2.0 SAMPLING LOCATIONS AND RATIONALE

2.1 Sampling Areas

Soil, ground water, surface water, sediment and fish samples were collected from on- and off-site locations to characterize the Brunswick Wood Preserving Superfund site and determine its impact on the environment. The rationale and protocols developed for the remedial investigation sampling program are discussed in the following sections. Included are sample location maps which depict the locations of all samples collected, by media, for this investigation. Tables 2-1 through 2-6 contain the sampling locations and descriptions for all of the soil, ground water, surface water, sediment and fish samples, respectively.

Samples were collected during two phases of the remedial investigation. Most of the samples were collected in February and March 1997 (Phase I), when the bulk of the samples were collected. In October 1997, additional samples (Phase II) were collected after a review of the Phase I data indicated that additional samples were needed to adequately characterize the site.

2.1.1 Soil

During Phase I, 152 soil samples were collected from 78 locations. This sample total includes duplicates and other quality assurance samples. During Phase II, an additional 26 samples were collected from 14 locations, including previously sampled grids and additional grids that could not be accessed during Phase I due to the presence of the encapsulated waste cells. Discussions regarding the quality assurance samples are in Section 2.5.2.2.

Surface soil samples were collected to represent 56 on-site grids and 28 off-site, or perimeter grids, for a total of 84 locations. These samples represented the interval from 0 inches to 6 inches below ground surface and were collected as five point composites. The perimeter grids and on-site

grids located in the northeast corner of the site, beyond the historically active areas of the site, represented the largest grids sampled for the investigation and were approximately 300 feet square (grids P1 through P31 and grids 57 through 69). The aliquots in these grids were collected at a distance of 100 feet from the center of the grid in the direction of each corner of the grid. Grids 7 through 26, located along the southern boundary of the on-site area, are rectangular grids, 150 feet by 300 feet. A five point aliquot pattern was also used in these grids, with the aliquots being collected at locations 100 feet from the center, towards the corners of the rectangles. Grids 28 through 51 were 150 feet square or closely approximating this configuration. A five point aliquot pattern was used in these grids, with the aliquots being collected at locations 60 to 70 feet from the center, towards each corner of the grid or area. Grids 1 through 5 and 53 through 56 were irregular in shape and size. Because of these irregularities, no specific aliquot pattern was established for these grids. The sample teams were instructed to collect five aliquots at locations that were representative of the area. Grids 70 through 75 were located in the area previously occupied by the encapsulated waste cells and were approximate rectangles, roughly 150 feet wide and 200 to 300 feet long. An expanded five point aliquot pattern, similar to that used in grids 7 through 26 was used in these grids.

The sample for volatile organic analyses was collected from the center aliquot of the square and rectangular grids, prior to any mixing. In the irregular shaped grids, the volatile organic sample was collected at the aliquot location nearest the center of the area. This location was documented in the field book. After collection of the volatile organic compound sample, the remaining aliquots were collected and all aliquots were mixed to provide a uniform and representative sample of the area.

At some locations, obstructions were present, such as buildings, waste cells or large areas of concrete. The grid aliquot pattern was sometimes altered to accommodate these obstructions and the nature of the accomodation was described in the field book. At some grid locations, where the entire grid was thick, reinforced concrete, the grid was abandoned and a single, grab sample was collected to represent the surface sample at the grid.

Because the potential for subsurface contamination at the perimeter grids was considered minimal, the subsurface soil sampling program was initially restricted to the on-site soil sample locations only. However, because of high concentrations of PAH compounds detected in perimeter grids P5 and P29, subsurface samples were collected during Phase II to determine if subsurface contamination existed.

During Phase I sampling at each of the on-site locations, the subsurface sample was collected from the interval of 24-inches to 30-inches below ground surface. These samples were collected as grabs. During Phase II sampling, additional sampling at a depth of 48-inches to 54-inches below ground surface was conducted at grids 34, 36, 38 and 54. This sampling was needed to further characterize contamination identified in the earlier samples collected at a depth of 24 inches at these locations. Additionally, at the six new grids sampled during Phase II (grids 70 through 75) samples consisted of surface soil and two subsurface intervals consisting of 24-inches to 30-inches and 48-inches to 54-inches.

Grids 8, 10 and 12, located in the eastern ponded area, were under water. Because of this, no subsurface soil samples were collected from these grids.

Figure 2-1 shows the location and identity of all soil samples. These locations generally correspond to the locations proposed in the final work plan. Several of the proposed grids that could not be sampled because they were completely obscured by the encapsulated waste cells during Phase I were ultimately sampled during Phase II. Others, primarily within the perimeter grids, were omitted due to extreme inacessibility. Several grids, after evaluating their locations in the field, were considered unnecessary and were omitted from the scope of work.

2.1.2 Ground Water

During Phase I of the investigation, nineteen ground water samples were collected from

eighteen (18) locations, including fifteen (15) temporary monitoring wells and three (3) potable well locations. Figure 2-2 shows the locations of these samples.

With the exception of one location in the residential area south of the site, the temporary monitoring wells were installed in clusters of two wells. Each cluster consists of a shallow well, installed at a depth of 20 feet and screened from 10 to 20 feet, and a deep well, installed at a depth of 40 feet and screened from 30 to 40 feet. The single well installed in the residential area was installed to a depth of 40 feet and was screened from 20 to 40 feet. Each well was constructed of 2-inch stainless steel riser and was screened with No. 10 stainless steel wire-wrapped screen.

Construction details for each of the potable wells was not available but, based on conversations with property owners and site operators, it is believed that the depths of these wells are probably in excess of 100 feet for each well.

During Phase II, an additional 46 ground water samples were collected from 19 direct push ground water sampling locations. Samples were generally collected from two to three depths at each location. Figure 2-3 shows the locations of the direct push ground water sampling locations.

2.1.3 Surface Water and Sediment

A total of 22 surface water locations and 29 sediment locations were sampled during this investigation. All of the creek or stream-based surface water locations were co-located with sediment sample stations. However, several surface water samples were located in the on-site ponds; these samples are not necessarily co-located with a corresponding sediment or soil sample, as the case may be, collected from the substrate of the ponds. In addition, the sediment sampling locations for which there are no corresponding surface water samples generally represent dry ditches. These locations are identified in Figures 2-4 and 2-5 and are described in detail below.

2.1.3.1 Burnett Creek and Tributaries

Burnett Creek and it's tributaries are tidally influenced estuaries which are located in the immediate vicinity of the Brunswick Wood Preserving site. Burnett Creek flows through the western corner of the site and a tributary of Burnett Creek is located immediately upstream of the site on the opposite side of the creek from the site. Six samples were collected from locations in Burnett Creek and the tributary, in the immediate vicinity of the site (locations 219 - 223 and 225, shown on Figure 2-4). These locations were selected to provide upstream surface water and sediment quality, tributary influence and downstream quality. Another location in Burnett Creek (Station 224, Figure 2-5) was sampled downstream of the site, where the creek flows past U. S. Hwy 341. Another tidal creek, Dillard Creek, located to the west of the confluence of Burnett Creek and the Buffalo River, was sampled to provide background or reference data to which the Burnett Creek data could be compared (Station 228, Figure 2-5). All of these locations were co-located surface water and sediment sample locations.

2.1.3.2 On-Site Surface Water

On-site surface water consist of numerous ponds or excavations containing water. Six samples were collected from the CCA area pond/excavation and ponds IM-4 and IM-5, all located near the eastern extent of the site (stations 201-206, shown on Figure 2-4). Surface water and sediment samples were generally co-located at the sample locations in these ponds. Three other pond or excavation area samples were collected from the excavations near the western extent of the site, in the area of the office building (stations 230-232, shown on Figure 2-4). In general, the water samples were collected from near the center of each of the first three distinct ponded areas and the sediment/soil substrate samples were composited from four to five areas within each of these areas.

2.1.3.3 On-site and Near On-site Water-Filled Ditches

A small creek flows year round in the ditch on the north side of Perry Lane Road. It originates northeast of the site and flows along the ditch to a point near the main entrance to the site, at which point, it turns northwest and flows directly to Burnett Creek. Two sets of co-located surface water and sediment samples were collected from this creek, one generally upstream of any possible influence from the site, and another after several culverts from the site empty into it (Stations 208 and 211, shown on Figure 2-4).

Several ditches, up to several feet deep, are located at the eastern end of the site. One originates on-site and is connected with the perimeter grid area to the east via a large diameter culvert. Immediately east of the culvert, another deep ditch connects with this ditch and is oriented northwest-southeast. Flow is generally undiscernable in this ditch. Two co-located surface water and sediment samples were collected from these ditches (Stations 226-229, shown on Figure 2-4).

2.1.3.4 Dry Ditches

Sediment samples only were collected from dry ditches along Perry Lane Road and the CSX Railroad. A total of ten sediment samples were collected (Stations 207-218, excluding 209 and 210, shown on Figure 2-4). Samples were generally taken to characterize any contamination present on both sides of the road (and railroad).

2.1.4 Fish Tissue

Fish were collected from four locations, processed into tissue samples and were analyzed for dioxin/furans. Two fish sampling sites were located in the ditch north of Perry Lane Road, one upstream of the main outfall from the site and one downstream of the outfall. Fish samples, comprised primarily of various forage fish, including, in order of predominance, top minnow, mosquito fish, gobi,

darter, sucker, sunfish, silverside and mummichog, were also collected from Burnett Creek, near the Perry Lane Road bridge and the railroad trestle and in Dillard Creek, about three miles west of the site. Dillard Creek was selected as the reference stream location due to it's similarity to the Burnett Creek location, including the highway bridge and trestle. The fish were prepared as whole body samples prior to shipment. Fish collection locations are shown on Figure 2-6.

2.2 Sample Identification

Samples collected during the investigation were assigned a unique sample number incorporating a site identifier, a sample location number, and a media identifier. The following identification system was used:

BW-XXX-YYY

BW identifies the site as the Brunswick Wood site, XXX denotes the sample location number, and YYY denotes the media. The sample location identification protocol is as follows:

Soil	001 - 199 series
Sediment and Surface Water	200 - 299 series
Ground Water	300 - 399 series
Quality Control Samples	400 - 499 series

The media are identified using the following key:

SF	Surface Soil (0"-6")
SB	Subsurface Soil (generally 24"-30")
SD	Sediment
SW	Surface Water
GW	Ground Water

Additional qualifiers were used with the ground water designations, i.e., GWS refers to

shallow temporary well and GWD refers to a deep temporary well. Some slight deviations from this identification protocol occurred, however, all samples were uniquely identified. Environmental samples collected for QA/QC purposes, primarily co-located duplicates and variability duplicates, were identified by appending "D" or "V" to the media suffix. BW-223-SDD, for example, would indicate a co-located sediment duplicate collected at location , whereas BW-034V indicates a variability duplicate collected at soil sampling location 034. The variability duplicate was collected at an offset pattern identical to the regular aliquot pattern and described in the field book for each duplicated sample location.

2.3 Sample Collection and Handling Procedures

All samples were collected, preserved, handled and documented in accordance with the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), May 1996. (4)

2.4 Sample Analysis

All samples were analyzed for volatile and extractable organic compounds, including pesticides and PCBs, and metals. In addition, 50 sediment and soil samples and four fish tissue samples were also analyzed for dioxin compounds.

All analyses were conducted in accordance with the Analytical Support Branch Operations and Quality Control Manual (ASBOQCM) (5) or as specified by the existing US-EPA standard procedures and protocols (Statement of Work) for the contract analytical laboratory program.

2.5 Quality Assurance

Quality assurance (QA) began in the planning stage and continued through sample collection,

analyses, reporting and final review. The methods that were used to ensure data quality for the Brunswick Wood Preserving remedial investigation are discussed below.

2.5.1. Organization and Responsibilities

The Field Project Coordinator (Donald Hunter) had overall responsibility for field QA and for ensuring that the prescribed routine quality control (QC) procedures defined in the work plan were implemented and documented.

Laboratory analyses were conducted either by the SESD Analytical Support Branch (ASB) or through the contract laboratory program (CLP). Overall responsibility for the ASB laboratory QA resting with the ASB management. William H. McDaniel, Chief, Organic Section and Jenny Scifres, Chief, Inorganic Chemistry Section were primarily responsible for ensuring that prescribed routine QC procedures were applied and documented in the ASB laboratory. Gary Bennett, Chief, Laboratory Evaluation and Quality Assurance Section, was primarily responsible for ensuring that QA/QC procedures were applied to the samples submitted through the CLP for analysis. Approximately one-half of the samples collected for extractable organic analyses and all of the dioxin samples were analyzed by a CLP laboratory.

2.5.2 Sample Collection

2.5.2.1 General

As previously indicated, all samples were collected in accordance with Section 4 of the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (4). The quality assurance and quality control procedures described in this manual were designed to ensure that representative samples are collected from the various media sampled.

2.5.2.2 Quality Control Samples

Duplicates collected at ground water, surface water and sediment sample locations were checks of consistency and reproducibility of sampling technique. The soil duplicates, however, were collected to provide data on the variability of compound or analyte concentrations within a given area, i.e., grid. Rather than compare analytical results for adjacent or co-located soil samples in a grid, duplicates were collected at a significantly offset aliquot patterns to provide data which could be used to evaluate the variability of contaminant concentrations within a given area. This type of data is used to determine if further characterization sampling is necessary in an area. Actual duplication rates for the investigation were five percent for ground water, nine percent for surface water, ten percent for sediment and six percent for soils. The duplicates collected for ground water and surface water were generally very comparable, based primarily on a review of the metals data. There were very few organic compounds detected in the water samples which could be compared, particularly in the surface water samples. The sediment duplicates were very similar, reflective of the same suite of detected compounds, present in a similar range of concentrations.

Since it is expected that much of the future emphasis at the Brunswick Wood Preserving site will be placed on soil contamination, particularly with respect to possible additional soil removal, the results of the variability duplicate sampling were examined in greater detail. The analytical results for the variability duplicates are summarized in Tables 2-7 through 2-9. These tables contain side-by-side comparisons of the variability duplicates with their corresponding sample results. The degree of variability appeared to be a function of the analyte group evaluated. In general, there was little significant variability with respect to the metals analyses. In several grids, however, (grids 23, 48, 68, P11 and P25), there was moderate to significant variability observed after comparing the organic results. If the concentrations observed within the variability detected in any of the grids approach or exceed remediation levels, additional sampling may be warranted to better define the variability to provide an adequate characterization for remedial purposes.

In addition, a number of quality control blanks were used to provide assurance that the data generated was of useable quality. These samples are listed and described in Table 2-10. The analytical results are summarized in Table 2-11. Two water trip blanks were prepared for shipments containing water samples. These blanks were prepared at the SESD lab and were analyzed for volatile organic compounds. The trip blanks were handled and stored with the samples collected from the site and provided a check to determine if samples may have been contaminated during handling, storage and shipment. A soil trip blank was also prepared at the SESD lab for use with soil/sediment shipments samples. No volatile organic compounds were detected in any of the trip blanks.

There was no publically supplied water system on-site which could be used to supply water to the organic-free water system. There was, however, a potable well on-site installed by the removal contractor to supply water needs for the removal. This well had been sampled and shown to be free of contamination, therefore the decision was made to use this source to supply water to the decon operations and the organic-free water system. A sample of the raw water was collected and analyzed and was found to contain only typical inorganic constituents at normal concentrations.

Two organic-free water system blanks were collected during the investigation. These served as both system blanks and preservative blanks. In addition, two equipment rinse blanks were also prepared on two different occasions. No organic compounds were detected in any of these blanks, however, aluminum and/or zinc was detected in each of the samples except for the first organic-free water system blank. These occurrences are not considered significant, with respect to the site.

A post-preservative water blank was also prepared after collection of the last water sample. This sample provided assurance that the preservative used to preserve all metals samples had not been inadvertantly contaminated during sample preservation during the course of the investigation.

2.5.3 Quality Control/Quality Assurance

Analytical quality control and quality assurance depends in large part on careful consideration and attention to chain of custody, instrument calibration procedures, routine QC checks, data validation and reporting, and the laboratory's routine procedures for assessing precision and accuracy. These aspects of quality control and assurance are covered in the Analytical Support Branch Laboratory Operations and Quality Control Manual (ASBLOQCM) (5) for in-house analyses. For analyses run through the Contract Laboratory Program, the same aspects are covered in the CLP Statement of Work.

2.5.4 Precision, Accuracy, Representativeness, Completeness, and Comparability

The precision, comparability and accuracy of sample analysis is addressed in the (ASBLOQCM) (5) and the most recent CLP Statement of Work. With regards to completeness, one-hundred percent of the samples collected were analyzed.

2.6 Investigation Derived Waste Management

Material that was generated during the investigation that was subject to investigation derived waste consideration and management includes:

- Purge and development water from monitoring wells
- Decontamination fluids generated at the decontamination pad
- Dirty clothing and other garbage generated during activities, including Tyvek™ suits, plastic sheeting, cardboard boxes, aluminum foil, etc.

Purge water from the temporary wells and the uncontaminated potable wells was discharged to the ground. Decontamination fluids, except for solvent, was pumped from the decon pad to one of the on-site ponds. The solvent was collected and returned to the lab for proper management. All of

the material included in the last bulleted category above were bagged and placed in a leased roll-off container and disposed of by a locally contracted solid waste management firm.