RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
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30 May 1990 W-6138

Martin Commercial Fueling
P.O. Box 408
Burlington, Washington 98232

Attention: Mr. Val Martin

Subject: Summary of Analytical Laboratory Test Results
115 West Kincaid Street
Mount Vernon, Washington

Mr. Martin:

This letter presents the results of continued analytical laboratory testing performed on additional groundwater samples collected from each of 4 monitoring wells installed for the above referenced project. The samples were collected and analyzed as a result of a meeting at the Washington State Department of Ecology (Ecology) on 2 May 1990, in which representatives Tim Peter and Sean Donnan from Rittenhouse-Zeman & Associates, Inc., Val Martin of Martin Commercial Fueling, Roger Howard from Skagit County, and Joe Hickey (WDOE) attended. Collection and analysis of the samples was performed to provide sufficient data to establish trends of groundwater quality with respect to time. This letter is intended to be used in conjunction with previous RZA correspondence for this project.

Groundwater quality has been an issue on-site where dissolved petroleum hydrocarbon contaminant remediation of groundwater has been occurring since July of 1989. In addition, groundwater quality issues have been addressed off-site in upgradient, cross-gradient, and downgradient positions with respect to the source. Monitoring well MW-1 is located on Martin Commercial Fueling property, installed through the previous tank cavity (and presumed source) and associated backfill material while monitoring wells MW-2 and MW-3 are located on Skagit County property currently used for parking. Monitoring well MW-4 is located in the front landscaped area of the Skagit County

Courthouse. Figure 1, the Site and Exploration Plan is included with this document and should be referenced for approximate monitoring well locations.

The remediation system, in operation since mid-1989, was reportedly turned off by Martin Commercial Fueling representatives on Thursday, 3 May 1990. The system was shut-off to allow the groundwater regime beneath the site to equilibrate to static conditions prior to sampling. Our sample collection commenced approximately one week following shut-off of the system. Samples were collected with the aid of disposable polyethylene bailers. In addition to eliminating the decontamination procedures required between sample collection with a single, PVC, teflon, or stainless steel bailer, disposable bailers reduce the risk of cross-contamination between collected water samples, and increase sample integrity. Following collection by hand bailing, samples were immediately placed in laboratory prepared glass containers sealed with a teflon septum. Samples were then placed on ice prior to transfer to the analytical testing laboratory. Rittenhouse-Zeman & Associates, Inc. strict "chain-of-custody" procedures were maintained to ensure sample integrity.

Former groundwater quality studies performed at this site include samples collected from monitoring wells MW-2, MW-3, and MW-4 following installation during May 1989. Selected volatile aromatic constituent (BTEX) concentrations were found to be below the method detection limits for all samples collected from these wells. Total petroleum hydrocarbon (TPH) concentrations in samples collected from these wells were determined to be detectable and, in only one case (MW-2), above the current draft cleanup criteria of 15 parts per million (ppm), established by Ecology. Groundwater in monitoring well MW-2 exhibited no sheen and a TPH concentration of 21 ppm at that time, analyzed by laboratory test procedure 418.1.

Based on our meeting at Ecology on 2 May 1990, it was determined that additional sampling of outlying wells would prove beneficial. As with our May 1989 sampling event, recent analytical data indicates that BTEX concentrations are all below the method detection limit of 0.001 parts per million (ppm). Total petroleum hydrocarbons by EPA Method 418.1 indicated 13, 19 and 12 parts per million in monitoring wells MW-2, MW-3, and MW-4, respectively. Total petroleum hydrocarbons performed by EPA SW-846

Modified Method 8015 indicated concentrations all below the laboratory detection limit of 10 ppm.

On 10 May 1990, Mr. Jon Sondergaard, a representative from our office, arrived at the subject site to collect referenced groundwater samples. For our May 1990 sampling event, two methods of TPH quantification were utilized. These test methods included EPA Method 418.1 as well as EPA SW-846, EPA Method 8015 Modified. Test Method 418.1, performed in the laboratory by infrared spectrophotometry (IR), is a commonly used, inexpensive test method. RZA's prior project experience has determined that the use of EPA test method 418.1 for analysis of total petroleum hydrocarbons may not be valid in materials containing a high level of natural organic material. Based on our experience, it is our opinion that any number of natural, organic materials will result in reported laboratory results containing elevated TPH concentrations by this test method.

Technical papers that were recently presented at a National Conference further point out the complexity of selecting an appropriate analytical method that will accurately reflect conditions of the material being tested. The discussions note the non-specific results of this particular test method (418.1), and indicate that background interferences may result, particularly in soils or groundwater with high organic or silt content. It is our opinion that given the material properties in this situation, EPA Method Modified 8015 is a more appropriate test method, particularly since past gasoline leakage or spillage is targeted as a suspected source of the "TPH contamination." EPA Method 8015 is capable of differentiating fuel hydrocarbons from the natural organics of soil or groundwater. It should noted that Ecology has indicated the 8015 Method as the regulatory recommended test procedure of gasoline and related "light" hydrocarbon quantification.

Monitoring well MW-1, advanced through the former tank cavity and associated backfill material, has been utilized as a groundwater recovery well since July, 1989. Following approximately 4 months of operation, groundwater samples have been collected and analyzed from this well at periodic intervals. Table 1 following this letter presents changes in contaminant concentrations in groundwater samples collected from monitoring well MW-1.

Based on our meeting with Ecology on 2 May 1990, monitoring well MW-1 was incorporated in the additional water sampling event. Groundwater samples, collected from monitoring well MW-1 on 10 May 1990 were reported as containing slightly elevated concentrations of benzene and toluene when compared to those previously submitted for analyses. These fluctuations in contaminant concentrations in groundwater can be explained by several reasons. Typically, groundwater pump and treat systems exhibit significant reductions in contaminant concentrations initially, with apparent efficiency decreasing through time. This largely is a function of contaminant transport mechanisms rather than an actual decrease in system efficiencies. An aqueous phase (dissolved) organic contaminant, such as benzene, is subject to many phenomena which contribute to variability of concentration with respect to location and time. All substances have an inherent organic carbon content, soil notwithstanding. Carbon by nature, exhibits an affinity for other organics, and has the ability to adsorb such contaminants to its surface. This is easily demonstrated by referencing the use of "activated carbon" systems for stripping of organic contaminants from groundwater in pump and treat systems. These systems are commonly employed where air quality criterion are strict to a point such that conventional air stripping methods, such as used on the Martin Commercial Fueling site in Mount Vernon, can not be employed. Studies have proven that an aquifer media (soil) with increased total organic carbon content will provide the potential for greater attenuation or "adsorption" of an organic contaminant than a media with a lesser organic carbon fraction.

Fluctuations in groundwater elevations have also been shown to influence organic contaminant concentrations through time. As groundwater levels decrease, many organic contaminants can be "suspended" on soil particulates within the unsaturated portion of an aquifer. As groundwater levels rise to that point or beyond, as a result of seasonal influence, potential resolublization of contaminants can occur.

Our most recent sampling event and associated results indicate groundwater quality within the area of the previous tank cavity has not changed significantly. In addition, water quality information obtained from upgradient, cross-gradient, and downgradient monitoring wells indicate non-detectable concentrations of BTEX, and in our opinion, negligible concentrations of TPH, as performed by EPA Method 418.1. As a result of our most recent water sampling from MW-1, it appears that continued pumping and treating

of groundwater fluids through time will not result in significant reductions of contaminant concentrations in that area. We therefore recommend that groundwater pump and treat system operation not continue for any further length of time. Rittenhouse-Zeman & Associates, Inc. recommends that the downgradient monitoring well on Skagit County Courthouse property (MW-4) undergo continued monitoring through successive sampling events. The frequency of sample collection from this well could consist of quarterly or semi-annual events for a period of one to two years, at which time, if contaminant detections have not occurred, sampling and analyses could cease.

We appreciate this opportunity to be of continued service to Martin Commercial Fueling. If you have any questions, comments, or require additional information, please do not hesitate to call at your earliest convenience.

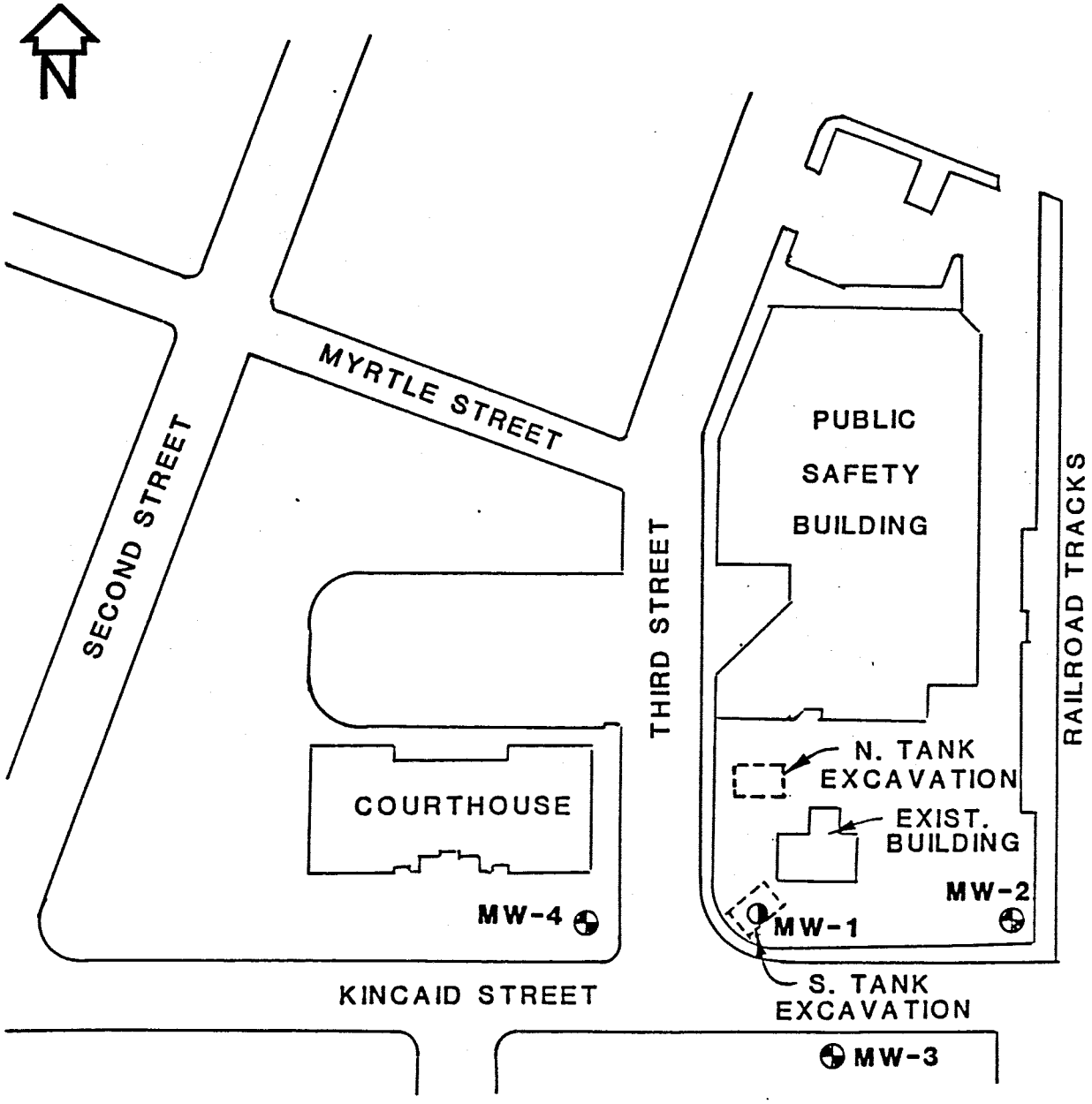
Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

Sean W. Donnan
Senior Hydrogeologist

Alvin R. Zeman, P.E.
President

SWD:cao1



EXPLANATION

- ◓ INDICATES MONITORING WELLS THIS CONTRACT
- ◑ INDICATES EXISTING MONITORING WELL

MARTIN COMMERCIAL FUELING
MT. VERNON, WASHINGTON

SITE & EXPLORATION PLAN

FIGURE 1

W.O. W-6138
BY JTC
DATE JUN 1989
SCALE N.T.S.

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
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Table 1

Changes in Contaminant Concentrations in Groundwater

Samples Collected from MW-1

Date	TPH Method 418.1 (ppm)	TPH Method 8015 Modified (ppm)	Benzene (ppm)	Toluene (ppm)	Ethylbenzene (ppm)	Xylenes (ppm)
4/24/89	39.40	---	5.01	2.71	1.20	8.34
7/26/89	Air Stripper Operational					
11/21/89	6.0	---	0.339	0.228	0.010	0.670
02/05/90	8.0	---	0.240	0.125	<0.001	0.395
03/16/90	7.0	---	0.299	0.001	0.003	1.568
05/10/90	21.0	19	0.770	0.066	<0.001	1.560

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922- 5047

Report To: Rittenhouse-Zeman Date: May 16, 1990

Report On: Analysis of Water Lab No.: 11275

IDENTIFICATION:
Samples Received on 05-11-90
Project: W-6138

ANALYSIS:

Lab Sample No.	1	2	3	4
Client Identification	MW-1	MW-2	MW-3	MW-4
Matrix/Units	Water ppm	Water ppm	Water ppm	Water ppm
Benzene	0.770	< 0.001	< 0.001	< 0.001
Toluene	0.066	< 0.001	< 0.001	< 0.001
Ethyl Benzene	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes	1.56	< 0.001	< 0.001	< 0.001
BTEX by EPA SW-846 Method 8020				
Total Petroleum Hydrocarbons by EPA Method 418.1	21.0	13.0	19.0	12.0
Total Petroleum Fuel Hydrocarbons by EPA SW-846 Modified Method 8015	19	< 10	< 10	< 10
TPH as	Gasoline			

SOUND ANALYTICAL SERVICES

C. Larry Zuraw

C. LARRY ZURAW