DESIGNING A HYDROGEOLOGIC ASSESSMENT OF A SNM FACILITY UNDERGOING DECOMMISSIONING: MEETING MULTIPLE PROJECT OBJECTIVES

John David Harrison, M.S., M.B.A.
B & W Nuclear Environmental Services, Inc.

ABSTRACT

Designing a Hydrogeologic Assessment to incorporate several project objectives into one work plan is the topic of this paper. The assessment was part of an overall program to Decommission a SNM Facility licensed by the U.S. Nuclear Regulatory Commission. It was designed to obtain a high level of data for the following: (1) a radiological pathway analysis, (2) groundwater and soil characterization, and (3) remedial design. In order to obtain the data, specific data needs were determined and requirements established. Work tasks and methodologies were developed once the data needs were determined and requirements established. These tasks and methodologies were then resource loaded to establish the cost and schedule of the program. Once cost and schedule were agreed upon, then the work plan was written and implemented. In addition, lessons learned from this program will be discussed.

INTRODUCTION

A Hydrogeological Assessment was implemented at the B & W - Nuclear Environmental Services, Inc. (B & W-NESI) Apollo, Pennsylvania Decommissioning site. In order to optimize project resources multiple project objectives were incorporated into one work plan. The objectives were:

- Provide input data for a radiological pathways analysis to assess the maximum levels of residual radioactive material to determine compliance with regulatory requirements.
- Perform a preliminary scanning to date to determine the occurrence and distribution of chemicals in ground water and soils.
- Obtain subsurface information for use in remedial design.
- Obtain a high level of data quality.

BACKGROUND

The work plan was developed for and implemented at the site of a U.S. Nuclear Regulatory Commission (NRC) licensed Special Nuclear Material (SNM) facility. The facility is located in the borough of Apollo, Pennsylvania and is operated by The Babcock & Wilcox Company (B&W). The site is currently undergoing decommissioning in accordance with a plan filed at the NRC under the management of B&W Nuclear Environmental Services, Inc. (NESI). These operations are anticipated to lead to the eventual termination of the NRC license and release of the site for unrestricted use. See Fig. 1.

Since 1957 manufacturing uranium oxide fuels for Federal contracts and the commercial nuclear power industry was the primary business of this facility. Before nuclear fuel manufacturing operations commenced, steel mill operations, which started in the mid 1800's, were housed at the site. Nuclear operations were housed in two buildings, a two story Manufacturing plant and a one story Laundry building. The remainder of the facility consists of approximately 10,118 square meters of open property. See Fig. 2.

Operations conducted at the facility consisted primarily of the chemical conversion of both low enriched uranium (LEU) and high enriched uranium (HEU) hexafloride gas into uranium dioxide powder. Production of both HEU and LEU began in 1958 with production of HEU terminated in 1978 and LEU terminated in 1983. These operations were housed in the Manufacturing plant. In addition both the decontamination of protective apparel and submarine control rod drive mechanisms occurred between 1960 and 1984.These operations were housed in the Laundry Building.

The site is located in the flood plain of the Kiskiminetas River and was developed through fill placement, including steel mill slag, on alluvium. The alluvium rests on weathered sedimentary bedrock. Depth to bedrock increases towards the river and ranges from about 4.6 to 15.3 meters below the ground surface. See Fig. 3.

Previous characterization efforts consisted of radiological characterization of soils over the entire site and chemical characterization of shallow subsurface soils in the open areas for EP Toxicity characteristics.

DESIGNING THE HYDROGEOLOGIC ASSESSMENT

To meet the project objectives specific data needs had to be determined and data requirements established. The specific data needs were broke down into four types: geology, hydrology/hydrogeology, groundwater quality, and soil quality. Specific data needs for each group are identified below.

Geology

1. Generally characterize all unconsolidated geologic units and fill materials below the site including determination of the thickness and lateral extent of each unit.
2. Identify the bedrock formation type below the site and determine its depth.
3. Characterize the degree of fracturing in the upper 20 feet of bedrock.

Hydrology/Hydrogeology

1. Identify the water table and any perched water table conditions.
2. Identify all significant ground water bearing zones which have been impacted with radiological or chemical contamination to a depth of 20 feet below the top of bedrock.
3. Determine ground water horizontal and vertical potentiometric head components, flow directions, and rates for each significant water bearing unit. Estimate hydrogeologic parameters in each significant water

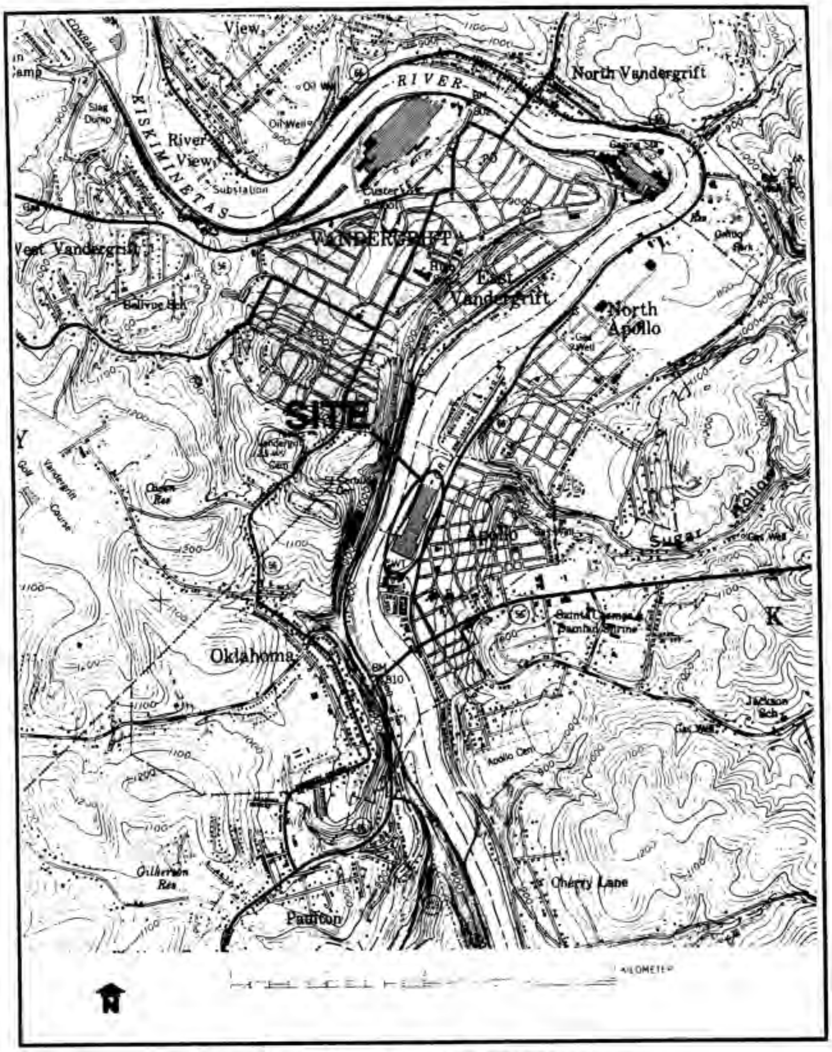

Fig. 1. Location map of Apollo Factory.

bearing unit including horizontal and vertical hydraulic conductivities were appropriate.

4. Estimate the Kiskiminetas River flow rates, range of water levels, and the hydrodynamic interrelationship with surrounding ground water bearing units, including estimation of average ground water discharge rates.
5. Estimate areal surface water and rain fall infiltration rates.

Ground Water Quality

1. Determine the occurrence, distribution, and concentration of the mobile fraction of radiological contamination and chemical substances in ground water.
2. Determine background *ground water* radiological activity and chemistry.
3. Identify major factors affecting the transport of radiological contamination and chemical substances in ground water.
4. Use major ion chemistry and the occurrence of specific compounds associated with former on-site and nearby off-site land use to "fingerprint" ground water contamination source areas.

Soil Quality

1. Investigate the occurrence of radiological contamination and chemical substances in subsurface unconsolidated materials at each drilling location. A significant data base with regard to radiological contamination of shallow soils already existed, but additional data was required to determine if deeper radiological contamination existed, or if any chemicals were present in subsurface materials. Although a complete contamination assessment of the unconsolidated subsurface materials was beyond the scope of this project, relevant data was collected where possible.
2. Identify factors affecting the transport of radiological contamination in the unsaturated zone.
3. Use the occurrence of specific compounds associated with former on-site land use to "fingerprint" sources of subsurface contamination.

Data Quality

In order to meet the high level of data quality required data requirements had to be established. The following levels of data were required:

- Level II Data Quality Objectives (DQOs) for field screening activities.

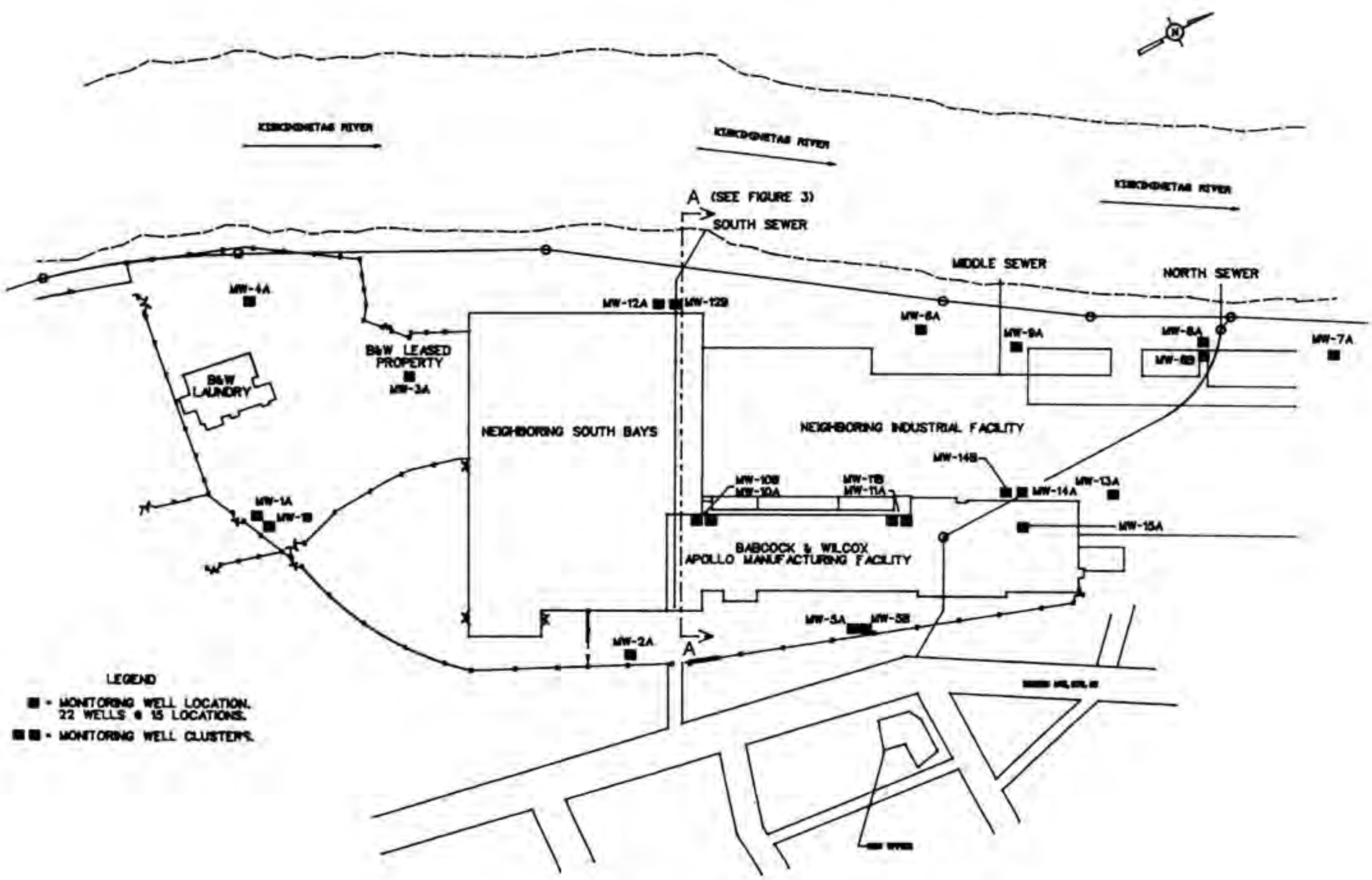

Fig. 2. Site plan, "Monitoring Well Locations".

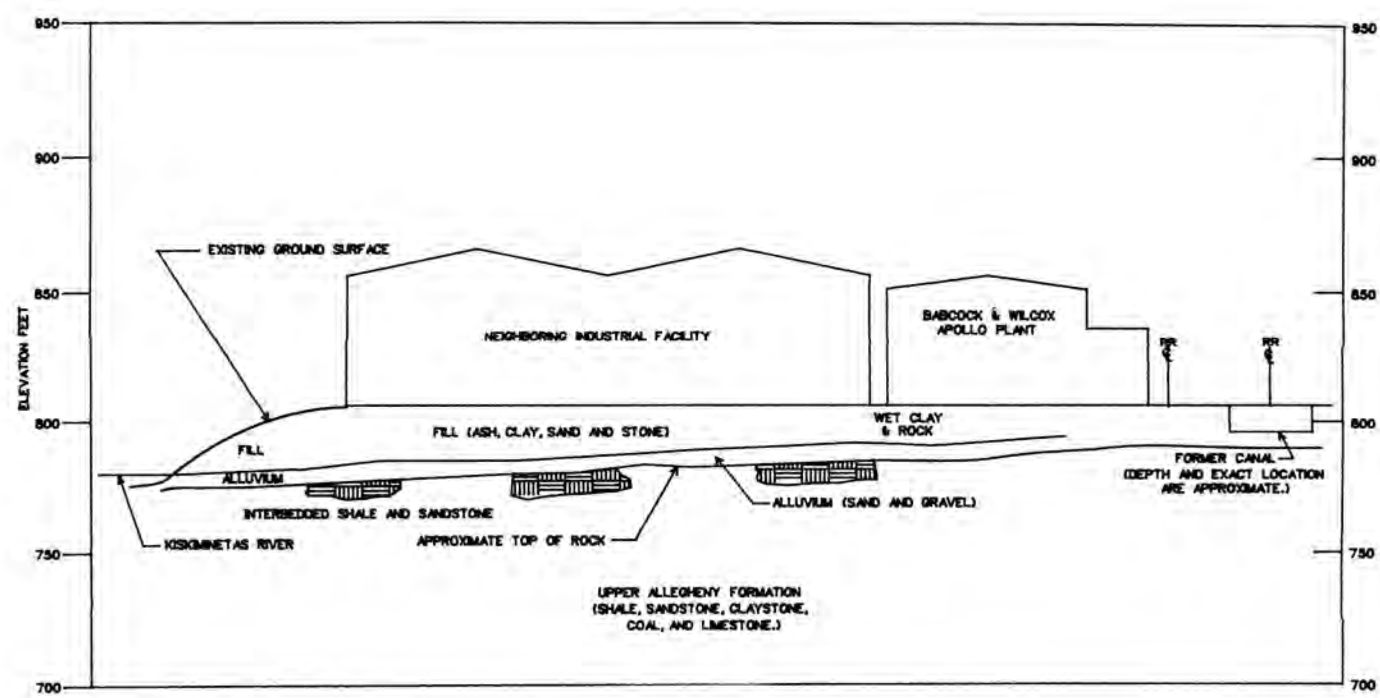

Fig. 3. Cross section A-A.

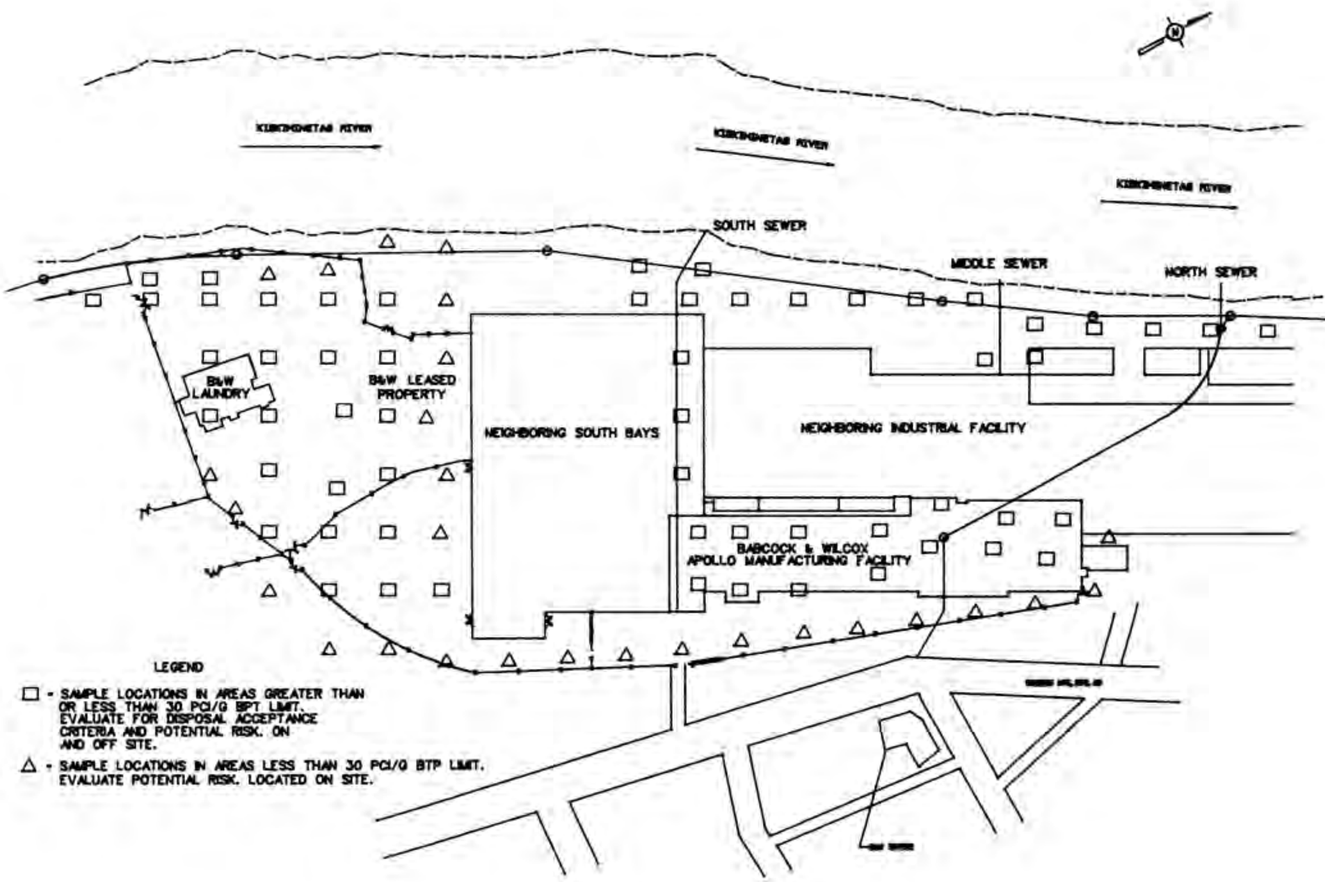

Fig. 4. Sample location plan.

- Level III DQOs for routine water chemistry analysis, such as major ions. These analyses were conducted in accordance with appropriate methodologies presented in the Environmental Protection Agency's (EPA's) Methods for the Chemical Analysis of Water and Waste as well as "Test Methods For Evaluation of Solid Waste".
- Level IV DQOs for radiological and TCL chemical analysis. This was consistent with the most recent statement of work for the EPA Contract Laboratory Program (CLP).

After the specific data needs and requirements were determined, work tasks and methodologies were developed. Methodologies were developed for drilling and well installation as well as groundwater and soil sampling and analysis. The methodologies were developed from standard protocols modified to site specific conditions.

After these tasks and methodologies were developed, they were resource loaded to determine the overall cost and schedule. After the cost and schedule were agreed to, the tasks and methodologies were combined into the work plan for the hydrogeological assessment.

When writing the plan, NRC office of solid waste and emergency response, American Society for Testing Material, Occupational Safety and Health Administration, and state guidance were used as guidance documents in drafting the work plan. Once the plan reached general acceptance and was funded, both schedule and cost controls were developed. The plan was then implemented from contractor selection through final reporting.

LESSONS LEARNED

All the objectives were met or exceeded, but with the benefit of "20/20 hindsight" some areas could be improved so that future hydrogeological assessments would be completed in the most efficient manner. Based on our experience, the following should be incorporated into all hydrogeological assessments for the most effective program:

- Planning to identify/correct problems early and evaluate situations to optimize the schedule should be done on a daily basis. Daily planning played a key role in this project and helped tremendously in meeting the objectives in a timely and cost effective manner.
- Development of the sampling wells to lowest reasonably achievable levels of turbidity should be accomplished before field operations begin. Well development was continued until the temperature, pH, and conductivity of water removed from the well reached equilibrium. Turbidity was measured, but

who will be using the data. This will help to ensure that all the data required to complete the necessary work will be gathered and that everyone feels a part of the team.

- Both radiological and chemical sampling should be performed at all well locations. This allows for the comparison of all locations to determine potential contamination patterns.
- Radiological, chemical, and geotechnical samples taken from the same location should have a common sample tracking number. Comparison of different data from the same location will be easier.

CONCLUSION

Designing a Work Plan for a Hydrogeologic Assessment to meet multiple project objectives is critical. This type of work plan insures that the assessment fits the overall project objectives. Also, multiple characterization programs can be molded into one cost effective program. Developing a Work Plan is a very time consuming project, but it is time well spent. Scheduling and budgeting sufficient time for Work Plan preparation is invaluable in meeting multiple project objectives.

BIBLIOGRAPHY

The Babcock & Wilcox, Nuclear Environmental Services, 1991. Apollo Decommissioning Plan. July 30, 1991.

REMCOR, Inc., 1990. Work Plan/ Quality Assurance Project Plan Hydrologic Assessment of Apollo Facility. Prepared for Babcock & Wilcox, October 24, 1990.

REMCOR, Inc., 1991. Hydrogeologic Assessment Report of Apollo Facility. Prepared for Babcock & Wilcox, April 10, 1991.