms minimum input impedance. Outputs provide 1 mV for every count on the displays, accurate to ±10 counts.

Power Supply: 6 alkaline "D" cells provide 700 hours operation minimum at 8 hours per day (1,000 hours typical). A low battery indicator warns when to replace batteries.

Size: 21.1 x 10.4 x 30 cm, 2.5 kg (8.3 x 4.1 x 11.8 inches, 5.5 lbs)

Carrying Case: 21.6 x 41.9 x 61.7 cm, 5 kg (8.5 x 16.5 x 24.3 inches, 11 lbs)



*YSI conductivity calibrator solution (left) and Zobell Solution for checking ORP electrode function.*

## HOW TO ORDER

Please order directly from a YSI franchised dealer using the following part numbers.

YSI 3560 Water Quality Monitoring System, includes:
- YSI 3500 Water Quality Monitor
- YSI 3550 Flow-Through Sample Chamber with fittings & tubing
- YSI 3510 Temperature Probe
- YSI 3520 Flow-Through Conductivity Cell
- YSI 3530 pH Electrode

YSI 3500 Water Quality Monitor
YSI 3520 Flow-Through Conductivity Cell
YSI 3530 pH Electrode
YSI 3510 Temperature Probe
YSI 3540 Oxidation Reduction Potential Electrode
YSI 3682 Zobell Solution (for ORP Probe)
YSI 3550 Sample Chamber
YSI 3167 Conductivity Calibrator Solution, 1.0 millimhos/cm
YSI 3168 Conductivity Calibrator Solution, 10.0 millimhos/cm
YSI 3169 Conductivity Calibrator Solution, 50.0 millimhos/cm
YSI 3570 Recorder Interface Cable
YSI 3575 Platinizing Adaptor
YSI 3580 Carrying Case
YSI 3045 Platinizing Instrument
YSI 3140 Platinizing Solution

YSI Incorporated
Yellow Springs, Ohio 45387 USA • Phone 513 767-7241 • 800 343-HELP • Fax 513 767-9353 • Telex 205437

Attachment JCO-008-2

# WELL WIZARD® SAMPLING PUMPS

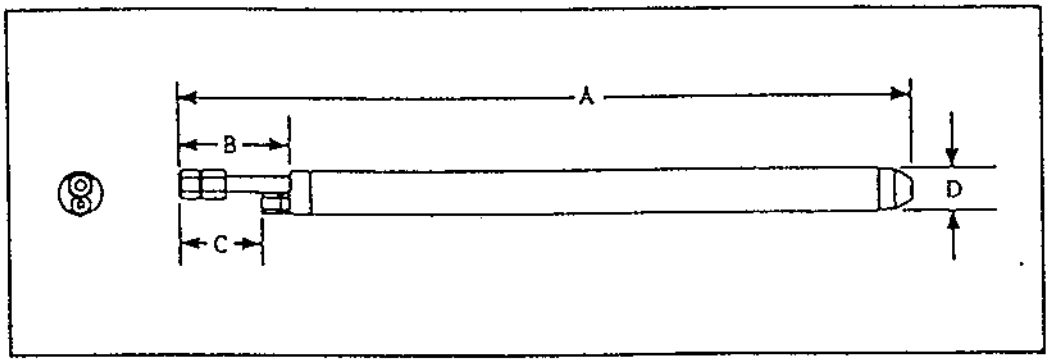
## DESCRIPTION

- Designed to provide accurate samples of groundwater quality, including volatile compounds.
- Pneumatically-operated positive gas displacement bladder pumping mechanism prevents drive gas contact with water sample and avoids alteration of sample quality. Requires portable controller.
- Pump flow rate can be maximized for well purging and decreased for sample vial filling by using controller adjustments.
- Available in choice of materials of construction and optional deep well models.

## APPLICATION INFORMATION

- Pumps normally supplied pre-assembled to tubing assembly and cap. Tubing assembly length is supplied per customer specifications.
- Intake screens available; consult QED.

## SPECIFICATIONS



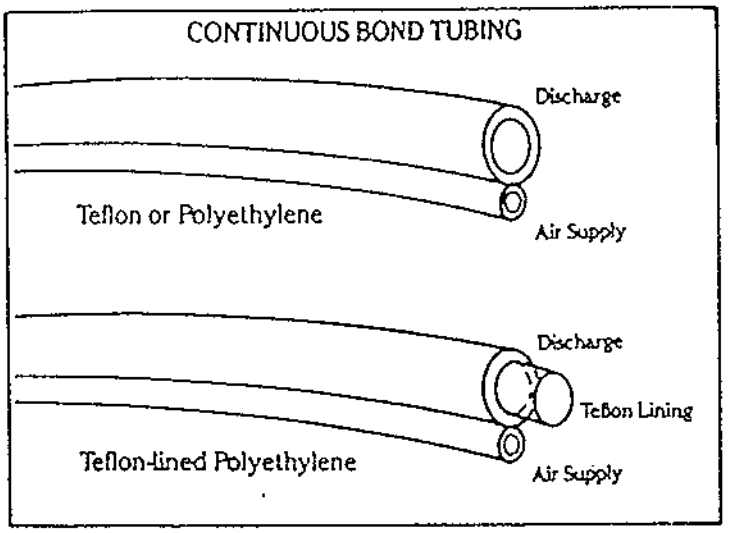

| Pump Model | Body Material | Bladder Material | Tube Fittings | | Maximum Lift (feet) | A (inches) | B (inches) | C (inches) | D (inches) | Pump Weight (pounds) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Air Supply | Discharge | | | | | | |
| P-1100 | PVC | PVC | Polypropylene ¼" O.D. Tube | ½" O.D. Tube | 300 | 40.85 | 4.65 | 3.70 | 1.66 | 3 |
| P-1101 | PVC | Teflon | Polypropylene ¼" O.D. Tube | ½" O.D. Tube | 300 | 40.85 | 4.65 | 3.70 | 1.66 | 3 |
| T-1100 | Teflon | Teflon | Teflon ¼" O.D. Tube | ½" O.D. Tube | 250 | 40.33 | 4.13 | 2.96 | 1.66 | 4 |
| P-1201 | PVC/ 316 S.S. | Teflon | Polypropylene ¼" O.D. Tube | ½" O.D. Tube | 300 | 41.23 | 4.02 | 3.06 | 1.50 | 4 |
| T-1200 | Teflon/ 316 S.S. | Teflon | 316 S. S. ¼" O.D. Tube | ½" O.D. Tube | 300 | 41.14 | 3.93 | 3.06 | 1.50 | 5 |
| P-1101H | PVC | Teflon | 316 S. S. ¼" O.D. Tube | ½" O.D. Tube | 1000 | 40.75 | 4.50 | 3.70 | 1.66 | 3 |
| P-1201H | PVC/ 316 S.S. | Teflon | 316 S. S. ¼" O.D. Tube | ½" O.D. Tube | 1000 | 41.37 | 4.16 | 3.20 | 1.50 | 4 |

# TUBING ASSEMBLIES

## SAMPLING PUMP & PURGE MASTER™

### DESCRIPTION

- Tubing assemblies are all controlled quality virgin grade materials, without printing.
- Standard tubing is shipped cut to exact length and pre-assembled to well cap and pump per customer specifications. Bulk tubing is also available.
- Continuous bond, twin line tubing eases system handling and installation and aids in the use of portable water level probes.




### APPLICATION INFORMATION

- Consult QED for maximum continuous lengths.
- Couplers available.

### SPECIFICATIONS

| Tubing Bundle Model Number | Material | Air Supply O.D. (inches) | Air Supply I.D. (inches) | Discharge O.D. (inches) | Discharge I.D. (inches) | Maximum Working Pressure (psi) | Maximum Recommended Pump Depth (feet) | Bond Type | Used On |
|---|---|---|---|---|---|---|---|---|---|
| P-5100 | Polyethylene | 0.250 | 0.170 | 0.500 | 0.375 | 125 | 250 | Continuous Bond | Model 1100 and 1200 Sampling Pumps |
| PR-5100 | Polypropylene | 0.250 | 0.170 | 0.500 | 0.375 | 300 | 600 | Cable Wrap | P-1101H and P-1201H Sampling Pumps |
| PT-5100 | Teflon-lined Polyethylene | 0.250 | 0.170 | 0.500 | 0.375 | 125 | 250 | Continuous Bond | Model 1100 and 1200 Sampling Pumps |
| T-5110 | Teflon | 0.250 | 0.170 | 0.500 | 0.375 | 240 | 500 | Continuous Bond | Model T-1100 and T-1200 Sampling Pumps |
| N-5110 | Consult QED | 0.250 | 0.170 | 0.500 | 0.375 | 500 | 1000 | Cable Wrap | P-1101H and P-1201H Sampling Pumps |
| P-5500 | Polyethylene | 0.500 | 0.375 | 0.875 | 0.625 | 150 | 200* | Cable Wrap | Model HR-4500 and HR-4600 Purge Pumps |
| T-5510 | Teflon | 0.500 | 0.375 | 0.875 | 0.750 | 125 | 200* | Teflon Ring | Model HR-4700 Purge Pump |

*Maximum pump depth recommendations based upon Purge Pump intended use limits.

# UNPROTECTED CAPS FOR 2"-6" WELLS

## MODEL 2120 (for standard applications)

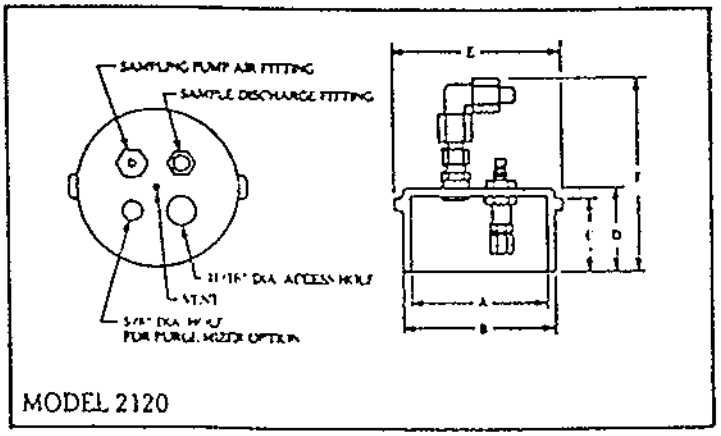
### DESCRIPTION

- Designed to mount connecting hardware for sampling pumps and the optional Purge Mizer.
- PVC body with brass and polypropylene fittings standard; other materials available at additional cost.
- Polypropylene discharge elbow included to direct sample flow to sample vial without kinking tube. Teflon elbow available at extra charge.
- Caps designed to fit nominal pipe size casings; adaptors for other sizes available.
- Protective plugs provided for unused ports in caps.

### APPLICATION INFORMATION

- All caps can be used with dedicated or portable water level indicators.
- Model 2020 or 2120 cap required with use of Purge Mizer.

### SPECIFICATIONS (dimensions in inches)




MODEL 2120

| Casing Size* | Model Number | A | B | C | D | E | F Min. | F Std. |
|---|---|---|---|---|---|---|---|---|
| 2" | 2120-A | 2.39 | 2.72 | 1.00 | 1.18 | 2.72 | 4.51 | 13.09 |
| 3" | 2120-B | 3.52 | 4.00 | 2.07 | 2.50 | 4.38 | 5.83 | 13.09 |
| 4" | 2120-C | 4.52 | 5.22 | 2.25 | 2.62 | 5.49 | 5.95 | 13.09 |
| 5" | 2120-D | 5.58 | 6.12 | 3.00 | 3.44 | 6.12 | 6.77 | 13.09 |
| 6" | 2120-E | 6.65 | 7.34 | 3.25 | 3.85 | 7.58 | 7.18 | 13.09 |

*Casing sizes listed denote nominal pipe size designations. See page 16 for actual internal and external diameters.

## MODEL 2150 (for Purge Master™ high rate purge pump)

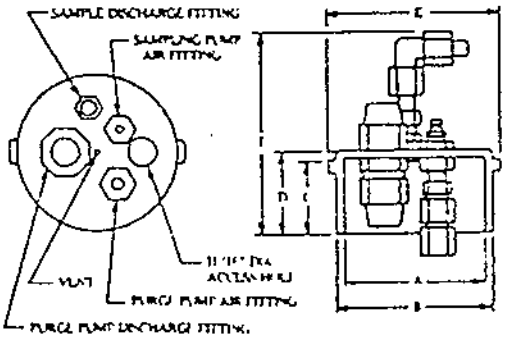
### DESCRIPTION

- Designed to mount connecting hardware for sampling pumps and optional Purge Master purge pumps.
- PVC body with brass and polypropylene fittings standard; other materials available at additional cost.
- Polypropylene discharge elbow included to direct sample flow to sample vial without kinking tube. Teflon elbow available at extra charge.
- Caps designed to fit nominal pipe size casings; adaptors for other sizes available.
- Protective plugs provided for unused ports in caps.

### APPLICATION INFORMATION

- All caps can be used with dedicated or portable water level indicators.
- NOT FOR USE WITH PURGE MIZER.

### SPECIFICATIONS (dimensions in inches)




MODEL 2150

| Casing Size* | Model Number | A | B | C | D | E | F Min. | F Std. |
|---|---|---|---|---|---|---|---|---|
| 4" | 2150-C | 4.52 | 5.22 | 2.25 | 2.62 | 5.49 | 5.95 | 13.09 |
| 5" | 2150-D | 5.58 | 6.12 | 3.00 | 3.44 | 6.12 | 6.77 | 13.09 |
| 6" | 2150-E | 6.65 | 7.34 | 3.25 | 3.85 | 7.58 | 7.18 | 13.09 |

*Casing sizes listed denote nominal pipe size designations. See page 16 for actual internal and external diameters.

# CONTROLLERS/DRIVER CONTROLLERS

## MODEL 3013 (Standard & High Pressure Controller)

### DESCRIPTION

- Designed to automatically cycle sampling and purge pumps, using an external compressed gas source.
- Adjustable sample flow throttle.
- Independently adjustable pump cycle times.
- Includes two, 20-foot heavy-duty industrial air supply and delivery hoses (std.) with quick-connect fittings (connection to air source uses a 1/4-inch male pipe thread fitting).
- Rugged fiberglass case.

### OPTIONAL FEATURE

- Pump manifold, Model 3000, allows simultaneous operation of three sampling pumps within a 20 ft. radius of controller. Three 20 ft. hose assemblies are included with manifold.

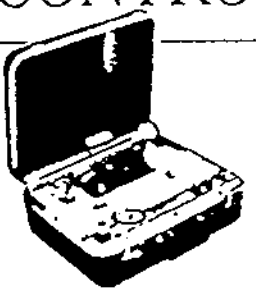
### APPLICATION INFORMATION

- Can be used with all sampling pumps, Purge Mizers, Purge Masters, Purge Mizer Controllers, dedicated water level indicators and cap assemblies.
- No batteries or electric supply required.
- Pump flow performance curves for this controller are shown on page 3.

### SPECIFICATIONS

| Model Number* | Maximum Supply Pressure (psig) | Maximum Pump Depth (ft) | Weight (lbs) |
|---|---|---|---|
| 3013 | 125 | 250 | 22 |
| 3013H | 300 | 600 | 26 |
| 3013UH | 500 | 1000 | 32 |

*Size for all models: 18"L x 15-1/4"W x 6-3/4"H.



## MODEL 3011 (Driver-Controller)

### DESCRIPTION

- Designed to power and automatically cycle sampling pumps with an internal 12 V DC compressor.
- Oilless 100 PSI Compressor.
- Adjustable sample flow throttle.
- Independently adjustable pump cycle times.
- Includes 20 feet of heavy-duty industrial air supply hose (std.) with quick-connect fittings.
- Rugged fiberglass case.
- 15 feet of quick-connect power cord with battery clamps.

### OPTIONAL FEATURE

- Pump manifold, Model 3000, allows simultaneous operation of three sampling pumps within a 20 ft. radius of controller. Three 20 ft. hose assemblies are included with manifold.

### APPLICATION INFORMATION

- Can be used with all sampling pumps, Purge Mizers, Purge Mizer Controllers, dedicated water level indicators, and cap assemblies. Use of external compressed air source recommended with Purge Master pumps.
- Requires external power source, 12 V DC, 11 amp.
- 75 feet maximum lift recommended for efficient purging.
- Unit can operate from external compressed air source for maximum 200-ft. lift.
- Pump flow performance curves for this driver-controller are shown on page 3.

### SPECIFICATIONS

- Weight: 25 lbs.
- Size: 18"L x 15-1/4"W x 6-3/4"H
- Compressor output:
  0.70 SCFM at 0 PSIG
  0.43 SCFM at 40 PSIG
  0.35 SCFM at 60 PSIG
  0.21 SCFM at 100 PSIG

# DRIVER-CONTROLLERS

## MODEL 3111

### DESCRIPTION

- Designed as a self-contained compressed air source for automatic cycling of sampling and purge pumps.
- Includes a mobile gasoline driven compressor and a pump controller.
- 3 HP industrial/commercial Briggs and Stratton engine with lined cylinder, stellite valve and seat, replaceable bearing, and solid-state ignition. Uses unleaded fuel.
- Oilless 100 PSI compressor.
- Adjustable sample flow throttle.
- Independently adjustable pump cycle times.
- Includes two, 20-foot heavy-duty industrial air supply and delivery hoses with quick-connect fittings.
- Rugged fiberglass case.
- Quick disassembly of wheels and handle for ease of handling and transport.
- 16" high flotation tires.

### OPTIONAL FEATURES

- Pump manifold, Model 3000, allows simultaneous operation of three sampling pumps within a 20 ft. radius of controller. Three 20 ft. hose assemblies are included with manifold.
- HR option provides 20% higher output compressor for maximum purge pump flow rates.
- Low submergence valve, Model 3017, assures maximum sampling pump flow rates when pump intake is submerged 10 feet or less.

### APPLICATION INFORMATION

- No batteries or electric supply required.
- Can be used with all sampling pumps, Purge Mizers, Purge Masters, Purge Mizer Controllers, dedicated water level indicators, and cap assemblies.
- 2.5 hours operation on a full tank of gasoline.
- 200 feet maximum lift with internal compressed air source.
- 250 feet maximum lift with external compressed air source.
- Pump flow performance curves for this driver-controller are shown on page 3.

### SPECIFICATIONS

- Weight: 100 lbs.
- Size: 49-1/2"L x 25-1/2"W x 21-1/2"H
- Compressor Output:
  4.40 SCFM at 0 PSIG
  3.10 SCFM at 40 PSIG
  2.80 SCFM at 60 PSIG
  2.55 SCFM at 100 PSIG

## MODEL 3111-HP

### DESCRIPTION

- Designed for deeper wells, this self-powered unit automatically cycles sampling pumps.
- Includes a high pressure mobile gasoline driven compressor and a pump controller.
- 3 HP industrial/commercial Briggs and Stratton engine with lined cylinder, stellite valve and seat, replaceable bearing, and solid-state ignition. Uses unleaded fuel.
- Oilless 165 PSI two stage compressor.
- Adjustable sample flow throttle.
- Independently adjustable pump cycle times.
- Includes two, 20-foot heavy-duty industrial air supply and delivery hoses with quick disconnects.
- Rugged fiberglass case.
- Quick disassembly of wheels and handle for ease of handling and transport.
- 16" high flotation tires.

### OPTIONAL FEATURE

- Pump manifold, Model 3000, allows simultaneous operation of three sampling pumps within a 20 ft. radius of controller. Three 20 ft. hose assemblies are included with manifold.

### APPLICATION INFORMATION

- No batteries or electric supply required.
- Can be used with all sampling pumps, Purge Mizers, Purge Masters, Purge Mizer Controllers, dedicated water level indicators, and cap assemblies.
- 2.5 hours operation on a full tank of gasoline.
- 320 feet maximum lift with internal compressed air source.
- 600 feet maximum lift with external compressed air source.

### SPECIFICATIONS

- Weight: 111 lbs.
- Size: 49-1/2"L x 25-1/2"W x 21-1/2"H
- Compressor Output:
  2.4 SCFM at 0 PSIG
  2.27 SCFM at 70 PSIG
  2.2 SCFM at 125 PSIG
  2.1 SCFM at 165 PSIG

Attachment JCO-008-3

.45 Micron Filter

# DISASSEMBLY & ASSEMBLY FOR 2.4 LITER BARREL FILTER

BARREL FILTER UNIT fully assembled comes with 3 tripod legs to hold unit off the surface so sample container can be fitted underneath it.

To get unit ready for use turn upside down and rest unit on 3 aluminum stand-off legs so bottom of unit can be removed. Remove bottom of unit to set up or change the membrane filter. (Always release air pressure from unit before disassembly). Next unscrew polycarbonate swing-a-way nuts. It's not necessary to take nuts off completely, just loosen until you can swing off of bottom acrylic plate. Take bottom plate and set aside. With unit still upside down fill cylinder with a measured amount of water to be filtered (normally not over 2 liters) being careful to pour directly into cylinder and not around lip where O-ring and filter paper rests. Reassemble unit in this order (Figure 1.): O-ring (A), prefilter (if used) (B), membrane filter (C), filter support screen (D). Polycarbonate pop-out center (E) will stay in bottom plate. Replace bottom plate of unit carefully not to disturb centering of screen, filters and O-ring. Once unit is aligned, start assembly of swing-a-way nut & bolts. Make sure that care is taken in tightening bolts evenly by tightening one nut a little, then moving around to the next, then the next one, and so on until nuts are finger-tightened only.

Unit Shown Upside Down
For Loading Membranes

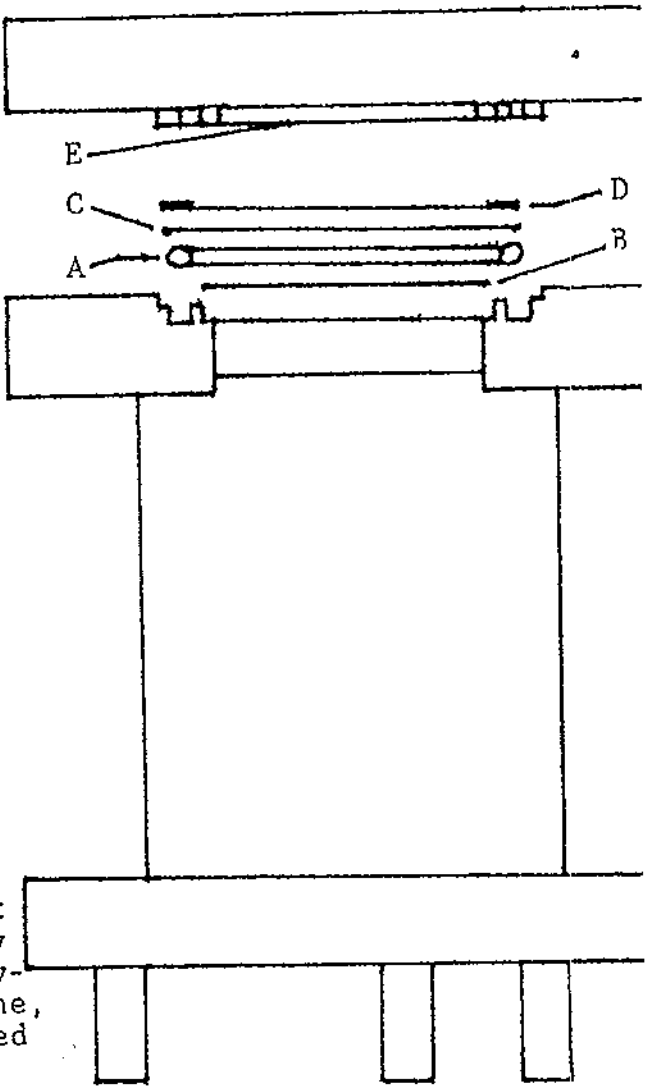



Figure 1. Pressure Filter Parts and Construction

## Filtration

Connect a pressure bulb, air pump or nitrogen bottle (with regulator not to exceed 30 p.s.i.g.) to unit and slowly increase the pressure.
CAUTION: Although each unit has been pressure tested at 60 p.s.i.g., personal safety demands that actual operating pressure NEVER EXCEEDS 30 P.S.I.G.

Ordinarily samples will filter quickly at much lower pressures, and it will seldom be necessary to apply pressure in excess of 20 p.s.i.g. In fact, it has been found that when a filter becomes clogged with residue and the filtration rate slows to a trickle, much more is to be gained by releasing the pressure and replacing the clogged filter with a new one than by increasing the pressure on the filter beyond the recommended 30 p.s.i.g. maximum.

## Care of Filter Unit

Acrylic is a moderately soft plastic material and is easily scratched. Therefore, reasonable care should be used in handling and cleaning the filter unit. Abrasive cleaners should not be used, and all sediment residues should be removed immediately by flushing and thorough rinsing. Organic solvents which attack the plastic should, of course, be avoided. Mild detergent solutions or dilute mineral acids may be used without damage to the filter unit. With proper treatment, the unit will give long and satisfactory service.

## Notes

1. Discard the first 150-200ml of filtrate passing through each fresh filter.

2. The air valve in the pressure hose serves as a check valve, a pressure relief valve, and as a convenient means of connecting a tire pump to the filter unit. Whatever means is used to apply pressure to the filter unit, a check valve is needed to maintain pressure and a relief valve is a great convenience in lowering the pressure inside the unit before disassembly.

## Specifications

| | | |
|---|---|---|
| Membrane Filter Size | - | 102mm |
| Prefilter Size | - | 90mm |
| Material of Barrel Filter | - | Acrylic |
| Pressure Relief Valve set at | - | 35 p.s.i.g. |
| Fittings-Polyethylene | - | 3/8 pipe |
| Pop-out Center | - | Polycarbonate |
| Swing-a-way Nut & Bolt Assembly | - | Polycarbonate |

# CLEANING

## CLEANING

To clean Plexiglas, wash with plenty of non-abrasive soap or detergent and water using the bare hand to feel and dislodge any caked dirt or mud. A soft grit-free cloth, sponge or chamois may be used but only as a means of carrying water to the plastic. Dry with a clean damp chamois. Hard, rough cloths will scratch Plexiglas and should not be used. If the Plexiglas has just been unmasked or if masking adhesive has been left on the surface, it must be removed before washing the sheet. Dampen facial tissues with clean refined kerosene and apply to all areas covered with adhesive. Allow this to remain in contact for several minutes to soften the adhesive. Daub, do not wipe, the adhesive and discard tissue which has picked up the softened material. Repeat until all the adhesive has been removed and then wash as described above.

For interior installations, where water cannot be used freely, Plexiglas should first be dusted very lightly (not wiped) with a soft, clean cloth or feather duster. Then the surface can be wiped carefully with a soft, wet cloth or chamois. The cloth or chamois should be kept free of grit by rinsing it often in clean water.

Grease and oil may be removed with hexane, kerosene, white (not aviation or ethyl) gasoline, aliphatic naptha (no aromatic content), or isopropyl alcohol.

Do not use solvents such as acetone, benzene, carbon tetrachloride, fire extinguisher fluid, dry cleaning fluid and lacquer thinners, since they attack the Plexiglas surface. Do not use window sprays or kitchen scouring compounds.

# Attachment JCO-008-4

## Sample Containers, Preservation and Holding Times

From "Field Methods Manual", State of Vermont Dept of Environmental Conservation

## 6.4 SAMPLE PRESERVATION AND HOLD TIMES

| Measurement | Container | Preservative | Maximum Hold Time |
|---|---|---|---|
| **PHYSICAL** | | | |
| Color | P, G | Cool, 4° C | 48 hours |
| Conductance | P, G | Cool, 4° C | 28 days, if filtered |
| Percent Solids | P, G | Cool, 4° C | ASAP |
| Residue | | | |
| Filterable | P, G | Cool, 4° C | 7 days |
| Non-Filterable | P, G | Cool, 4° C | 7 days |
| Total | P, G | Cool, 4° C | 7 days |
| Volatile | P, G | Cool, 4° C | 7 days |
| Temperature | P, G | None required | Analyze Immediately |
| Turbidity | P, G | Cool, 4° C | 48 hours |
| **CHEMICAL** | | | |
| Alkalinity | P, G | Cool, 4° C | 14 days |
| BOD | P, G | Cool, 4° C | 48 hours |
| COD | P, G | pH <2 (2ml $H_2SO_4$/L) Cool, 4° C | 28 days |
| Chlorophyll | P, G | Dark, cool, 4° C | 6 hours |
| Chlorine | P | None | Analyze Immediately |
| Cyanide | P, G | pH >12 (2ml 10 N NaOH/L) and 0.06 g ascorbic acid/L Cool, 4° C | 24 hours |
| Hardness | P, G | pH <2 (2ml $HNO_3$/L) Cool, 4° C | 6 months |
| Oil & Grease | G only | pH <2 (5 ml 1:1 HCl/L) Cool, 4° C | 28 days |

6.4 (Continued)

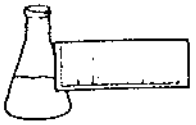
| Measurement | Container | Preservative | Maximum Hold Time |
|---|---|---|---|
| Oxygen Dissolved | | | |
| Probe | G only | None required | Analyze Immediately |
| Winkler | G only | Store in dark $MnSO_4$, I-/Azide | 8 hours |
| Phenolics | G only | $CuSO_4$, $H_3PO_4$ Cool, $4^oC$ | 24 hours |
| pH | P, G | Cool, $4^o$ C | ASAP |
| NUTRIENTS | | | |
| Chloride | P, G | None required | 28 days |
| Nitrogen | | | |
| Ammonia | P, G | pH <2 (2 ml $H_2SO_4$/L) Cool, $4^o$ C | 28 days |
| Kjeldahl, Total | P, G | pH <2 (2 ml $H_2SO_4$/L) Cool, $4^o$ C | 28 days |
| Nitrate/ Nitrite | P, G | pH <2 (2 ml $H_2SO_4$/L) Cool, $4^o$ C | 28 days |
| Nitrate | P, G | Cool, $4^o$ C | 48 hours |
| Nitrite | P, G | Cool, $4^o$ C | 48 hours |
| Phosphorus, Total | G | None required | 28 days |
| Ortho Phosphorus | G | Cool, $4^o$ C | 48 hours |
| Sulfate | P, G | Cool, $4^o$ C | 28 days |
| METALS | | | |
| Total, Dissolved | P, G | pH <2 (2 ml $HNO_3$/L) Cool, $4^o$ C | 6 months |
| Chromium, Hex. | P, G | Cool, $4^o$ C | 24 hours |

6.4 (Continued)

| Measurement | Container | Preservative | Maximum Hold Time |
|---|---|---|---|
| Mercury | P,G | pH <2 (2 ml $HNO_3$/L) | 28 days |
| BACTERIOLOGICAL | | | |
| Fecal coliform | P only | Cool, 4° C | .6 hours |
| Total coliform | P only | Cool, 4° C | 6 hours |
| Fecal strep | P only | Cool, 4° C | 6 hours |
| ORGANICS | If chlorinated: $Na_2S_2O_3$: | | |
| Method 801 | G vial | Cool, 4° C | 14 days |
| Method 802 | G vial | Cool, 4° C<br>pH <2 w 1:1 HCl | 14 days |
| Method 824 | G vial | Cool, 4° C | 14 days |
| Propane | G vial | Cool, 4° C | 14 days |
| Method 827 | G Amber | Cool, 4° C | 7 days to extraction<br>40 days after |
| Method 808 | G Amber | Cool, 4° C | 7 days to extraction<br>40 days after |

NOTE: G = Glass
P = Plastic (Nalgene)

From General Distribution
ENDYNE LABORATORY SERVICES



# ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

## SAMPLING AND PRESERVATION OF SAMPLES

| PARAMETER | METHOD | VOLUME REQUIRED mls | CONTAINER* | PRES. | HOLD. TIME days |
|---|---|---|---|---|---|
| Acid/Base/ Neutral | 625 | 2/1000 | G/T | 4 C | 7/40 |
| IAP | | 2000 | P | 4 C | |
| -pH | 150.1 | | | | immediate |
| -Cl | 325.3 | | | | 28 |
| -$NH_3$ | 350.3 | plus | | | 28 |
| -$NO_2$ | 354.1 | | | | 2 |
| -$NO_3$ | 353.3 | | | | 2 |
| -TKN | 351.4 | | | | 28 |
| -TP | 365.2 | 250 | G | | 28 |
| -TDP | 365.2 | 250 | G | | 28 |
| -$BOD_5$ | 405.1 | | | | 2 |
| -Alkalinity | 310.1 | | | | 14 |
| Residual Chlorine | 330.5 | 100 | G/T | none | immediate |
| COD | 410.1 | 100 | P,G/T | $H_2SO_4$ pH<2 | 28 |
| Color | 110.2 | 100 | P,G/T | 4 C | 2 |
| Conductance | 120.1 | 100 | P,G/T | 4 C | 28 |
| Cyanides | 600. | 1000 | P,G/T | NaOH pH>12 | 14 |
| Fluoride | 340.2 | 100 | P | none | 28 |
| Foaming Agent MBAS | 425.1 | 400 | P,G/T | 4 C | 2 |
| Metals, Diss. | 200series | 1000 | P | filter,$HNO_3$ | 180 |
| Metals,Total | 200series | 1000 | P | digest,$HNO_3$ | 180 |
| Oil + Grease | 413.1 | 2/1000 | G/T | HCl pH<2 | 14 |
| Total Hydrocarbons | 418.1 | 2/1000 | G/T | HCl pH<2 | 14 |

SAMPLING AND PRESERVATION OF SAMPLES

| PARAMETER | METHOD | VOLUME REQUIRED mls | CONTAINER* | PRES. | HOLD. TIME days |
|---|---|---|---|---|---|
| Pesticides + PCB's | 608 | 2/1000 | G/T | 4 C | 7/40 |
| Phenols | | 500 | G/T | $H_2SO_4$ pH<2 | 14 |
| Purgeables | 8240,8010 8020,624 601,602 | 2/40 | G/T | 4 C no bubbles | 14 |
| Purgeables | 502.2 | 2/40 | G | $Na_2SO_4$ 4 C | 14 |
| Solids, Settleable | 160.5 | 1000 | P,G/T | 4 C | 2 |
| Solids, Total | 160.3 | 100 | P,G/T | 4 C | 7 |
| TSS | 160.2 | 100 | P,G/T | 4 C | 7 |
| TDS | 160.1 | 100 | P,G/T | 4 C | 7 |
| TVS | 160.4 | 100 | P,G/T | 4 C | 7 |
| Sulfide | | 500 | P,G/T | 2 ml ZnAc | 7 |
| Sulfite | | 100 | P,G/T | none | immediate |
| TOC | | 500 | G/T | $H_2SO_4$ pH<2 | 28 |
| Total Coliform | | 125 | P(sterile) | 4 C | 6 hours |
| Fecal Coliform | | 125 | P(sterile) | 4 C | 6 hours |
| Turbidity | 180.1 | 100 | P,G/T | 4 C | 2 |
| Herbicides | 509B | 2/1000 | G | 4 C | 14 |

* P = Plastic
  G = Glass
  T = Teflon Seal

E... G.A. Irwin, B.W. Lium, and K.V. Slack, U.S. Geological Survey, Techniques of Water Resources Investigation (USGS TWRI), Book 5, Chapter A4 (1977). Available from: U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202. Cost: $9.25 (subject to change). Table IA.

(13) "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," by M.J. Fishman and Linda C. Friedman; U.S. Geological Survey Open File Report 85-495 (1986). Available from U.S. Geological Survey, Western Distribution Branch, Box 24525, Denver Federal Center, Denver, CO 80225. Cost $108.75 (subject to change). Table IB, Note 1.

(14) "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," N.W. Skougstad and others, editors, USGS TWRI, Book 5, Chapter A1 (1979). Available from U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202. Cost $10.00 (subject to change). Table IB, Note 7.

(15) "Methods for Analysis of Organic Substances in Water," by D.F. Goerlitz and Eugene Brown; USGS TWRI, Book 5, Chapter A3 (1972). Available from U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202. Cost $0.90 (subject to change). Table IB, Note 23; Table ID, Note 4.

(16) "Water Temperature—Influential Factors, Field Measurement and Data Presentation," by H.H. Stevens, Jr., J. Ficke, and G.F. Smoot; USGS TWRI Book 1, Chapter D1, 1975. Available from U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202. Cost $1.60 (subject to change). Table IB, Note 31.

(17) "Selected Methods of the U.S. Geological Survey of Analysis of Wastewaters," by M.J. Fishman and Eugene Brown; U.S. Geological Survey Open File Report 76-77 (1976). Available from U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202. Cost $13.50 (subject to change). Table IE, Note 2.

(18) Official Methods of Analysis of the Association of Official Analytical Chemicals, methods manual, 14th Edition (1985). Price: $145.50. Available from: The Association of Official Analytical Chemicals, 1111 N. 19th Street, Suite 210, Arlington, VA 22209. Table IB, Note 2.

(19) "American National Standard on Photographic Processing Effluents," April 2, 1975. Available from: American National Standards Institute, 1430 Broadway, New York, New York 10018. Table IB, Note 8.

(20) "An Investigation of Improved Procedures for Measurement of Mill Effluent and Receiving Water Color," NCASI Technical Bulletin No. 253, December 1971. Available from: National Council of the Paper Industry for Air and Stream Improvements, Inc., 260 Madison Avenue. Cost available from publisher. Table IB, Note 17.

(21) Ammonia, Automated Electrode Method, Industrial Method Number 378-75WE, dated February 19, 1976. Technicon AutoAnalyzer II. Method and price available from Technicon Industrial Systems, Tarrytown, New York 10591. Table IB, Note 6.

(22) Chemical Oxygen Demand, Method 8000, Hach Handbook of Water Analysis, 1979. Method and price available from Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537. Table IB, Note 13.

(23) OIC Chemical Oxygen Demand Method. Method and price available from Oceanography International Corporation, 512 West Loop, P.O. Box 2980, College Station, Texas 77840. Table IB, Note 12.

(24) ORION Research Instruction Manual, Residual Chlorine Electrode Model 97-70, 1977. Method and price available from Orion Research Incorporation, 840 Memorial Drive, Cambridge, Massachusetts 02138. Table IB, Note 15.

(25) Bicinchoninate Method for Copper, Method 8506, Hach Handbook of Water Analysis, 1979, Method and price available from Hach Chemical Company, P.O. Box 300, Loveland, Colorado 80537. Table IB, Note 18.

(26) Hydrogen Ion (pH) Automated Electrode Method, Industrial Method Number 378-75WA, October 1976. Technicon AutoAnalyzer II. Method and price available from Technicon Industrial Systems, Tarrytown, New York 10591. Table IB, Note 20.

(27) 1, 10-Phenanthroline Method for Iron, Hach Method 8008. Method and price available from Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537. Table IB, Note 21.

(28) Periodate Oxidation Method for Manganese, Method 8034, Hach Handbook for Water Analysis, 1979. Method and price available from Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537. Table IB, Note 22.

(29) Nitrite Nitrogen, Hach Method 8507, Method and price available from Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537. Table IB, Note 24.

(30) Zincon Method for Zinc, Method 8009, Hach Handbook for Water Analysis, 1979. Method and price available from Hach Chemical Company, P.O. Box 389, Loveland, Colorado 80537. Table IB, Note 32.

(31) "Direct Determination of Elemental Phosphorus by Gas-Liquid Chromatography," by R.F. Addison and R.G. Ackman, Journal of Chromatography, Volume 47, No. 3, pp. 421-426, 1970. Available in most public libraries. Back volumes of the Journal of Chromatography are available from Elsevier/North-Holland, Inc., Journal Information Centre, 52 Vanderbilt Avenue, New York, NY 10164. Cost available from publisher. Table IB, Note 27.





(c) Under certain circumstances the Regional Administrator or the Director in the Region or State where the discharge will occur may determine for a particular discharge that additional parameters or pollutants must be reported. Under such circumstances, additional test procedures for analysis of pollutants may be specified by the Regional Administrator, or the Director upon the recommendation of the Director of the Environmental Monitoring and Support Laboratory, Cincinnati.

(d) Under certain circumstances, the Administrator may approve, upon recommendation by the Director, Environmental Monitoring and Support Laboratory, Cincinnati, additional alternate test procedures for nationwide use.

(e) Sample preservation procedures, container materials, and maximum allowable holding times for parameters cited in Tables IA, IB, IC, ID, and IE are prescribed in Table II. Any person may apply for a variance from the prescribed preservation techniques, container materials, and maximum holding times applicable to samples taken from a specific discharge. Applications for variances may be made by letters to the Regional Administrator in the Region in which the discharge will occur. Sufficient data should be provided to assure such variance does not adversely affect the integrity of the sample. Such data will be forwarded by the Regional Administrator to the Director of the Environmental Monitoring and Support Laboratory in Cincinnati, Ohio for technical review and recommendations for action on the variance application. Upon receipt of the recommendations from the Director of the Environmental Monitoring and Support Laboratory, the Regional Administrator may grant a variance applicable to the specific discharge to the applicant. A decision to approve or deny a variance will be made within 90 days of receipt of the application by the Regional Administrator.

TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

| Parameter No./name | Container[1] | Preservation[2,3] | Maximum holding time[4] |
|---|---|---|---|
| **Table IA—Bacterial Tests** | | | |
| 1-4. Coliform, fecal and total | P, G | Cool, 4°C, 0.008% $Na_2S_2O_3$[5] | 6 hours |
| 5. Fecal streptococci | P, G | do | 6 hours |
| **Table IB—Inorganic Tests** | | | |
| 1. Acidity | P, G | Cool, 4°C | 14 days |
| 2. Alkalinity | P, G | do | 14 days |
| 4. Ammonia | P, G | Cool, 4°C, $H_2SO_4$ to pH < 2 | 28 days |
| 9. Biochemical oxygen demand | P, G | Cool, 4°C | 48 hours |
| 11. Bromide | P, G | None required | 28 days |
| 14. Biochemical oxygen demand, carbonaceous | P, G | Cool, 4°C | 48 hours |
| 15. Chemical oxygen demand | P, G | Cool, 4°C, $H_2SO_4$ to pH < 2 | 28 days |
| 16. Chloride | P, G | None required | 28 days |
| 17. Chlorine, total residual | P, G | do | Analyze immediately |
| 21. Color | P, G | Cool, 4°C | 48 hours |
| 23-24. Cyanide, total and amenable to chlorination | P, G | Cool, 4°C, NaOH to pH > 12, 0.6g ascorbic acid[6] | 14 days[7] |
| 25. Fluoride | P | None required | 28 days |
| 27. Hardness | P, G | $HNO_3$ to pH < 2, $H_2SO_4$ to pH < 2 | 6 months |
| 28. Hydrogen ion (pH) | P, G | None required | Analyze immediately |
| 31, 43. Kjeldahl and organic N | P, G | Cool, 4°C, $H_2SO_4$ to pH < 2 | 28 days |
| **Metals:**[8] | | | |
| 18. Chromium VI | P, G | Cool, 4°C | 24 hours |
| 35. Mercury | P, G | $HNO_3$ to pH < 2 | 28 days |
| 3, 5-8, 10, 12, 13, 15, 17, 27, 29, 28, 30, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75. Metals, except chromium VI and mercury | P, G | $HNO_3$ to pH < 2 | 6 months |
| 38. Nitrate | P, G | Cool, 4°C | 48 hours |
| 39. Nitrate-nitrite | P, G | Cool, 4°C, $H_2SO_4$ to pH < 2 | 28 days |
| 40. Nitrite | P, G | Cool, 4°C | 48 hours |
| 41. Oil and grease | G | Cool, 4°C, $H_2SO_4$ to pH < 2 | 28 days |



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TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES—Continued

| Parameter No./name | Container [1] | Preservation [2,3] | Maximum holding time [4] |
|---|---|---|---|
| 42. Organic carbon | P, G | Cool, 4°C, HCl or $H_2SO_4$ to pH<2. | Do. |
| 44. Orthophosphate | P, G | Filter immediately, Cool, 4°C | 48 hours. |
| 46. Oxygen, Dissolved Probe | G Bottle and top. | None required | Analyze immediately. |
| 47. Winkler | do | Fix on site and store in dark | 8 hours. |
| 48. Phenols | G only | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days. |
| 49. Phosphorus (elemental) | G | Cool, 4°C | 48 hours. |
| 50. Phosphorus, total | P, G | Cool, 4°C, $H_2SO_4$ to pH<2 | 28 days. |
| 53. Residue, total | P, G | Cool, 4°C | 7 days. |
| 54. Residue, Filterable | P, G | do | 7 days. |
| 55. Residue, Nonfilterable (TSS) | P, G | do | 7 days. |
| 56. Residue, Settleable | P, G | do | 48 hours. |
| 57. Residue, volatile | P, G | do | 7 days. |
| 61. Silica | P | do | 28 days. |
| 64. Specific conductance | P, G | do | Do. |
| 65. Sulfate | P, G | do | Do. |
| 66. Sulfide | P, G | Cool, 4°C add zinc acetate plus sodium hydroxide to pH>9. | 7 days. |
| 67. Sulfite | P, G | None required | Analyze immediately. |
| 68. Surfactants | P, G | Cool, 4°C | 48 hours. |
| 69. Temperature | P, G | None required | Analyze. |
| 73. Turbidity | P, G | Cool, 4°C | 48 hours. |
| Table IC—Organic Tests [5] | | | |
| 13, 18-20, 22, 24-28, 34-37, 39-43, 45-47, 56, 66, 88, 89, 92-95, 97 Purgeable Halocarbons | G, Teflon-lined septum | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6] | 14 days. |
| 6, 57, 90 Purgeable aromatic hydrocarbons | do | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6], HCl to pH2 [8] | Do. |
| 3, 4, Acrolein and acrylonitrile | do | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6], Adjust pH to 4-5 [10] | Do. |
| 23, 39, 44, 49, 53, 67, 70, 71, 83, 85, 96, Phenols [11] | G, Teflon-lined cap. | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6] | 7 days until extraction, 40 days after extraction. |
| 7, 38 Benzidines [12] | do | do | 7 days until extraction. [13] |
| 14, 17, 48, 50-52 Phthalate esters [12] | do | Cool, 4°C | 7 days until extraction; 40 days after extraction. |
| 72-74 Nitrosamines [12,14] | do | Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$ [6] | Do. |
| 76-82 PCBs [12] acrylonitrile | do | Cool, 4°C | Do. |
| 54, 55, 65, 69 Nitroaromatics and isophorone [12] | do | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6] store in dark. | Do. |
| 1, 2, 5, 8-12, 32, 33, 58, 59, 64, 68, 84, 86, Polynuclear aromatic hydrocarbons. [12] | do | do | Do. |
| 15, 16, 21, 31, 75 Haloethers [12] | do | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6] | Do. |
| 29, 35-37, 60-63, 91, Chlorinated hydrocarbons [12] | do | Cool, 4°C | Do. |
| 87 TCDD [12] | do | Cool, 4°C, 0.008% $Na_2S_2O_3$ [6] | Do. |
| Table ID—Pesticides Tests | | | |
| 1-70 Pesticides [12] | do | Cool, 4°C, pH 5-9 [15] | Do. |
| Table IE—Radiological Tests | | | |
| 1-5, Alpha, beta and radium | P, G | $HNO_3$ to pH<2 | 6 months. |

Table II Notes

[1] Polyethylene (P) or Glass (G)

[2] Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[3] When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.95 or greater); Nitric acid ($HNO_3$) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid ($H_2SO_4$) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater), and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See § 136.3(e) for details.

[5] Should only be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

[7] Samples should be filtered immediately on-site before adding preservative for dissolved metals.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] Sample receiving no pH adjustment must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 12, 13 (re the analysis of benzidine).

[12] If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the sample will be extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[38 FR 28758, Oct. 16, 1973, as amended at 41 FR 52781, Dec. 1, 1976; 49 FR 43251, 43258, 43259, Oct. 26, 1984; 50 FR 691, 692, 695, Jan. 4, 1985; 51 FR 23693, June 30, 1986; 52 FR 33543, Sept. 3, 1987]

EDITORIAL NOTE: Information collection requirements contained in § 136.3(e) have not been approved by the Office of Management and Budget and are not effective, pending OMB approval.



### § 136.4 Application for alternate test procedures.

(a) Any person may apply to the Regional Administrator in the Region where the discharge occurs for approval of an alternative test procedure.

(b) When the discharge for which an alternative test procedure is proposed occurs within a State having a permit program approved pursuant to section 402 of the Act, the applicant shall submit his application to the Regional Administrator through the Director of the State agency having responsibility for issuance of NPDES permits within such State.

(c) Unless and until printed application forms are made available, an application for an alternate test procedure may be made by letter in triplicate. Any application for an alternate test procedure under this paragraph (c) shall:

(1) Provide the name and address of the responsible person or firm making the discharge (if not the applicant) and the applicable ID number of the existing or pending permit, issuing agency, and type of permit for which the alternate test procedure is requested, and the discharge serial number.

(2) Identify the pollutant or parameter for which approval of an alternate testing procedure is being requested.

(3) Provide justification for using testing procedures other than those specified in Table I.

(4) Provide a detailed description of the proposed alternate test procedure, together with references to published studies of the applicability of the alternate test procedure to the effluents in question.

(d) An application for approval of an alternate test procedure for nationwide use may be made by letter in triplicate to the Director, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268. Any application for an alternate test procedure under this paragraph (d) shall:

(1) Provide the name and address of the responsible person or firm making the application.

(2) Identify the pollutant(s) or parameter(s) for which nationwide approval of an alternate testing procedure is being requested.

(3) Provide a detailed description of the proposed alternate procedure, together with references to published or other studies confirming the general applicability of the alternate test procedure to the pollutant(s) or

# Attachment JCO-008-5

## Groundwater Sampling Form

THE JOHNSON COMPANY, INC.
5 State Street
Montpelier, Vermont 05602

FORM-JCO-HYDRO-007
Sheet of
JCO File #:

Date:_____ Project I.D.:_____

Location:_____

Site/Well No.:_____ Coded/Replicate No.:_____

Sampler:_____

Weather:_____ Time Started:_____ Time Completed:_____

EVACUATION DATA

Description of Measuring Point (MP):_____

Height of MP Above/Below Land Surface:_____ MP Elevation:_____

Depth to Water Below MP:_____ Total Well Depth:_____

Diameter of Casing:_____ Column of Water in Well:_____

Gallons per Foot[1]:_____ Gallons in Well:_____

Gallons Pumped/Bailed Prior to Sampling:_____

SAMPLING DATA/FIELD PARAMETERS

Temperature:_____ °C/°F Color:_____

Specific Conductance:_____ umhos/cm Odor:_____

pH:_____ Std. units. Appearance:_____

ORP:_____ mv.

| Parameter | Measurement | Units |
|---|---|---|

Other (specific ion; OVA; HNU; Etc).____

Sampling Method and Material:_____

| Parameter | Container Descripton | Preservative |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Remarks:_____

[1] Well casing volumes - Gal./ft.

1.25" = 0.077 2.00" = 0.16 3.00" = 0.32 4.00" = 0.65
1.50" = 0.10 2.50" = 0.24 3.50" = 0.50; 6.00" = 1.46

# Attachment C

# State of Qualifications

# STATEMENT OF QUALIFICATIONS

## The Johnson Company, Inc.
## Montpelier, Vermont

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*August 1990*

*Prepared by:*

THE JOHNSON COMPANY, INC.

*5 State Street - Montpelier, Vermont 05602*

*(802)229-4600*

*ENVIRONMENTAL SCIENCES AND ENGINEERING*

TABLE OF CONTENTS

# 1.0 BACKGROUND

## 1.1 INTRODUCTION

The Johnson Company was founded in 1978 by Martin L. Johnson, Ph.D., P.E. to provide quality civil engineering and environmental consulting services.

Over twenty professionals work out of our Montpelier, Vermont office. National recruitment has brought together a qualified group of engineers and scientists specializing in the fields of:

- Civil Engineering
- Environmental Engineering
- Hydrology
- Geology
- Hydrogeology
- Soil Science
- Aquatic Biology/Wetlands
- Environmental Permitting
- CADD and Computer Technology

The Johnson Company has been retained by such organizations as Central Vermont Public Service Corporation, Colt Industries, Consolidated Power Corporation, Monsanto Agricultural Corporation, Simmonds Precision, Ethan Allen, Inc., and Unifirst Corporation to offer engineering and scientific guidance and knowledge. In several of these projects, The Company has defined political, economical, statutory, and environmental boundaries to mitigate conflicts and accelerate solutions.

The success of The Johnson Company can be directly attributed to the talented staff it has attracted and maintained. This unique union of professional backgrounds fosters the effective undertaking of a variety of complicated projects. Strong technical competence and sound judgement contribute to the successful completion of projects.

## 1.2 SUBSURFACE CONTAMINATION

The Johnson Company has been in business for over twelve years and has been at the forefront of the evolution of Vermont's approach to environmental contamination. We have worked on numerous uncontrolled hazardous waste sites in Vermont and elsewhere, some of which are listed in the following section.

We have managed many remedial investigation/remedial action projects in Vermont under the jurisdiction of the Agency of Natural Resources Hazardous Sites Management Section. These projects include non-aqueous phase liquid recovery, excavation of buried waste, pumping and treatment of contaminated groundwater and soil vapor extraction. We have had extensive involvement in the Wells G & H Superfund Site in Woburn, Massachusetts, one of New England's most problematic contamination sites. Our work at the Unifirst Site in Williamstown, Vermont has also added significantly to our knowledge of the behavior and characteristics of contamination by halogenated aliphatic (and other) compounds.

We have worked on numerous petroleum contamination sites, including the largest non-aqueous phase liquid (NAPL) recovery effort in the State of Vermont under the auspices of the Agency of Natural Resources Petroleum Sites Management Section (PSMS). These projects have given us experience in solute transport characterization, NAPL transport and mobility processes, vapor phase transport, design and implementation of remedial systems and monitoring and sampling techniques.

The Johnson Company has worked for potentially responsible parties (PRPs) at a number of Superfund sites including: The Wells G & H Site in Woburn, Massachusetts; the Auburn Road Landfill in Londonderry, New Hampshire; and the Tansitor Electronics Site in Bennington, Vermont. We are very familiar with the CERCLA and RCRA processes.

The Johnson Company is one of Vermont's leading firms in the area of environmental site assessments (ESAs). We worked extensively with the Vermont Bankers Association and the Department of Environmental Conservation to develop a sound and realistic policy for site assessment accompanying the transfer of industrial or commercial property. Performing ESAs requires skills in conducting thorough background studies, identifying potential sources of contamination and then

following up with limited investigations. These skills are directly applicable to the first crucial stages of remedial investigations.

We have worked extensively on retrospective and prospective pesticide and herbicide studies under the provisions of the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA). These studies typically involve sampling for compounds in trace quantities under stringent Quality Assurance/Quality Control measures.

The Johnson Company maintains extensive computer capabilities including personal computers, word processing and desktop publishing work stations, a local area network and computer aided drafting and design (CADD) work stations. We have numerous graphing and graphics software packages, a sophisticated database management system and groundwater modeling capabilities. We are interfaced with several extensive data bases, which allow us instant access to information in virtually any field. We maintain in-house streamflow and climate databases on optical disks, which cover the eastern United States. Our personnel are extremely proficient in the application of computer technology, resulting in our recent selection by the Vermont DEC to develop a Hazard Ranking System and software package for the State of Vermont.

We maintain state-of-the-art survey equipment including total station electronic distance meter (EDM), electronic field book and computer interface.

## 2.0 EXPERIENCE

### 2.1 PARTIAL CLIENT LISTING

ADDISON COUNTY SOLID WASTE DISTRICT - *Landfill Closure Plan*
ADVANCE PROPERTY MANAGEMENT - *Environmental Site Assessment*
AGRI-MARK, INC. - *Dairy Process Water Disposal Design and Permitting*
BARRE GRANITE ASSOCIATION - *Dewatering Design, State Grant Application*
BEN AND JERRY'S HOMEMADE, INC. - *Land Application and Disposal of Process Wastes*
CABOT FARMERS COOPERATIVE CREAMERY - *Land Assessments for Whey Disposal Suitability*
CALEDONIA OIL COMPANY - *Investigation of Subsurface Petroleum Contamination*
C.E. BRADLEY LAB, INC. - *Remedial Investigation and Remediation*

CENTRAL VERMONT PUBLIC SERVICE CORPORATION - *Electric Rate Setting*

CENTRAL VERMONT SEPTIC SERVICE - *Interim Certification for Land Application of Septage*

CITIZENS UTILITIES COMPANY - *Power Transmission Line Permitting*

COLT INDUSTRIES COMPANY - *Remedial Investigation, Remedial Action*

CONSOLIDATED POWER COMPANY - *Natural Gas Cogeneration Facility Permitting*

CYPRUS INDUSTRIAL MINERALS - *Facility Siting for Talc Mining Facility*

DOVER SCHOOL BOARD - *Soils Investigation and Wastewater Disposal Evaluation*

DOWNS, RACHLIN AND MARTIN - *Expert Witness Services*

ELMSLIE DAM - *Replacement Dam Design, Construction Supervision and Inspection*

ETHAN ALLEN, INC. - *Groundwater Contamination Investigation and Remediation*

GOODWIN, PROCTOR AND HOAR - *Expert Witness Services Relating to Hazardous Waste Sites*

GREEN MOUNTAIN POWER CORPORATION - *River Low-Flow Studies*

HARTIGAN COMPANY, INC. - *Interim Certification for Septage Waste Disposal*

HOWARD BANK - *Underground Storage Tank Investigation*

MERIDAN-STINEHOUR PRESS - *Design of Process Wastewater Treatment and Disposal System and Groundwater Contamination Investigation*

MONSANTO AGRICULTURAL CHEMICALS - *Pesticide Fate Analyses, Expert Witness Testimony*

NATIONAL LIFE INSURANCE - *Drainage Evaluation, Investigation and Design*

OKEMO REALITY DEVELOPMENT CORPORATION - *Water Supply Development*

OLD FOX CHEMICAL COMPANY - *Hazardous Waste Management and Remediation*

PALISADES LANDFILL - *Solid Waste Recycling Facility Design, Hydrogeological Investigation and Leachate Monitoring*

PIKE INDUSTRIES - *Road Design and Permitting for Gravel Quarry*

PSE, INC. - *Natural Gas Co-generation Facility Siting and Permitting*

SIMMONDS PRECISION - *Closure of Hazardous Waste Storage Facility, Environmental Site Assessment, Remediation of Contaminated Soil*

STATE OF VERMONT - *Pollution Investigation and Abatement Projects, Development of Computerized Hazard Ranking System*

STATE OF VERMONT DEPARTMENT OF AGRICULTURE - *Proposed Gas Pipeline Impact Study*

UNIFIRST CORPORATION - *Hazardous Waste Remediation*

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT - *Consulting in Hydrology and Natural Resources Management: Maseru, Lesotho; Mbabane, Swaziland, Katmandu, Nepal; Kumning, People's Republic of China; Manila, Philippines*

VERMONT GAS SYSTEMS, INC. - *Permitting and Design for Demand Peak Shaving Facility*

VERMONT SOLID POWER, INC. - *Resource Recovery Facility Development and Permitting*

VERMONT STRUCTURAL STEEL - *Site Remediation: Soil Removal and Groundwater Monitoring*

VERMONT BANKERS ASSOCIATION - *Environmental Site Assessment Strategy*

VILLAGE OF EAST THETFORD - *Fire Water Supply Feasibility Study*

WYMAN'S, INC. - *Design and Permitting for Waste Treatment System, Remedial Investigation and Remedial Action.*

## 2.2 REPRESENTATIVE SUBSURFACE CONTAMINATION PROJECTS

Representative projects are listed below under the heading of the lead regulatory entity for each site.

*U.S. EPA Sites.*

Wells G & H, Woburn, Massachusetts

Auburn Road, Londonderry, New Hampshire

Tansitor Electronics, Bennington, Vermont

Plywood Ranch Asbestos Site, Nashua, New Hampshire

*Vermont Department of Environmental Conservation Sites*

C.E. Bradley Laboratories, Inc., Brattleboro, Vermont

Ethan Allen, Inc., Orleans, Vermont

Wyman's Meter and Tank, Inc., Berlin, Vermont

Vermont Structural Steel, Burlington, Vermont

Meriden Stinehour Press, Lunenberg, Vermont

Unifirst Inc., Williamstown, Vermont

Simmonds Precision, Middlebury and Vergennes, Vermont

Raymond S. Roberts, Inc., Bennington, Vermont

Old Poultney Dump, Poultney, Vermont

LeBeau and O'Brien Oil Company, Vergennes, Vermont
Colt Industries, St. Johnsbury, Vermont
Northern Petroleum, Washington, Vermont
S.B. Collins, Swanton, Vermont
C.P. Dudley Store, E. Montpelier, Vermont
Johnson & Dix, Ludlow, Vermont
Vermont Agency of Transportation, Colchester, Vermont
Central Vermont Truck Stop, Berlin, Vermont

## 2.3 REPRESENTATIVE PROJECT SUMMARIES

**1) Goodwin, Proctor & Hoar, Woburn, MA**

*evaluation of treatment alternatives for a superfund site*

The Johnson Company, working for Goodwin, Proctor & Hoar, a Boston law firm representing an industrial corporation, evaluated the U.S. EPA's documentation and findings for the cleanup of the Wells G & H Superfund site in Woburn, Massachusetts. The Johnson Company provided a critical technical review of the remedial investigation performed by the U.S. EPA contractor. This review included on-site sampling and analysis as well as working with leading experts in various environmental fields such as the colloidal transport of polynuclear aromatic hydrocarbons in groundwater. As one of six potentially responsible parties at the site, the client wished to initiate a remedial program to control potential liability. We designed, cost estimated and documented a variety of control and treatment programs to address remediation objectives, as well as a number of monitoring and sampling efforts to fully characterize and delineate the extent of contamination. Our recommended approach also included a program which will track the effectiveness of the various remedial efforts as they progress.

2) Auburn Road Landfill

*Superfund Site*

Environmental Project Control (EPC) was retained by legal counsel for one of the PRPs of a Superfund Site in southern New Hampshire. The Johnson Company was retained by EPC to provide technical and production staff and assistance to EPC in fulfillment of their obligations.

The project site is a municipal and industrial landfill with a history of operations spanning several decades. The Record of Decision (ROD) issued by U.S. EPA was reviewed in conjunction with as much of the Remedial Investigation/Feasibility Study (RI/FS) data and additional investigatory data as could be obtained. A comprehensive analysis of the site conditions including soils, geology, hydrology, meteorology, and ecology was undertaken. A conceptual model and hypothesis was developed for contaminant history as well as contaminant transport and fate within the site and along the migrational pathways. The past, present and potentially future land uses for the site and immediately surrounding areas were evaluated.

Additional data requirements, both conformational and previously unaddressed needs, were assessed with conclusions and recommendations provided. The Johnson Company provided a detailed description was provided of the data gathering tasks required to confirm the conceptual understandings of the site and to proceed in the Remedial Design and Remedial Action process. A phased approach to remedial efforts was outlined as were the conceptual remedial strategies to achieve site compliance. Detailed recommendations were made regarding data acquisition methods, analytical methods and remedial technology selection. A detailed cost estimate and schedule were provided which included negotiations, recommended investigations, feasibility studies and remedial actions. Presentations of the above with findings, conclusions and recommendations were made to the PRPs and to U.S. EPA Region I. This project is currently in a negotiations stage between the PRPs and the U.S. EPA.

3) Tansitor Electronics

*review of Hazard Ranking Score and negotiations with Governmental Agencies.*

The Tansitor Electronics Superfund Site is located 7 miles west of Bennington, Vermont. Tansitor manufactures a number of electronic components for various defense industries. Disposal of manufacturing wastes from the 1950's until early 1979 resulted in contamination of the surficial aquifer with various chlorinated volatile organic compounds and metals.

The Johnson Company was retained to comment on the proposed Hazard Ranking Score of the site, prior to it's listing on the National Priority List (NPL). The Johnson Company has also prepared detailed cost estimates of a proposed, State led, Remedial Investigation/Feasibility Study. Currently, The Johnson Company is involved in negotiations with the PRPs and U.S. EPA for a U.S. EPA supervised RI/FS.

4) C.E. Bradley Laboratories, Brattleboro, VT

*subsurface contamination investigation and remediation*

A release of solvents was suspected at the site of an industrial coatings and paint manufacturer. The Johnson Company designed and implemented a groundwater monitoring network which detected several feet of free phase solvent contamination on the water table as well as extensive dissolved phase groundwater contamination. The nature and extent of the contamination was defined and a groundwater recovery and treatment system was installed. Due to the extremely low permeability of the sediment, The Johnson Company proposed a multifaceted Phase II approach to augment groundwater recovery and treatment including groundwater recharge, in-situ biodegradation and landfarming with vapor abatement. Remediation of the site is now in progress.

5) Ethan Allen, Inc., Orleans, VT

*hazardous waste investigation and remediation*

The Johnson Company was hired by Ethan Allen Furniture to investigate and remediate contamination caused by stains and solvents which had been disposed of at an on-site landfill. Our investigation included determination of site geology, groundwater movement patterns and rates, and

the extent of soil and water contamination. A geophysical survey was undertaken to locate buried drums, which were subsequently removed. A remedial program was designed and successfully implemented. The site is presently in the closure process.

6) **Unifirst Corporation, Williamstown, VT**

*groundwater investigation, remediation and ongoing monitoring*

The Johnson Company was initially hired in 1983 to assess the extent of contamination from leaking industrial solvents. We designed a remedial program including source removal and groundwater collection and treatment; provided operations and maintenance services and ongoing sampling, monitoring and reporting; specified, coordinated and documented ultimate disposition of various hazardous wastes; negotiated and obtained all required governmental approvals; and provided expert testimony in several subsequent court cases.

7) **Wyman's Meter and Tank, Inc. Montpelier, VT**

*subsurface investigation, remediation and hazardous waste treatment facility design*

The Johnson Company was called in when Wyman's, a fuel tank cleaning business, was suspected of degrading the ground and surface water quality in a wetland adjacent to their site. Our investigation revealed that the company's wastewater disposal system had contaminated the surficial aquifer. Our remedial action effectively mitigated the impact to the wetland, a nearby river and water supplies, and protected a confined aquifer below. The Johnson Company developed a closure and post closure plan resulting in the successful closure of the site. In addition, we evaluated treatment alternatives which would prevent further contamination of the site by Wyman's petroleum contaminated wash water. We also design and permitted a new hazardous waste treatment and recycling system which has served as a prototype for wastewater treatment systems at other facilities in the Northeast.

8) Colt Industries, St. Johnsbury, VT

*petroleum release investigation and remediation*

A petroleum sheen on the Sleepers River prompted the Vermont Department of Environmental Conservation to require an investigation at the former Colt Industries manufacturing site. The Johnson Company designed and implemented a groundwater monitoring network which revealed the presence of a layer of fuel oil several feet thick on the water table adjacent to a river. A remedial system was installed which consisted of two laterally extended wells located parallel to the river. The configuration of four groundwater recharge galleries was determined on the basis of groundwater modeling done by The Johnson Company. An automatic, programmable recharge controller was installed, and the system has recovered approximately eight thousand gallons of fuel oil from low permeability sediments. Meanwhile, a surface water sampling program demonstrated that minimal impact to the water quality of the river had occurred.

9) Monsanto Agricultural Company, St. Louis, MO

*fate analysis of an agricultural herbicide, Deerfield, MA*

The Johnson Company performed an investigation and analysis of an agricultural herbicide's impact on soil and groundwater for this major agricultural chemical manufacturer. A field-scale retrospective study was conducted at two test sites in western Massachusetts which included groundwater and soil monitoring and an analysis of leaching potential. The Johnson Company's research and subsequent expert testimony convinced the Commonwealth of Massachusetts not to revoke the registration of the herbicide.

10) Vermont Structural Steel, South Burlington, VT

*environmental site assessment, remedial investigation and closure*

The Johnson Company was hired by Vermont Structural Steel to perform an Environmental Site Assessment on a property which they owned and planned to sell. We installed groundwater monitoring wells and implemented a sampling procedure for soil and groundwater contamination. Our investigation revealed subsurface contamination on the site. Based on our findings, we immediately designed and implemented a remediation plan that removed contaminated soil from the

site. A subsequent groundwater monitoring program satisfied the involved parties and regulatory agencies and enabled the property transfer to proceed.

**11) Old Poultney Dump, Poultney, Vermont**

*response to CERCLIS process*

Suspected dumping of mercury and solvents in the town landfill prompted EPA to initiate the CERCLA evaluation process for the site. In response to requests by the Vermont Department of Environmental Conservation, the Town of Poultney retained The Johnson Company to investigate the presence and associated risk of these hazardous wastes. Geophysics and unconsolidated and bedrock monitoring wells were used to hydrogeologically characterize the site. The results of this investigation clearly show that there were no significant impacts on the environment from this former town dump.

## 2.4 REFERENCES

Available upon request.

## 2.5 HAZARDOUS SITE TRAINING

All of The Johnson Company employees involved in hazardous waste operations, have received 40 hours of OSHA approved training in compliance with 29 CFR 1910.120. An additional 8 hours of supervision training has been attended by a core group of hazardous waste operation project managers. The Johnson Company has a full compliment of personal protective equipment to meet OSHA Level C requirements. That is adequate for the majority of waste operations. Additional equipment to meet OSHA Level B is available on demand. Johnson Company corporate policy mandates the use of safety equipment to protect all employees, subcontractors and the general public during site operations. Our safety program is the most comprehensive in the State of Vermont.