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John P. Cahill
Commissioner

November 19, 1999

Ms. Gayle M. Bahn
Arch Chemicals, Inc.
P.O. Box 800
1200 Lower River Road
Charleston, TN 37310

Re: Arch Chemicals (#828018a) - 100 McKee Road, Rochester (C)
- **Your 8/2/99 and 9/21/99 letters**
- **Quarterly Report #22**
- **F039 waste guidance**

Dear Ms. Bahn:

Regarding your notification that Arch intends to decommission its overburden extraction system, the Department agrees that the system is ineffective but it is not clear that the wells are "non-functional". What is meant by non-functional and extremely low yields? Please quantify recent yields and the contaminant mass removed by these wells. The Department previously requested reporting of well yields and contaminant mass removal among other items in a 2/8/99 letter but the information has not been received.

In your 8/2/99 letter, you stated that the overburden extraction wells were installed in 1983 in an effort to contain groundwater contamination detected beneath the plant. The September 1982 Hydrogeological Investigation Report authored by Mr. Michael Belotti indicated that these 2-inch diameter overburden wells were installed in January 1982 for monitoring purposes in response to the 1981 discovery of chloropyridines in the Ness production wells located on Buffalo Road about 1000 feet south of the Olin plant. Olin decided to convert these wells to pumping wells in 1983 (said to be cheaper than French or gravity drains) after significant groundwater contamination was discovered along the west, east, and south property boundaries in 1982. For a number of years, Olin maintained that the Ness wells were contaminated by overburden flow and down the well casing until the installation of bedrock wells proved otherwise. A 1985 report showed the following yields from the overburden system which approach an estimated groundwater flux of 4800 gallons/day:

July 1985	4720 gallons/day
August 1985	2150 gallons/day
September 1985	3805 gallons/day

October 1985 3394 gallons/day

Such reporting appears to cease in 1985; are records available at the plant which could be shared with the Department. Do historical records show a decline over time?

Piezometric contour plots in quarterly reports over the last few years show very little drawdown in many of the extraction overburden wells which suggests that some wells were pumped only sporadically and in later years, perhaps not at all (inconsistent operation/maintenance). 1995 data (5/95 and 9/95) showed considerable drawdown (521'-522') in a number of perimeter wells but the key SW corner appeared unaddressed. A non-pumping condition plot in 11/95 is consistent with many subsequent plots. For example, the 8/97 plot shows no drawdown at a number of wells (e.g., W-1, W-3, W-5, S-2, E-1). Oddly, plots from 2/97,12/97 and 6/98 show mounding (>535') conditions (e.g., W-3, W-4, and E-1) in some wells, reflective of injection rather than extraction wells; how are these observations interpreted/explained? Has the system been operated optimally and if not, why not?

The Department is unaware of any other sites which have used 2" monitoring wells for long-term groundwater extraction purposes. As noted in previous correspondence, pumping from 2" monitoring wells is not likely to be efficient; the small radius coupled with the small slot openings presents very little open area to the aquifer. You mentioned that new wells designed for pumping would likely provide higher yields and greater capture but that a large number would be required. How many wells of what specifications are envisioned and would interceptor trenches work better and be more cost-effective? Properly-designed wells and other interception alternatives need thorough evaluation in the FS.

Your letter implies that the bedrock extraction system may be adequate to contain contaminant plumes onsite and intend to use data from the SE part of the site in an attempt to prove it. Given historic and current data showing overburden problems on the west perimeter (Firth Rixson (formerly Monroe Forgings) excavation data and MW-106), the south perimeter (detection of 10 ppm of chloropyridines in the overburden groundwater from the adjacent property to the south) as well as high contaminant levels in some bedrock property-line and proximal offsite wells (e.g., PZ-102, 103, 104, and 105), it's not clear that further analysis of existing data in the SE would accomplish this objective. Certainly collection of additional offsite overburden data would be helpful (add EC-1, PZ-104, and MW-105 for overburden monitoring and consider adding other key locations). Also, concerns over the lab sample area and the resulting plume flowing NW have not been adequately addressed; the source area and plume are undefined particularly in bedrock.

Given the uncertainties of overall containment and data which indicate continued and long-term gaps in perimeter containment, it would seem reasonable to have an alternative in place prior to decommissioning these overburden wells. Given the relatively slow groundwater velocity in the overburden (tens of feet per year), a short lapse of time before an alternative is in place may not compromise overall containment (such as it currently exists) but clearly overburden contamination must be addressed as soon as feasible. Another key issue has been limitations on the capacity of the plant treatment system to treat extracted groundwater; has this limitation hindered containment efforts (optimal pumping of all extraction wells); what are the yields (GPM), depths and drawdowns of all pumping wells (GPM) and any variations with time; what is the current treatment capacity relative to extracted groundwater volumes; does this capacity vary with time and with plant processes and hence affect containment efforts over time?

Note that the use of a 5-foot contour interval for bedrock piezometric data as used in recent quarterly reports severely limits the interpretation and usefulness of the plots. It appears that BR-6A and perhaps other wells are no longer pumping; please clarify and follow the quarterly report recommendations (page 6) in my 2/8/99 letter to you. Other unresolved/unaddressed issues in the 2/8/99 letter include Other Source Areas (page 5), such as the lab sample area, the BR-101 area, and the occurrence of chloropyridines at the Beehler-Radford (#828054) site which was reported as part of your consultant's investigation of possible other sources of chloropyridines to the Erie Barge Canal. It was noted that Olin has detailed disposal records; could you provide the disposal locations and estimated amounts of Olin wastes at each disposal location?

Regarding the draft letter work plan for the DPE Pilot Test:

1. The stated hydraulic conductivities (10^{-4} cm/sec for overburden and 10^{-3} to 10^{-4} cm/sec for bedrock) have been repeatedly questioned as low estimates in previous correspondence (e.g., in a 1/6/98 letter on the final Phase II RI report (page ES-2):

   "The stated range of hydraulic conductivity data for shallow bedrock (4×10^{-5} to 1.7×10^{-3} cm/sec) appears underestimated considering the pump test data at BR-6A and BR-7A (10^{-2} to 10^{-3} cm/sec), the instantaneous slug recovery at BR-105 (>10^{-2} cm/sec), and the offsite slug tests along the canal (10^{-2} to 10^{-3} cm/sec). Also, much of the overburden data appears to be in the 10^{-3} cm/sec range. Further, the stated transmissivity range on page E-3 (250 to 350 ft^2/d) appears underestimated considering the range of data for BR-7A on page 2-24 (300 to 600 ft^2/day) and the data presented in Table 2-13 (250 to 1300 ft^2/day) for BR-6A. These data are key parameters in groundwater flow modeling, capture zone/containment analysis, and groundwater flux and flow estimates.")

2. Is the log available for PW-10 and were any soil samples collected during drilling?

3. What type of groundwater pump will be used?

4. Other nearby wells should also be monitored for water levels and vacuum if possible (unsaturated screens) and measurements should be made frequently (certainly more often than "daily").

5. Vacuum of 3" to 5" Hg is quite low; consider ramping up step-wise (10" then 20") and measure differences in contaminant recovery and vacuum influence.

6. Is three days sufficient to properly evaluate the technology?

Finally regarding your inquiry about the F039 waste code, the following is guidance from Albany staff:

Contaminated soils cannot be F039 because F039 only applies to certain leachate, and soil wouldn't meet the definition of leachate. Whether "contaminated fluids" are F039 is a trickier question. Technically "leachate" is defined in such a way that it would meet the regulatory definition of leachate (defined at 370.2(b)(113) as "a liquid, including any suspended components or dissolved compounds in the liquid, which has been in contact with or passed through solid waste, including hazardous waste" {this is a slightly different definition that what EPA has in 260.10}. EPA raises the stakes by specifically stating at 6/1/90 FR 22619 that "a generator does not have the option to continue classifying their multi-source leachate (under the waste code carry-through) as all the listed wastes from which it is derived; multi-source leachate must be classified as F039."

Fluids obtained from drilling/excavation activities meet the definition of leachate. However, to avoid causing unnecessary confusion if the contaminated soil were to be identified as a host of listed wastes (e.g., K###, F00x, etc.) but the fluids identified instead as F039, it appears that the mandatory usage of F039 for the drilling/excavation fluids can be waived here. (After all, EPA also stated in the above Federal Register that EPA considers the switch to F039 to be a "bookkeeping change")

So, in summary, F039 cannot be used for the contaminated soil and F039 is not required for the drilling/excavation fluids.

In lieu of F039, what waste codes must be used? It would be all the listed hazardous waste codes that apply, of course, but also any characteristic codes that come from constituents that cannot be traced back to a parent listed hazardous waste. For example, if there is no evidence that carbon tetrachloride found in Arch/Olin's soils/fluids came from a listed hazardous waste source and if the soils or fluid fail the TCLP for D019, then the D019 waste code - - as well as all the listed codes - - must be assigned to the waste. (This only becomes important when determining what the applicable LDR treatment standards).

Thank you for your continued cooperation and please contact me with any questions or comments.

Sincerely,

James H. Craft
Engineering Geologist

c: M.J. Peachey, J. Moloughney, M. Desmond,
S. Shost, NYSDOH J. Albert, MCDOH

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1200 Lower River Road
Charleston, TN 37310
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September 21, 1999

Mr. James H. Craft
New York State
Department of Environmental Conservation
6274 East Avon-Lima Road
Avon, NY 14414

Dear Mr. Craft:

As part of the Feasibility Study ongoing at the Arch Chemicals-Rochester site, I am submitting for your information the attached work plan for the pilot testing of a dual-phase extraction well. The pilot test is intended to determine whether dual-phase extraction could be an effective technology to accomplish significant mass removal of site-related contaminants within the former contaminant source areas.

The pilot test will be conducted on the newly installed recovery well, PW10. Recovery well PW10 was installed in August of this year adjacent to overburden monitoring well B17. The pilot test is scheduled for the fourth quarter 1999. In accordance with the Order of Consent, your office will be notified of the actual test date.

If, after examining the attached work plan, you have questions or concerns, please contact me at (423) 780-2175.

Sincerely,

Gayle M. Bahn
Manager, Environmental Issues

Cc: Mary Jane Peachy, NYSDEC
R.J. Stadalius, Arch Chemicals, Inc.
R. Gahagan, Arch Chemicals, Inc.
W.D. Mitchell, Arch Chemicals, Inc.
T.R. Eschner, Harding Lawson Associates, w/o att.

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Harding Lawson Associates

September 1, 1999

Ms. Gayle Bahn
Arch Chemicals, Inc.
P.O. Box 800, Lower River Road
Charleston, TN 37310

Subject: **Arch Rochester Site Feasibility Study**
Draft Letter Work Plan for Dual Phase Extraction Pilot Test

Dear Ms. Bahn:

This letter describes the proposed pilot testing of dual-phase extraction (DPE) as a potential remediation technology at the Arch Chemicals Plant in Rochester, New York. This work plan includes a brief overview of DPE and how the technology could potentially contribute to the overall site remediation strategy for the Arch Site, and a description of the proposed test procedures for the pilot study.

Background

Groundwater beneath the Arch Plant has been impacted by past releases of process-related chemicals including chloropyridines and chlorinated volatile organic compounds (VOCs). Contamination is present in overburden groundwater and within the fractured dolomite bedrock. A perimeter groundwater extraction and treatment system is currently operating at the Arch Plant to prevent off-site migration of contaminated groundwater. This investigation is intended to determine whether DPE may be an effective technology to accomplish significant mass removal of site-related contaminants within the former source areas as a supplement to the perimeter extraction system. The test will compare the performance of DPE (as measured by total contaminant mass removal from the test well) to the performance of groundwater extraction from the same well under non-vacuum conditions. The results of this pilot test will be used in the Feasibility Study to evaluate potential final remedies for the Arch site.

Technology Description

Dual-phase extraction technologies remove both contaminated groundwater and soil vapors from the same extraction well. The two methods of extraction may complement each other, resulting in a higher rate of contaminant mass removal than either technology would yield alone. The effectiveness of DPE depends on several factors, including:

- volatility of the contaminants of concern;
- hydrogeologic conditions in the subsurface; and
- distribution of contaminants in the subsurface.

In general, DPE is considered to be most effective on VOCs (compounds with vapor pressures exceeding 1mm Hg), and in low to moderate hydraulic conductivity soils. In low hydraulic conductivity settings (i.e., in wells that achieve groundwater pumping rates of less than 5 gallons per minute), a high vacuum approach is typically used, which results in both removal of soil gas and, in many cases, increased flow of contaminated groundwater and non-aqueous phase liquids to the well.

With DPE, groundwater extraction within the well creates a cone of depression that allows for vapor movement through the formerly saturated or partially-saturated soils, including the capillary fringe where concentrations of lighter VOCs typically are highest. In addition, VOCs with low water solubility and high affinity for soil carbon may be more effectively removed by exposure to soil venting and volatilization than by desorption and recovery in a groundwater extraction system.

DPE can also enhance the removal of dissolved groundwater contamination and NAPL by creating a pneumatic gradient in the well in addition to the hydraulic gradient. This phenomenon tends to be more pronounced in low hydraulic conductivity soils, where higher vacuums can be attained and deeper cones are formed.

Applicability of DPE to Conditions at the Arch Site. Conditions at the Arch site are not ideal for the application of DPE for two reasons. First, a substantial portion of the contaminants of concern consists of chloropyridines, which are semi-volatile compounds with vapor pressures lower than 1 mm Hg. These compounds are not expected to be appreciably removed with the vapor phase of the DPE process; however, it is possible that the pneumatic gradients in the DPE well could enhance the mass removal rate of chloropyridines in the groundwater extraction component of the technology. Second, a substantial portion of the contaminant mass is present within the shallow fractured bedrock beneath the site. It is estimated that roughly 40 percent of the total VOC contaminant mass resides within the shallow bedrock groundwater. Groundwater pumping at the site would not be expected to dewater the upper bedrock to any significant degree. Even if bedrock were dewatered, vapor movement would be predominantly through larger, connected fractures, whereas much of the contaminant mass is likely to be located within dead-end fractures or even permeated into the rock matrix. Therefore, it is anticipated that the groundwater pumping associated with DPE will result in the bulk of the mass removal from the well.

Despite the discouraging site conditions, there are portions of the site where elevated quantities of VOCs are found within the overburden groundwater (most notably, in the area near monitoring well B17). This is where it is possible that DPE may provide significantly enhanced mass removal rates over groundwater extraction alone. Therefore, the proposed pilot test described in this work plan will be conducted in the B17 area, at a location that would also be well suited to continued groundwater pumping if the DPE test is unsatisfactory.

Hydraulic conductivities in the subsurface at the Arch site, as estimated from slug testing in site monitoring wells, are generally in the 10^{-4} cm/sec range in overburden soils, and in the 10^{-3} to 10^{-4} cm/sec range in the shallow fractured bedrock. Typical well yields from existing extraction wells in the shallow bedrock are in the 5 to 10 gallons per minute range. These yields indicate that the use of high-vacuum DPE techniques, such as a drop-tube entrainment system, would be inefficient. Therefore, a lower vacuum, two-pump system consisting of separate groundwater and vacuum pumps will be used for the pilot test.

Pilot Test Procedures

This section of the work plan describes the procedures that will be used to test the potential effectiveness of DPE as a remediation technology for the Arch site. The test has been designed primarily to assess whether DPE might produce substantially increased contaminant mass removal rates over groundwater extraction alone. The scope does not currently include procedures for determining full-scale design parameters, but rather is a "proof of principal" test to provide adequate data to evaluate the potential use of DPE in the site feasibility study.

Extraction Well Location and Design. A new extraction well was installed in August 1999 adjacent to monitoring well B17, immediately east of the main plant building on site. Data from B17 indicate this area is a "hot spot" for both chloropyridines and VOCs in overburden groundwater. Additionally, the shallow bedrock groundwater at this location is expected to contain high levels of site-related contaminants, based on the site conceptual model. The extraction well is a 4-inch i.d. stainless steel well, screened from approximately 6 feet to approximately 46 feet below ground surface (bgs). The depth to groundwater is approximately 10 feet bgs, and the top of bedrock is at approximately 16 feet bgs. A copy of the well log is attached to this work plan.

Test Equipment. The extraction well will be equipped with a downhole positive displacement pump with the intake set at approximately 40 feet bgs. The pump will be controlled with high and low level switches to maintain the water level in the well at approximately 25 feet bgs, +/- 2 feet. In addition, an electronic transducer will be installed within the well to provide groundwater elevation measurements. The discharge from the pump will be connected to the existing groundwater treatment system on site. The groundwater discharge line will be equipped with a totalizing flow meter, sampling port, and throttling valve for monitoring and control of the water discharge from the test well.

A separate vacuum line will be attached to the wellhead for connection to a vacuum pump. All connections at the wellhead will be made airtight using gaskets and/or food-grade grease (e.g., vegetable shortening). Vacuum will be applied using a regenerative blower or rotary vane vacuum pump. The vacuum line will include a vacuum gauge, knock-out pot, flow meter, and sampling port. Air discharge will pass through a vapor-phase carbon adsorption unit before being discharged to the atmosphere. In addition, nearby monitoring well B17 will be equipped with a vacuum gauge and an electronic transducer for measuring water elevation to allow for monitoring of vacuum and drawdown responses during the test. Figure 1 provides a schematic of the test setup.

Groundwater Extraction Test. The initial phase of the pilot test will consist of a period of groundwater pumping from test well PW10 prior to establishment of a vacuum. This will allow for establishing baseline values for sustained yield and mass removal rates through conventional groundwater extraction. It will also result in the creation of a cone of depression prior to initiating vapor phase extraction. It is estimated that groundwater pumping will continue for a minimum of three days prior to initiation of the vapor phase extraction. Water level measurements in PW10 and nearby monitoring well B17 will be taken daily through this period to evaluate drawdown conditions in the saturated overburden. Water quality samples will also be collected daily from PW10 (for up to three days) to measure the mass removal of site-related contaminants.

Dual-Phase Extraction Test. Once baseline conditions have been established and documented under groundwater pumping alone, the vacuum pump will be hooked up to the well. A target vacuum of 3 to 5 inches of mercury will be established within the well. The vapor stream will pass through a knock-out pot to remove entrained water, and will then be passed through a vapor-phase granular activated carbon adsorber for treatment. Groundwater pumping will continue throughout this phase of the test, and water elevations and total flow will continue to be measured to determine whether the pneumatic gradient established in the well affects the well's yield. The test will continue for approximately 3 days. During this phase of the test, the following measurements will be made to document performance of the DPE technology:

- vapor and water flow rates
- daily water and vapor samples
- daily PID readings on influent and effluent streams to the vapor-phase GAC adsorber
- daily water level measurements on PW10 and B17
- daily vacuum readings on PW10 and B17
- daily weather observations (temperature, barometric pressure, rainfall)

Analytical Program. Water samples will be collected as grab samples and placed into pre-prepared sample containers provided by the analytical laboratory. Samples will be shipped by courier or overnight delivery to Severn Trent Laboratories in Amherst, NY, and will be analyzed for VOCs by EPA Method 8260 and chloropyridines by EPA Method 8270. Vapor samples will be collected in Summa canisters over an 8-hour period and shipped by courier or overnight delivery to the analytical laboratory (to be selected) for analysis by EPA Method TO-14 for VOCs.

Data Evaluation and Reporting. The results of the pilot test will be presented and evaluated in the site Feasibility Study that is currently under preparation. An interim letter report discussing the results will also be prepared. Particular attention will be focused on contaminant mass removal rates in the vapor phase, and a comparison of contaminant mass removal in the water phase under vacuum and non-vacuum conditions.

Schedule. Upon receipt of all necessary approvals of the work plan, HLA will require three weeks to procure and assemble the necessary equipment. The test will require two weeks to implement, and analytical results will be available four weeks after completion of the test. Data evaluation and the interim letter report will be completed two weeks following receipt of all analytical results.

Please call if you have questions or comments about any aspect of this work plan.

Sincerely,

HARDING LAWSON ASSOCIATES

Thomas R. Eschner, P.G.
Associate Project Manager

Jeffrey E. Brandow, P.E.
Feasibility Study Lead

attachments

File: 47980
Task 1

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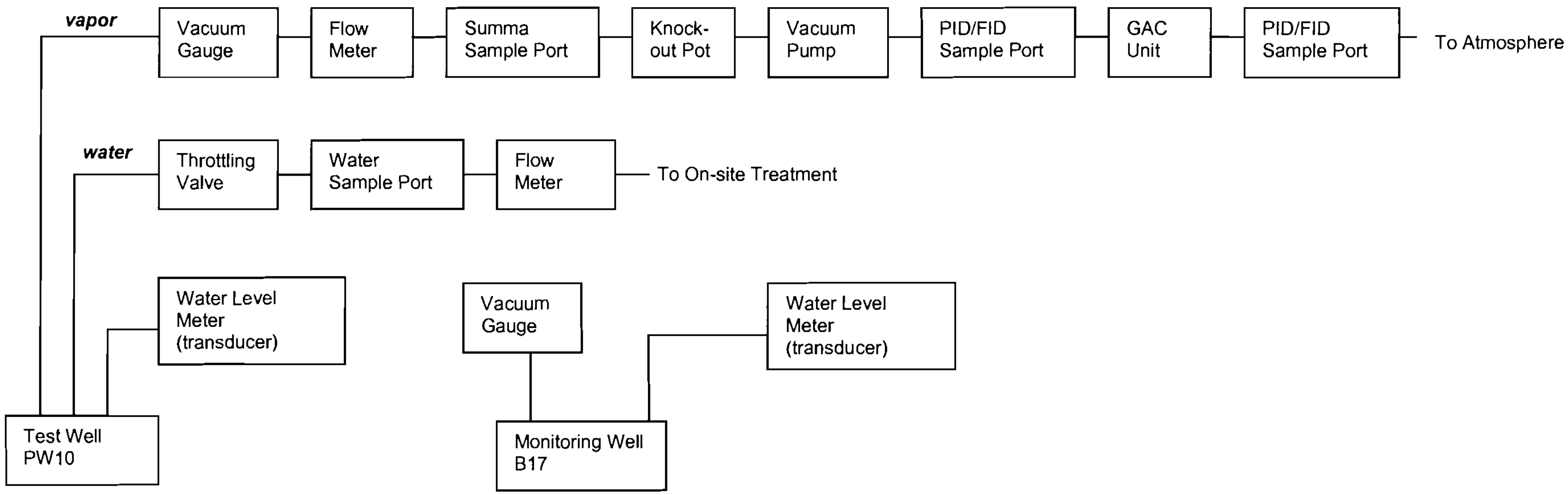
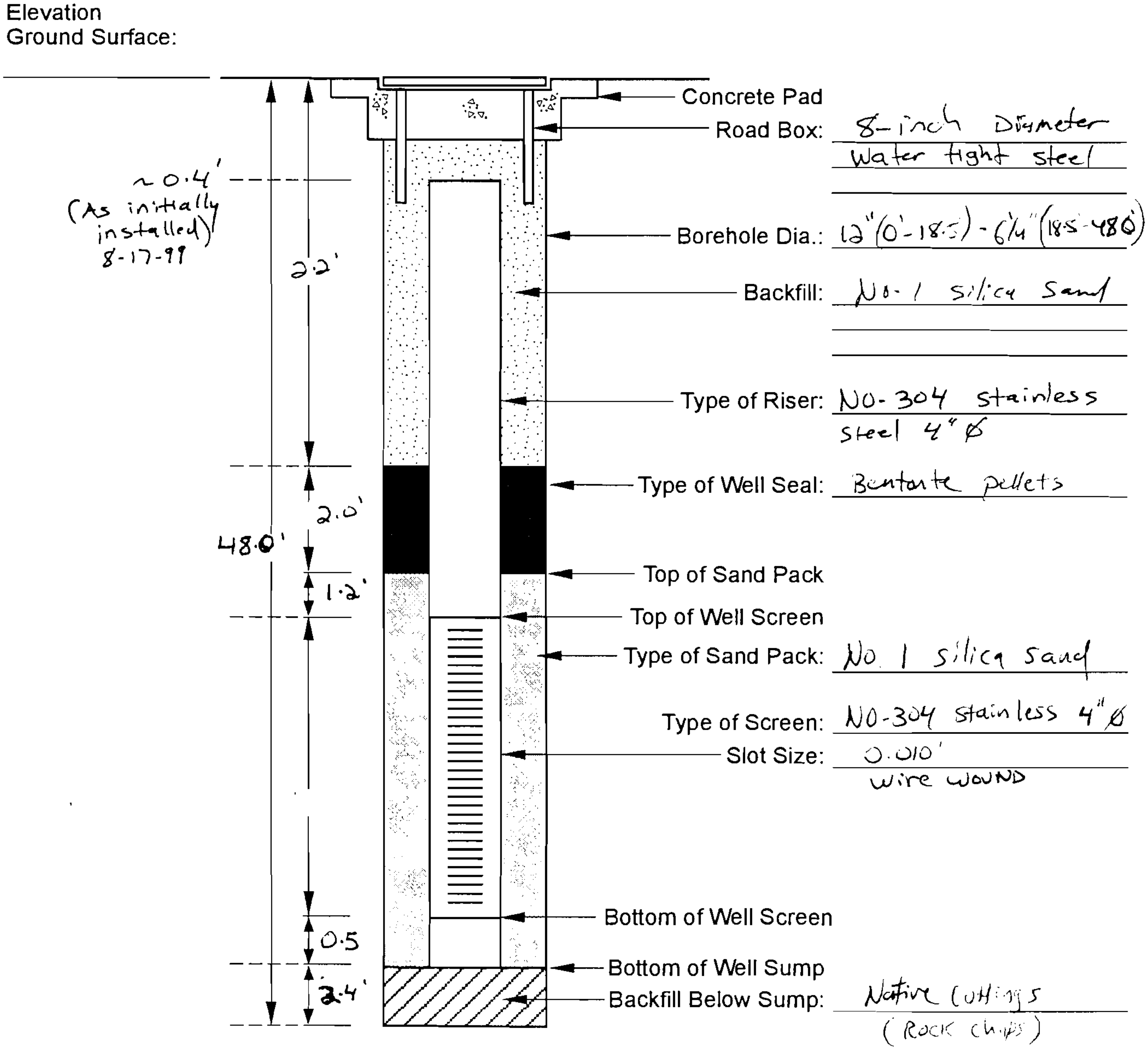


FIGURE 1
PILOT TEST SCHEMATIC
ARCH CHEMICALS ROCHESTER PLANT

Well: PW10



WELL CONSTRUCTION DETAILS
ARCH ROCHESTER
FEASIBILITY STUDY
ROCHESTER, NY

Harding Lawson Associates

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