# 4.0 GROUNDWATER RECOVERY AND TREATMENT SYSTEM

## 4.1 Assessment Objective and Methodology

As requested by DNREC in correspondence dated May 4, 2001, ENSR attempted to assess the groundwater recovery and treatment system operated at the Metachem facility. The purpose of this evaluation was to confirm that operation and maintenance of this system conformed to the requirements of the settlement agreement between Metachem (Standard Chlorine of Delaware, Inc.) and DNREC, Civil Action No. 88-11 JLL, dated December 14, 1987.

Comment No. 16 of DNREC's May 4, 2001 correspondence specifically requests that this assessment determine how the ground water is handled, the effectiveness of the scrubber system and its recovery rates, and if all groundwater is always treated through the scrubber. The agency also requested clarification as to the ultimate disposition of the recovered groundwater, and how/if it is utilized within the facility. ENSR notes that in this correspondence DNREC refers to a "scrubber". The remediation system in place at Metachem does not utilize a scrubber. ENSR interprets this comment to refer to the air stripper that is currently used and is the primary unit process which removes the total benzene species (TBS) from the recovered groundwater stream.

Correspondence dated December 21, 2001 from DNREC to Metachem requires that this audit report also include a review of EPA's Record of Decision (ROD) for the site, dated March 9, 1995. The purpose of this review is assessing Metachem's compliance with the provisions of this ROD. ENSR's compliance evaluation was limited to those provisions for which a schedule had been defined in the ROD and that were required to be in place by Metachem during the period of review for this audit, either completed in full or conducted on a routine basis.

## 4.2 Methodology

On September 6, 2001 and January 14, 2002, ENSR met with Metachem's environmental department to discuss operation and maintenance (O&M) of the system and conduct a visual inspection and document review. The interviews with Metachem personnel included discussions regarding the following items:

- Operation and Maintenance of the system;
- Past and existing performance issues;
- General system specifications;
- Reporting and permit compliance;
- System history;

- Past and proposed system modifications;
- Typical flow rates and conditions;
- Removal efficiencies;
- Spill/discharge and site history; and
- System and Site layout.

ENSR reviewed the following documents as part of this assessment:

- Quarterly Monitoring Reports for the Groundwater Recovery System (April 1995 – July 2001)
- Air Emission Inventories (1996 – 2000)
- Feasibility and Final Design Report (Weston, September 1984)
- Ground Water Flow Diagram (March 29, 1984)
- Documentation Report- Ground Water Recovery Operations (Weston, undated- circa 1988)
- DNREC / EPA Consent Order (November 14, 1988)
- Miscellaneous Figures, Maps and Process Diagrams
- NPDES Permit No. DE 0020001
- DNREC correspondence re: Environmental Compliance Audit Workplan dated May 4, 2000 and December 21, 2001
- Chronological Table of Shutdown Events, as provided by Metachem, for the period 1988 - 2001(Refer to Table 9 of this report)

ENSR also performed complete system walkthroughs with a Metachem Operator in order to observe all unit processes in the system; to evaluate the condition of the equipment; and to observe any signs of obvious negligence or poor maintenance or operational conditions. At the time of ENSR's first site visit, the ground water recovery system and air stripper were not in operation. ENSR's auditor was informed that there had been a bearing failure on the air stripper blower and the system was awaiting repair. At the time of the second visit on January 14, 2002, the system was fully operational, with the exception of recovery well RW-2, which was being serviced to address low flow rates at that location.

## 4.3 System Overview

The groundwater recovery system was designed for containment and recovery of the TBS plume. Figure 5 presents a general flow chart of the groundwater recovery and treatment system as currently configured. Groundwater is extracted from five recovery wells (RW-1, RW-2, RW-3, RW-4 and RW-5) via submersible well pumps. All extracted groundwater is discharged into the primary equalization tank (Tank T41).

Figure 5. Groundwater Recovery and Treatment System Flow.

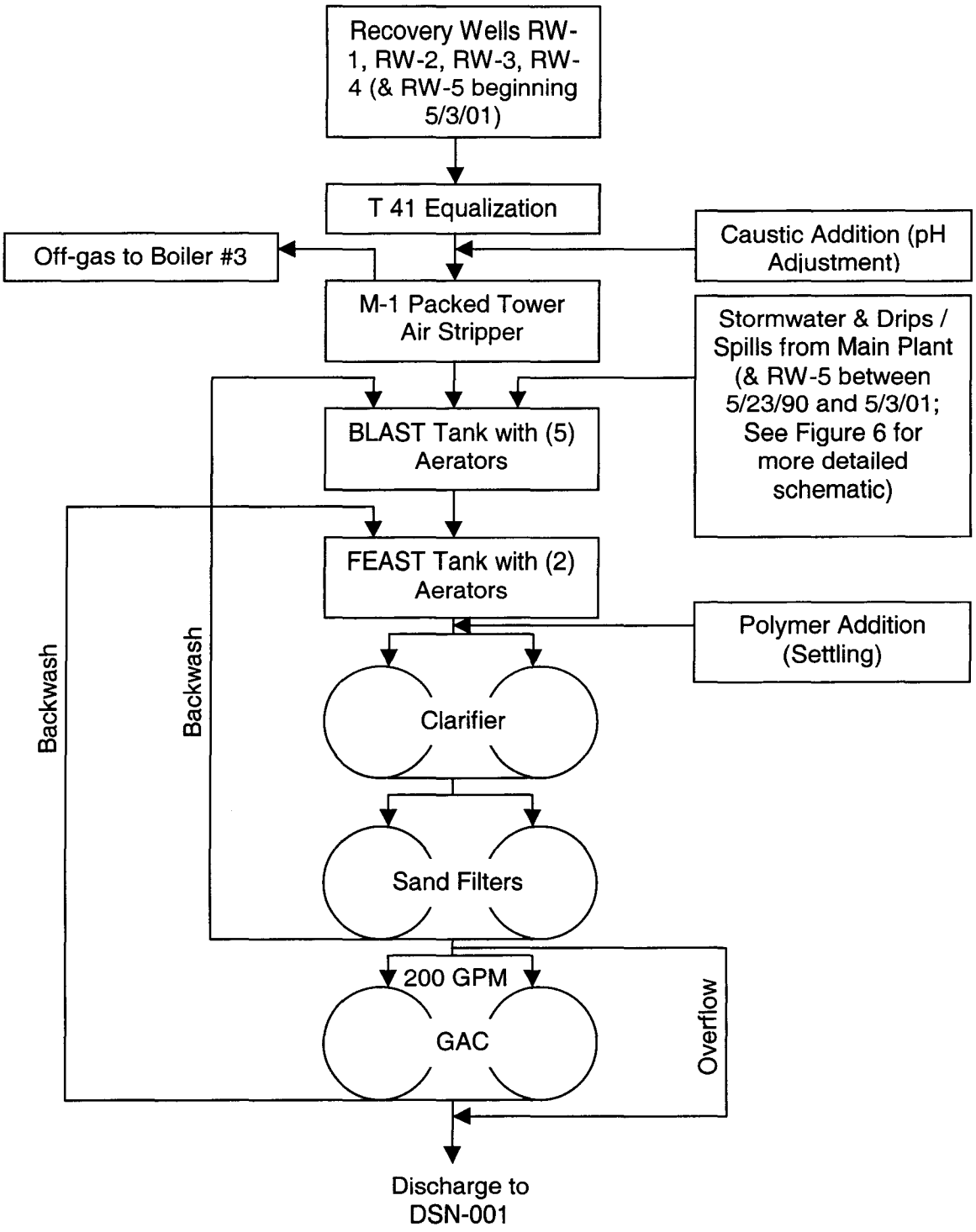
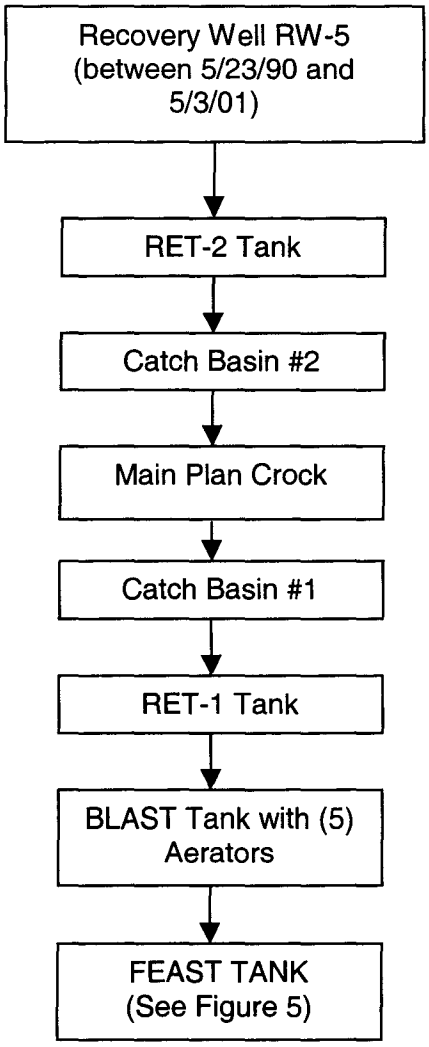


Figure 6. Recovery Well RW-5 Flow Between 5/23/90 and 5/3/01.



Note that the discharge from recovery well No. 5 (RW-5) has not always been directly to tank T41. Specifically, as presented in Figure 6, between May 23, 1990 and May 3, 2001, RW-5 discharged to the BLAST Tank (via other plant wastewater piping), bypassing the M-1 Packed Tower Air Stripper. Since May 3, 2001, all recovered groundwater has been treated with the Air Stripper and all downstream treatment units as presented in Figure 5.

The typical pH of extracted groundwater is approximately 4 standard units (S.U.), therefore caustic is injected into the discharge from Tank T41 in order to bring the stream to approximately neutral pH. Groundwater in Tank T41 is pumped into a packed tower Air Stripper (M-1) where nearly all of the TBS in the waste stream are removed. Groundwater in the M-1 sump is pumped directly into the 400,000-gallon blending and air stripping tank (BLAST tank) where five, 7.5 HP aerators provide additional TBS removal.

Stormwater flow, sand filter backwash and main plant flow also discharge into the BLAST tank. Overflow from the BLAST tank flows by gravity into the flow equalization tank (FEAST tank) where a small amount of volatiles are also removed via two aerators. Treated water in the FEAST tank is pumped into two clarifiers in parallel for the first stage of solids removal. Prior to the clarifiers, polymers are injected into the waste stream to assist in settling.

Solids, which accumulate in the clarifiers, are removed to Sludge Storage and Decanting Tank (SLET tank) for processing and drying. Two sand filters in parallel remove additional solids after the clarifiers. The sand filters are backwashed automatically based on pressure differential with backwash water discharging to the head of the BLAST tank.

The final treatment of the waste steam is via two 8,000-pound granular activated carbon (GAC) filters in parallel for final polishing including TBS adsorption. The GACs are manually backwashed twice daily and backwash water discharges to the head of the FEAST tank. The GACs handle up to 200 gallons-per-minute (GPM) and all overflow bypasses the GAC filters for direct discharge. All treated water from the plant is pumped to discharge to DSN-001 to the Delaware River approximately one mile from the facility in accordance with NPDES permit No. DE 0020001.

Vapor discharge from the air stripper (which contains the stripped TBS from the groundwater) is directed to the onsite No. 3 boiler fresh air intake manifold. In this way, TBS vapors are burned in the boiler combustion chamber. The boiler is acting similar to a thermal oxidizer for the air stripper exhaust and in practice, the control efficiency of a thermal oxidizer ranges from 98%-99.99% for volatile organic compounds (VOC), including TBS. Therefore, a 99% control efficiency for the boiler (99% removal) is not unreasonable for total VOC; however, the actual control efficiency for any individual VOC such as benzene could be higher or lower than 99% based on a number of parameters (i.e., chamber temperature, residence time, benzene feed rate, etc.).

## 4.4 Analytical Data Review

ENSR reviewed analytical results collected by Metachem in assorted reports and determined that removal efficiencies for TBS across the air stripper are in compliance with industry standards. The most recent 2000 Air Emission Inventory for the facility, dated May 23, 2001, includes influent and effluent TBS aqueous phase concentrations across the air stripper. In the report, the aqueous data are presented on a monthly basis. As is indicated in Table 8, the removal efficiency for the air stripper averaged 98.65% for TBS over the calendar year. Specifically, a total of 6,698.7 pounds of TBS were detected in the waste stream from the wells throughout the year and 90.2 pounds were detected in the effluent aqueous stream form the air stripper. The calculated efficiency of the air stripper (98.65%) is compatible with industry standards. In 2000, 6,608.5 pounds of TBS were converted from aqueous to vapor phase via the air stripper and these vapors were burned in the on-site boiler. The 90.2 pounds of TBS remaining in the treated groundwater were removed in several stages: via volatilization in the BLAST and FEAST tanks or via adsorption in the final GAC polishing units. Weekly effluent monitoring, as required by the NPDES permit, indicate that TBS concentrations remain in compliance with permit limits, therefore the treatment system is performing adequately.

## 4.5 Assessment of System Compliance

### 4.5.1 Civil Action No. 88-11 JLL

The specific requirements of this Civil Action considered for this assessment determined to relate specifically to this groundwater recovery system were identified as follows:

- Paragraph 2 requires control over the northward migration of contaminants and recovery of the contaminated groundwater to the maximum feasible extent. The paragraph allowed for the potential for system expansion to achieve this control. Since the startup of the recovery system, an additional recovery well (RW-5) has been added to the system to increase recovery rates. Data from the Quarterly Monitoring Reports show that a large mass of contaminants have been removed from the ground, indicating that the existing groundwater recovery and treatment system has been effective in reducing contaminant concentrations. Insufficient information is provided by the isopleths of total benzene species (TBS) concentration in groundwater and the groundwater table contour maps to either confirm or refute that control over the northward migration of contaminants has actually been achieved.

- Paragraph 3 requires the use of an air stripper for groundwater treatment with offgas treatment via the No. 3 boiler. This condition has been met.

- Paragraph 5 set forth sampling requirements which have been met.

- Paragraph 6 set forth reporting and record-keeping requirements, which have been met to a great extent. The paragraph required that a Delaware-registered Professional Geologist sign all reports. This condition does not appear to have been met for all reports reviewed during this assessment.

### 4.5.2 December 2001 DNREC Request

Correspondence dated December 3 and 21, 2001 from DNREC requested that this audit report include a review of the system while it was in operation and a summary of system downtime and maintenance activities since its installation. DNREC requested information detailing how the system operates and why it is down so frequently. As discussed above, during the January 14, 2001 site inspection ENSR observed the system while in operation. During this inspection, the system appeared to be operated as designed, with no obvious evidence of poor operation and maintenance. Table 9 details provides a history of system downtime for each recovery well, the period of time that the unit was out of service, the cause and details of maintenance activities completed for significant non-routine downtime period. This information was compiled from Quarterly Monitoring Reports submitted by Metachem.

ENSR was also request to review Metachem's compliance with the EPA March 1995 ROD with respect to the groundwater recovery and treatment system. The ROD sets forth numerous requirements. At the present time, it appears that Metachem is in the Remedial Design phase of the Interim Groundwater Action. The following requirements of the ROD were reviewed:

- Metachem is required to perform annual inspections and integrity testing of Catch Basin #1 to ensure that there are no future releases. The ROD requires that Catch Basin #1 undergo integrity testing no less than once per year, consisting of a hydrostatic test or some equivalent to determine the integrity of the catch basin. Documentation was provided to confirm that a visual inspection of this catch basin was conducted in November 2001. There was no evidence that similar visual inspections were conducted prior to 2001. The summary report of the 2001 inspection makes indicates that the system liner has been repaired a few years earlier. Maintenance and Operations personnel could provide no records of hydrostatic testing or other integrity testing for this basin. Based upon interviews with these personnel, it appears that no integrity tests have been conducted and documentation of only one visual inspection since 1995 was found.

- The ROD requires operation and maintenance of the existing groundwater extraction wells and air stripper treatment. Metachem performs routine O&M on the existing system, and all recovered groundwater is currently treated with the air stripper. All stripper offgas goes directly to the fresh air intake of the plant boilers, as required.

- According to the ROD, the next phase of the Remedial Design installation of a vertical barrier to groundwater migration toward Red Lion Creek. According to Metachem representatives, installation of a slurry wall is expected to occur in 2003.

- The ROD requires that the existing recovery wells pump at design capacity in order to control the contaminant plume. During the January 2002 inspection, Metachem representatives reported that the combined flow from all active recovery wells was between sixty and seventy-five gallons-per-minute (gpm). According to early reports submitted to DNREC by the system installation contractor (Weston), if four of the five wells are operating at a flow rate of 5 gpm per well, or 20 gpm total combined flow, the design objectives of plume containment system will be met. Therefore, at a total flow rate of sixty gpm, hydraulic control of the contaminant plume may be achieved. Information regarding groundwater contour maps, which address plume containment, have been submitted by Metachem in Quarterly Monitoring Reports.

### 4.6 Summary and Conclusions:

Based on the document review, site observations and interviews conducted with Metachem personnel, ENSR offers the following conclusions related to operation of the current groundwater recovery system:

- Groundwater appears to be handled in a responsible and acceptable manner;
- All groundwater is reported to always be treated with the air stripper (with the exception of RW-5 groundwater between 5/23/90 and 5/3/01);
- Based on analytical results, the average efficiency for TBS removal via the air stripper was greater than 98.6% in 2000, which is compatible with standard industry practices;
- Based on analytical results, the air stripper removed approximately 6,608 pounds of a total of approximately 6,698 pounds of TBS from the extracted groundwater stream in 2000;
- According to the reported existing plant configuration and system diagrams, recovered groundwater is treated in a step-wise fashion via equalization, pH adjustment, air stripping, aeration, polymer addition, clarification, sand filtration and activated carbon polishing prior to being discharged to DSN-001 (Delaware River) in accordance with NPDES Permit No. DE0020001;
- No treated groundwater is reported to be utilized at the facility at this time although plans for groundwater reuse are under review by Metachem management; and
- Based on analytical results, the TBS recovery rates from the groundwater are acceptable and within standard industry practices.

Based on observations during the site visit, all indications are that, when operational, the system performs effectively within typical design parameters in recovery of TBS from groundwater.

Laboratory analytical results were reviewed and the general configuration of the system indicates that the existing system performs adequately in the recovery of TBS from groundwater.