Phase 1 Intermediate Design Report
Hudson River PCBs Superfund Site

Attachment G – Design Analysis: Processing Facilities

General Electric Company
Albany, New York

August 22, 2005

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Attachment G – Design Analysis: Processing Facilities

1. General

This attachment and the associated tables and calculations (Exhibits G-1.1 through G-8.1) present the rationale for the selection and sizing of the various pieces of equipment and individual facilities that will collectively comprise the sediment and water processing facilities at the Energy Park site. It presents the basis and results of calculations used in the design, and incorporates the results of treatability studies, where appropriate.

The overall process flow diagram for the processing facility is presented in Sections 3.6.4.1 and 3.6.4.2 and shown on Contract Drawings P-2002 and P-2003. This attachment presents the assumptions and calculations used to size those components in the general order they are discussed in Section 3.6, but the reader is referred to that section for a complete narrative of how the components interact with each other.

The Phase 1 Intermediate Design and treatability studies were both developed using examples of four dredged sediment types, illustrating a range of conditions encountered horizontally and vertically in the river. Particle size distributions were determined for samples or sample segments during the Year 1 and Year 2 SSAP programs. The sample results were sorted by percent fines (% passing 0.074 millimeter [mm]) and the data set was separated into four equal quadrants. The analyses within each quadrant were averaged and reported as sediment types S1, S2, S3, and S4 (see Exhibit G-1.1). The particle size distributions for the Year 1 and Year 2 SSAP data are combined and presented in Exhibit G-1.1, while separate particle size distributions for the Year 1 and Year 2 data sets are displayed in Exhibit G-1.2.

During the treatability studies (see Treatability Study Appendix), samples of Hudson River sediments were collected from areas where PSDs and PCB concentrations were representative of sediment types S1, S2, S3, and S4. Summary analyses of these baseline sediment samples are shown in Exhibits G-1.3 and G-1.4.

The four different sediment types represent the range of properties that the processing facilities must be capable of handling. It is not expected that equal quantities of each sediment type will be dredged. Estimated quantities of each sediment type that will need to be processed will be developed during Phase 1 Final Design.

2. Size Separation

Mechanical Unloader (Clam Shell)

Barge unloader configurations are presented in Attachment F (Design Analysis: Unloading and Waterfront Facilities), along with unloading calculations and discussion of unloader sizes.

Hopper with Pipe Grizzly

Details pertaining to selection of bar screen (pipe grizzly), belt feeder, and inclined conveyor are presented in Exhibit G-2.1.

Trommel Screen

Loading calculations, trommel component sizing, and selection of a fixed stack conveyor are presented in Exhibit G-2.1. A screen opening size of 3/8 inch is the smallest size recommended by equipment suppliers.

Sediment Slurry Tank

The sediment slurry tank will be used to adjust the solids content of the trommel screenings to within the range of 20 to 30% (w/w) solids. This will form the feed to the hydrocyclones, as discussed below. Recycle water will be applied to both the trommel spray bars and the sediment slurry tank. The portion of recycle water added to the slurry tank will be added in response to a mass analyzer signal from within the slurry tank. The trommel sprays will add half or more of the required dilution water, so the recycle water added to the slurry tank will be a final trim. The slurry tank hydraulic residence time of 5 to 8 minutes is a compromise between the need for tankage large enough to equalize large short-term fluctuations in concentrations and a desire to minimize settling of coarse material within the slurry tank. A residence time of 5 to 8 minutes will represent a mixture of the contents of four to six clamshell swings.

Hydrocyclone System

The hydrocyclone system is sized to treat a continuous flow of sediment slurry. Type S1 sediments will create the highest solids loadings to the system, as shown in Table 3-35 (Material Balances). Sizing calculations were prepared by Krebs Engineers (Tucson, AZ), and are included in Exhibit G-2.1.

Treatability testing was performed to evaluate size separation technologies and the chemical properties of the separated solid fractions. Samples of four sediment types were wet screened in sufficient quantity to analyze the screened fractions for a number of parameters, including PCB, TOC, solids, pH, and specific gravity. Results are presented in Exhibit G-2.2. Other properties of the separated size fractions are presented on pages 227 to 238 of the appended *Treatability Studies Report*. These results show how solids and PCBs separate differently by particle size for different sediment types. The amount of PCB in coarse fractions was likely associated with the woody material observed in these samples.

Two hydrocyclone treatability testing campaigns were performed in August 2004 and December 2004. The August 2004 tests applied sediment S4 (28% fines) at feed concentrations of 10 and 15% (w/w), while the December 2004 tests applied sediments S2-2 (17% fines) and S3-4 (36% fines) at feed concentrations of 15 and 25% (w/w), respectively. Hydrocyclone testing in the December 2004 tests used a cyclostack and higher solid feed concentration. In general, these runs achieved better performance than observed in the August 2004 hydrocyclone testing. Hydrocyclone testing results and material balances are shown in Exhibit G-2.3.

Based on the results of these tests and advice from Joseph Keene of KD Engineering (Tucson, AZ) and Krebs Engineers, a hydrocyclone feed solids content in the neighborhood of 25% (w/w) was established as a target, with a range of 20 to 30% considered acceptable.

Vibratory Dewatering Screens

For purposes of Phase 1 Intermediate Design, 120 square feet (ft^2) of vibratory dewatering screens (to recover -40 mesh x +400 mesh) was recommended by Derrick Corporation for dewatering the estimated 300 tons of solids per day of hydrocyclone underflow resulting from the treatment of sediments generated from dredging 4,300 cy/day of type S1 material.

Treatability studies evaluated the drainage characteristics of the coarse fraction. Coarse settled solids (79% solids) from S1 sediment gravity drained to 86% after 24 hours, while coarse solids (71% solids) from S2 sediment drained to 73% after 24 hours. Coarse solids (42% solids) from hydrocyclone underflow testing of sediment S4 drained to 77% solids after 24 hours. Drainage results are summarized in Exhibit G-2.5. Some of the water loss was likely due to evaporation. While this testing showed that separated coarse solids will release additional water, the test was not representative of dryness that may be attained by vibratory dewatering screens. For purposes of completing the Intermediate Design, it was assumed that hydrocyclone underflow will dewater on a vibratory screen to a solids content of 85% by weight. This will be refined after further consultation with the equipment vendors.

Process Water Storage Tanks

The size separation process water storage tank will receive and store recycle water from solids processing for use in trommel screen washing and addition to the sediment slurry tank. This tank, located at the waterfront, will provide 1-hour residence time when type S1 sediment is processed, as presented in Exhibit G-2.1.

The treated water storage tank, also located at the waterfront, will provide treated water (from process filtration and GAC treatment) for use as decontamination wash water, as presented in Exhibit G-2.1.

3. Thickening and Dewatering

Hydrocyclone overflow will be directed to the hydrocyclone wet well, where it will be pumped to the solids thickening and dewatering system. The slurry pumps and piping from the hydrocyclone wet well are sized in Exhibit G-3.1.

Dredge Slurry Holding Tanks

The dredge slurry holding tanks serve as flow equalization prior to thickening of the hydrocyclone underflow. As developed in Exhibit G-3.1, two tanks with a storage volume of 700,000 gallons each will provide a storage capacity for 8 hours of hydrocyclone underflow generated by processing type S1 sediment. Eight hours of storage would also provide a buffer period of offloaded storage in the event a portion of the thickening or dewatering facilities was under repair or maintenance. More importantly, these tanks are required to cope with water imbalances that will likely occur when changes in sediment types are delivered for processing, and especially when processing needs change as a result of intermixing inventory barge loads followed by residuals barge loads (or vice versa).

Mixing energy studies were performed to determine the mixing energy needed to keep slurries in suspension. Results of mixer studies in 5-gallon and 55-gallon containers are presented on pages 331 to 337 of the Treatability Studies Appendix. The range of velocity gradients (G) from 200 to 800 sec^{-1} all kept solids in suspension for gravity-decanted fines from slurry types S1 to S4B. Vendors have recommended five 75-hp mixers for each 700,000-gallon tank. These mixers can provide a velocity gradient of 205 sec^{-1} when the tank is at full capacity.

The sizing of dredge slurry holding tank transfer pumps is included in Exhibit G-3.1.

Thickener Conditioning Tanks

Chemical screening tests were performed on 100 milliliter (mL) samples to evaluate the effects of polymer treatment on thickening fine solids (<#200 sieve) from sediment S2-2-07. Coagulant polymer (GE Betz Developmental E) doses of 9.7 pounds per dry ton (lbs/dry T solids) achieved the fastest settling rates. See Exhibit G-3.2a.

Additional settling tests with polymer screening were performed using 2 liter (L) samples of hydrocyclone overflows from treatment of sediment type S2-2. The screening used combinations of cationic polymer coagulants with cationic and anionic polymer flocculants. The results, shown in Exhibit G-3.2b, led to the tentative selection of cationic coagulant GE Betz Developmental E at a dose of 6 lb/dry T combined with anionic flocculant GE Betz AE1115 at a dose of 3 lb/dry T.

Polymer preparation and addition systems will be developed to permit chemical-enhanced thickening, as described above, for cationic and anionic polymer treatment. These details will be developed during Phase 1 Final Design, or in accordance with performance specifications.

Gravity Thickener System

Gravity thickener sizing calculations are presented in Exhibit G-3.1, using results of the 2-L cationic and anionic polymer treatments with hydrocyclone overflow from treating S2-2-07 <#200 samples. These calculations indicate the need for two 60-foot diameter thickeners. A water depth of 12 feet is recommended by vendors.

Dewatering Conditioning Tanks

Dewatering polymer screening and confirmation tests were performed to select polymers for use in filter press testing. Screening test results are shown in Exhibits G-3.4 and G-3.5. These results indicated that various cationic coagulant products performed similarly within dosage ranges of 2 to 13 lbs/dry T for gravity-desanded slurries. Optimum cake solids ranged between 60 to 70% at 4 to 9 lbs/dry T polymer doses, with no strong trend from S1 to S4.

Comparison of thickened vs. unthickened filter press feeds and feed solids of 3 to 25% suggests some improvement of cake solids concentrations with increasing feed solids concentrations. Polymer coagulant doses of 6 to 10 lbs/dry T solids were required for thickening.

A mixing sub-study was performed to evaluate mixing needs and floc sensitivity to mixing or shear (see page 451 of the appended *Treatability Studies Report*. The results indicated that 3 minutes of over-mixing at 100 revolutions per minute (rpm) resulted in a loss of 10 to 12 % cake solids. This is typical of performance losses that might be expected from excessive floc shear.

The polymer conditioning facilities at the processing facility should be designed with variable mixing speed capability to allow the operator to avoid excessive mixing conditions.

Based on the results of polymer screening and the pilot scale tests described below, a cationic coagulant such as GE Betz Developmental E will be used for Phase 1 dewatering within a dosage range of 7 to 19 lbs/dry T. This dosage range may be modified if polymer treatment will be used in the gravity thickeners. Additional testing of thickened sediments will continue during Phase 1 Final Design.

Polymer preparation and addition systems will be developed to permit chemical-enhanced dewatering, as described above, for cationic polymer treatment. These details will be developed during Phase 1 Final Design or in accordance with performance specifications.

Recessed Chamber Filter Press Dewatering System

Dewatering treatability studies included bench-scale filter press simulations (BFPs or "hockey pucks") using a test apparatus from US Filter. These bench-scale tests were used to evaluate the effects of several variables. The program also included tests using a 1 ft^2 pilot-scale plate and frame filter press (PFP). The PFP tests were conducted to generate water for water treatment pilot tests. The main variable that changed for the PFP tests was the feed sediment types. Exhibit G-3.6 is a listing of all the bench-scale and pilot-scale tests.

Exhibit G-3.7a lists results of treatments with GE Betz Developmental E polymer, 100 psi and 30- 60-minute runs. The data were then divided into BFP and PFP for each matrix. For the BFP runs, the results were selected for the dosage that produced highest cake solids when a series of dosages was performed. For PFP, it was assumed that all dosages were close to optimal. The pilot-scale results did not significantly differ from similar bench-scale tests. In general, it is expected that sediments can be dewatered to 55 to 65% solids (see comparisons in Exhibit G-3.7b).

The filter press tests used "simulated" hydrocyclone overflow as feed. This simulated feed was produced by settling the sediment slurry for 1 to 2 minutes to simulate the coarse solids removal expected during hydrocyclone separation. Bench-scale filter press tests were also run on actual hydrocyclone overflow from pilot tests (Exhibit G-3.8). The actual hydrocyclone overflows appear to require polymer doses higher than the simulated feeds and produce cake solids of 45 to 55%, as compared to 55 to 65% for the simulated feeds. When freshly-diluted sediment samples were passed across a #400 screen, the resulting fines required high polymer doses and produced BFP cakes in the 45 to 55% range, similar to the hydrocyclone overflows.

Several BFP runs evaluated cake release screening for alternative fabric porosities. See Exhibit G-3.9. The tests included fabrics with porosities ranging from 0.5 to 15 cubic feet per minute (cfm). All of the tested fabrics had good release and clear filtrate; cake solids and filtrate volumes were similar within each of the two sediments tested. Specific filter press vendors may need to perform similar testing for other media.

Most BFP runs and all PFP runs were conducted at filter feed pressures of 100 psi. Within tests BFP-82 to BFP-92, several feed pressures of 125 and 225 psi were performed. Improvements of cake solids at the higher pressures were inconsistent. Run BFP-84 at 125 psi had cake solids of 71.5% vs 67.1% for BFP-83 at 100 psi. However, curiously, BFP-88 at 100 psi produced cake solids of 59.2%, compared to BFP-90 at 125 psi, which had cake solids of 58.9% and BFP-91at 225 psi, which had cake solids of 54.6%.

Cake solids vs. time were evaluated in runs BFP-144, BFP-133, and BFP-145. Cake solids improved around 10% solids points from 45 to 60 minutes, with little further cake dryness achieved by increasing the time to 60 to 90 min. Similar time trends can be observed by plotting filtrate volumes from individual BFP and PFP tests (no BFP tests went beyond 90 minutes, but some PFP tests went to 120 to 150 minutes).

The pooled data in Exhibit G-3.6 were evaluated by multiple regression, with results presented and discussed in Exhibit G-3.10. Cake solids were best predicted by the fines content in the matrix, next by filter press feed % solids, and then by scale of the test (bench vs. pilot). Curiously, polymer dose was not statistically significant – see discussion in Exhibit G-3.10.

For several of the PFP runs, filtrate samples were analyzed. These analyses are summarized in Exhibit G-3.11. Suspended solids ranged 2 to 42 milligrams per liter (mg/L), with an average of 13.4 mg/L. TOC and dissolved organic carbon (DOC) ranged 3 to 14 mg/L, with an average of 7.8 mg/L. Total PCB ranged 430 nanograms per liter (ng/L) to 46 micrograms per liter (µg/L), with an average of 17.6 µg/L.

Alternatives to dewatering by plate and frame filter press include belt presses and centrifuges. Some screening tests were performed to estimate polymer consumption and cake solids achievable by these processes. Test results are shown in Exhibit G-3.12. The belt press screening tests achieved average 52% solids, only slightly lower than the 55 to 65% solids produced by PFP tests. Centrifugation achieved average 49% cake solids. It is notable that the centrate suspended solids and PCB concentrations were approximately 100 times that of PFP filtrate.

Filter press sizing calculations are presented in Exhibit G-3.1. Phase 1 processing will require 12 plate and frame filter presses, each with a capacity of 600 cubic feet. Press cake (55 to 65% solids) will discharge to roll-off boxes located below each press.

Press filtrate will discharge to the recycle water equalization tank, where it will mix with overflow from the thickeners. Sizing of the recycle water equalization tank is included in Exhibit G-3.1. Water from this tank is used to supply the size separation process water storage tank located at the waterfront.

4. Solidification and Stabilization

Stabilization/solidification treatability testing was performed to evaluate the effectiveness of various dosages of solidification agents on raw slurries and filter cake. The test data and observations are summarized on pages 759 to 760 in the Treatability Studies Appendix. Generally, it is noted that quicklime performed better at lower doses than other reagents tested. Dosages of 15 to 25+% were required, with very high dosages for S4 sediments. Typically, stabilization/solidification is performed at dosages of 7 to 10%. Filter press cakes all passed the paint filter test and did not require stabilization/solidification. Based on treatability testing, quicklime would be the material of choice for stabilizing off-spec batches of filter press cake.

Storage/transport stability tests were performed to ascertain the potential for water to be released from processed material during transport. A shaker test was used to simulate motion during transport that might result in water release from dewatered or solidified sediments. Results are presented in the appended *Treatability Studies Report*. All mixes were stable, and only three samples had a detectable amount of free water released.

5. Process Water Treatment

Process water treatment was tested during treatability studies. The treatment train included settling, filtration, and carbon adsorption. The processes were tested at a range of commonly applied hydraulic loading rates using filtrates produced during pilot tests by dewatering each of the sediment types (S1, S2, S3, and S4B) with PFPs. Results of the testing are included in Tables 23 and 24 of the appended *Treatability Studies Report*. These results are also summarized in Exhibits G-4.2 (Settled Filtrate) and G-4.3 (Process Water Filtration and Granular-Activated Carbon Adsorption). The tests were not designed to follow the processes through full cycles of headloss development or carbon exhaustion. Rather, the tests were intended to represent a snapshot of the process removal capabilities when treating waters from various sediments over a range of hydraulic loadings. The column tests were equilibrated for at least 10 bed volumes of flow before sampling.

After settling for 2 hours, the supernatants were used to feed the process filter and two GAC columns in series. Settled dewatering process effluents from the four sediment types were applied to the process filter (4-inch diameter x 4-foot bed height) at hydraulic loadings of 2, 6, and 10 gallons per minute per square foot (gpm/ft^2).

The process filter was connected in series to a train of two GAC columns (4-inch diameter x 5-foot bed height each), also in series. Sampling between the GAC columns and after the lag column allowed evaluation of two hydraulic loadings during each run. The three applied flow rates achieved carbon loading rates of 19 and 38 minutes, 6 and 13 minutes, and 4 and 8 minutes empty-bed contact times (EBCTs).

Exhibit G-3.11 shows PFP filtrate suspended solids ranging from 2 to 42 mg/L (13.4 mg/L average) and PCBs ranging from 0.43 to 46 µg/L (17.6 µg/L average). Exhibit G-4.2 shows settled PFP filtrates with suspended solids undetectable (at a detection limit of about 2 mg/L) in four of the five tests, and 13 mg/L for settled H1S4B filtrate. The settled filtrates had PCBs ranging from 40 to 1,100 ng/L. Heavy metals in the settled PFP filtrates were all well below the WQC Substantive Requirements.

Exhibit G-4.3 shows removals across the process filter and GAC columns. The feed PCBs were low for all sediment types, ranging from 22 to 56 ng/L. The process filter showed consistent further removals of PCBs, with filter effluents ranging from 12 to 46 ng/L (discounting a 76 ng/L outlier). The lead and lag GAC effluents were undetectable for PCBs at a detection limit of 9.3 to 9.8 ng/L (except for H1S4B with 17 ng/L from the lead column and undetectable from the lag column).

Even though feed heavy metals were all below WQC Substantive Requirements, there were consistent reductions of chromium, copper, and lead across the GAC, and to a lesser extent across the process filter. Cadmium and mercury were below detection levels in feeds and effluents. In other tests, effluent from RSSCT carbon columns was tested for mercury using EPA Method 1631. Mercury was not present at detection levels of 0.00051 µg/L. When present in feed streams, there were also expected reductions in COD, 5-day BOD5, TOC, DOC, TKN, and nitrate, typically to non-detectable levels from the lag GAC.

There were no outstanding differences in removals owing to the three hydraulic loadings tested.

The DRET tests provide some additional perspective on the potential solubilization of heavy metals from Hudson River sediments within the processing facilities, although that is not the intent of the DRET test. See Exhibit G-4.4. Settled (unfiltered) DRET water was observed to contain cadmium, chromium, lead, and mercury concentrations exceeding WQC Substantive Requirements; however, none of the filtered waters contained heavy metals above the WQC Substantive Requirements. Note that the DRET test uses a 1% sediment slurry, mixed, then settled. The sediment concentrations in the processing facility will be on the order of 25%. The metals in the PFP filtrates (Exhibit G-4.2) and the filter/GAC tests (Exhibit G-4.3) were not significantly different from the DRET test filtrates, indicating that dissolved metal concentrations are not sensitive to original slurry concentrations.

Process Water Equalization Tanks

The METSIM material balances (presented in Table 3-35) indicate that processing of inventory dredging barges during the 1-month Phase 2 demonstration period (conducted during Phase 1) will produce 300 to 409 gpm (0.43 to 0.59 [mgd]) of water to be treated, depending on the sediment type being processed. The material balances further indicate that processing of residuals dredging barges will generate 780 to 860 gpm (1.1 to 1.2 mgd) of water. Based on these expected flow rates, two water treatment trains of 500 gpm each will be constructed for Phase 1.

Excess water will be directed from the recycle water equalization tank (T-21001) to the process water equalization tank (T-30101). The 60,000-gallon process water equalization tank will provide a 60-minute retention/equalization time at the design flow rate of 1,000 gpm (Exhibit G-4.1). Either one or both process water treatment trains will draw from this tank.

Rapid/Mix and Flocculation Tanks

During the pilot studies, solids present in the PFP filtrate settled readily without further chemical treatment. However, to provide flexibility, chemical feed, rapid mix, and flocculation tanks will be provided with each 500 gpm train. These will be available for polymer addition and/or metal coagulant.

As presented in Exhibit G-4.1, a 1,500-gallon rapid mix basin (3 minutes) and a 2,500-gallon flocculation basin (5 minutes) will be provided along with appropriate mixers, to be specified during Phase 1 Final Design.

Clarifiers

The flocculation basins will each lead to a high-rate clarifier. A number of clarifiers are available that operate at hydraulic loading rates of 0.23 to 0.25 gpm/sf. Clarifiers are often supplied with integral rapid mix and flocculation facilities. Other clarifier systems (e.g., Krofta) may be integrated with filter media.

Process Filter Systems

Process filter systems are discussed in Exhibit G-4.1. A design hydraulic loading of 3.9 gpm/ft^2 is suggested. This rate is consistent with the screening tests done during treatability studies. Two filter units per process train are suggested.

Backwash water will be provided for an upflow rate of 15 gpm/ft^2 (1,000 gpm) and a backwash time of 15 minutes per filter once per day, for a total backwash requirement of 60,000 gallons per day. This is 4% of the forward flow at design loading.

Granular Activated Carbon Systems

As described in Exhibit G-4.1, four GAC vessels are recommended for each 500 gpm process water treatment train. Each GAC vessel will be designed for a recommended EBCT of 20 minutes, with two trains of two GAC vessels in series. Each vessel will contain 20,000 pounds of GAC, with a bed volume of 700 cubic feet. Piping will allow reversal of lead and lag columns in each train.

RSSCTs have been conducted to allow prediction of GAC bed life and breakthrough profiles. The results are currently being compiled and will be reported during Phase 1 Final Design. Available test results indicate that at typical loadings, the bed life is likely to last well beyond a single dredging season. Bag filters or cartridge filters will be provided at the end of each GAC train. Bag filter media will likely be 5 or 10 microns.

Backwash Holding Tank

A single 200,000-gallon backwash holding tank (T-30901) will serve the backwash needs of all filter columns and GAC columns. In addition, this tank will provide holding for decontamination and plant wash waters at all process areas, including rail yard decontamination needs. A listing of plant water needs is included in Exhibit G-4.1.

6. Stormwater Treatment

Design Storms

Three types of stormwater runoff are described in Section 3.6 of the Phase 1 IDR. These include Type I stormwater, which has the potential to contact PCB-containing materials; Type II stormwater, which has the potential to collect non-PCB sediments as a result of peripheral site activities; and Type III stormwater, which runs across areas of the site which are undisturbed and/or not involved in site activities.

Exhibit G-8.1 presents a tally of the Type I runoff areas and presents runoff volume calculations associated with 10-, 25-, and 100-year return interval storms. Type I stormwaters will be collected, stored, and treated as described below. Type II stormwaters will be gravity-drained to four stormwater sediment basins. These grass-surfaced basins will allow sedimentation and recharge, but will overflow to surface waters during higher-flow periods. Type III stormwaters will follow current recharge or discharge patterns.

Stormwater Treatment Systems

Type I stormwaters will be collected and routed as described in Section 3.6 of the Phase 1 IDR. Three types of storage systems will be used. Above-ground tanks will contain runoff (3.5 MG) from a 10-year 24-hour storm. Curbing and piping will contain additional storm volume (0.6 MG) generated from a 25-year 24-hour storm (4.1 MG), while curbing will contain additional storm volume (1.0 MG) generated from a 100-year 24-hour storm (5.1 MG).

A third water treatment train (in addition to the two described in Section G.5 [Process Water Equalization Tanks]) will be used to treat Type I stormwaters. This will be an additional 500 gpm train identical to the two 500 gpm process water treatment trains. Stormwater treatment will use available capacity, as needed, from the two process trains. If dredging is discontinued for any period, the process water treatment trains can be fully utilized for stormwater treatment. Similarly, when not needed to treat stormwater, the stormwater train can be available to address non-routine process treatment needs.

7. Processed Material Staging and Load-out Facilities

Waterfront Staging

Four types of materials will be staged and managed at the waterfront facility. These include:

- Large debris removed separately by grapple or sling. This may include logs and rocks, as well as large cultural debris, such as tires, appliances, or shopping carts;
- Debris greater than 6 inches in diameter rejected from the pipe grizzly;
- Debris greater than 3/8 inch in diameter rejected from the trommel screen; and
- Coarse solids from hydrocyclone underflow and dewatering screen.

Estimated quantities and temporary staging areas are presented in Exhibit G-5.1. Calculations of transport vehicles and trip cycles are also included. In the calculations a 16-hour work day is intended to represent a 67% utilization rate over a 24-hour day. Downtime is anticipated for truck maintenance, fueling, shift changes, and potential waiting time if loading or unloading operations experience delays.

Filter Cake Staging

At peak Phase 1 production, 12 filter presses will each produce a drop of 22 cy of 55% solids filter cake every 3 hours, for a total of 105 drops per day. These solids will drop into 30 cy roll-off containers. Two roll-off trucks will each need to transport two containers per hour from the filter press building to the fine sediment staging area.

Railside Staging

Exhibit G-5.1 presents five Phase 1 train scenarios. These scenarios list the weekly barged and processed sediment amounts, and calculate load-out volumes in accordance with assumed numbers of unit trains shipped each week. The net difference between each week's input and output becomes the additional cumulative storage volume. Each scenario reaches a maximum peak storage volume that declines as dredging production is reduced or as rail service is increased. The two principal scenarios were:

- Three trains per week (Scenarios 4 and 5) require 22,000 to 34,000 cy storage.
- Two trains per week (Scenario 1) require 83,000 cy storage.

The scenario utilizing two trains per week was selected as the basis for storage sizing because it minimizes the potential effects of rail service unreliability on processing facility operations. The 83,000-cy storage scenario can be accommodated in the four to five storage cells/structures shown on the Contract Drawings. This scenario will require the use of stackers to attain 20-foot high storage cells. The storage cells would include two for fine sediment cake, two for coarse sediments, and one for debris.

Exhibit G-5.1 also includes calculations for loading staged materials into rail cars. Four 8.7 cy wheel loaders (two loading coarse materials from the north staging cells and two loading fine sediments from the south staging cells) can load one 81-car unit train in 8 hours, not including train movement times.

8. Site Work, Roads, Utilities, and Administrative Areas

Stormwater

Stormwater handling was discussed in Section G.6 in connection with treatment requirements. The sizing of the Type II Stormwater Sediment Basins is being finalized in conjunction with the site grading plan. These basins will be modified during Phase 1 Final Design. Similarly, the curbed Type I stormwater impounded areas and piping systems are being finalized along with the site grading plan, and will be presented in the Phase 1 FDR.

Site Grading

The site grading plan will continue during Phase 1 Final Design. Approximate earthwork and fill quantities developed to date are presented in Exhibit G-8.1. These preliminary calculations indicate a need for an estimated 100,000 cy of net differential to be supplied by imported fill during the beginning of the Phase 1 construction period.

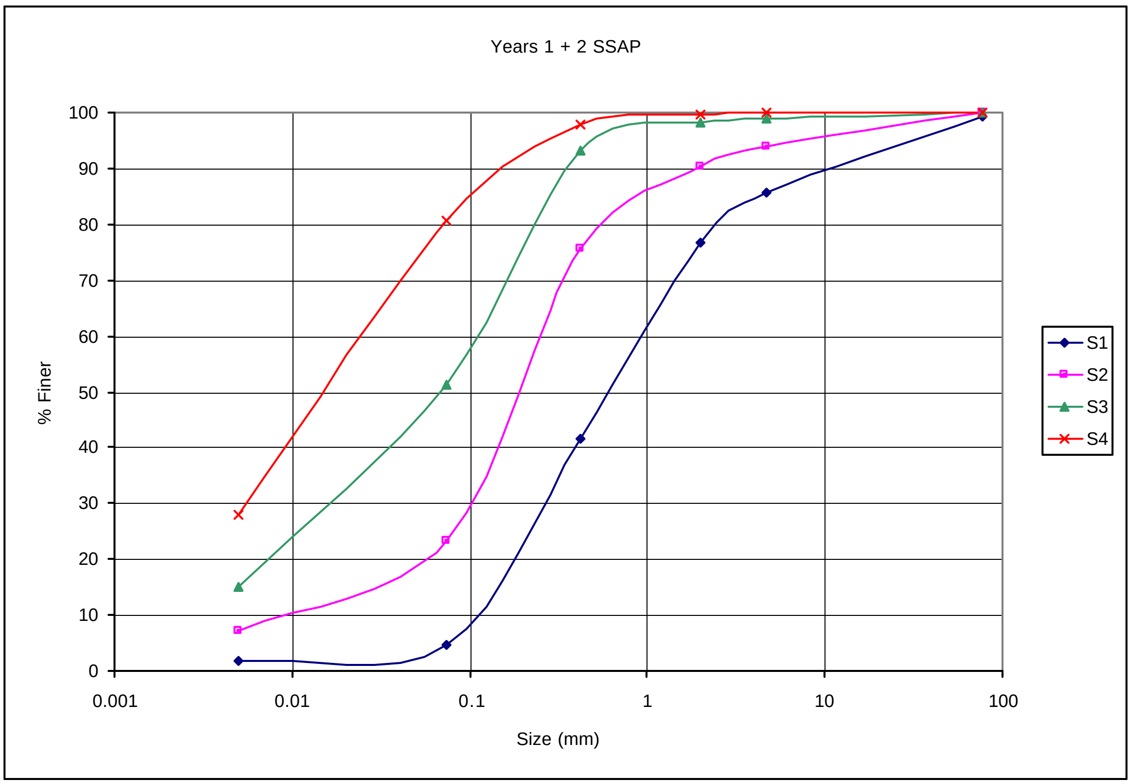
Exhibit G.1

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Attachment G.1.1 - SSAP Sediment Characteristics - Years 1 + 2

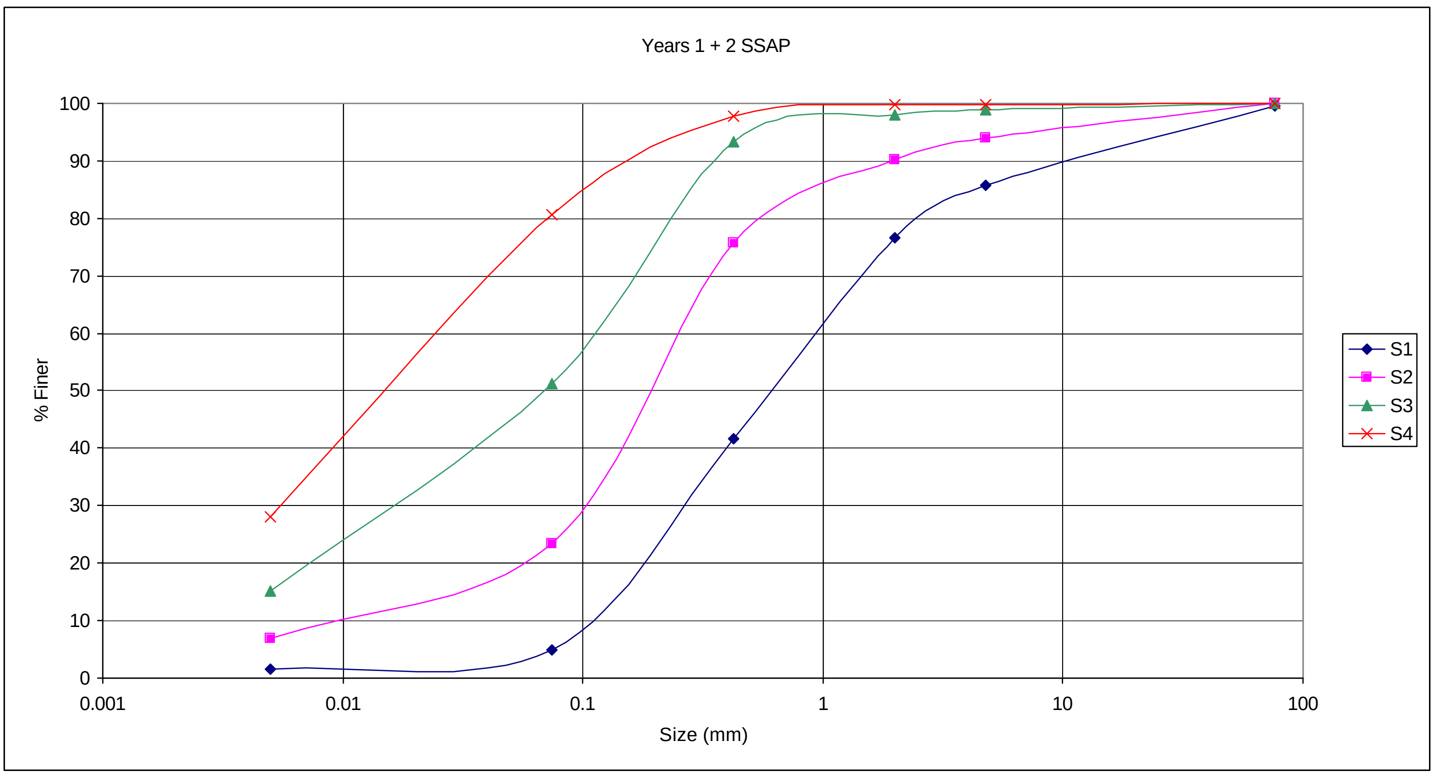
		Cum. % passing size (mm) - Quartile Average						D50	% Fines	Solids Sp. Grav.	Solids	PCB	TOC
		0.005	0.074	0.425	2.0	4.75	76.2	(mm)	<74um	(g/mL)	% (w/w)	mg/kg	mg/kg
Yr 1	S-1 Coarsest quartile	1.0	4.6	42.5	72.7	84.4	100.0	0.81	4.6	2.68	77.6	33.9	5,200
Yr 1	S-2 Coarse-fine	2.5	11.9	52.8	76.9	86.2	100.0	0.40	11.9	2.60	71.9	49.3	12,800
Yr 1	S-3 Fine-coarse	9.7	32.8	80.4	92.4	95.6	100.0	0.20	32.8	2.48	59.7	159	26,700
Yr 1	S-4 Finest quartile	34.5	76.4	96.1	98.8	99.3	100.0	0.03	76.4	2.39	50.1	196	39,000
Yr 1	**Overall Average**	**11.8**	**31.1**	**67.7**	**85.1**	**91.3**	**100.0**	**0.26**	**31.1**	**2.54**	**64.9**	**106.9**	**20,800**
													0
Yr 2	S-1 Coarsest quartile	2.1	5.2	43.4	79.3	86.9	99.3	0.71	5.2	2.70	79.0	9.4	5,500
Yr 2	S-2 Coarse-fine	8.4	28.3	82.7	93.5	95.9	100.0	0.21	28.3	2.56	63.2	58.9	24,400
Yr 2	S-3 Fine-coarse	16.0	55.0	94.1	98.5	99.1	100.0	0.07	55.0	2.47	54.6	117	34,400
Yr 2	S-4 Finest quartile	26.4	81.0	98.1	99.9	99.9	100.0	0.03	81.0	2.42	48.2	124	38,900
Yr 2	**Overall Average**	**13.2**	**42.3**	**79.5**	**92.8**	**95.5**	**99.8**	**0.15**	**42.3**	**2.54**	**61.3**	**84.9**	**25,800**
													0
Yr 1+2	S-1 Coarsest quartile	1.6	4.8	41.7	76.7	85.7	99.5	0.80	4.8	2.70	79.1	15.1	4,900
Yr 1+2	S-2 Coarse-fine	7.0	23.3	75.6	90.2	94.0	100.0	0.25	23.3	2.56	64.9	77.2	21,400
Yr 1+2	S-3 Fine-coarse	15.1	51.2	93.2	98.1	98.8	100.0	0.07	51.2	2.48	55.6	110	33,500
Yr 1+2	S-4 Finest quartile	28.1	80.7	97.9	99.8	99.9	100.0	0.03	80.7	2.42	48.5	138	39,200
Yr 1+2	**Overall Average**	**12.9**	**40.0**	**77.0**	**91.1**	**94.6**	**99.9**	**0.17**	**40.0**	**2.54**	**62.0**	**90.0**	**24,700**



General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

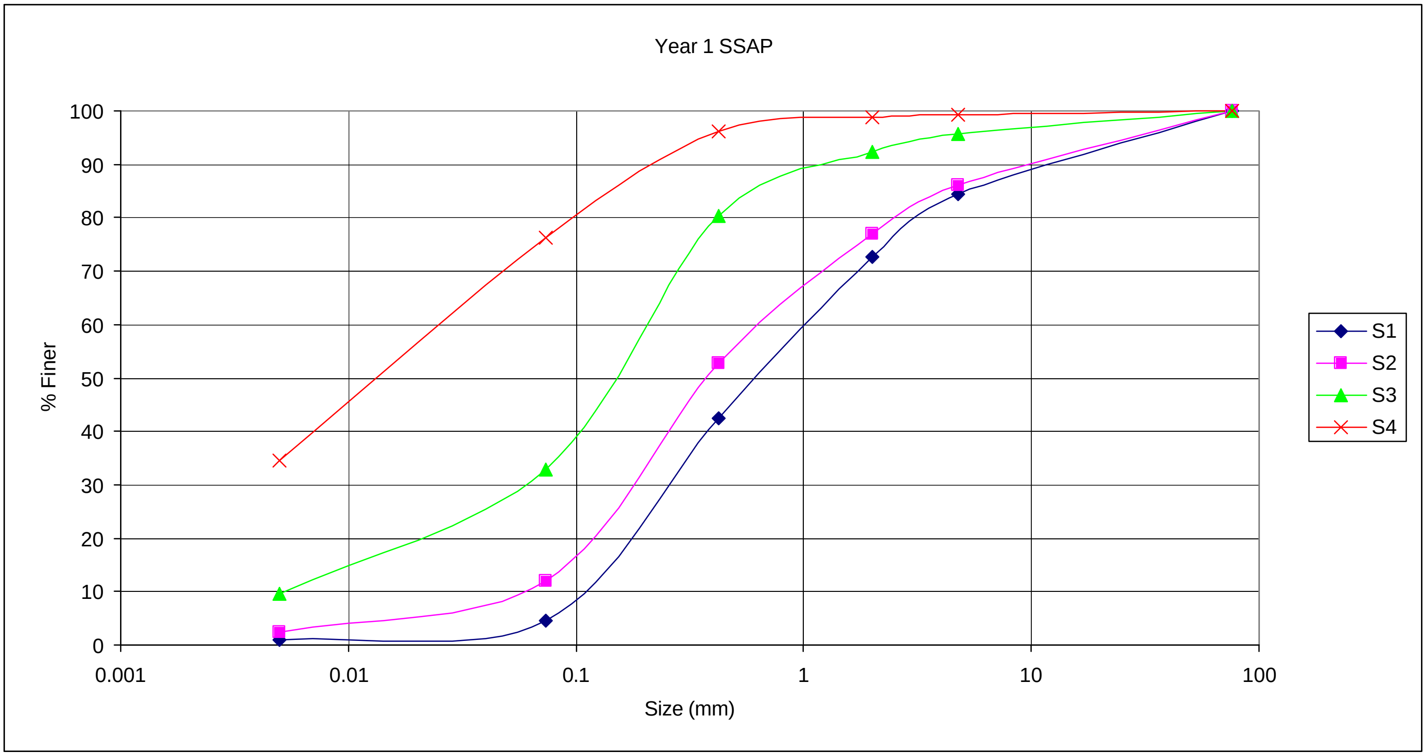
Exhibit G.1.1 - SSAP Sediment Characteristics - Years 1 + 2

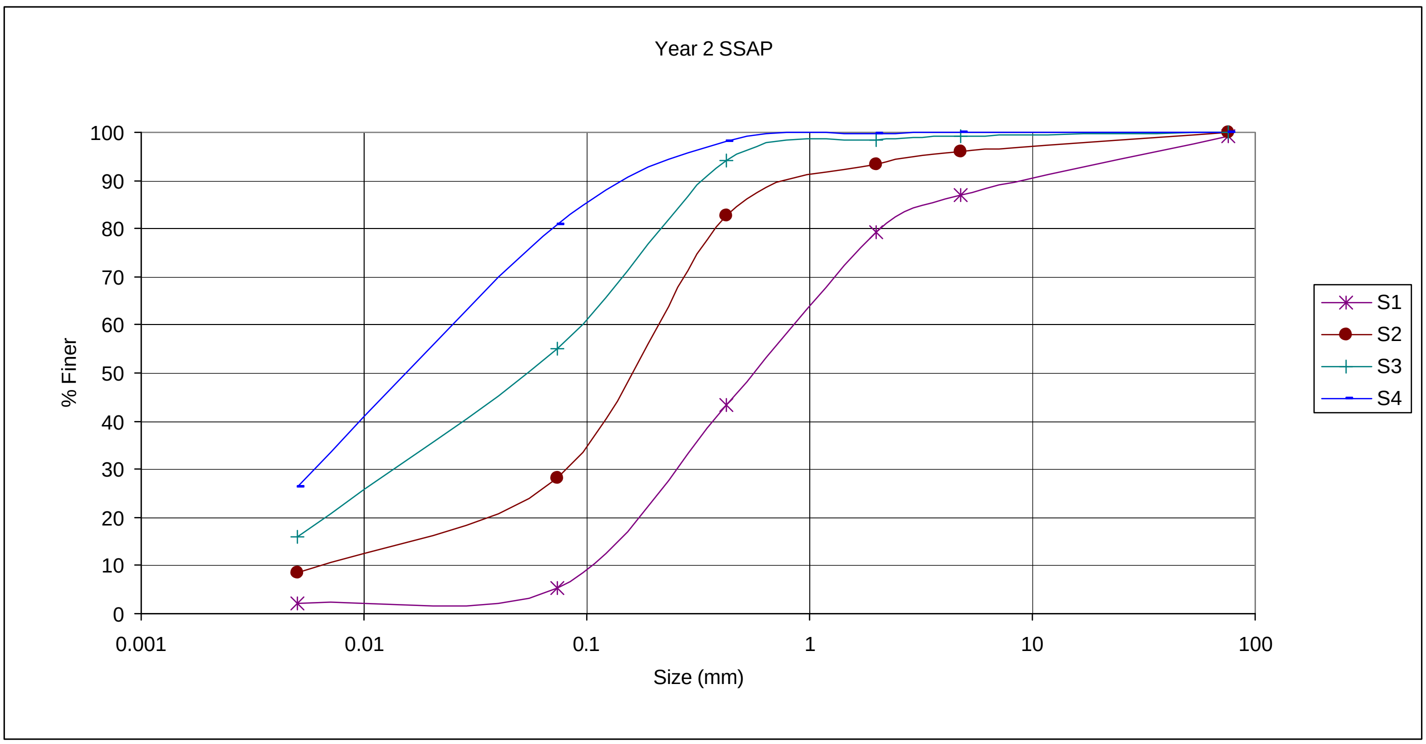
		Cum. % passing size (mm) - Quartile Average						D50	% Fines	Solids Sp. Grav.	Solids	PCB	TOC
		0.005	0.074	0.425	2.0	4.75	76.2	(mm)	<74um	(g/mL)	% (w/w)	mg/kg	mg/kg
Yr 1	S-1 Coarsest quartile	1.0	4.6	42.5	72.7	84.4	100.0	0.81	4.6	2.68	77.6	33.9	5,200
Yr 1	S-2 Coarse-fine	2.5	11.9	52.8	76.9	86.2	100.0	0.40	11.9	2.60	71.9	49.3	12,800
Yr 1	S-3 Fine-coarse	9.7	32.8	80.4	92.4	95.6	100.0	0.20	32.8	2.48	59.7	159	26,700
Yr 1	S-4 Finest quartile	34.5	76.4	96.1	98.8	99.3	100.0	0.03	76.4	2.39	50.1	196	39,000
Yr 1	**Overall Average**	**11.8**	**31.1**	**67.7**	**85.1**	**91.3**	**100.0**	**0.26**	**31.1**	**2.54**	**64.9**	**106.9**	**20,800**
													0
Yr 2	S-1 Coarsest quartile	2.1	5.2	43.4	79.3	86.9	99.3	0.71	5.2	2.70	79.0	9.4	5,500
Yr 2	S-2 Coarse-fine	8.4	28.3	82.7	93.5	95.9	100.0	0.21	28.3	2.56	63.2	58.9	24,400
Yr 2	S-3 Fine-coarse	16.0	55.0	94.1	98.5	99.1	100.0	0.07	55.0	2.47	54.6	117	34,400
Yr 2	S-4 Finest quartile	26.4	81.0	98.1	99.9	99.9	100.0	0.03	81.0	2.42	48.2	124	38,900
Yr 2	**Overall Average**	**13.2**	**42.3**	**79.5**	**92.8**	**95.5**	**99.8**	**0.15**	**42.3**	**2.54**	**61.3**	**84.9**	**25,800**
													0
Yr 1+2	S-1 Coarsest quartile	1.6	4.8	41.7	76.7	85.7	99.5	0.80	4.8	2.70	79.1	15.1	4,900
Yr 1+2	S-2 Coarse-fine	7.0	23.3	75.6	90.2	94.0	100.0	0.25	23.3	2.56	64.9	77.2	21,400
Yr 1+2	S-3 Fine-coarse	15.1	51.2	93.2	98.1	98.8	100.0	0.07	51.2	2.48	55.6	110	33,500
Yr 1+2	S-4 Finest quartile	28.1	80.7	97.9	99.8	99.9	100.0	0.03	80.7	2.42	48.5	138	39,200
Yr 1+2	**Overall Average**	**12.9**	**40.0**	**77.0**	**91.1**	**94.6**	**99.9**	**0.17**	**40.0**	**2.54**	**62.0**	**90.0**	**24,700**



General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.1.2 - SSAP Sediment Characteristics - Year 1 & Year 2





General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.1.3 - Baseline Sediment Sample Data

Sample ID: Date Collected:		S1 6/10/2004	S1-DUP 6/10/2004	S2 5/19/2004	S3 5/19/2004	S4B 6/24/2004	S4B-DUP 6/24/2004
Total PCBs	mg/kg	8	11.3	138	101	490	466
Total PAHs	mg/kg	0.316 J	0.581 J	0.245 J	1.97 J	0.656 J	0.496 J
Ammonia Nitrogen	mg/kg	27.4	13.1	96.7	213	390	384
Bulk Density	g/cc	1.3	1.5	0.75	0.79	0.41	0.37
Total Kjeldahl Nitrogen	mg/kg	891 X	822 X	1,480 X	1,680 X	4,320	4,140
TOC	mg/kg	7,800	8,600	30,000	33,000	85,000	73,000
Total Phosphorous (PO4)	mg/kg	532	78	690	828	1,170	1,270
Total Phosphorous (as P)	mg/kg	174	26	225	270	382	414
Percent Solids	%	79.1	79.1	53.1	56.8	33	33
Finer than #200	%	10.1	8.8	30.2	40.8	59.2	78.6
Total TEQs (WHO TEFs)	mg/kg	2.8E-06	NA	4.73E-06	0.00000377	0.00013	0.00012
Aluminum	mg/kg	5,330	5,270	8,380	9,360	14,000	14,100
Antimony	mg/kg	0.1 XN	0.11 XN	2.4 NE	1.4 NE	5.5 NE	6.5 NE
Arsenic	mg/kg	1.9 NE	1.5 NE	2.1	2	3.9	4
Barium	mg/kg	58.5 N	62.7 N	81	74.9	129	134
Beryllium	mg/kg	0.31	0.29	0.42	0.38	0.65	0.64
Cadmium	mg/kg	0.44 E	0.46 E	12.3	7	39.2 NE	36.8 NE
Calcium	mg/kg	1600	1590	2220	4340	5530	5540
Chromium	mg/kg	24.8 N	27.4 N	235	121	518	518
Cobalt	mg/kg	4.9	4.5	5.8	6.2	8.6	8.4
Copper	mg/kg	12.2	15.4	37.8	26.5	78.3	88.3
Iron	mg/kg	10200	9900	11900	13400	18600	18500
Lead	mg/kg	19.1	22.3	219 E	144 E	637	639
Magnesium	mg/kg	1980	1870	2230	3610	3410	3470
Manganese	mg/kg	121 N	123 N	107	159	184	183
Mercury	mg/kg	0.066	0.072	1.6	0.79	3.9	4.1
Nickel	mg/kg	8.4	7.9	12.8	12.4	21.5	20.9
Potassium	mg/kg	898	957	835	762	1280	1360
Selenium	mg/kg	0.47 X	0.44 X	0.74 XN	0.72 XN	1.5 N	1.5 XN
Silver	mg/kg	0.048 X	0.053 X	0.26	0.21	0.91	0.87
Sodium	mg/kg	116 E	99.5 E	148 E	140 E	279 E	269 E
Thallium	mg/kg	0.22 *	0.077 X*	0.097 X	0.075 X	0.32	0.56
Vanadium	mg/kg	14.9 E	15.6 E	33.9 E	26.6 E	73.5 E	71.5 E
Zinc	mg/kg	52.9 E	51.3 E	194 E	147 E	521 NE	510 NE

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and submitted to Severn Trent Laboratories, Inc. (Pittsburgh and Burlington), Paradigm Analytical Laboratories, and Northeast Analytical Services, Inc. for analysis.
2. Results have not yet been validated. Additional qualifiers will be added, as needed, following validation.
3. Total 2,3,7,8-TCDD toxicity equivalents (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) derived by the World Health Organization (WHO) and published by Van den Berg et al. in Environmental Health Perspectives 106(2), December 1998.
4. Results are presented in dry weight.
5. mg/kg = milligrams per kilogram.
6. g/cc = grams per cubic centimeter.
7. NA - Not analyzed.

8. Laboratory Data Qualifiers:
   Organics (PAHs, PCDD/PCDFs)
      E - Analyte exceeded calibration range.
      J - Indicates an estimated value less than the practical quantitation limit (PQL).
      Q - Indicates the presence of quantitative interferences.
      DPE - Polychlorinated Diphenyl Ether (PCDPE) Interference.
   Inorganics (TAL Metals, Total Kjeldahl Nitrogen)
      B - Indicates an estimated value between the lower calibration limit and the target detection limit.
      E - Matrix interference.
      N - Indicates sample matrix spike analysis was outside control limits.
      X - Method blank contamination.
      * - Serial dilution results not within 10%. Applicable only if analyte concentration is at least 50X the IDL in original sample.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.1.4 - Baseline Sediment Sample Data

Sample ID: Date Collected:		S4 5/19/2004	S4A 6/10/2004	S2-2	S3-2	S3-3	S3-4	S4B-2
Total PCBs	mg/kg	162	100	73	13	156	89	351
Total PAHs	mg/kg	1.45 J	1.09 J	0.567 U	0.537 U	4.15	1.77 J	0.874 U
Ammonia Nitrogen	mg/kg	75.2	37.5	37.7	56.5	116	45.4	121
Bulk Density	g/cc	0.78	0.82	0.74	0.87	0.78	0.88	0.42
Total Kjeldahl Nitrogen	mg/kg	1.83	1,730 X	1,110	1,170	1,270 X	1,390	2,580
TOC	mg/kg	34,000	33,000	56,000	17,000	19,000	27,000	53,000
Total Phosphorous (PO4)	mg/kg	671	147	648	887	622	964	26 U
Total Phosphorous (as P)	mg/kg	219	48	211	289	203	315	9
Percent Solids	%	56.9	58.5	58.1	61.6	55	59.6	37.4
Finer than #200	%	28.1	29.6	16.8	30.3	20.4	36.4	69.1
Total TEQs (WHO TEFs)	mg/kg	8.4E-06	2.6E-05	3.5E-05	8.3E-06	4.9E-05	3E-05	9.1E-05
Aluminum	mg/kg	7,760	7,240	4,760	6,240	8,150	6,860	11,000
Antimony	mg/kg	1.4 J	0.97 N	0.67 E	0.27 B	2.6	0.87	2.6
Arsenic	mg/kg	1.8 J	1.3 NE	1.3	0.98	2.2	1.5	4.3
Barium	mg/kg	64.6	67.7 N	63.8	44.7	66.6	60.5	120
Beryllium	mg/kg	0.36	0.38	0.26	0.35	0.38	0.29	0.66
Cadmium	mg/kg	6.3	16.3 E	5.2	1.5	15.4	6.1	18.9
Calcium	mg/kg	2,560	2,750	1,700	2,950	2,220	3,230	5,550
Chromium	mg/kg	195	130 N	157	38.4	287 X	97.4 X	303
Cobalt	mg/kg	5.9	6.6	4.4	4.1	5.8	4.2	8.1
Copper	mg/kg	38	28.3	26	10.1	38.2	21	58.9
Iron	mg/kg	10,500	10,500	7,580	8,670	9,760	9,770	17,800
Lead	mg/kg	192 J	151	146 X	36.6 X	280	105	355 X
Magnesium	mg/kg	2,100	2,090	1,340 X	1,800 X	2,450	1,950	3,450 X
Manganese	mg/kg	105	206 N	53.9	62.5	86.4	82.4	189
Mercury	mg/kg	0.9	1.3	0.94	0.21	1.5	0.7	2.2
Nickel	mg/kg	12.4	11.2	9.5	6.4	11.5	8.6	18.7
Potassium	mg/kg	788	828	437	507	687	714	1300
Selenium	mg/kg	0.66 J	0.79 X	0.760 B	0.86	0.91 B	0.65 B	1.7
Silver	mg/kg	0.25	0.54	0.180	0.051 B	0.46 X	0.2	0.54
Sodium	mg/kg	167 J	169 E	130	162	177 X X	164	234
Thallium	mg/kg	0.074	0.14 X	0.440 XE	0.0980 XB	0.530	0.420	0.200 XB
Vanadium	mg/kg	30.7 J	22.4 E	16.8	16.2	40.2 X	26.3	40.2
Zinc	mg/kg	173 J	130 E	148 E	66	259 X	113	313

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc., and were submitted to Severn Trent Laboratories, Inc. (Pittsburgh and Burlington), Paradigm Analytical Laboratories, and Northeast Analytical Services, Inc. for analysis.
2. U = Indicates the constituent was not detected. The value preceding the U indicates the laboratory quantitation limit.
3. Results have not yet been validated. Additional qualifiers will be added, as needed, following validation.
4. Total 2,3,7,8-TCDD toxicity equivalents (TEQs) were calculated using Toxicity Equivalency Factors (TEFs) derived by the World Health Organization (WHO) and published by Van den Berg et al. in Environmental Health Perspectives 106(2), December 1998.
5. Results are presented in dry weight.
6. mg/kg = milligrams per kilogram.
7. g/cc = grams per cubic centimeter.

8. Laboratory Data Qualifiers:
   Organics (PAHs, PCDD/PCDFs)
      E - Analyte exceeded calibration range.
      J - Indicates an estimated value less than the practical quantitation limit (PQL).
      Q - Indicates the presence of quantitative interferences.
      DPE - Polychlorinated Diphenyl Ether (PCDPE) Interference.
   Inorganics (TAL Metals, Total Kjeldahl Nitrogen)
      B - Indicates an estimated value between the lower calibration limit and the target detection limit.
      E - Matrix interference.
      N - Indicates sample matrix spike analysis was outside control limits.
      X - Method blank contamination.
      * - Serial dilution results not within 10%. Applicable only if analyte concentration is at least 50X the IDL in original sample

Exhibit G.2

Size Separation Design Calculations

Exhibit G.2.1

Size Separation Design Calculations

Hopper with Pipe Grizzly

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Hopper w/ Pipe Grizzly	20437	TEM	8/4/05	1/2

CALCS. BY TEM ; DATE 8/4/05   CHECKED BY [illegible] ; DATE 8/8/05

① Feed Rate to Hopper - calculated two ways:

ⓐ $\frac{1000 \text{ CY Barge of S1 sediment}}{3 \text{ hr maximum off-load time}} = \frac{333 \text{ CY}}{\text{hr}} \times \frac{1.52 \text{ wtons}}{\text{CY of S1 sediment}} =$

$= \boxed{\frac{506 \text{ wet tons}}{\text{hr}} \text{ fed to hopper}} \approx \boxed{510 \text{ wtons/hr}}$

ⓑ 5 CY clamshell @ 90% full w/ 50 second swing time

$= \frac{5 \text{ CY (S1 sediment)}}{50 \text{ seconds}} \times (0.90) \times \frac{3600 \text{ sec}}{\text{hr}} \times \frac{1.52 \text{ wtons}}{\text{CY of S1 sediment}}$

$= \boxed{492 \frac{\text{wtons}}{\text{hr}} \approx 500 \frac{\text{wtons}}{\text{hr}}}$

② Hopper Sizing

- Hopper will be fed by single 5 CY clamshell
- Hopper needs to be sized to accommodate maximum width of clamshell when fully open
- Clamshell assumed to be < 15' wide when open, therefore hopper currently specified is 20' x 20'.

③ Hopper Screening Requirements

- Hopper to be fitted with a pipe grizzly with 6-inch spacing (6-inch spacing dictated by Trommel Screen Vendor

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson River - Hopper w/ Pipe Grizzly	20437	TEM	8/4/05	2/2

CALCS. BY ____ ; DATE ____ CHECKED BY SEO ; DATE 8/8/05

③ Cont'd

- Pipe grizzly shall be constructed with tapered pipes (5" at top, 6 to 6.5" at bottom) to distribute load

- Pipe grizzly shall be installed at angle equal to angle of repose (where oversize material (+6") will fall off). Angle of pipe grizzly shall be field adjustable necessary to obtain angle of repose

④ Belt Feeder (accepts U/F from hopper)

- Belt Feeder shall be sized to accommodate maximum hopper feed rate of 510 wtons/hr

- Belt Feeder shall be designed wide enough necessary to distribute load equally (may consider vibratory feeder)

- Belt Feeder shall be equipped with variable speed necessary to equalize flow to rotary trommel screen

⑤ Inclined Conveyor (conveys sediment from belt feeder to rotary trommel screen)

- Inclined Conveyor sized to accommodate maximum hopper feed rate of 510 wtons/hr

- Inclined conveyor shall be installed at angle that will permit transfer of material containing 40%

Rotary Trommel Screen

① Feed Rate to Trommel

- Feed rate assummed to be equal to maximum feed rate to hopper ≈ **510 wtons/hr**

- Rotary trommel screen shall be sized for 510 wtons/hr of S1 sediment (72% solids)

- Rotary trommel screen shall be constructed with distribution feeder necessary to evenly distribute incoming feed

- Rotary trommel screen shall be constructed with spray pipe assembly tolerant of incoming water feed with 1% or higher suspended solids

② Rotary Trommel Screen Oversize Material Inclined Conveyor

Per METSIM material balance - Table 3-26, the maximum oversize solids discharge rate from trommel screen =

$$= \frac{998 \text{ wet tons S1}}{\text{day}} \times \frac{1}{15 \text{ hr continuous offloading}}$$

$$= 66.5 \text{ wtons/hr} \approx \boxed{70 \text{ wtons/hr}}$$

- Conveyor shall be sized to transport a maximum 70 wtons/hr to clay pile

- Oversize solids anticipated to consist of 90% solids

Sediment Slurry Tank

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE- Hudson River - Sediment Slurry Tank	20437	TEM	8/4/05	1

CALCS. BY TEM ; DATE 8/4 CHECKED BY SRG ; DATE 8/8/05

① Sediment Slurry tank sizing:

ⓐ estimate max feed rate to Hydrocyclone:
Per METSIM MATERIAL BALANCE - Table 3-26

Stream # 103

$\frac{7860 \text{ wtons}}{24 \text{ hr day}} = \frac{327.5 \text{ wtons}}{\text{hr}}$ = 24 hr average off-loading rate

MAXIMUM design offloading rate ≈ 510 wtons/hr

* Conversion Factor = $\frac{510}{327.5}$ = 1.56

Apply this conversion factor to METSIM stream # 107 to get maximum hydrocyclone feed rate

= 3,185 gpm × 1.56 = 4968 gpm ≈ **5,000 gpm**

ⓑ Minimum required retention time @ sediment slurry tank = 5 minutes (JOE KEANE)

SEDIMENT SLURRY TANK VOLUME = 5,000 gpm × 5 minutes

= **25,000 GALLONS**

ⓒ SEDIMENT SLURRY tank shall be constructed with sloping sidewalls necessary to direct all slurry/solids to Hydrocyclone feed pump suction line.

Hydrocyclone System

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Hydrocyclone System	20437	TEM	8/4/05	1/2

CALCS. BY TEM ; DATE 8/5 CHECKED BY SRG ; DATE 8/8/05

① Per sediment slurry tank sizing calculations,
maximum Hydrocyclone Feed Rate = 5,000 gpm

② **6-inch Hydrocyclone Calculations**

Per attached 7/19/05 Calculations from Krebs Engineers,

33 operating 6-inch-diameter Krebs cyclones required when processing an influent feed = 4779 GPM

$\therefore \dfrac{4779 \text{ GPM}}{33 \text{ 6-inch cyclones}} \approx$ **145 gpm/6-inch Krebs Cyclone**

@ 5,000 gpm × $\dfrac{\text{6-inch Krebs Cyclones}}{145 \text{ gpm}}$ = **34 operating 6-inch Hydrocyclones**

③ **10-inch Hydrocyclone Calculations**

Per attached 7/19/05 calculations from Krebs Engineers,

14 operating 10-inch-diameter Krebs Cyclones required when processing an influent feed = 4,779 Gpm

$\therefore \dfrac{4779 \text{ GPM}}{14 \text{ 10-inch cyclones}} = \dfrac{341 \text{ Gpm}}{\text{10-inch cyclone}}$

@ 5,000 GPM × $\dfrac{\text{CYCLONE}}{341 \text{ GPM}}$ ≃ **15 operating 10-inch Hydrocyclones**

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River – Hydrocyclone System	20437	TEM	8/4/05	2/2

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY [illegible] ; DATE 8/8/05

④ MAXIMUM Hydrocyclone OverFlow discharge rate

Per METSIM MATERIAL BALANCE, TABLE 3-26,

Stream # 111, = 2540 GPM × 1.56 (conversion Factor = to 3 hr barge offloading) = 3,962 GPM

≈ 4,000 GPM

⑤ MAXIMUM Hydrocyclone UnderFlow discharge rate

Per METSIM MATERIAL BALANCE, TABLE 3-26

Stream # 112 = 645 GPM × 1.56 = 1,006 GPM ≈ **1,000 GPM**

$= \frac{4,627 \text{ d tons}}{\text{dy}} \times \frac{\text{dy}}{24\text{hr}} \times 1.56 =$ **300 solid tons / hr**

MATTHEW RYAN - RE: Pump Calcs and 10" Hydrocyclones

From: "Mike Wilkins" <mwilkins@KREBS.COM>
To: "MATTHEW RYAN" <MRYAN@bbl-inc.com>
Date: 8/4/2005 10:49 AM
Subject: [illegible]

Matthew,

For discussion I am looking at the 8/4/05 GMAX6 run (corrected from the 7/19/05 run) and the 7/27/05 run that were both done on the S1 (107 HC Feed) data.

Each GMAX6 (6 inch) cyclone is able to handle 145 gpm with a 2 inch vortex at a 15 psi pressure drop. The total estimated recovery based on the PSD was 93.3% of the material in the feed. This was based on this cyclone having a d50 of 19.5 microns. The d50 defines the point were a particle has a 50/50 chance of going out the top or the bottom of the cyclone. After reviewing the recovery sheets, this cyclone had 100% recovery of all particles 200 mesh (75 microns) and courser that had a density of 2.7 or heaver. The cyclone also had a 97.7% recovery at 400 mesh (37 microns) of all 2.7 SG and heavier particles.

Each DS10LB-GMAX (10 inch) cyclone is able to handle 341 gpm with a 4 inch vortex at a 14.4 psi pressure drop. The total estimated recovery based on the PSD was 93.0% of the material in the feed. This was based on this cyclone having a d50 of 27.6 microns. The d50 defines the point were a particle has a 50/50 chance of going out the top or the bottom of the cyclone. After reviewing the recovery sheets, this cyclone had 100% recovery of all particles 100 mesh (150 microns) and courser that had a density of 2.7 or heaver. The cyclone also had a 82.1% recovery at 400 mesh (37 microns) of all 2.7 SG and heavier particles.

U.S.D.A. Classification
Gravel = 2.0-100 mm (2000+ microns)
Very Coarse Sand = 1.0=2.0 mm (1000-2000 microns)
Coarse Sand = 0.5-1.0 mm (500-1000 microns)
Medium Sand = 0.25-0.5 mm (250-500 microns)
Fine Sand = 0.1-0.25 mm (100-250 microns)
Very Fine Sand = 0.05-0.1 mm (50-100 microns)
Silt = 0.002-0.05 mm (2-50 micrcns)
Clay = <0.002 mm (<2 microns)

As you can see from above, both cyclones are more than capable of having a strong recover of all three classifications of sand. If you have any further questions, please let me know.

Sincerely,

Mike Wilkins

Regional Sales Manager
Krebs Engineers
(520) 829-5303 phone
(520) 909-7831 cell
(520) 844-1962 fax

[illegible]
[illegible]
Sent: Friday, July 29, 2005 7:36 AM

KREBS ENGINEERS

SHEET: 1

DATE: 19- July-05

BY: MWW

Client: Blasland, Bouck & Lee, Inc.

Problem: Cyclone recovery of S1 (107 HC Feed) Data at the 16HR hour rate based on Table 2 - Loadings METSIM Material Balances Phase 2 Basis of Design.

Number, Model Krebs Cyclones: 33 operating GMAX6-3193-SRC Krebs Cyclones

	Inlet Area	Vortex Finder	Apex	Pressure Drop
Orifices:	2.20 sq. in.	2.00 in.	1.25	26.5 PSI

Specific Gravity: Solids: 2.700 Liquid: 1.000 Temperature: Amb.°F Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW	CYCLOWASH
STPH Solids	307.22	19.47	287.75	0.00
STPH Liquids	1082.68	1075.02	123.32	115.67
STPH Slurry	1389.89	1094.49	411.07	115.67
Wt Solids	22.10	1.78	70.00	0.00
S.G. Slurry	1.162	1.011	1.788	1.000
Vol% Solids	9.51	0.67	46.36	0.00
GPM Slurry	4779.00	4322.74	918.26	462.00
M3/Hr. Slurry	1085.42	981.79	208.56	104.93

Ref: 15.4 4.0 53.0

Mesh	Micron	FEED			OVERFLOW			UNDERFLOW			ACT.
		Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	REC.
40	425.0	50.50	50.50	155.1	0.00	0.00	0.0	53.92	53.92	155.1	100.0
60	250.0	62.80	12.30	37.8	0.00	0.00	0.0	67.05	13.13	37.8	100.0
100	150.0	75.10	12.30	37.8	0.00	0.00	0.0	80.18	13.13	37.8	100.0
200	75.0	91.80	16.70	51.3	0.00	0.00	0.0	98.01	17.83	51.3	100.0
400	37.0	92.70	0.90	2.8	0.04	0.04	0.0	98.97	0.96	2.8	99.7
-400	-37.0	100.00	7.30	22.4	100.00	99.96	19.5	100.00	1.03	3.0	13.2
TOTAL				307.22			19.47			287.75	93.7

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, AZ 85743
TEL: (520) 744-8200 FAX: (520) 744-8300
www.krebs.com

KREBS ENGINEERS

SHEET: 1

DATE: 27-July-05

BY: MWW

Client: Blasland, Bouck & Lee, Inc.

Problem: Cyclone recovery of S1 (107 HC Feed) Data at the 16HR hour rate based on Table 2 - Loadings METSIM Material Balances Phase 2 Basis of Design.

Number, Model Krebs Cyclones: 14 operating DS10LB-GMAX-SRC

	Inlet Area	Vortex Finder	Apex	Pressure Drop
Orifices:	7.80 sq. in.	4.00 in.	2.0	14.4 PSI

Specific Gravity: Solids: 2.700 Liquid: 1.000 Temperature: Amb.°F Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW	CYCLOWASH
STPH Solids	307.22	21.65	285.56	0.00
STPH Liquids	1082.68	1075.96	122.38	115.67
STPH Slurry	1389.89	1097.61	407.95	115.67
Wt Solids	22.10	1.97	70.00	0.00
S.G. Slurry	1.162	1.013	1.788	1.000
Vol% Solids	9.51	0.74	46.36	0.00
GPM Slurry	4779.00	4329.71	911.29	462.00
M3/Hr. Slurry	1085.42	983.38	206.97	104.93

Ref: 27.6 4.0 53.0

Mesh	Micron	FEED			OVERFLOW			UNDERFLOW			ACT.
		Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	REC.
40	425.0	50.50	50.50	155.1	0.00	0.00	0.0	54.33	54.33	155.1	100.0
60	250.0	62.80	12.30	37.8	0.00	0.00	0.0	67.56	13.23	37.8	100.0
100	150.0	75.10	12.30	37.8	0.00	0.00	0.0	80.79	13.23	37.8	100.0
200	75.0	91.80	16.70	51.3	0.22	0.22	0.0	98.74	17.95	51.3	99.9
400	37.0	92.70	0.90	2.8	2.51	2.29	0.5	99.54	0.79	2.3	82.1
-400	-37.0	100.00	7.30	22.4	100.00	97.49	21.1	100.00	0.46	1.3	5.9
TOTAL				307.22			21.65			285.56	93.0

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, AZ 85743
TEL: (520) 744-8200 FAX: (520) 744-8300
www.krebs.com

Vibratory Dewatering Screens

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE- Hudson River Vibratory Dewatering Screens	20437	TEM	8/4/05	1/1

CALCS. BY TEM ; DATE ______ CHECKED BY [illegible] ; DATE 8/8/05

Per Hydrocyclone calculations, maximum anticipated Hydrocyclone underflow discharge rate = $\frac{300 \text{ solid tons}}{\text{hr}}$

Per Derrick Corporation, each 5' X 12' vibratory dewatering screen can process 150 to 200 $\frac{\text{s tons}}{\text{hr}}$

$\therefore$ @ $300 \frac{\text{solid tons}}{\text{hr}} \times \frac{\text{hr} \div \text{capacity}}{150 \text{ solid tons}} =$ **2 units required**

Each 5' X 12' screen will be designed to recover − 40 x + 400 MESH MATERIAL

Process Water Storage Tanks

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Process Water Storage Tanks	20437	TEM	8/5/05	1/

CALCS. BY TEM ; DATE 8/4/05 CHECKED BY JRG ; DATE 8/8/05

① SIZE Separation Process Water Storage Tank

Tank designed to store recycle water required for rotary trommel screen, sediment slurry tank, and hydrocyclone wet well discharge line flushing

Per Metsim Material Balance, Table 3-26,

maximum required recycle water occurs when processing 4,300 in situ CY/dy of S1 sediment

$= 2{,}534 \text{ gpm} \times \frac{24 \text{ hr}}{\text{dy}} \times \frac{60 \text{ min}}{\text{hr}} = 3{,}648{,}960 \text{ gallons}$

Tank sized to provide one hour retention

$= 3{,}648{,}960 \text{ gallons} \times \frac{1}{24 \text{ hr}}$ 1.56 (conversion factor - base off flows in Ā 510 wtons/hr)

$= \boxed{237{,}182 \text{ gallons}}$

② Treated Water Storage Tank

Tank designed to hold treated water needed for decon/wash water

Assumed usage for decon wash water =

$= 25 \text{ gpm} \times 16 \text{ hrs (operating hrs)} \times \frac{60 \text{ min}}{\text{hr}} = \boxed{24{,}000 \text{ GALLONS}}$

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.2.2 - Size Separation Summary

		H1S1					
Sieve Number	**Particle Size (µm)**	**Solids % Retain**	**PCBs (ppm)**	**% Solids**	**TOC (mg/kg)**	**Specific Gravity**	**pH**
--	--	(S1)	8.0	79.1%	7,800	--	--
10	2,000	26.2%	9.6	92.6%		2.52	8.01
20	850	6.2%	6.3	76.8%		2.64	7.47
40	425	9.3%	4.6	77.8%		2.82	7.19
60	250	14.4%	5.1	74.9%	5,300	2.82	7.18
80	180	12.5%	3.3	76.0%		2.94	6.94
100	150	6.2%	3.7	76.2%		3.02	6.91
200	75	11.2%	7.2	74.9%		2.97	7.08
<200	<75	14.0%	24	47.7%	--	2.54	6.22
Weighted Avg.		--	8.9	76.3%	--	--	--

		H1S2					
Sieve Number	**Particle Size (µm)**	**Solids % Retain**	**PCBs (ppm)**	**% Solids**	**TOC (mg/kg)**	**Specific Gravity**	**pH**
--	--	(S2)	138	54.3%	30,000	--	--
10	2,000	3.8%	36	73.0%		1.99	6.29
20	850	3.9%	60	55.8%		2.38	6.48
40	425	7.4%	82	58.2%		2.63	6.66
60	250	11.1%	37	66.4%	20,000	2.60	6.74
80	180	15.3%	17	69.3%		2.66	6.84
100	150	7.5%	24	68.5%		2.75	6.62
200	75	15.6%	24	65.9%		2.85	6.65
<200	<75	35.4%	320	35.0%	--	2.41	5.81
Weighted Avg.		--	135	55.0%	--	--	--

		S3					
Sieve Number	**Particle Size (µm)**	**Solids % Retain**	**PCBs (ppm)**	**% Solids**	**TOC (mg/kg)**	**Specific Gravity**	**pH**
--	--	--	101	57.4%	33,000	--	--
10	2,000	3.1%	62	51.9%		2.35	6.73
20	850	1.4%	128	61.2%			6.00
40	425	2.5%	55	42.8%		2.47	6.18
60	250	3.3%	18.1	32.0%	20,000	2.66	6.12
80	180	7.6%	21.9	31.9%		2.65	6.44
100	150	5.8%	7.9	28.9%		2.70	6.57
200	75	26.3%	9.5	28.2%		2.69	6.67
<200	<75	50.0%	166	58.9%	--		5.80
Weighted Avg.		--	93	45.6%	--	--	--

		S4B					
Sieve Number	**Particle Size (µm)**	**Solids % Retain**	**PCBs (ppm)**	**% Solids**	**TOC (mg/kg)**	**Specific Gravity**	**pH**
--	--	--	490	33.0%	85,000	--	--
10	2,000	0.1%	1,460	86.3%		--	5.26
20	850	0.4%	1,720	86.8%		--	5.17
40	425	1.3%	1,600	81.9%		1.78	5.20
60	250	2.1%	1,399	81.4%	160,000		5.31
80	180	2.0%	843	73.3%		2.16	5.30
100	150	1.4%	505	65.7%			5.41
200	75	9.9%	306	52.8%		2.52	5.60
<200	<75	82.8%	465	59.5%	--	2.39	5.73
Weighted Avg.		--	498	60.1%	--	--	--

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.2.3 - Hydrocyclone Test Matrix

Date: 8/19/04, 8/20/04, 10/08/04, 10/28/04

Sed. Type	Target % Solids (w/w)	Cyclone	Vortex Finder	Cylinder	Trunc'd Cone	Feed Pressure (psi) Target	Feed Pressure (psi) Measured	Feed gpm	Feed % solids	Feed SpG (gm/mL)	Feed Solids (gm/L)	Feed PCB (mg/kg)	Feed Solids Flux (gm/min)	Feed PCB Flux (gm/min)	Overflow gpm	Overflow % solids	Overflow SpG (gm/mL)	Overflow Solids (gm/L)	Overflow PCB (mg/kg)	Overflow Solids Flux (gm/min)	Overflow PCB Flux (gm/min)	Underflow - Total gpm	Underflow - Total % solids	Underflow - Total SpG (gm/mL)	Underflow - Total Solids (gm/L)	Underflow - Total PCB (mg/kg)	Underflow - Total Solids Flux (gm/min)	Underflow - Total PCB Flux (gm/min)	Solids Flux IN (gm/min)	Solids Flux OUT (gm/min)	Solids O/F % of OUT	Solids U/F % of OUT	PCB Flux IN (gm/min)	PCB Flux OUT (gm/min)	PCB O/F % of OUT	PCB U/F % of OUT
S4	10	D4B	1	Y	N/A	5	5 +/- 0.5	25.8	4.60	2.59	47.3	244.3	4,628	1.13	24.8	1.65	2.59	16.67	790	1565	1.24	1.0	14.1	2.59	154.8339	1,019	604	0.62	4,628	2,169	72.2%	27.8%	1.13	1.85	66.8%	33.2%
S4	10	D4B	1	Y	N/A	10	10 +/- 0.5	33.4	4.60	2.59	47.3	244.3	5,976	1.46	32.4	0.37	2.59	3.71	4105	455	1.87	1.0	13.0	2.59	141.8402	1,128	511	0.58	5,976	965	47.1%	52.9%	1.46	2.44	76.4%	23.6%
S4	10	D6B	3	Y	1.25	5	5 +/- 0.5	55.5	4.60	2.59	47.3	244.3	9,944	2.43	45.5	2.19	2.59	22.20	720	3823	2.75	10.0	16.4	2.59	182.1671	393	6,895	2.71	9,944	10,718	35.7%	64.3%	2.43	5.46	50.4%	49.6%
S4	10	D6B	3	Y	1.25	10	10 +/- 0.5	72.0	4.60	2.59	47.3	244.3	12,900	3.15	61.0	1.98	2.59	20.04	730	4628	3.38	11.0	13.1	2.59	142.3209	685	5,926	4.06	12,900	10,553	43.9%	56.1%	3.15	7.44	45.4%	54.6%
S4	10	D6B	3	Y	0.75	5	5 +/- 0.5	50.1	4.60	2.59	47.3	244.3	8,976	2.19	46.0	2.38	2.59	24.15	660	4205	2.78	4.1	19.2	2.59	217.8309	200	3,380	0.68	8,976	7,586	55.4%	44.6%	2.19	3.45	80.4%	19.6%
S4	10	D6B	3	Y	0.75	10	10 +/- 0.5	73.3	4.60	2.59	47.3	244.3	13,133	3.21	67.0	1.85	2.59	18.71	710	4745	3.37	6.3	16.0	2.59	177.671	207	4,237	0.88	13,133	8,982	52.8%	47.2%	3.21	4.25	79.4%	20.6%
S4	10	D6B	2.25	Y	0.75	5	5 +/- 0.5	41.7	4.60	2.59	47.3	244.3	7,474	1.83	41.0	1.7	2.59	17.18	750	2666	2.00	0.7	34.0	2.59	429.1057	331	1,159	0.38	7,474	3,825	69.7%	30.3%	1.83	2.38	83.9%	16.1%
S4	10	D6B	2.25	Y	0.75	10	10 +/- 0.5	61.5	4.60	2.59	47.3	244.3	11,024	2.69	60.5	2.74	2.59	27.87	700	6382	4.47	1.0	30.8	2.59	379.1047	316	1,479	0.47	11,024	7,860	81.2%	18.8%	2.69	4.93	90.5%	9.5%
S4	10	D6B	2.25	N	0.75	5	5 +/- 0.5	41.6	4.60	2.59	47.3	244.3	7,460	1.82	41.0	3.03	2.59	30.87	428	4791	2.05	0.6	49.7	2.59	714.4929	42	1,715	0.07	7,460	6,506	73.6%	26.4%	1.82	2.12	96.6%	3.4%
S4	10	D6B	2.25	N	0.75	10	10 +/- 0.5	41.6	4.60	2.59	47.3	244.3	7,460	1.82	41.0	3.14	2.59	32.02	474	4969	2.36	0.6	29.7	2.59	362.564	192	870	0.17	7,460	5,839	85.1%	14.9%	1.82	2.52	93.4%	6.6%
S4	10	D6B	3	N	0.75	5	5 +/- 0.5	41.6	4.60	2.59	47.3	244.3	7,460	1.82	41.0	2.97	2.59	30.25	483	4695	2.27	0.6	33.2	2.59	416.7769	90	1,000	0.09	7,460	5,695	82.4%	17.6%	1.82	2.36	96.2%	3.8%
S4	10	D6B	3	N	0.75	10	10 +/- 0.5	66.1	4.60	2.59	47.3	244.3	11,843	2.89	60.0	3.61	2.59	36.92	443	8384	3.71	6.1	7.3	2.59	76.46036	399	1,765	0.70	11,843	10,149	82.6%	17.4%	2.89	4.42	84.1%	15.9%
S4	10	D6B	3	N	0.75	10	10 +/- 0.5	66.1	4.60	2.59	47.3	244.3	11,843	2.89	60.0	2.89	2.59	29.42	327	6682	2.18	6.1	12.7	2.59	137.5148	109	3,175	0.35	11,843	9,857	67.8%	32.2%	2.89	2.53	86.3%	13.7%
																															65.3%					
S4	15	D4B	1	Y	N/A	5	5 +/- 0.5	22.1	10.17	2.59	108.4	244.3	9,061	2.21	20.0	4.31	2.59	44.3	600	3347	2.01	2.1	21.1	2.59	242.5419	852	1,946	1.66	9,061	5,293	63.2%	36.8%	2.21	3.67	54.8%	45.2%
S4	15	D4B	1	Y	N/A	10	10 +/- 0.5	34.9	10.17	2.59	108.4	244.3	14,309	3.50	32.7	3.67	2.59	37.5	610	4636	2.83	2.2	21.6	2.59	249.6283	971	2,088	2.03	14,309	6,724	68.9%	31.1%	3.50	4.85	58.2%	41.8%
S4	15	D6B	3	N	0.75	5	5 +/- 0.5	44.4	10.17	2.59	108.4	244.3	18,211	4.45	39.1	7.11	2.59	74.3	536	10996	5.89	5.3	29.3	2.59	357.6883	136	7,148	0.97	18,211	18,144	60.6%	39.4%	4.45	6.86	85.9%	14.1%
S4	15	D6B	3	N	0.75	10	10 +/- 0.5	68.7	10.17	2.59	108.4	244.3	28,179	6.88	60.8	7.89	2.59	82.9	650	19062	12.39	7.9	24.3	2.59	285.8519	149	8,569	1.28	28,179	27,631	69.0%	31.0%	6.88	13.67	90.6%	9.4%
S4	15	D6B	3	Y	0.75	5	5 +/- 0.5	44.5	10.17	2.59	108.4	244.3	18,261	4.46	36.2	7.28	2.59	76.2	545	10426	5.68	8.4	21.9	2.59	253.5302	112	8,013	0.90	18,261	18,439	56.5%	43.5%	4.46	6.58	86.3%	13.7%
S4	15	D6B	3	Y	0.75	10	10 +/- 0.5	71.7	10.17	2.59	108.4	244.3	29,402	7.18	58.0	6.55	2.59	68.2	546	14982	8.18	13.6	32.4	2.59	403.9425	268	20,809	5.58	29,402	35,791	41.9%	58.1%	7.18	13.76	59.4%	40.6%
S4	15	D6B	2.25	Y	0.75	5	5 +/- 0.5	39.7	10.17	2.59	108.4	244.3	16,275	3.98	35.9	5.19	2.59	53.6	389	7277	2.83	3.8	31.2	2.59	386.6547	186	5,547	1.03	16,275	12,824	56.7%	43.3%	3.98	3.87	73.2%	26.8%
S4	15	D6B	2.25	Y	0.75	10	10 +/- 0.5	59.5	10.17	2.59	108.4	244.3	24,404	5.96	54.4	7.10	2.59	74.2	447	15275	6.83	5.1	42.4	2.59	573.3789	104	11,025	1.15	24,404	26,300	58.1%	41.9%	5.96	7.98	85.6%	14.4%
S4	15	D6B	2.25	Y	1.25	5	5 +/- 0.5	43.8	10.17	2.59	108.4	244.3	17,953	4.39	36.9	4.64	2.59	47.8	491	6672	3.28	6.9	36.0	2.59	462.9497	176	12,038	2.12	17,953	18,710	35.7%	64.3%	4.39	5.40	60.7%	39.3%
S4	15	D6B	2.25	Y	1.25	10	10 +/- 0.5	52.6	10.17	2.59	108.4	244.3	21,585	5.27	43.9	5.68	2.59	58.9	458	9794	4.49	8.7	20.8	2.59	238.1664	478	7,816	3.73	21,585	17,609	55.6%	44.4%	5.27	8.22	54.6%	45.4%
S4	15	D6B	2.25	N	0.75	5	5 +/- 0.5	34.5	10.17	2.59	108.4	244.3	14,145	3.46	33.1	4.64	2.59	47.8	470	5987	2.81	1.4	38.0	2.59	495.9375	49	2,590	0.13	14,145	8,577	69.8%	30.2%	3.46	2.94	95.7%	4.3%
S4	15	D6B	2.25	N	0.75	5	5 +/- 0.5	34.5	10.17	2.59	108.4	244.3	14,145	3.46	33.1	5.06	2.59	52.2	600	6538	3.92	1.4	52.4	2.59	771.4948	29	4,030	0.12	14,145	10,568	61.9%	38.1%	3.46	4.04	97.1%	2.9%
S4	15	D6B	2.25	N	0.75	10	10 +/- 0.5	49.2	10.17	2.59	108.4	244.3	20,198	4.93	47.3	3.77	2.59	38.6	495	6906	3.42	2.0	49.9	2.59	720.3216	44	5,317	0.23	20,198	12,223	56.5%	43.5%	4.93	3.65	93.6%	6.4%
S4	15	D6B	2.25	N	0.75	10	10 +/- 0.5	49.2	10.17	2.59	108.4	244.3	20,198	4.93	47.3	4.63	2.59	47.7	558	8534	4.76	2.0	49.5	2.59	710.5304	207	5,244	1.09	20,198	13,779	61.9%	38.1%	4.93	5.85	81.4%	18.6%
S4	15	D6B	1	Y	N/A	2	2 +/- 0.5	52.8	10.17	2.59	108.4	244.3	21,650	5.29	50.3	3.29	2.59	33.6	497	6393	3.18	2.5	29.3	2.59	357.205	620	3,367	2.09	21,650	9,760	65.5%	34.5%	5.29	5.26	60.4%	39.6%
S4	15	D6B	3	N	N/A	15	15 +/- 0.5	92.6	10.17	2.59	108.4	244.3	37,978	9.28	74.7	3.88	2.59	39.7	557	11222	6.25	17.9	32.2	2.59	401.501	284	27,157	7.72	37,978	38,378	29.2%	70.8%	9.28	13.97	44.8%	55.2%
																															56.9%					

Date: 12/15/2004; 12/16/2004

Sed. Type	Target % Solids (w/w)	Cyclone	Vortex Finder	Cylinder	Apex Diameter	Feed Pressure (psi)	Overflow Vacuum (" Hg)	Feed gpm	Feed % solids	Feed SpG (gm/mL)	Feed Solids (gm/L)	Feed PCB (mg/kg)	Feed Solids Flux (gm/min)	Feed PCB Flux (gm/min)	Overflow gpm	Overflow % solids	Overflow SpG (gm/mL)	Overflow Solids (gm/L)	Overflow PCB (mg/kg)	Overflow Solids Flux (gm/min)	Overflow PCB Flux (gm/min)	Underflow gpm	Underflow % solids	Underflow SpG (gm/mL)	Underflow Solids (gm/L)	Underflow PCB (mg/kg)	Underflow Solids Flux (gm/min)	Underflow PCB Flux (gm/min)	Solids Flux IN (gm/min)	Solids Flux OUT (gm/min)	Solids O/F % of OUT	Solids U/F % of OUT	PCB Flux IN (gm/min)	PCB Flux OUT (gm/min)	PCB O/F % of OUT	PCB U/F % of OUT
S2-2	25	D6B w/	2.25 "	no	1.25 "	10	-2	140.0	22.4	2.59	259.7	33.9	137,623	4.67	120	5.07	2.59	52.30	47.7	23,755	1.13	20.0	66.0	2.59	1,110	18.7	83,994	1.57	137,623	107,749	22.0%	78.0%	4.67	2.70	41.9%	58.1%
S2-2	25	D6B w/	2.25"	no	1.25 "	10	-2	132.5	26.8	2.59	320.8	54.2	160,873	8.72	115	5.25	2.59	54.20	78.0	23,592	1.84	17.5	73.4	2.59	1,336	30.2	88,494	2.67	160,873	112,086	21.0%	79.0%	8.72	4.51	40.8%	59.2%
S2-2	25	D6B w/o	2.25"	no	3/4 "	10	0	116.5	21.6	2.59	249.0	56.0	109,806	6.15	110	6.30	2.59	65.50	77.0	27,271	2.10	6.5	65.4	2.59	1,093	85.0	26,884	2.29	109,806	54,154	50.4%	49.6%	6.15	4.38	47.9%	52.1%
S2-2	15	D6B w/	2.25"	no	1.25 "	10	-2	137.0	16.0	2.59	177.4	31.4	92,004	2.89	122	3.02	2.59	30.80	100	14,223	1.42	15.0	64.0	2.59	1,054	21.0	59,851	1.26	92,004	74,074	19.2%	80.8%	2.89	2.68	53.1%	46.9%
S2-2	15	D6B w/	2.25"	no	1.25 "	10	-2	135.0	18.6	2.59	210.0	29.0	107,293	3.11	119	3.20	2.59	32.60	254	14,684	3.73	16.0	73.9	2.59	1,353	27.9	81,918	2.29	107,293	96,601	15.2%	84.8%	3.11	6.02	62.0%	38.0%
S3-4	25	D6B w/	2.25"	no	1.25 "	10	-2	112.5	26.7	2.59	319.3	25.0	135,981	3.40	93	11.09	2.59	119.00	155	41,889	6.49	19.5	70.3	2.59	1,237	17.2	91,281	1.57	135,981	133,169	31.5%	68.5%	3.40	8.06	80.5%	19.5%
S3-4	25	D6B w/	2.25"	no	1.25 "	10	-2	125.0	26.5	2.59	316.5	35.9	149,738	5.38	104	10.39	2.59	111.00	166	43,694	7.25	21.0	70.0	2.59	1,227	14.9	97,567	1.45	149,738	141,261	30.9%	69.1%	5.38	8.71	83.3%	16.7%
S3-4	25	D6B w/o	2.25"	no	3/4 "	10	0	103.5	26.4	2.59	315.1	67.1	123,425	8.28	99	18.21	2.59	205.00	37.8	76,817	2.90	4.5	65.7	2.59	1,101	12.4	18,755	0.23	123,425	95,571	80.4%	19.6%	8.28	3.14	92.6%	7.4%
S3-4	15	D6B w/	2.25"	no	1.25 "	10	-2	127.5	22.0	2.59	254.4	26.9	122,747	3.30	111	4.18	2.59	42.90	133	18,024	2.40	16.5	68.6	2.59	1,185	14.2	74,011	1.05	122,747	92,035	19.6%	80.4%	3.30	3.45	69.5%	30.5%
S3-4	15	D6B w/	2.25"	no	1.25 "	10	-2	138.5	18.9	2.59	213.8	24.1	112,083	2.70	125	4.72	2.59	48.60	252	22,994	5.79	13.5	68.7	2.59	1,188	20.4	60,707	1.24	112,083	83,701	27.5%	72.5%	2.70	7.03	82.4%	17.6%

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.2.4 - PCB and Solids Balance

	INPUTS			OUTPUTS						
Stream Number	103	402	501	106	305	391	490	590		
Description	Dredge Slurry	Decon Water	Storm Water	Oversize	Cake Load-out	Coarse Load-out	Process Effl	Storm Effl	Mass In (dry T/d)	Mass Out (dry T/d)
Tot. mass (wet T/d)	6,620	150	6,685	321	2,139	2,617	2,088	6,290		
Solids mass (dry T/d)	3,656	0.752	33.4	289	1,176	2,224	0.0063	0.0189	3,690	3,689
Solids (%)	55.2	0.50	0.50	90.0	55.0	85.0	0.0003	0.0003		
Uptime (%)	100	100	100	67	100	100	100	100		
Operating flow (gpm)	724	25	1,111	35	234	205	348	1,049		
PCB mass (dry T/d)	0.329	0.00007	0.0030	0.010	0.285	0.037	0.0000001	0.0000004	0.332	0.332
PCB conc (mg/kg S)	90	90	90	35	242	17	222	213		
PCB conc (mg/L)	76	0.45	0.45	48	203	30	0.00007	0.00006		
Solids (mg/L)		5,011	5,012				3.0	3.0		

Note:
Dredging at 4,300 cy/d; S2/S3 sediment type.

Exhibit G.2.5 - Coarse Fraction Drainage Data Sheet

Slurry ID	Sample Weight	Date/ Time/ Initials	% Solids Concentration (w/w)				Collected Water Volume (mL)		
			Initial	24 hr	48 hr	72 hr	24 hr	48 hr	72 hr
H1S1-01 Coarse	1.0 kg	7/13/04 0930 JL	78.70	85.82	86.22	86.79	0	0	0
H1S2-01 Coarse	1.0 kg	7/13/04 0935 JL	70.60	73.62	72.91	73.63	6.3	0	0
S4-HC-15-UF	1.0 kg	8/30/04 1400 SC	41.83	77.36	77.06	73.5	345	9	4

Exhibit G.3

Includes:
Slurry Pumps from Hydrocyclones
Dredge Slurry Holding Tanks
Gravity Thickeners
Dredge Slurry Holding Tank Transfer Pump
Dewatering Conditioning Tanks
Thickener Sludge Pumps
Polymer Addition to Thickeners
Polymer Addition to Filter Presses
Filter Press Feed Pumps
Filter Presses
Recycle Water Equalization Tank

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Exhibit G.3.1

Thickening and Dewatering Design Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Slurry Pumps from Hydrocyclones

Slurry Pumps from Hydrocyclones to the Dredge Slurry Holding Tanks/Gravity Thickeners

- Distance from Hydrocyclones to Dredge Slurry Holding Tanks is approximately 1200 linear feet.

- Slurry properties based on manufacturer's field experience (Metso Minerals).

- Percent solids of slurry conveyed will be 2% to 18%.
    - Based on METSIM values.

- Specific gravity of slurry conveyed will be 1.17.
    - Calculated SG based on percent solids.

- Static head will be 20 feet.
    - Assume above grade storage tanks with working tank depth of approximately 20 feet.

- Pump will operate by means of flooded suction.

- Pumps will be sized based on maximum capacity.

- Basis of design flow is 2,768 gallons per minute.
    - Based on METSIM values.

- Pumps will be arranged in 2 trains of 2 pumps each.

- Supplemental pump for barge unloading free water will be added to one process train
    - Supplemental pump allows for barge unloading free water conveyance during peak instantaneous conveyance of hydrocyclone overflow.

- System is designed to cover failure of 1 pump per train (hydrocyclone overflow only).

- Each pump will have a capacity range of 692 to 2800 gallons per minute (hydrocyclone overflow only).

- Supplemental pump will have maximum capacity of 1,150 gallons per minute.
    - Based on estimated barge unloading rate and upstream pump capacities.

- Each pump will be 125 horsepower (hydrocyclone overflow only).
    - Manufacturer's estimate based on design conditions.

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson	20437	BSC	8/5/05	1/1

CALCS. BY ________ ; DATE ________ CHECKED BY JCP ; DATE 8/5/05

Dredge Slurry Holding Tank pumps

★ Use METSIM Flow Data

Q = 2768

★ Assume 2 trains of 2 pumps each

★ Each pump must be capable of pumping all flow for that train

$$\left(\frac{2768\ gal}{min}\right)\left(\frac{1}{2\ trains}\right) = \frac{1384\ gpm}{train}$$

$$1384\ gpm \Big/ 2\ pumps\ a\ train = 692\ gpm\ per\ pump$$

∴ Each pump must have a range of 692 gpm to 1384 gpm

∴ Each pump should have a max of 1400 and a min of 650

Thickener to Dewatering Conditioning Tanks, Slurry pumps

★ assume 4 trains of 1 pump each

★ assume 902 gpm Flow from METSIM

$$\left(\frac{902\ gal}{min}\right)\left(\frac{1}{4\ trains}\right) = 225.5\ gpm\ per\ pump$$

∴ Each pump must be able to pump 226 gpm

Dredge Slurry Holding Tanks

Dredge Slurry Holding Tanks

- Total storage volume of 1,400,000 gallons.
  - Based on 8 hours of storage at design flow.
  - Storage volume also allows for equalization of different sediment types.
- Dredge slurry holding tanks will be constructed of above grade bolted steel tanks.
  - This construction method will provide a cost effective and efficient thickener installation. It will also simplify tank removal.
- Mixers will be required to maintain suspension of solids in dredge slurry holding tanks.
- Each of 2 dredge slurry holding tanks will be designed to contain 700,000 gallons of dredge slurry.
- Dredge slurry holding tanks will each have a diameter of 70 feet.
- Dredge slurry holding tanks will each have a height of 26 feet.
- Actual depth of dredge slurry in dredge slurry holding tanks will vary.
- Percent solids for dredge slurry will average 10 percent by weight, with a range of 2.1 to 17.9 percent.
  - Based on METSIM values.
- Mixer design based on a range of G-values between 200 per second and 800 per second.
  - Based on the treatability study results.

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT GE HUDSON DREDGE SLURRY HOLDING TANKS	PROJ. NO.	BY JCP	DATE 8/5/05	SHEET 1/1

CALCS. BY ____ ; DATE ____ CHECKED BY BSC ; DATE 8/5/05

- PROVIDE TOTAL 1,400,000 GALLONS OF STORAGE VOLUME
- PROVIDE TWO, 700,000 GALLON HOLDING TANKS
- EACH TANK 70-FT DIAMETER WITH 28-FT SIDE WALL HT.
- PROVIDE MIN. 3-FT OF FREEBOARD IN EACH HOLDING TANK
- VOLUME CHECK:
  - 70 FT Ø, AREA = $\pi\left(\frac{D}{2}\right)^2$ = 3,848 SF
  - 25 FT WATER DEPTH
  - VOL. EQUAL TO 25 FT × 3,848 SF = 96,200 CF = 720,000 GAL ✓
- TYPE OF TANK: BOLTED STEEL, ABOVEGRADE STORAGE TANK

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE HUDSON DREDGE SLURRY HOLDING TANK - MIXING		JRF	8/5/05	

CALCS. BY ____ ; DATE ____ CHECKED BY JRG ; DATE 8/8/05

TOTAL VOLUME = 1,400,000 GAL.
VOL. EACH TANK = 700,000 GAL.

TANK DIAMETER = 70 FT
WATER DEPTH = 24 FT

VELOCITY GRADIENT = 200 MIN TO 800 MAX (PER TREAT. TESTING)
SPECIFIC GRAVITY = 1.17
PERCENT SOLIDS = 2.1% MIN. TO 17.9% MAX. (PER METSIM)

PER MANUFACTURERS RECOMMENDATIONS, EACH TANK TO BE EQUIPPED WITH:

- 5 MIXERS
- EACH 75 HP
- TOP ENTRY INTERFERENCE MIXERS

Gravity Thickeners

Gravity Thickeners

- Gravity Thickener feed will be approximately 2 percent solids.
  - Based on METSIM values.

- Gravity Thickener underflow will be approximately 15 percent solids.
  - Based on optimal feed concentration to filter presses per filter press manufacturers.

- Two tanks provided to allow for operational flexibility and the ability to take a unit off-line if necessary. Each unit will be sized to treat the highest solids loading scenario, S4 (1,616 dry tons per day).

- Gravity Thickener solids loading will be designed for 0.3 tons dry solids per square foot of thickener per day (dry T/sf-da).
  - This solids loading rate is consistent with manufacturer's recommendations for sediment thickening.

  - Current treatability tests support this loading rate. Using the modified Talmage and Fitch method for various thickener feed concentrations, the theoretical design loading ranges from 0.21 to 0.35 dry T/sf-da for various slurry feed concentrations.

- Gravity Thickeners will consist of two, 60 feet diameter units with a 12 feet water depth
  - Sizing based on assumed loading rate and manufacturer's recommendations.

- Gravity Thickeners will be constructed of above grade steel tanks.
  - This thickener construction method will provide a cost effective and efficient thickener installation. Will also simplify tank removal at end of processing period.

- Provisions for an anionic flocculant and cationic coagulant will be provided to enhance particulate settlement and thickening.
  - Current treatability testing has demonstrated optimum settling and thickening using a combination of a cationic polymer coagulant (approximately 60 to 250 ppm GE Betz Developmental E) and an anionic polymer flocculant (approximately 30 to 125 ppm PolyFloc AE1115).

- Gravity Thickeners will be fed from slurry pumps from either the hydrocyclones or dredge slurry holding tanks.
  - During normal operations, hydrocyclone overflows will be conveyed to the thickeners for thickening prior to being fed to the filter presses for dewatering. Under conditions where surplus dredge slurry has been stored, the thickeners will be fed from the dredge slurry holding tanks.

MEMORANDUM

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

To: John Perriello

From: Brenna Mannion

Date: 08/05/05

cc: Scott Schiller

Re: Thickener Sizing from Laboratory Settling Tests.

There are three applicable methods to determine gravity thickener surface area per ton of sludge from laboratory settling tests, they are as followed:

- Modified Talmage and Fitch Method;
- Oltmann Method; and
- Coe and Clevenger Method.

The Coe and Clevenger method underestimates the thickener area needed because it uses the initial (rapid) settling rate, making finding the "compression point" unnecessary. Both the Modified Talmage and Fitch and Oltmann methods require that the compression point of the solids is first determined in order to find the underflow time (t_u). The Modified Talmage and Fitch method tends to provide the most conservative estimate of thickener area.

Since the desired concentration for the finished sludge product is known to be 150 kg/m^3 (15% solids), we can determine the final mud line height using a proportionality equation and the known initial concentration and initial mud line height. At the determined final height, a line is drawn on the graph, and for each method the underflow time (t_u) is determined. For the Modified Talmage-Fitch method the intersection of the line tangent to the compression point, and the final mud line height, provides the underflow time (t_u). For the Oltmann method, the intersection of the line connecting the initial height point to the compression point, and the final height line, provide the underflow time (t_u'). For the Coe and Clevenger method, all that is necessary is the initial instantaneous settling rate in m/day. This represents the highest rate of settling achieved by the solids, which decreases with time. (Example calculations for each method are attached).

The data used to execute these models were 2 Liter column settling tests of type S3 sediments as provided by GE on July 5, 2005. Four different solids loading percentages were tested with six different combinations of coagulant (Developmental E), and flocculent (AE1115). The settling tests with coagulant and flocculent which provided the most efficient settling for each of the four given solids loadings, were dosages selected for gravity thickener area determination. The four optimal settling tests are as follows:

- 2.51% solids, 61ppm Dev E, 30.4ppm AE1115
- 4.01% solids, 123ppm Dev E, 61.5ppm AE1115
- 6.20% solids, 187ppm Dev E, 93.4ppm AE1115
- 8.56% solids, 252ppm Dev E, 126ppm AE1115

In order to determine the underflow times, the results were graphed, spanning the full settling test duration of 1440 minutes. To obtain more accurate underflow times, the information was re-plotted to only include the settling data for the initial 30 to 40 minutes. The graphs are attached.

To determine the most accurate compression point for each sample, Barnea graphs were also developed using the dimensionless height, H' and settling rate U calculated from the mud-line heights and times. The formulas are as follows:

$$U_n = (h_{n-1} - h_{n+1}) / (t_{n+1} - t_{n-1})$$

$$H'_n = (h_n - h_\infty) / (h_o - h_\infty)$$

Settling rate U (cm/s) is plotted against the dimensionless height H' on a log-log scale. The Barnea plots are attached.

The compression points determined using the Barnea plots correspond to the mud-line plots by data point number. By counting the number of points on the Barnea plots, the corresponding compression point could be determined on the height vs. time plots. Using these plots, the tangent and secant lines were plotted over the graphs according to the Modified Talmage and Fitch and Oltmann methods.

The tables and equations from the analysis are attached.

BAM

GE Thickener Analysis Table

Data from BBL Graphs based on GE Lab Data (Metric)

Test Sample	Co (kg/m^3)	Ho (m)	Cu (kg/m^3)	Hu (m)	U (initial settling rate m/day)	tu (per 1440 min.)	tu' (per 1440 min.)	Co (ton/m^3)	Talmage-Fitch Area m^2/(ton-24Hrs)	Oltmann Area m^2/(ton-24Hrs)	Oltmann Area xSF 1.2 m^2/(ton-24Hrs)	Oltmann Area xSF 2.0 m^2/(ton-24Hrs)	Coe-Clevenger Area m^2/(ton-24Hrs)
									Formula = tu/HoCo	Formula = tu'/CoHo	Formula = tu'/CoHo	Formula = tu'/CoHo	Formula = (1/Co - 1/Cu)/U
2.51% solids, 61ppm Dev E, 30.4 AE1115	25.1	0.422	150	0.071	838.1	0.005	0.002	0.028	0.440	0.184	0.221	0.369	0.036
4.01% solids, 123ppm Dev E, 61.5 AE1115	40.1	0.427	150	0.114	66.1	0.007	0.002	0.044	0.368	0.129	0.155	0.258	0.251
6.20% solids, 187ppm Dev E, 93.4 AE1115	62	0.433	150	0.179	30.0	0.008	0.006	0.068	0.263	0.195	0.234	0.390	0.286
8.56% solids, 252ppm Dev E, 126 AE1115	85.6	0.438	150	0.250	18.0	0.011	0.009	0.094	0.269	0.218	0.262	0.437	0.253

Data from BBL Graphs based on GE Lab Data (English)

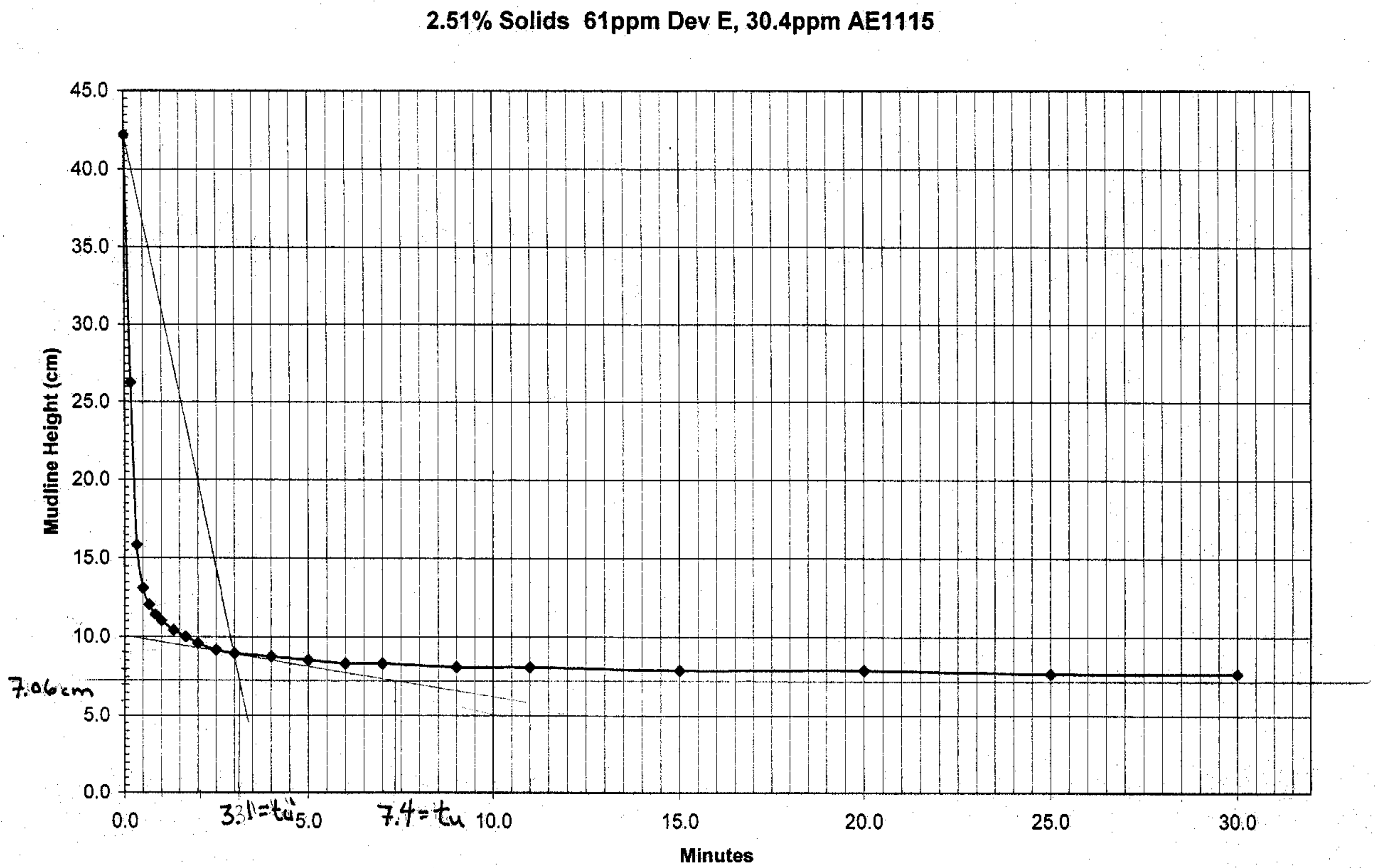
USE THIS METHOD (→ Talmage-Fitch Area)

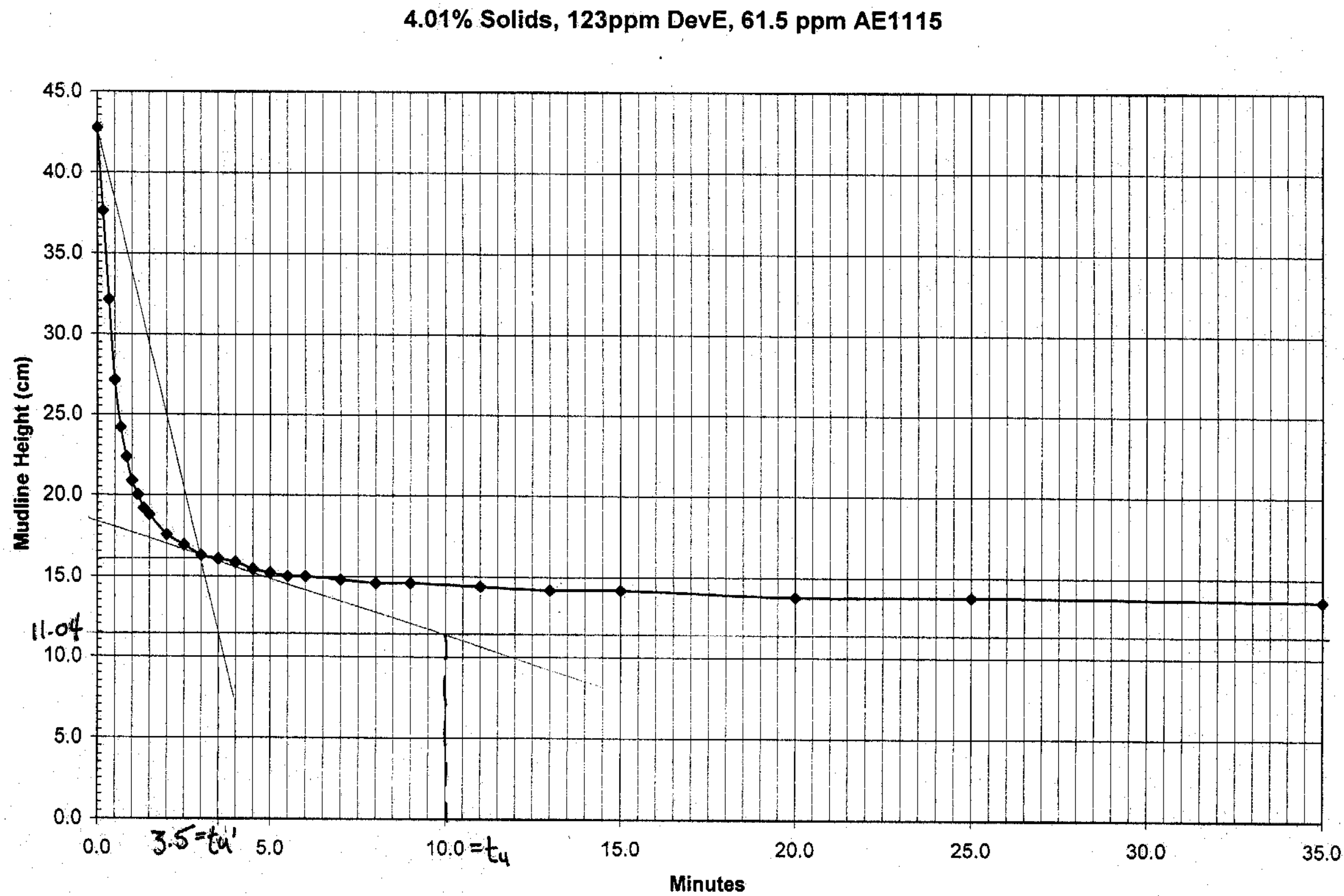
Test Sample		Talmage-Fitch Area ft^2/(ton-24Hrs)	Oltmann Area ft^2/(ton-24Hrs)	Oltmann Area xSF 1.2 ft^2/(ton-24Hrs)	Oltmann Area xSF 2.0 ft^2/(ton-24Hrs)	Coe-Clevenger Area ft^2/(ton-24Hrs)
		Formula = tu/HoCo	Formula = tu'/CoHo	Formula = tu'/CoHo	Formula = tu'/CoHo	Formula = (1/Co - 1/Cu)/U
2.51% solids, 61ppm Dev E, 30.4 AE1115		4.74	1.98	2.38	3.97	0.39
4.01% solids, 123ppm Dev E, 61.5 AE1115		3.96	1.39	1.66	2.77	2.70
6.20% solids, 187ppm Dev E, 93.4 AE1115		2.83	2.10	2.52	4.19	3.08
8.56% solids, 252ppm Dev E, 126 AE1115		2.89	2.35	2.82	4.70	2.72
AVG. =		3.605	1.955	2.345	3.908	2.22
LOADING RATE ; T/SF-DA =		0.28	0.51	0.43	0.26	0.45

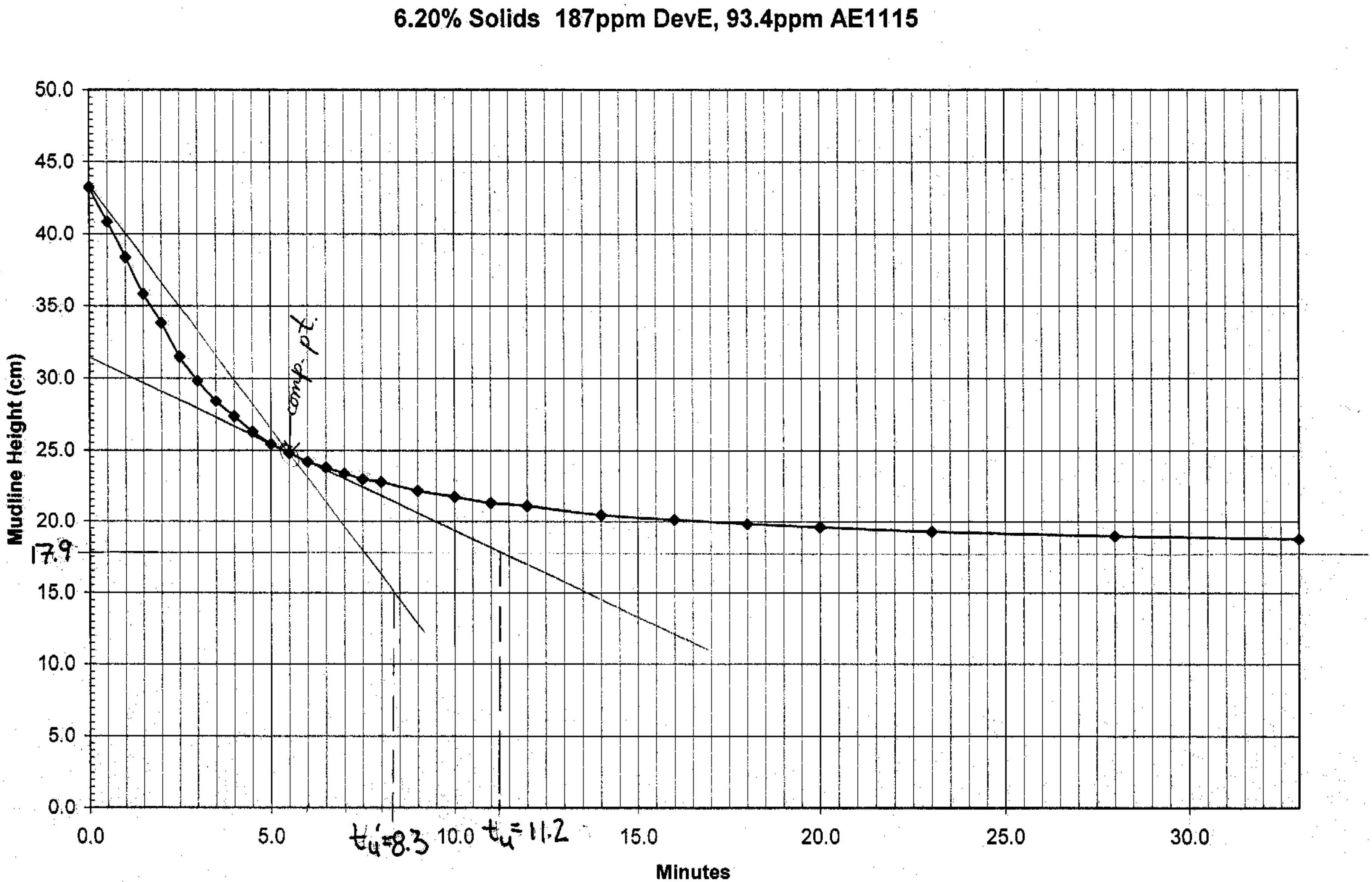
RANGE ; T/SF-DA 0.21 - 0.35

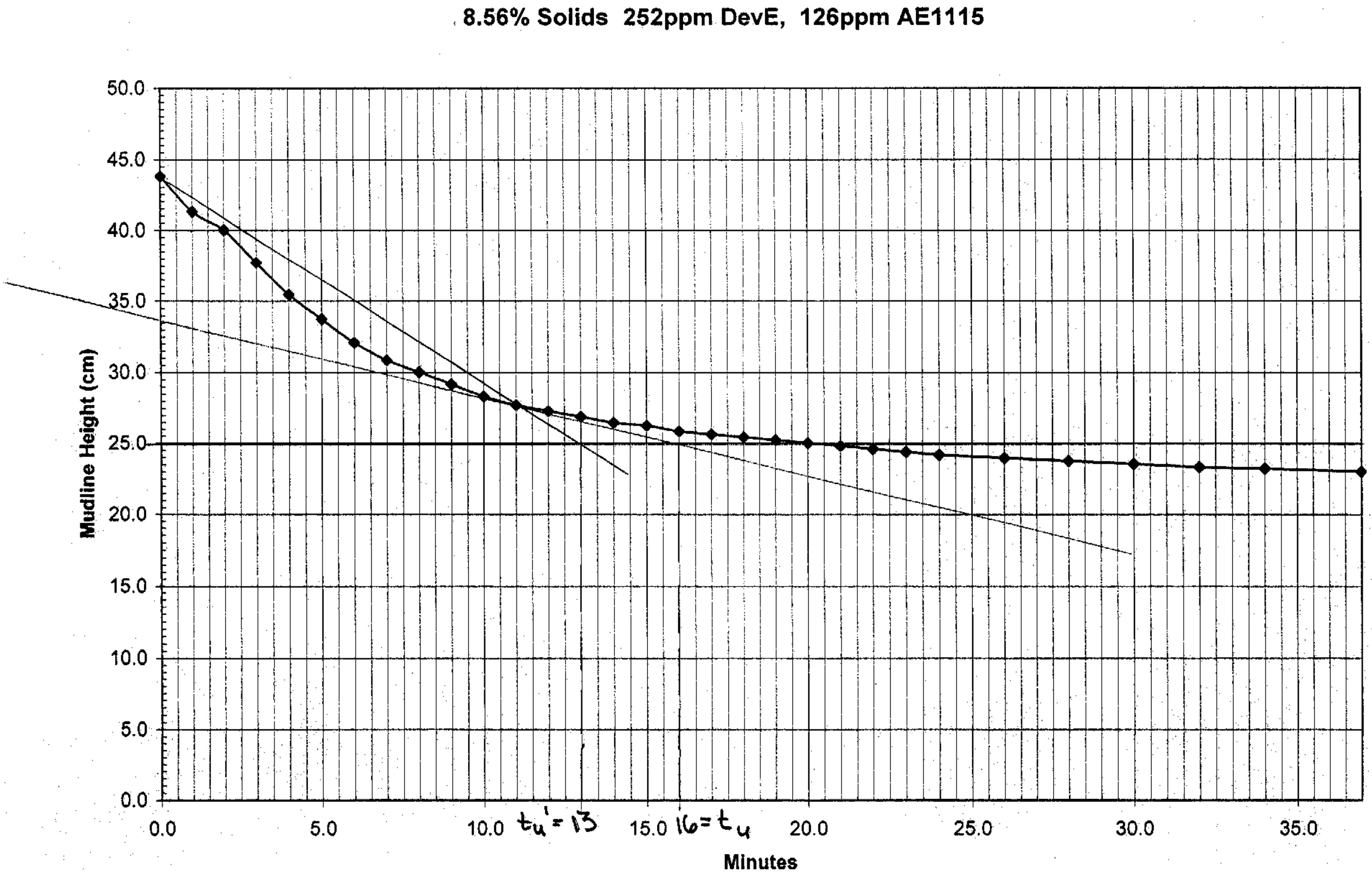
GRAVITY THICKENER SURFACE AREA ; USE 0.3 T/SF-DA

- THICKENER FEED SOLIDS LOADING (DRY T/DAY) = 1,616
- AREA REQUIRED = 1,616 / 0.3 = 5,387 SF
- TWO THICKENERS, EA ; 5,387 / 2 = 2,694 SF ; 60 FT DIA.


2.51% Solids 61ppm Dev E, 30.4ppm AE1115
Mudline Height (cm)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
7.06cm
0.0
5.0
10.0
15.0
20.0
25.0
30.0
3.1=tü
7.4=tu
Minutes

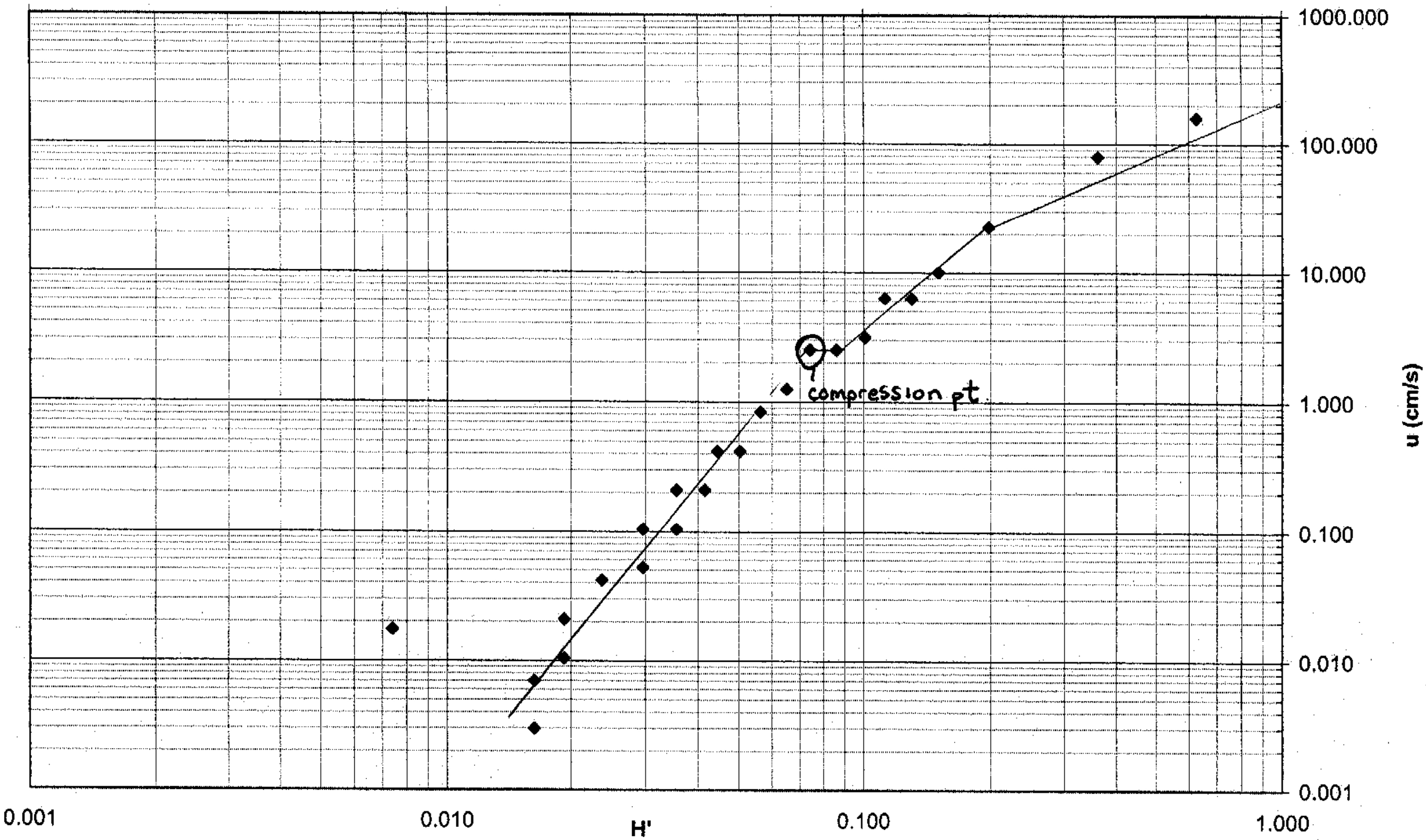

4.01% Solids, 123ppm DevE, 61.5 ppm AE1115
Mudline Height (cm)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
11.04
10.0
5.0
0.0
0.0
3.5 = tu'
5.0
10.0 = tu
15.0
20.0
25.0
30.0
35.0
Minutes


6.20% Solids 187ppm DevE, 93.4ppm AE1115
Mudline Height (cm)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
17.9
15.0
10.0
5.0
0.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Minutes
comp. pt.
t'u=8.3
tu=11.2


8.56% Solids 252ppm DevE, 126ppm AE1115
Mudline Height (cm)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
5.0
10.0
$t_u' = 13$
15.0
$16 = t_u$
20.0
25.0
30.0
35.0
Minutes

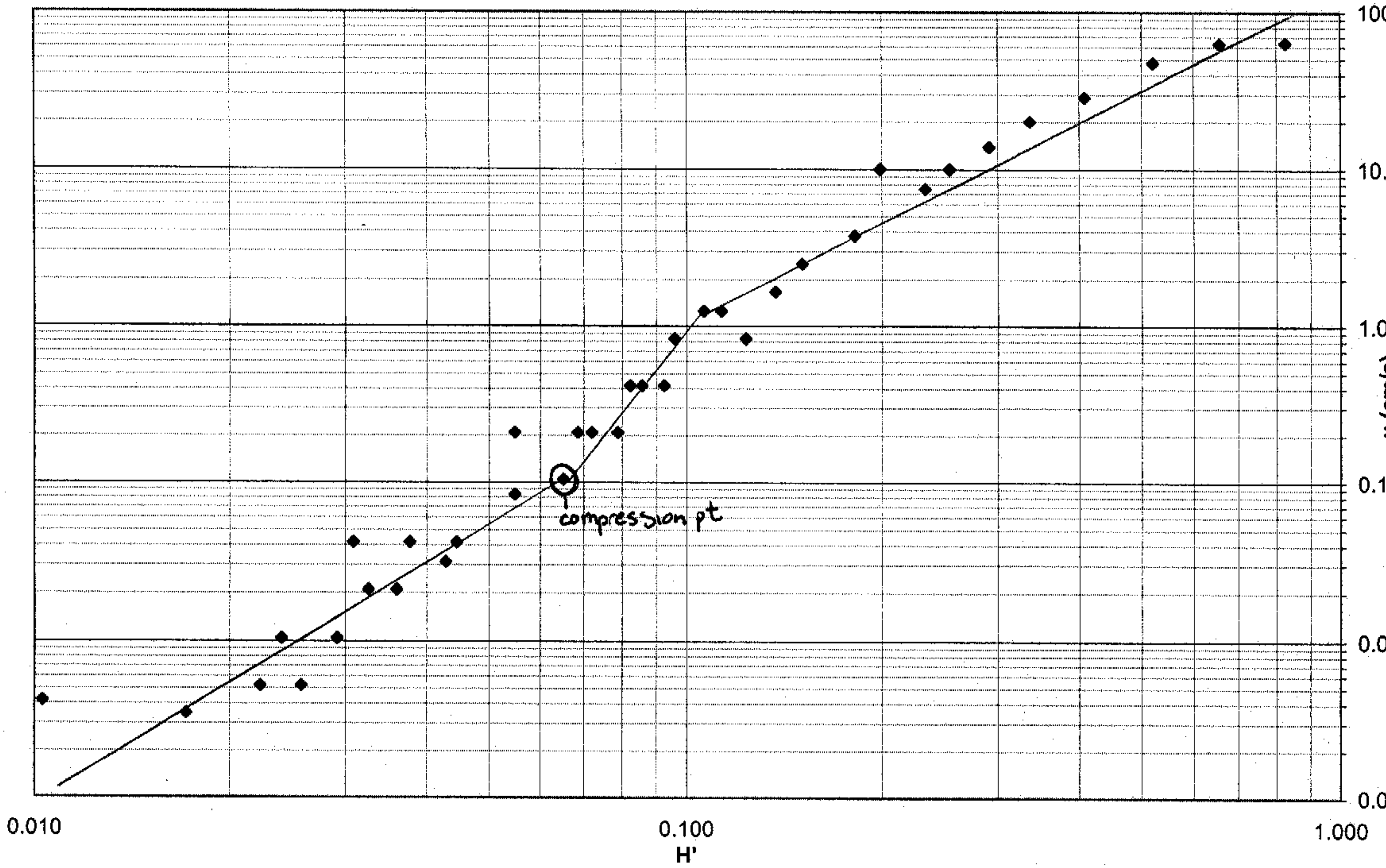
Barnea Plot

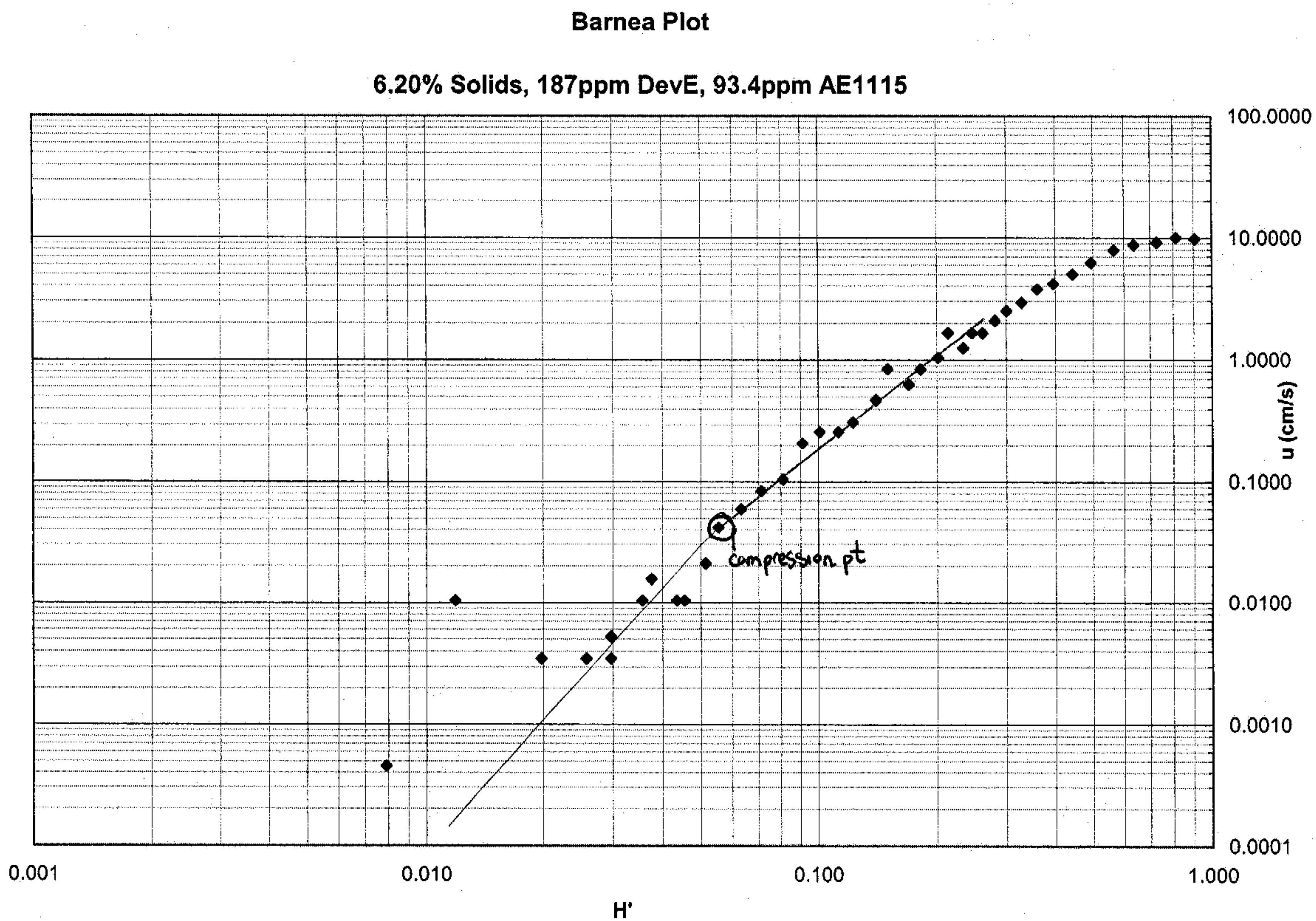
2.51% Solids, 61ppm DevE, 30.4ppm AE1115



Barnea Plot

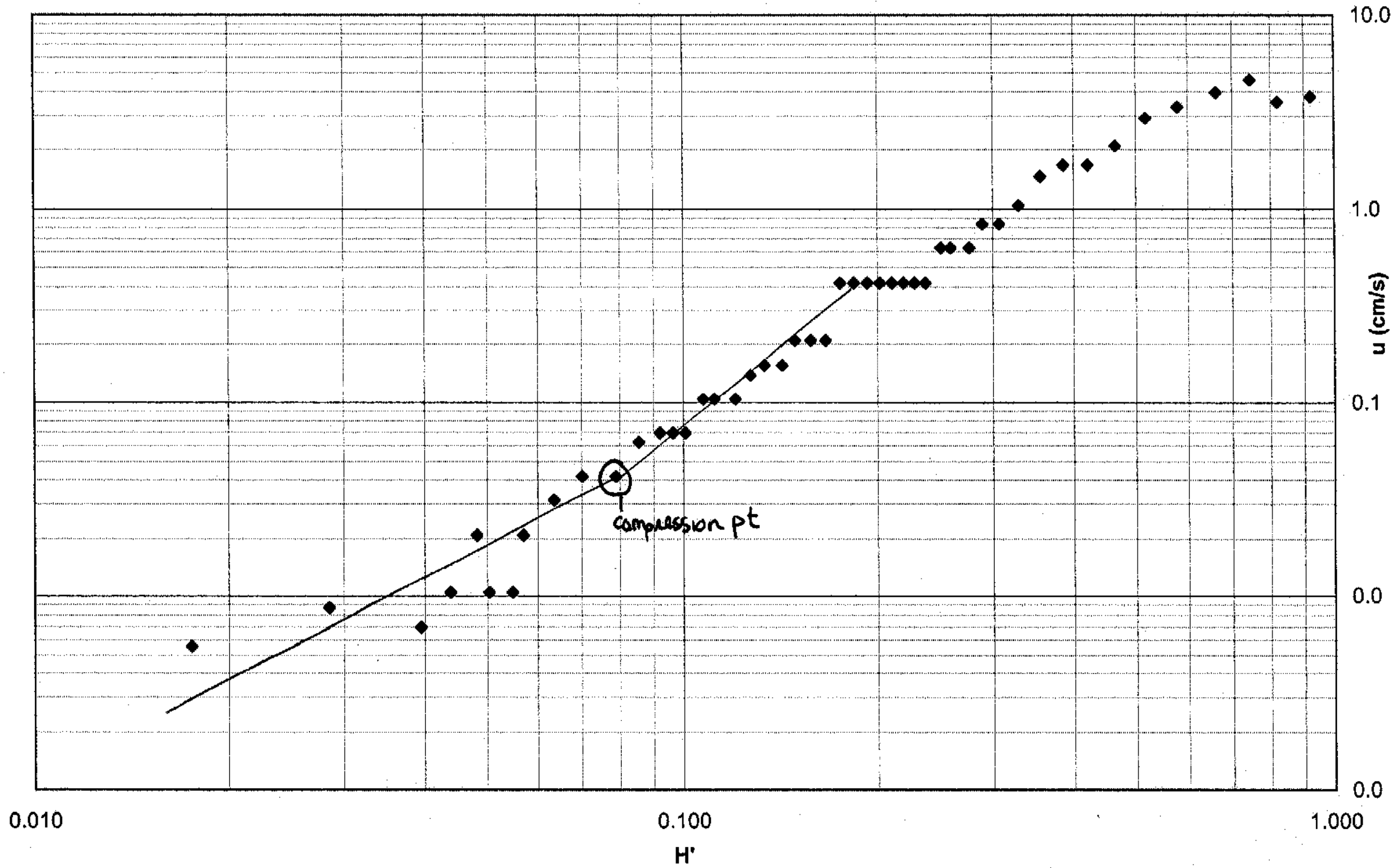
4.01% Solids, 123ppm DevE, 61.5ppm AE1115




Barnea Plot
6.20% Solids, 187ppm DevE, 93.4ppm AE1115
100.0000
10.0000
1.0000
0.1000
0.0100
0.0010
0.0001
u (cm/s)
0.001
0.010
0.100
1.000
H'
compression pt

Barnea Plot

8.56% Solids, 252ppm DevE, 126ppm AE1115



Dredge Slurry Holding Tank Transfer Pumps

Dredge Slurry Holding Tank Transfer Pumps

- Distance from Dredge Slurry Holding Tanks to the Gravity Thickeners is approximately 100 linear feet.
- Capacity of system will be 2,768 gallons per minute.
    - Based on METSIM values.
- Pumps will be arranged in 2 trains of 2 pumps each.
- Each train will have a capacity of 1,384 gallons per minute.
- Each pump will have a capacity of 1,400 gallons per minute.

Dewatering Conditioning Tanks

Dewatering Conditioning Tanks

- One dewatering conditioning tank per filter press train for a total of four dewatering conditioning tanks.

- Basis of design flow is 902 gallons per minute.
  - Based on METSIM values.

- Each dewatering conditioning tank will have 15 minutes of retention time.
  - Provides adequate contact time with polymer.

- Each dewatering condition tank will have a storage volume of 3,500 gallons.
  - Based on design flow and retention time.

- Each dewatering conditioning tank will have a diameter of 8 feet.

- Each dewatering conditioning tank will have a height of 10 feet.

- Percent feed solids to the dewatering conditioning tanks will range from 10% to 25%.
  - Based on METSIM values.

Thickener Sludge Pumps

Thickener Sludge Pumps from Gravity Thickeners to Dewatering Conditioning Tanks

- Distance from Gravity Thickeners to Dewatering Conditioning Tanks is approximately 400 linear feet.

- Basis of design flow is 902 gallons per minute.
  - Based on METSIM values.

- Percent solids of fluid conveyed will be 10% to 25%.
  - Based on METSIM values.

- 4 pumps will be arranged in 4 trains of 1 pump each.

- Each pump will normally operate at 226 gallons per minute.
  - Design flow will be conveyed by all 4 pumps together.

- Each pump will be 30 horsepower.
  - Manufacturer's estimate based on design conditions.

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson	20437	BSC	8/5/05	1/1

CALCS. BY ________ ; DATE ________ CHECKED BY [signature] ; DATE 8/15/05

Dredge Slurry Holding Tank pumps

☆ Use MetSim Flow Data
$Q = 2768$

☆ Assume 2 trains of 2 pumps each

☆ Each pump must be capable of pumping all flow for that train

$$\left(\frac{2768 \text{ gal}}{\text{min}}\right)\left(\frac{1}{2 \text{ trains}}\right) = \frac{1384 \text{ gpm}}{\text{Train}}$$

$$1384 \text{ gpm} \Big/ 2 \text{ pumps a train} = 692 \text{ gpm per pump}$$

∴ Each pump must have a range of 692 gpm to 1384 gpm

∴ Each pump should have a max of 1400 and a min of 650

Thickener to Dewatering Conditioning Tanks, Slurry pumps

☆ assume 4 Trains of 1 pump each

☆ assume 902 gpm Flow from MetSim

$$\left(\frac{902 \text{ gal}}{\text{min}}\right)\left(\frac{1}{4 \text{ Trains}}\right) = 225.5 \text{ gpm per pump}$$

∴ Each pump must be able to pump 220 gpm

Polymer Addition to Thickeners

Polymer Addition to Gravity Thickeners

- Polymer addition will include a cationic coagulant and an anionic flocculant.
  - Current treatability testing has demonstrated optimum settling and thickening using a combination of approximately 60 to 250 ppm of a cationic polymer coagulant (GE Betts Developmental E) and approximately 30 to 125 ppm of an anionic polymer flocculant (AE1115).

- Solids mass will be 1,616 dry tons per day
  - Based on METSIM values, treatability results and the attached calculations.

- 2 trains will be used for this operation
  - One train will be provided per gravity thickener.

- Chemical feed pumps will be arranged in 2 trains of 1 pump each.
  - Each pump will be sized for required design flow.

- Coagulant assumptions:

  - Coagulant usage at 10 pounds per dry ton will be 16,610 pounds
    - Based on METSIM values, treatability results and the attached calculations.

  - Density of coagulant will be 9.16 pounds per gallon
    - Based on METSIM values, treatability results and the attached calculations.

  - Maximum coagulant usage will be 1,764 gallons per day
    - Based on METSIM values, treatability results and the attached calculations.

  - Onsite storage capacity will be 2 weeks
    - Provides adequate on-site capacity at maximum feed rates while limiting frequency of coagulant deliveries.

  - Storage will be provided by means of 1 bulk storage tank at 22,000 gallons.
    - Based on the attached calculations.

  - Coagulant to be diluted to 5%.
    - Based on treatability study results.

  - Water usage will be 26 gallons per minute.
    - Based on previously stated water ratio and attached calculations.

- Flocculant assumptions:

  - Flocculant usage at 30 mg/l will be 1,000 pounds/day.
    - Based on METSIM values, treatability results and the attached calculations.

  - Density of flocculant will be 9.16 pounds per gallon

- Based on METSIM values, treatability results and the attached calculations.

- Maximum flocculant usage will be 109 gallons per day
  - Based on METSIM values, treatability results and the attached calculations.

- Onsite storage capacity will be 2 weeks
  - Provides adequate on-site capacity at maximum feed rates while limiting frequency of flocculant deliveries.

- Storage will be provided by means of 1 bulk storage tank at 2,000 gallons.
  - Based on the attached calculations.

- Flocculant to be diluted to 1%.
  - Based on treatability study results.

- Water usage will be 7.6 gallons per minute.
  - Based on previously stated water ratio and attached calculations.

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT GE HUDSON - COAGULANT @ THK.	PROJ. NO. 20437	BY DB	DATE	SHEET

CALCS. BY ______ ; DATE ______ CHECKED BY JG ; DATE 8/5/05

COAGULANT FOR ADDITION TO GRAVITY THICKENERS -

2768 GPM FEED RATE

1616 DRY TON/DAY

9.16 LB/GAL FOR COAGULANT

10 LB/TON DS POLYMER DOSAGE

→ (10)(1616) = 16160/9.16 = 1764 GAL/DAY ✓

DILUTE COAGULANT TO 5%

1764/.05 = 35280 GAL WATER NEEDED ✓

TOTAL FEED RATE = POLYMER + WATER

1764 + 35280 = 37044 GAL/DAY → 26 GPM ✓

STORAGE FOR 2 WEEKS -

(2)(6)(1764 GAL/DAY) = 21,168 GALS ✓

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE - POLYMER FLOCCULANT @ THC	20437	DG		

CALCS. BY ________ ; DATE ________ CHECKED BY [initials] ; DATE 8/5/05

POLYFLOC AE1115 - ANIONIC FLOCCULANT

FLOC. DOSE OF 20 mg TO 30 mg/L → ASSUME 30 m/L

2768 GPM FEED RATE → 10,478 l/m

(30 mg/l)(10,478 l/min) = .31 Kg/min

TOTAL FLOC PER DAY (.31)(24 HR/DAY)(60 min/HR) = 453 Kg/DAY

= 1,000 LB/DAY

DILUTION OF FLOC 0.1 TO 1%
↳ .001%

ASSUME FLOC 9.16 LB/GAL → 1000 LB/DAY / 9.16 LB/GAL = 109 GAL/DAY FLOC.

ASSUME 1% → 109/.01 = 10900 GAL/DAY WATER

2 WEEKS STORAGE → (2)(6)(109 GAL/DAY) = 1308 GAL

↳ 2,000 GAL TANK

→ 10900/24/60 = 7.6 GPM WATER

Polymer Addition to Filter Presses

Polymer Addition to Filter Presses

- Polymer addition will include a cationic coagulant.
  - Based on treatability study results.
- Solids mass will be 1,601 dry tons per day.
  - Based on METSIM values, treatability results and the attached calculations.
- 4 trains will be used for this operation.
  - Based on number of filter press trains.
- Chemical feed pumps be arranged in 4 trains of 1 pump each.
- Polymer usage at 7 pounds per dry ton will be 11,207 pounds.
  - Based on METSIM values, treatability results and the attached calculations.
- Polymer usage at 19 pounds per dry ton will be 30,419 pounds.
  - Based on METSIM values, treatability results and the attached calculations.
- Specific gravity of polymer will be 9.16 pounds per gallon
  - Based on METSIM values, treatability results and the attached calculations.
- Minimum polymer usage will be 306 gallons per train per day
  - Based on METSIM values, treatability results and the attached calculations.
- Maximum polymer usage will be 830 gallons per train per day
  - Based on METSIM values, treatability results and the attached calculations.
- Minimum polymer dosage will be 0.32 gallons per minute per train
  - Based on METSIM values, treatability results and the attached calculations.
- Maximum polymer dosage will be 0.86 gallons per minute per train
  - Based on METSIM values, treatability results and the attached calculations.
- Operating range of each pump will be 0.16 to 0.86 gallons per minute
  - Based on the attached calculations.
- Maximum polymer usage will be 3,321 gallons per day
  - Based on METSIM values, treatability results and the attached calculations.
- Onsite storage capacity will be 2 weeks
  - Provides adequate onsite capacity at maximum feed rates while limiting frequency of polymer deliveries.
- Coagulant storage for filter press addition will be combined with coagulant storage for gravity thickener addition. Additional storage necessary is 25,000 gallons.
  - Based on the attached calculations.

- Polymer to water ratio will be 1:10.
  - Assumption used to preliminarily size chemical feed pumps.
  - Based on treatability study results.

- Water usage will be 8.6 gallons per minute.
  - Based on previously stated water ratio and attached calculations.

- Water pump capacity will be 9.46 gallons per minute.
  - Based on previously stated water ratio and attached calculations.

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE HUDSON POLYMER DOSING FILTER PRESS SYSTEM	20137	DG	7/1/05	1 OF 2

CALCS. BY ________ ; DATE ________ CHECKED BY [signature] ; DATE 8/5/05

ASSUME 4 TRAINS

SOLID MASS 1601 DTPD

POLYMER USAGE AT 7 LB/DT → (7)(1601) = 11207 LB ✓

POLYMER USAGE AT 19 LB/DT → (19)(1601) = 30419 LB ✓

SPECIFIC GRAVITY OF POLYMER 1.1 ∴ (8.33)(1.1) = 9.16 LB/GAL ✓

MIN USAGE 11207/9.16 = 1223 GAL → 306 GAL/TRAIN/DAY ✓

MAX USAGE 30419/9.16 = 3321 GAL → 830 GAL/TRAIN/DAY ✓

MIN DOSE 1223/16/60 = 1.27 GPM → .32 GPM/TRAIN ✓

MAX DOSE 3321/16/60 = 3.46 GPM → .86 GPM/TRAIN ✓

GPM PER PUMP ([illegible] ~~2~~ 1 PUMP PER TRAIN ∴ ~~8~~ 4 PUMPS)

GPM PER PUMP (MIN) → ~~.16 GPM~~ 0.32 GPM
" (MAX) → ~~.43 GPM~~ 0.86 GPM

CHEM FEED PUMP FOR EACH TRAIN MUST BE CAPABLE OF MIN GPM OR 2X'S THE MAX (ASSUME ONE PUMP DOWN)

∴ ~~.16 - .86~~ 0.32 - 1.72 GPM PER PUMP

BULK STORAGE - ASSUME MAX USAGE 3321 GAL/DAY & 2 WK SUPPLY (6 DAYS/WK)

(3321 GAL/DAY)(12 DAY) = 39852 GAL

2 TANKS → 39852/2 = 19926 GAL ≈ 20,000 GAL EA

✓

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE - POLYMER	20137	[initials]	7/6/05	1 OF 1

CALCS. BY ______ ; DATE ______ CHECKED BY [signature] ; DATE 8/5/05

ASSUME 1:10 RATIO OF WATER TO POLYMER

(~~.86~~ 1.72)(10) = ~~8.6~~ 17.2 GPM WATER

MAX ∴ ~~8.6~~ 17.2 + ~~.86~~ 1.72 = **~~9.46~~ 18.9 GPM** PER PUMP

DILUTE CATIONIC COAGULANT 5 - 10% → SAY 10%

MIN (~~.16~~ 0.32)(10) = ~~1.6~~ 3.2 GPM WATER

∴ ~~1.6~~ 3.2 + ~~.16~~ .32 = **~~1.76~~ 3.52 GPM** PER PUMP

Filter Press Feed Pumps

Filter Press Feed Pumps

- Distance from Dewatering Conditioning Tanks to Filter Presses is approximately 200 linear feet.

- Pumps will be the centrifugal type.
  - Based on manufacturer's recommendations.

- Each feed pump will be capable of 900 gallons per minute.
  - Based on METSIM values.

- Feed pumps will convey fluids with approximately 15 percent solids.
  - Based on METSIM values.

- Each pump will have a 60 horsepower motor.
  - Based on manufacturer's specifications.

Filter Presses

Filter Presses

- Filter press feed will have a specific gravity of approximately 1.17.
  - Based on METSIM values and the attached calculations.

- Filter press cake will have a specific gravity of approximately 1.52.
  - Based on METSIM values and the attached calculations.

- Filter press feed will be approximately 15 percent solids.
  - Based on METSIM values and manufacturer's recommendation.

- Filter press cake will be approximately 55 percent solids.
  - Based on METSIM values and manufacturer's recommendation.

- Filter press cake will be approximately 1.5 inches thick in each plate.
  - Based on manufacturer's specifications.

- Filter presses will be operated 24 hours a day.
  - Based on optimization of operating time.

- Filter presses will be placed on platforms and elevated approximately 10 feet off of the floor of the filter press building to allow for the use of roll off containers transported by trucks.

- Each treatment train will have one installed spare.
  - Based on manufacturer's recommendations.

- Each filter press will have a cycle time of approximately 3 hours.
  - Based on manufacturer's field experience.

- Each filter press will be fed by an individual feed pump.
  - Based on manufacturer's recommendations.

- Each filter press will be fed by a centrifugal feed pump to a pressure of 100 pounds per square inch.
  - Based on manufacturer's recommendations.

- Each filter press feed pump will be capable of conveying 900 gallons per minute of 15 percent sediment slurry.
  - Based on manufacturer's recommendations.

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson Specific Gravity	20437	BSC	6/16/05	1/2

CALCS. BY ______ ; DATE ______ CHECKED BY [signature] ; DATE 8/5/05

Filter Press Feed

Q = 987 gpm

$$\left(\frac{987\ gal}{min}\right)\left(\frac{60\ min}{1\ hr}\right)\left(\frac{24\ hr}{1\ day}\right) = \frac{1421280\ gal}{day}$$

$$\left(\frac{1421280\ gal}{day}\right)\left(\frac{1\ cy}{202\ gal}\right) = \frac{7036.04\ cy}{day}$$

☆ From Metsim ⇒ 6945 ton/day

$$\left(\frac{6945\ ton}{day}\right)\left(\frac{2000\ lbs}{1\ Ton}\right) = \frac{13890000\ lbs}{day}$$

$$\frac{\left(\frac{13890000\ lbs}{day}\right)}{\left(\frac{7036.04\ cy}{day}\right)} = 1974.12\ lbs/cy$$

$$\left(1974.12\ lbs/cy\right)\left(\frac{.00059331\ lbs/cy}{1\ gm/mL}\right) = 1.17\ gm/mL \Rightarrow \underline{\underline{1.17\ S.G.}}$$

Filter Press Cake

Q = 327

$$\left(\frac{327\ gal}{min}\right)\left(\frac{60\ min}{1\ hr}\right)\left(\frac{24\ hr}{1\ day}\right) = \frac{470880\ gal}{day}$$

$$\left(\frac{470880\ gal}{day}\right)\left(\frac{1\ cy}{202\ gal}\right) = \frac{2331.09\ cy}{day}$$

☆ From Metsim ⇒ 2985 ton/day

(Cont'd on page 2)

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson Specific Gravity	20437	BSC	6/16/05	2/2

CALCS. BY ______ ; DATE ______ CHECKED BY [signature] ; DATE 8/5/05

Filter press Cake cont'd

$$\left(\frac{2985 \text{ ton}}{\text{day}}\right)\left(\frac{2000 \text{ lbs}}{\text{ton}}\right) = \frac{5970000 \text{ lbs}}{\text{day}}$$

$$\frac{\left(\frac{5970000 \text{ lbs}}{\text{day}}\right)}{\left(\frac{2331.09 \text{ cy}}{\text{day}}\right)} = 2561.03 \text{ lbs/cy}$$

$$\left(\frac{2561.03 \text{ lbs}}{\text{cy}}\right)\left(\frac{.00059333 \text{ lbs/cy}}{1 \text{ gm/mL}}\right) = 1.52 \text{ gm/mL} \Rightarrow \underline{\underline{1.52 \text{ s.g.}}}$$

FILTER PRESS SIZING CALCULATIONS

	TRIAL #1	TRIAL #2	TRIAL #3
FEED SLURRY			
Solids (% by wt) :	[redacted]	[redacted]	[redacted]
Specific Gravity :	[redacted]	[redacted]	[redacted]
Gallons/Day :	[redacted]	[redacted]	1,421,280
# Dry Solids/Day :	2,080,285	2080285	[redacted]
Cycle Time (hrs) :	[redacted]	[redacted]	[redacted]
Operating Time/Day :	[redacted]	[redacted]	[redacted]

FILTER CAKE

Solids (% by wt) :	[redacted]	[redacted]	[redacted]
Specific Gravity :	[redacted]	[redacted]	[redacted]
Cubic Feet/Day :	39877.9	39877.9	39877.9
Density (lbs/cf) :	94.8	94.8	94.8

FILTER PRESS SIZE

Cycles/Day :	12	8	6
Cubic ft/cycle:	**3323.16**	**4984.73**	**6646.31**
Volume/Cycle (gal) :	118440	177660	236880

Number of 600 cu ft presses	
#1	**6**
#2	**9**
#3	**12**

Recycle Water Equalization Tank

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Recycle Water EQ. TANK	20437	TEM	8/4/05	1/3

CALCS. BY TEM ; DATE 8/4/05 CHECKED BY [illegible] ; DATE 8/8/05

Recycle Water EQ. Tank Needs to store Waters Discharged from the thickeners and Filter presses. Water collected in this tank is either recycled to the waterfront for slurry make-up water or discharged to water treatment

EQ. tank needs to be large enough to provide maximum gallons of water to waterfront over shortest period of time (~15 hrs waterfront operation) plus necessary equalization volume for water treatment operations

(1) MAXIMUM Storage Volume of sediment slurry water required when waterfront process 4,300 in situ/cy dy of S1 sediment over 15 hrs while Thickening and Dewatering Systems process the same volume over 24 hrs.

Refer METSIM WATER BALANCE, Table 3-26

MAXIMUM REQUIRED RECYCLED WATER = 2534 gpm x 24 hr x 60 (Stream 1D4)

= 3,650,000 GALLONS (REQUIRED OVER 15 hrs)

MAXIMUM RECYCLE WATER PRODUCED AT THICKENER AND DEWATERING FACILITY (Stream # 4D4)

= 2809 gpm x 60 min x 15 hr = 2,528,100 GALLONS produced over 15 hrs

REQUIRED Storage NEEDED TO BE AVAILABLE AT START OF DAY = 3,650,000 - 2,528,100

= 1,122,000 GALLONS

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Recycle Water EQ. TANK	20437	TEM	8/4/05	2/3

CALCS. BY TEM ; DATE 8/4/05   CHECKED BY SRG ; DATE 8/8/05

(2.) MAXIMUM storage volume of water for treatment at water treatment plant occurs when process 4,300 INSITU cubic yards of S4 inventory one day (15 hr dy) after treating 4,300 cubic yards of S1 sediment

When treating S4 inventory, 694 x 24 x 60 (Stream 04 - METSIM, TABLE 3-36)

= **999,360 gallons (over 15 hrs)**

RECYCLE WATER PRODUCED AT THICKENER AND DEWATERING FACILITY over same 15 hrs = 1078 gpm x 60 x 15 = 970,200 GALLONS

Amt of water needed to be treated over same 15 hrs = 970,200 gallons - 999,360 gallons = **-29,160 GALLONS**

Amt of water needed to be generated for water treatment 9 hrs waterfront is not in operation

= 1,078 gpm x 60 min/hr x 9 hr = 582,120 gallons

Amt of Water EQUALIZATION REQUIRED when operating (2) 500 GPM TRAINS =

(1078 gpm - 1000 gpm) x 9 hrs x 60 min = **42,120 GALLONS**

Amount of WATER EQUALIZATION REQUIRED when operating (1) 500 GPM TRAIN

= (1,078 - 500 GPM) x 9 x 60 = **312,120 GALLONS**

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Recycle WATER EQ. TANK	20437	TEM	8/5/05	3/3

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY JRG ; DATE 8/8/05

Summary

Required water volume needed to process 4,300 in situ cy of S1 sediment in approximately 15 hrs when dewatering facility is operating on a 24 hr day

= **1,122,000 GALLONS**

Required additional water volume needed for water treatment plant equalization when processing 4,300 in situ CY of S4 sediment in approximately 15 hrs when dewatering facility is operating on a 24 hr day (assuming 1,000 GPM WTP capacity)

= 42,120 GALLONS

∴ Recycle Water Equalization tank size =

= 1,122,000 GAL + 42,120 GALLONS

= 1,164,120 gallons × 1.30 ≈ **1,500,000 GALLONS**

(30% safety factor will cover unplanned WTP downtime, and events that require use of river water for make-up supply)

Exhibit G.3.2a - Thickening with Polymer Coagulant

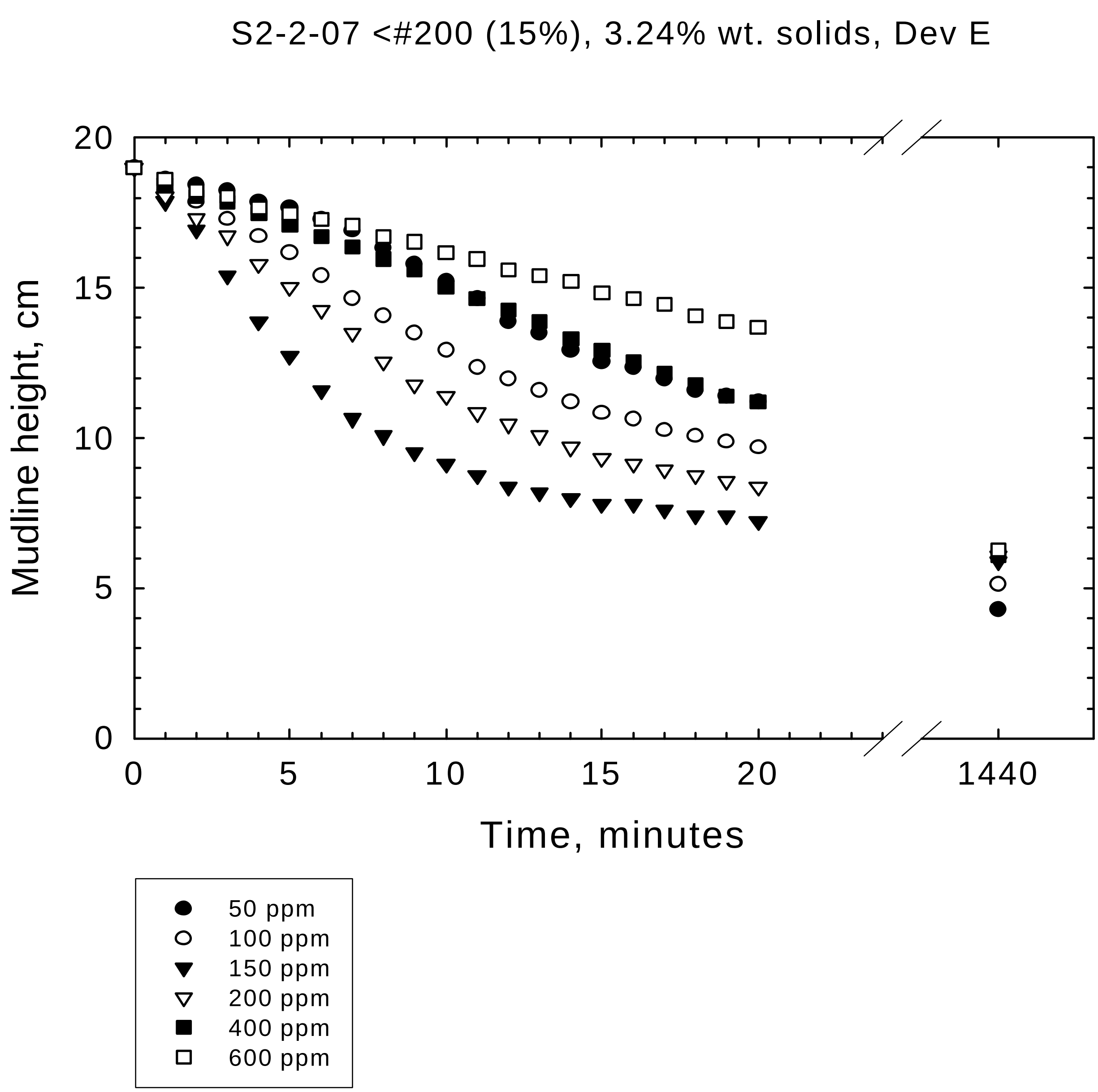
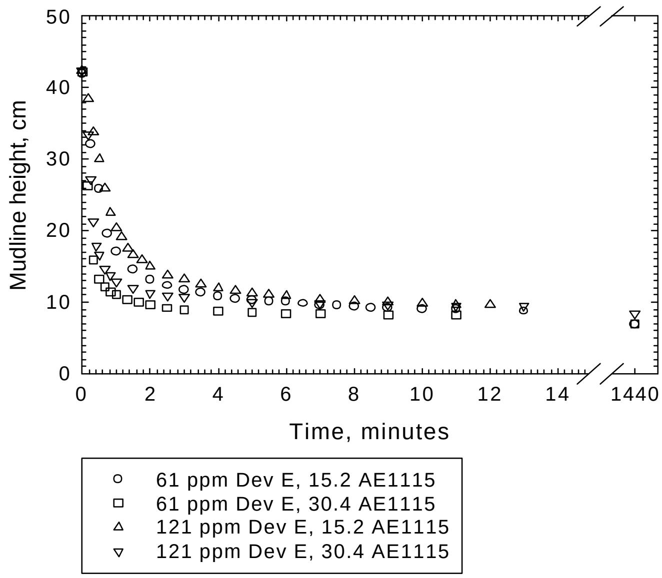
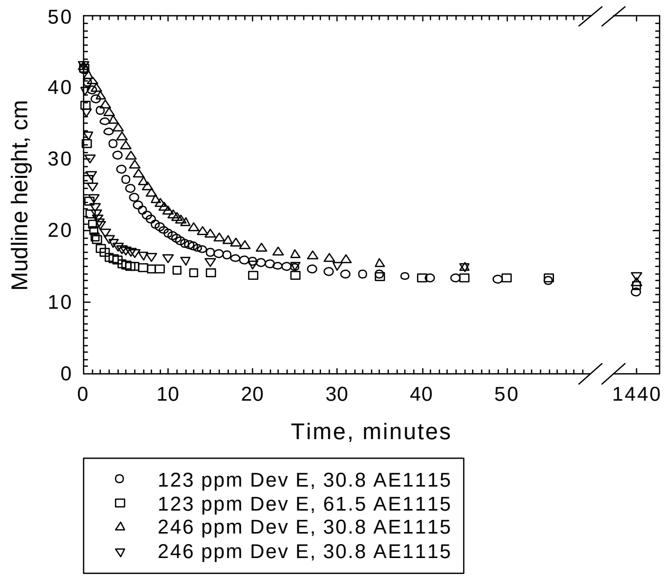


Exhibit G.3.2b - Thickening with Polymer Treatment

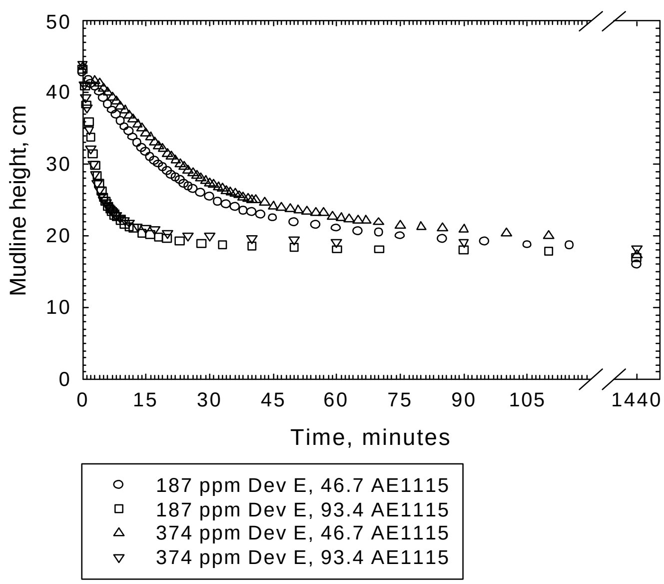
2.51% wt. solids initial



4.01% wt. solids initial



6.20% wt. solids initial



8.56% wt. solids initial

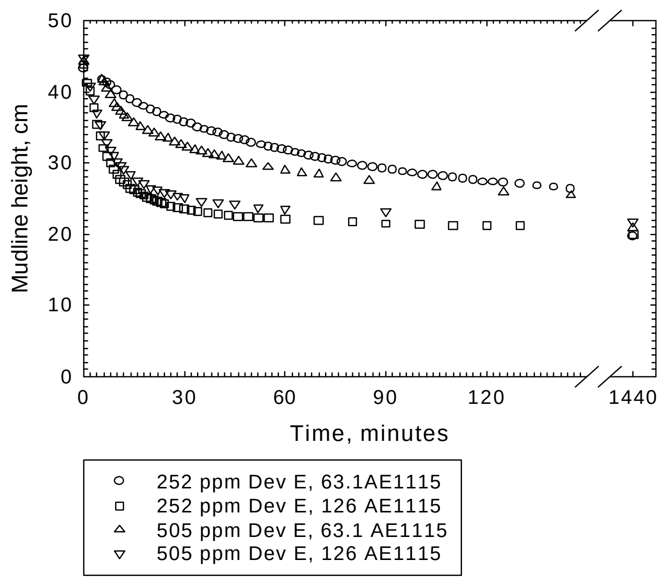
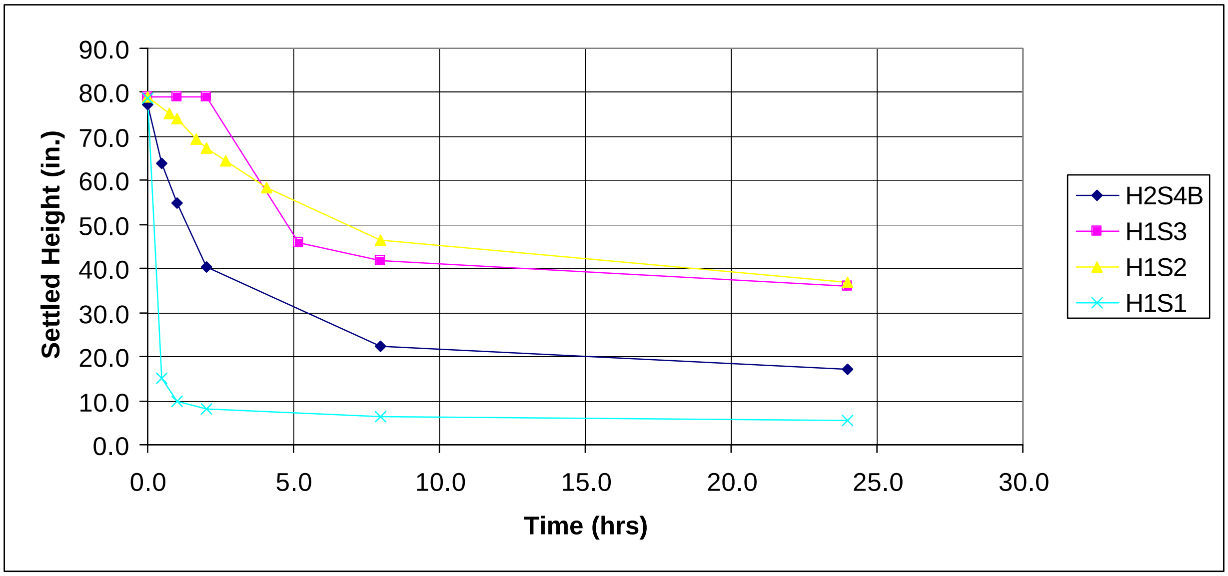


Exhibit G.3.3 - Primary Settling Column Results

Sample	initial % wt. solids	initial density s.g.	Time h	Interface height in.	Settled volume in.3	Settled density s.g.	% wt. solids
H2S4B	4.33	1.03	0.0	77.3	8737	1.03	4.3
	4.33	1.03	0.5	64.0	7238	1.03	5.2
	4.33	1.03	1.0	55.0	6220	1.04	6.0
	4.33	1.03	2.0	40.5	4580	1.05	8.1
	4.33	1.03	8.0	22.3	2516	1.10	14.1
	4.33	1.03	24.0	17.3	1951	1.12	17.7
H2S3	1.8	1.01	No interface observed				
H2S2	1.16	1.01	No interface observed				
H1S3	10.41	1.07	0.0	79.0	8935	1.07	10.4
	10.41	1.07	1.0	79.0	8935	1.07	10.4
	10.41	1.07	2.0	79.0	8935	1.07	10.4
	10.41	1.07	5.2	45.8	5174	1.12	17.2
	10.41	1.07	8.0	41.8	4722	1.13	18.6
	10.41	1.07	24.0	36.0	4072	1.15	21.2
H1S2	9.66	1.06	0.0	79.0	8935	1.06	9.7
	9.66	1.06	0.8	75.3	8511	1.07	10.1
	9.66	1.06	1.0	74.0	8369	1.07	10.3
	9.66	1.06	1.7	69.5	7860	1.07	10.9
	9.66	1.06	2.0	67.3	7606	1.08	11.2
	9.66	1.06	2.7	64.5	7295	1.08	11.7
	9.66	1.06	4.1	58.3	6588	1.09	12.8
	9.66	1.06	8.0	46.5	5259	1.11	15.7
	9.66	1.06	24.0	36.8	4156	1.14	19.4
H1S1	3.24	1.02	0.0	78.8	8906	1.02	3.2
	3.24	1.02	0.5	15.0	1696	1.11	15.7
	3.24	1.02	1.0	10.0	1131	1.16	22.4
	3.24	1.02	2.0	8.0	905	1.20	27.1
	3.24	1.02	8.0	6.5	735	1.25	32.1
	3.24	1.02	24.0	5.5	622	1.29	36.6

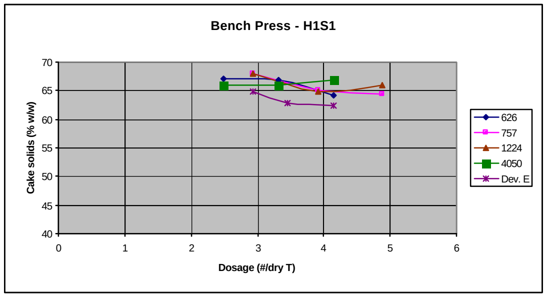
2.65 solids s.g. 12 in. dia 113 in.2

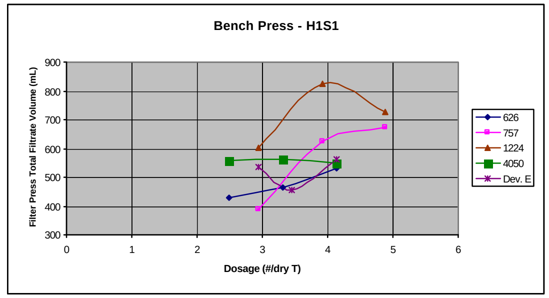
Note: No polymers were used in these tests.

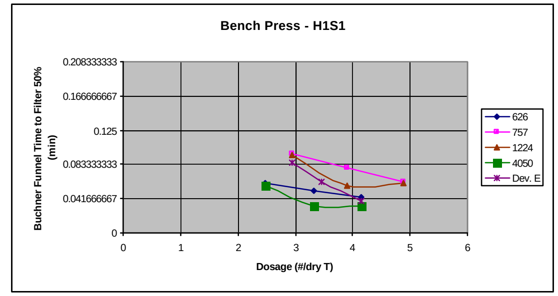


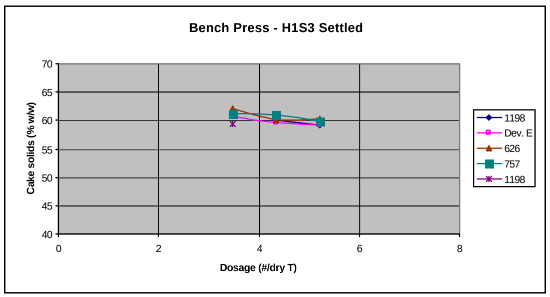
General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

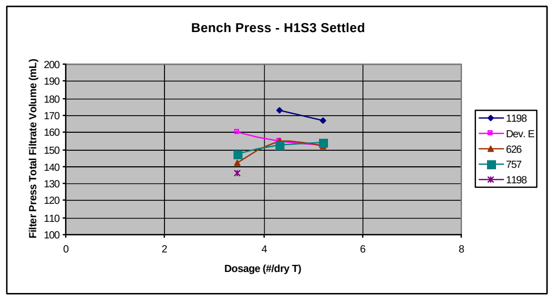
Exhibit G.3.4 - Filter Press Polymer Screening Results

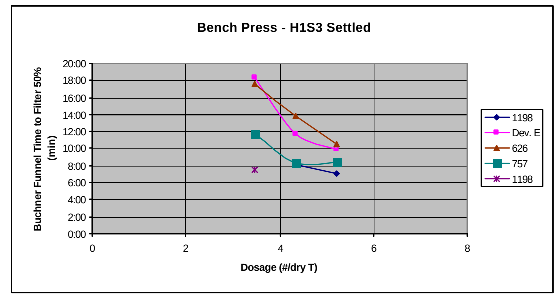


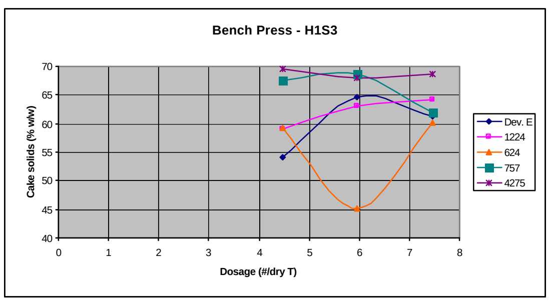


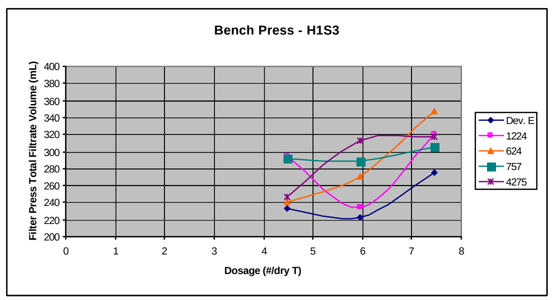


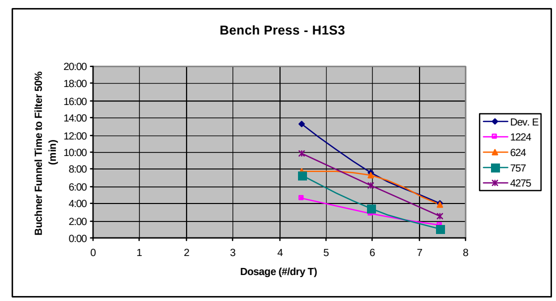


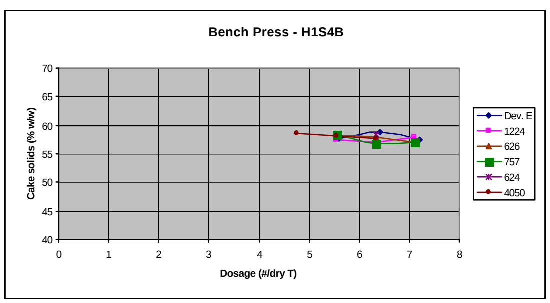


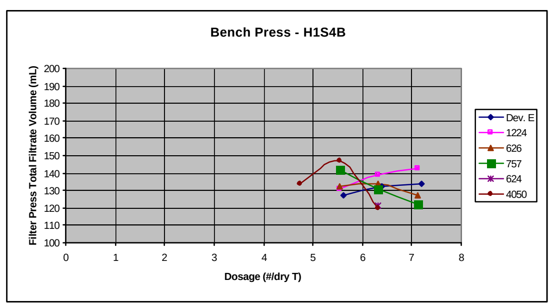


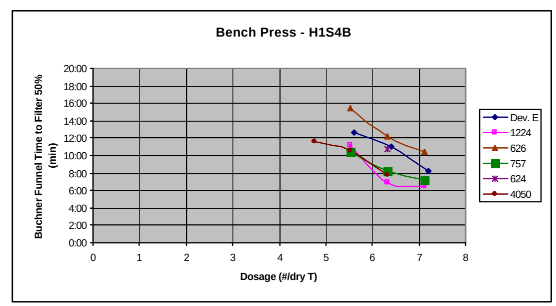






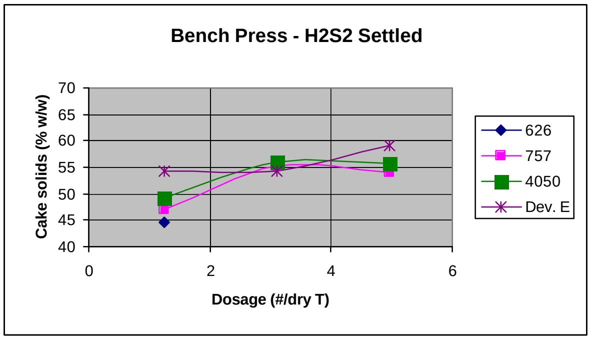


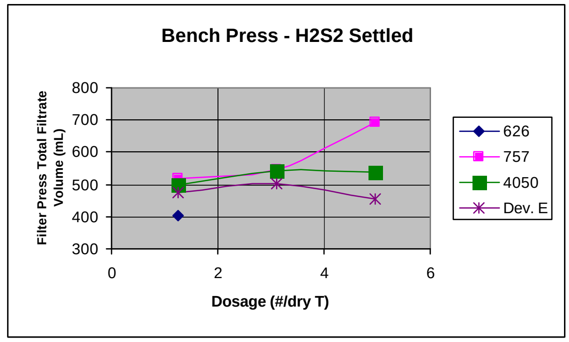


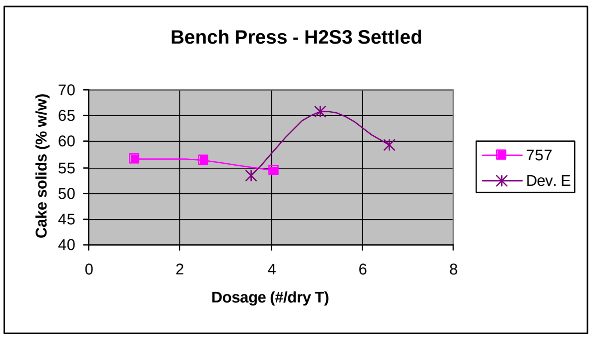


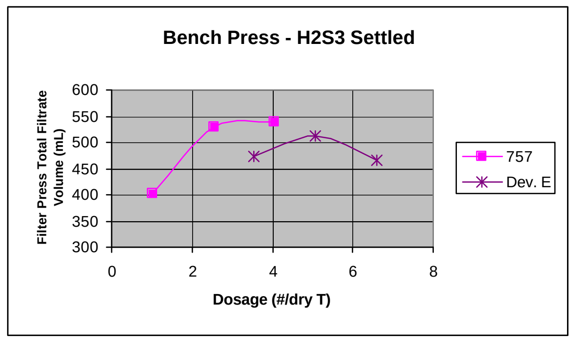
General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

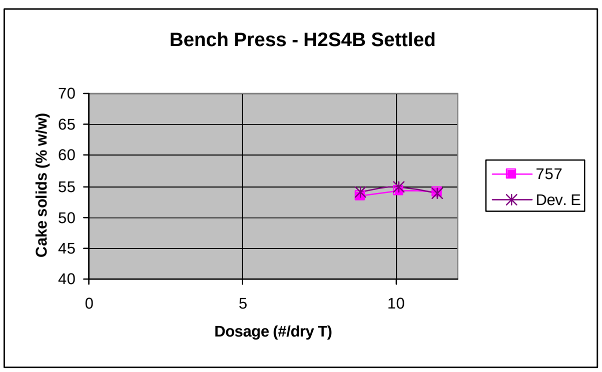
Exhibit G.3.5 - Filter Press Polymer Screening Results

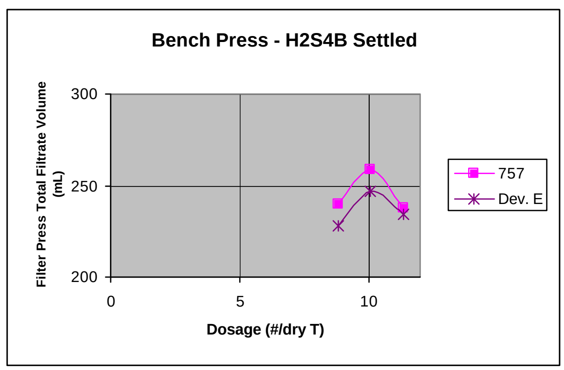


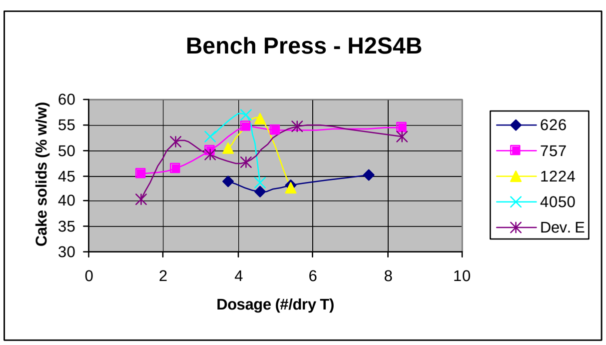


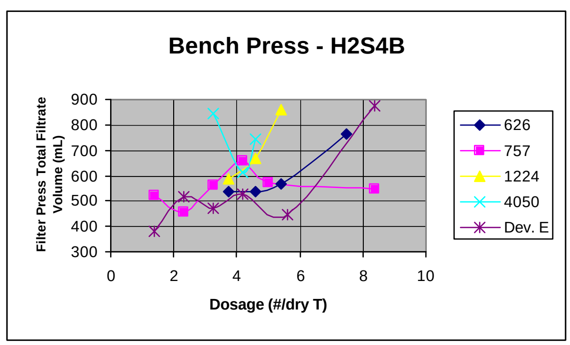












General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.6 - Bench and Pilot Filter Press Results

Scale	Test ID	Slurry ID	Matrix	Feed %Solids	Polymer ID	Polymer Dose (ppm)	Polymer (lb/dryT)	Cake %Solids	Total Press Time (min)	Pressure (psi)	Cake Quality
1	BFP-9	H1S3 Set. Solids	S3	23.07	1198	400	2.98	59.38	45	100	Fair
1	BFP-10	H1S3 Set. Solids	S3	23.07	1198	500	3.73	60.03	60	100	Good
1	BFP-11	H1S3 Set. Solids	S3	23.07	1198	600	4.47	59.12	60	100	Good
1	BFP-12	H1S3 Set. Solids	S3	23.07	Dev. E	400	2.98	60.73	60	100	Good
1	BFP-13	H1S3 Set. Solids	S3	23.07	Dev. E	500	3.73	59.72	60	100	Very good, no blinding
1	BFP-14	H1S3 Set. Solids	S3	23.07	Dev. E	600	4.47	59.16	60	100	good, no blinding
1	BFP-15	H1S3 Set. Solids	S3	23.07	626	400	2.98	62.08	60	100	Very good
1	BFP-16	H1S3 Set. Solids	S3	23.07	626	500	3.73	60.11	60	100	Good, no blinding
1	BFP-17	H1S3 Set. Solids	S3	23.07	626	600	4.47	60.21	60	100	fair
1	BFP-18	H1S3 Set. Solids	S3	23.07	757	400	2.98	61.24	60	100	very good, no blinding
1	BFP-19	H1S3 Set. Solids	S3	23.07	757	500	3.73	60.87	60	100	very good, no blinding
1	BFP-20	H1S3 Set. Solids	S3	23.07	757	600	4.47	59.79	60	100	good, no blinding
1	BFP-21	H1S4B-01	S4	24.97	Dev. E	700	4.76	57.59	60	100	good, no blinding
1	BFP-22	H1S4B-02	S4	24.97	Dev. E	800	5.44	58.84	60	100	very good, very slight blinding
1	BFP-23	H1S4B-03	S4	24.97	Dev. E	900	6.12	57.4	60	100	very good, very slight blinding
1	BFP-24	H1S4B-02	S4	25.29	1224	700	4.69	57.57	60	100	good, no blinding
1	BFP-25	H1S4B-02	S4	25.29	1224	800	5.36	56.94	60	100	good, slight blinding
1	BFP-26	H1S4B-02	S4	25.29	1224	900	6.03	57.94	60	100	very good, no blinding
1	BFP-27	H1S4B-02	S4	25.29	626	700	4.69	58.23	60	100	very good, very slight blinding
1	BFP-28	H1S4B-02	S4	25.29	626	800	5.36	57.95	60	100	very good, slight blinding
1	BFP-29	H1S4B-02	S4	25.29	626	900	6.03	56.91	60	100	good, no blinding
1	BFP-30	H1S4B-02	S4	25.29	757	700	4.69	58.27	60	100	very good, very slight blinding
1	BFP-31	H1S4B-02	S4	25.29	757	800	5.36	56.74	60	100	very good, very slight blinding
1	BFP-32	H1S4B-02	S4	25.29	757	900	6.03	57.05	60	100	very good, very slight blinding
1	BFP-33	H1S4B-02	S4	25.29	624	800	5.36	58.26	60	100	OK, stained, no blinding
1	BFP-34	H1S4B-02	S4	25.29	4050	600	4.02	58.67	60	100	very good, no blinding
1	BFP-35	H1S4B-02	S4	25.29	4050	700	4.69	58.08	60	100	very good, no blinding
1	BFP-36	H1S4B-02	S4	25.29	4050	800	5.36	57.59	60	100	very good, slight blinding
1	BFP-37	H1S3-04	S3	13.42	Dev. E	300	4.11	54.06	60	100	fair, OK - slight blinding
1	BFP-38	H1S3-04	S3	13.42	Dev. E	400	5.48	64.56	60	100	very good, very slight blinding
1	BFP-39	H1S3-04	S3	13.42	Dev. E	500	6.85	61.25	60	100	very good, very slight blinding
1	BFP-40	H1S3-04	S3	13.42	1224	300	4.11	59.13	60	100	good, slight blinding in lower half
1	BFP-41	H1S3-04	S3	13.42	1224	400	5.48	63.11	60	100	good, very slight blinding
1	BFP-42	H1S3-04	S3	13.42	1224	500	6.85	64.23	60	100	very good, no blinding
1	BFP-43	H1S3-04	S3	13.42	624	300	4.11	59.27	60	100	very good, slight blinding
1	BFP-44	H1S3-04	S3	13.42	624	400	5.48	45.05	60	100	OK, slight blinding on bottom half
1	BFP-45	H1S3-04	S3	13.42	624	500	6.85	60.18	60	100	excellent, no blinding
1	BFP-46	H1S3-04	S3	13.42	757	300	4.11	67.45	60	100	very good, slight blinding
1	BFP-47	H1S3-04	S3	13.42	757	400	5.48	68.69	60	100	good, slight sticking, slight blinding
1	BFP-48	H1S3-04	S3	13.42	757	500	6.85	61.96	60	100	very good, slight blinding
1	BFP-49	H1S3-04	S3	13.42	4275	300	4.11	69.64	60	100	good, some sticking, slight blinding
1	BFP-50	H1S3-04	S3	13.42	4275	400	5.48	68	60	100	very good, no blinding
1	BFP-51	H1S3-04	S3	13.42	4275	500	6.85	68.73	60	100	good, just slight blinding on bottom
1	BFP-52	H1S1-08	S1	4.09	1224	60	2.86	67.89	60	100	very good, 30% blinded
1	BFP-53	H1S1-08	S1	4.09	1224	80	3.81	64.8	60	100	good release, 50% blinded
1	BFP-54	H1S1-08	S1	4.09	1224	100	4.77	65.97	60	100	good, 30% blinded
1	BFP-55	H1S1-08	S1	4.09	757	60	2.86	67.92	60	100	good, moderate blinding
1	BFP-56	H1S1-08	S1	4.09	757	80	3.81	65.06	60	100	good, 40% blinding
1	BFP-57	H1S1-08	S1	4.09	757	100	4.77	64.5	60	100	very good, 40% blinding
1	BFP-58	H1S1-08	S1	4.09	Dev. E	60	2.86	64.92	60	100	good, 30% blinding
1	BFP-59	H1S1-09	S1	4.64	Dev. E	80	3.35	62.9	60	100	good, blinding
1	BFP-60	H1S1-10	S1	4.83	Dev. E	100	4.02	62.31	60	100	good, some blinding
1	BFP-61	H1S1-10	S1	4.83	626	60	2.41	66.98	60	100	very good, very slight blinding
1	BFP-62	H1S1-10	S1	4.83	626	80	3.22	66.83	60	100	good, some blinding
1	BFP-63	H1S1-10	S1	4.83	626	100	4.02	64.09	60	100	good, slight blinding
1	BFP-64	H1S1-10	S1	4.83	4050	60	2.41	65.96	60	100	good, slight blinding
1	BFP-65	H1S1-10	S1	4.83	4050	80	3.22	65.96	60	100	good, very slight blinding
1	BFP-66	H1S1-10	S1	4.83	4050	100	4.02	66.77	60	100	good, very slight blinding
1	BFP-67	H1S2-05	S2	8.46	624	300	6.73	37.92	60	100	good, some blinding
1	BFP-68	H1S2-05	S2	8.46	627	300	6.73	47.57	60	100	good, slight blinding
1	BFP-69	H1S2-05	S2	8.46	Dev. E	300	6.73	46.74	60	100	good, some blinding
1	BFP-70	H1S2-05	S2	8.46	1224	300	6.73	55.33	60	100	very good
1	BFP-71	H1S2-05	S2	8.46	757	300	6.73	57.64	60	100	very good, no blinding
1	BFP-72	H1S2-05	S2	8.46	4050	300	6.73	58.45	60	100	very good, no blinding
1	BFP-73	H1S2-05	S2	8.46	1198	300	6.73	57.2	60	100	very good, no blinding
1	BFP-74	H1S2-06	S2	8.38	627 EX	300	6.80	60.4	60	100	very good, very slight blinding
1	BFP-75	H1S2-06	S2	8.38	626	300	6.80	52.88	60	100	very good, no blinding
1	BFP-76	H1S2-06	S2	8.38	758	300	6.80	50.91	60	100	good, slight blinding
1	BFP-77	H1S3-06	S3	12.97	644	6000	85.25	64.29	60	100	firm
1	BFP-78	H1S3-06	S3	12.97	644+4884	,000 of each		62.98	50	100	Fair, somewhat soft

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.6 - Bench and Pilot Filter Press Results

Scale	Test ID	Slurry ID	Matrix	Feed %Solids	Polymer ID	Polymer Dose (ppm)	Polymer (lb/dryT)	Cake %Solids	Total Press Time (min)	Pressure (psi)	Cake Quality
1	BFP-79	H1S3-06	S3	12.97	Dev. E	400	5.68	70.44	60	100	good, soft top
1	BFP-79 Dup	H1S3-06	S3	12.97	Dev. E	400	5.68	72.82, 71.68	60	100	v. good, v. sl. soft top, sandy
1	BFP-80	H1S3-06	S3	12.97	Dev. E	400	5.68	72.75	60	100	v. good/excellent
1	BFP-81	H1S3-06	S3	12.97	Dev. E	400	5.68	72.73	60	100	good, very sandy, not esp. solid in all spots
1	BFP-82	H1S3-06	S3	12.97	Dev. E	400	5.68	69.16	60	100	v. good,
1	BFP-83	H1S3-06	S3	12.97	Dev. E	400	5.68	67.06	60	100	excellent
1	BFP-84	H1S3-06	S3	12.97	Dev. E	400	5.68	71.46	60	125	excellent
1	BFP-85	H1S2-07	S2	8.53	757	300	6.67	55.6	60	100	good, small soft spot on top
1	BFP-86	H1S2-07	S2	8.53	757	300	6.67	57.26	60	100	v. good, sl. soft top
1	BFP-87	H1S2-07	S2	8.53	757	300	6.67	54.7	60	100	good, small soft spot on top
1	BFP-88	H1S2-07	S2	8.53	757	300	6.67	59.24	60	100	very good, v.sl. Soft top
1	BFP-89	H1S2-07	S2	8.53	Dev. E	300	6.67	NA - incomplete cake	60	125	Poor, incomplete
1	BFP-90	H1S2-07	S2	8.53	757	300	6.67	58.94	60	125	good, sl. soft top
1	BFP-91	H1S2-08	S2	7.98	757	300	7.16	54.63	60	225	good, soft at top otherwise v. solid
1	BFP-92	H1S2-08	S2	7.98	Dev. E	300	7.16	48.29	60	225	fair, soft top
1	BFP-93	H1S2-08	S2	7.98	Dev. E	500	11.93	57.69	60	100	v. good, some blinding
1	BFP-94	H1S2-08	S2	7.98	757	300	7.16	49.19	60	100	good, no blinding
1	BFP-95	H1S2-08	S2	7.98	757	300	7.16	42.35	60	100	good, some blinding (~40%)
1	BFP-96	H1S2-08	S2	7.98	757	300	7.16	43	60	100	good, some blinding (~40%)
1	BFP-97	H1S2-08	S2	7.98	Dev. E	500	11.93	55.67	60	100	very good, some blinding
1	BFP-98	H1S2-08	S2	7.98	Dev. E	500	11.93	52.25	60	100	good, some blinding (same as BFP-9
1	BFP-99	H1S2-08	S2	7.98	Dev. E	500	11.93	51.8	60	100	good, some blinding (same as BFP-97,98)
1	BFP-100	H2S2 Settled Solids	S2	3.22	4050	20	1.22	49.16	60	100	good, no blinding
1	BFP-101	H2S2 Settled Solids	S2	3.22	4050	50	3.04	55.95	60	100	good, no blinding
1	BFP-102	H2S2 Settled Solids	S2	3.22	4050	80	4.87	55.75	60	100	good, no blinding, slight sticking
1	BFP-103	H2S2 Settled Solids	S2	3.22	757	20	1.22	46.9	60	100	good, no blinding
1	BFP-104	H2S2 Settled Solids	S2	3.22	757	50	3.04	55.35	60	100	good, no blinding
1	BFP-105	H2S2 Settled Solids	S2	3.22	757	80	4.87	54.13	60	100	good, very slight sticking, no blinding
1	BFP-106	H2S2 Settled Solids	S2	3.22	626	20	1.22	44.61	60	100	good, very slight blinding
1	BFP-107	H2S2 Settled Solids	S2	3.22	Dev. E	20	1.22	54.25	60	100	good, no blinding
1	BFP-108	H2S2 Settled Solids	S2	3.22	Dev. E	50	3.04	54.36	60	100	good, no blinding
1	BFP-109	H2S2 Settled Solids	S2	3.22	Dev. E	80	4.87	59.11	60	100	slight sticking, no blinding
1	BFP-111	H2S3 Settled Solids	S3	3.94	Dev. E	70	3.47	53.38	60	100	good, no blinding
1	BFP-110	H2S3 Settled Solids	S3	3.94	Dev. E	100	4.95	65.77	60	100	very good, no blinding
1	BFP-112	H2S3 Settled Solids	S3	3.94	Dev. E	130	6.44	59.35	60	100	very good, no blinding
1	BFP-113	H2S3 Settled Solids	S3	3.94	757	20	0.99	56.52	60	100	good, no blinding
1	BFP-114	H2S3 Settled Solids	S3	3.94	757	50	2.48	56.3	60	100	good, no blinding
1	BFP-115	H2S3 Settled Solids	S3	3.94	757	80	3.96	54.42	60	100	good, no blinding
1	BFP-116	H2S4B Settled Solids	S4	15.87	Dev. E	700	7.97	54.16	60	100	slight sticking, no blinding
1	BFP-117	H2S4B Settled Solids	S4	15.87	Dev. E	800	9.11	54.96	60	100	very good, no blinding
1	BFP-118	H2S4B Settled Solids	S4	15.87	Dev. E	900	10.25	53.82	60	100	good, very slight sticking, no blinding
1	BFP-119	H2S4B Settled Solids	S4	15.87	757	700	7.97	53.4	60	100	very good, no blinding
1	BFP-120	H2S4B Settled Solids	S4	15.87	757	800	9.11	54.22	60	100	very good, no blinding
1	BFP-121	H2S4B Settled Solids	S4	15.87	757	900	10.25	54.02	60	100	good release, no blinding
1	BFP-122	H2S4B-05	S4	4.29	Dev. E	30	1.36	40.41	60	100	very good release, no blinding
1	BFP-123	H2S4B-05	S4	4.29	Dev. E	50	2.27	51.63	60	100	very good, slight blinding
1	BFP-124	H2S4B-05	S4	4.29	Dev. E	70	3.18	49.12	60	100	very good release, no blinding
1	BFP-125	H2S4B-05	S4	4.29	Dev. E	90	4.09	47.58	60	100	very good release, no blinding
1	BFP-133	H2S4B-05	S4	4.29	Dev. E	120	5.45	54.59	60	100	very good, no blinding
1	BFP-130	H2S4B-05	S4	4.29	Dev. E	180	8.17	52.75	60	100	good release, no blinding
1	BFP-126	H2S4B-05	S4	4.29	757	30	1.36	45.4	60	100	good release, no blinding
1	BFP-127	H2S4B-05	S4	4.29	757	50	2.27	46.29	60	100	very good release, very slight blinding
1	BFP-128	H2S4B-05	S4	4.29	757	70	3.18	49.99	60	100	very good release, very slight blinding
1	BFP-129	H2S4B-05	S4	4.29	757	90	4.09	54.59	60	100	good release, no blinding
1	BFP-135	H2S4B-07	S4	4.81	757	120	4.84	54.01	60	100	very good, no blinding
1	BFP-131	H2S4B-05	S4	4.29	757	180	8.17	54.43	60	100	very good, no blinding
1	BFP-134	H2S4B-05	S4	4.29	4050	70	3.18	52.72	60	100	very good, very slight sticking
1	BFP-132	H2S4B-05	S4	4.29	4050	90	4.09	56.93	60	100	good release, no blinding
1	BFP-136	H2S4B-07	S4	4.81	4050	110	4.44	43.51	60	100	poor, stuck, no blinding
1	BFP-137	H2S4B-07	S4	4.81	1224	90	3.63	50.34	60	100	very good, very slight blinding
1	BFP-138	H2S4B-07	S4	4.81	1224	110	4.44	56.11	60	100	very good, very slight blinding
1	BFP-142	H2S4B-07	S4	4.81	1224	130	5.25	42.57	60	100	fair, sticking
1	BFP-139	H2S4B-07	S4	4.81	626	90	3.63	43.87	60	100	very good, no blinding
1	BFP-140	H2S4B-07	S4	4.81	626	110	4.44	41.95	60	100	good release, very slightly blinded
1	BFP-141	H2S4B-07	S4	4.81	626	130	5.25	42.99	60	100	very good, no blind
1	BFP-143	H2S4B-07	S4	4.81	626	180	7.27	45.02	60	100	very good, no blind

Exhibit G.3.6 - Bench and Pilot Filter Press Results

Scale	Test ID	Slurry ID	Matrix	Feed %Solids	Polymer ID	Polymer Dose (ppm)	Polymer (lb/dryT)	Cake %Solids	Total Press Time (min)	Pressure (psi)	Cake Quality
1	BFP-144	H2S4B-07	S4	4.81	Dev. E	120	4.84	45.27	45	100	very good, no blinding
1	BFP-145	H2S4B-07	S4	4.81	Dev. E	120	4.84	55.95	90	100	good, very slight sticking, no blind
1	BFP-146	H2S4B-07	S4	4.81	Dev. E	120	4.84	45.59	60	100	fair, soft top and center
1	BFP-147	H2S4B-07	S4	4.81	Dev. E	120	4.84	58.07	60	100	very good, no blind
1	BFP-148	S4-HC-10-OF	S4	4.011	Dev. E	100	4.87	n/a	60	100	good, no blinding
1	BFP-149	S4-HC-10-OF	S4	4.011	Dev. E	130	6.32	n/a	60	100	good, no blinding
1	BFP-150	S4-HC-10-OF	S4	4.011	Dev. E	220	10.70	36.61	60	100	v. good, no blinding
1	BFP-151	S4-HC-10-OF	S4	4.011	Dev. E	280	13.62	37.41	60	100	v. good, no blinding
1	BFP-152	S4-HC-10-OF	S4	4.011	Dev. E	380	18.49	48.69	60	100	v. good, no blind
1	BFP-153	S4-HC-10-OF	S4	4.011	Dev. E	450	21.89	50.26	60	100	v. good, no blinding
1	BFP-154	S4-HC-10-OF	S4	4.011	Dev. E	480	23.35	54.39	60	100	v. good, no blinding
1	BFP-155	S4-HC-10-OF	S4	4.011	Dev. E	550	26.76	54.38	60	100	v. good, no blinding
1	BFP-156	S4-HC-15-OF	S4	6.31	Dev. E	400	12.19	35	60	100	v. good, no blinding
1	BFP-157	S4-HC-15-OF	S4	6.31	Dev. E	500	15.24	40.5	60	100	v. good, no blinding
1	BFP-158	S4-HC-15-OF	S4	6.31	Dev. E	600	18.29	46.36	60	100	v. good, no blinding
1	BFP-159	S4-HC-15-OF	S4	6.31	Dev. E	700	21.34	46.02	60	100	v. good, no blinding
1	BFP-160	S4-HC-15-OF	S4	6.31	Dev. E	800	24.39	47.65	60	100	v. good, no blinding
1	BFP-161	S4-HC-15-OF	S4	6.31	Dev. E	900	27.43	50.19	60	100	v. good, no blinding
1	BFP-162	S4-HC-10-OF	S4	4.01	757	480	23.36	52.92	60	100	v. good, no blind
1	BFP-163	S4-HC-15-OF	S4	6.31	757	800	24.39	50.91	60	100	v. good, no blinding
1	BFP-164	H1S4A-01	S4	9.03	Dev. E	500	10.47	57.94	60	100	v. good, no blinding
1	BFP-165	H1S4A-01	S4	9.03	Dev. E	600	12.56	57.19	60	100	v. good, no blinding
1	BFP-166	H1S4A-01	S4	9.03	Dev. E	400	8.37	58.95	60	100	v. good, no sticking or blinding
1	BFP-167	H1S4A-01	S4	9.03	Dev. E	300	6.28	55.79	60	100	v. good, no sticking or blinding
1	BFP OF SS 01	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	100	1.71	NA	60	125	Incomplete
1	BFP OF SS 02	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	300	5.12	35.42	60	125	Poor
1	BFP OF SS 03	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	500	8.53	38.42	60	125	Poor
1	BFP OF SS 08	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	900	15.36	38.33	60	125	Poor
1	BFP OF SS 11	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	1500	25.60	47.47	60	125	Good
1	BFP OF SS 12	S2-2-HC-15-2 OF SS	S2	10.94	Dev. E	900	15.36	48.14	120	125	Good
1	BFP OF SS 04	S3-4-HC-15-1 OF SS	S3	14.45	Dev. E	1000	12.63	46.89	60	125	OK
1	BFP OF SS 05	S3-4-HC-15-1 OF SS	S3	14.45	Dev. E	1400	17.68	52.8	60	125	Very good
1	BFP OF SS 09	S3-4-HC-15-1 OF SS	S3	14.45	Dev. E	2000	25.26	52.65	60	125	Excellent
1	BFP OF SS 13	S3-4-HC-15-1 OF SS	S3	14.45	Dev. E	1000	12.63	54.59	120	125	Very Good
1	BFP OF SS 06	S3-4-HC-25-2 OF SS	S3	21.15	Dev. E	1400	11.54	46.33	60	125	Poor
1	BFP OF SS 07	S3-4-HC-25-2 OF SS	S3	21.15	Dev. E	1800	14.84	47.66	60	125	Poor
1	BFP OF SS 10	S3-4-HC-25-2 OF SS	S3	21.15	Dev. E	2500	20.61	51.97	60	125	Good
1	BFP OF SS 14	S3-4-HC-25-2 OF SS	S3	21.15	Dev. E	1800	14.84	54.39	120	125	Fair
2	PFP-1	H1S3-07	S3	14.62	Dev. E	600	7.48	65.75	60	100	Excellent, hard, solid cake.
2	PFP-2	H1S3-07	S3	14.62	Dev. E	600	7.48	61.23	30	100	Very good, less solid towards center
2	PFP-3	H1S3-07	S3	14.62	Dev. E	600	7.48	64.23	45	100	Excellent, hard, solids cake.
2	PFP-4	H1S2-09	S2	10.11	Dev. E	500	9.28	58.59	90	100	Excellent cake
2	PFP-5	H1S3-07	S3	14.62	Dev. E	600	7.48	62.18	45	100	solid
2	PFP-6	H1S2-09	S2	10.11	Dev. E	500	9.28		Terminated at 26:30 (insufficient feed)	100	N/A
2	PFP-7	H1S3-08	S3	12.33	Dev. E	600	9.00	62.76	45	100	solid
2	PFP-8	H1S2-10	S2	8.31	Dev. E	500	11.43	58.11	60	100	very good, slightly soft center
2	PFP-9	H1S3-08	S3	12.33	Dev. E	600	9.00	59.91	45	100	excellent, firm throughout
2	PFP-10	H1S2-10	S2	8.31	Dev. E	500	11.43		Terminated at 45 min (insufficient	100	N/A incomplete cake
2	PFP-11	H1S3-09	S3	9.88	Dev. E	600	11.42	67.16	45	100	excellent
2	PFP-12	H1S2-11	S2	8.94	Dev. E	500	10.58	61.22	90	100	excellent cake, firm
2	PFP-13	H1S2-11	S2	8.94	Dev. E	500	10.58	63.95	75	100	excellent
2	PFP-14	H1S3-09	S3	9.88	Dev. E	600	11.42	63.73	45	100	excellent
2	PFP-15	H1S3-09	S3	9.88	Dev. E	600	11.42	67.37	45	100	excellent
2	PFP-16	H1S2-12	S2	12.07	Dev. E	500	7.68	62.06	75	100	excellent
2	PFP-17	H1S3-11	S3	14.25	Dev. E	600	7.69	65.29	45	100	very good, slightly soft on top
2	PFP-18	H1S3-11	S3	14.25	Dev. E	600	7.69	63.61	45	100	excellent
2	PFP-19	H1S3-13	S3	14.5	Dev. E	600	7.55	67.8	45	100	excellent
2	PFP-20	H1S3-13	S3	14.5	Dev. E	600	7.55	65.09	45	100	excellent
2	PFP-21	H1S3-13	S3	14.5	Dev. E	600	7.55	63.07	45	100	excellent
2	PFP-22	H1S1-10	S1	3.15	Dev. E	60	3.74		120	100	incomplete
2	PFP-23	H1S1-11	S1	3.08	Dev. E	60	3.82		120	100	poor
2	PFP-24	H2S4B-03	S4	5.2	Dev. E	75	2.79		75	100	incomplete
2	PFP-25	H1S1-12	S1	2.56	Dev. E	60	4.61		150	100	incomplete
2	PFP-26	H2S4B-03	S4	3.62	Dev. E	75	4.05		60	100	incomplete
2	PFP-27	H2S4B-03	S4		Dev. E	75		39.1	180	100	fair, soft, incomplete top
2	PFP-28	H1S1-12	S1	2.56	Dev. E	60	4.61	68.6	300	100	fair, soft, incomplete top
2	PFP-29	H1S4B-05	S4	24.88	Dev. E	800	5.46	53.3	30	100	fair/good

Exhibit G.3.6 - Bench and Pilot Filter Press Results

Scale	Test ID	Slurry ID	Matrix	Feed %Solids	Polymer ID	Polymer Dose (ppm)	Polymer (lb/dryT)	Cake %Solids	Total Press Time (min)	Pressure (psi)	Cake Quality
2	PFP-30	H1S1-14	S1	3.46	Dev. E	60	3.40	60.7	126	100	incomplete, soft/wet tops
2	PFP-31	H1S4B-05	S4	24.88	Dev. E	800	5.46	52.72	30	100	fair/good
2	PFP-32	H1S4B-06	S4	24.1	Dev. E	800	5.67	58.56	60	100	very good, excellent
2	PFP-33	H1S1-15	S1	5.23	Dev. E	60	2.22	65.38	105	100	incomplete, soft/wet top
2	PFP-34	H1S4B-06	S4	24.1	Dev. E	800	5.67	58.33	45	100	excellent
2	PFP-35	H1S4B-06	S4	24.1	Dev. E	800	5.67	59.74	60	100	excellent
2	PFP-36	H1S4B-06	S4	24.1	Dev. E	800	5.67	59.62	60	100	excellent
2	PFP-37	H1S1-16	S1	2.86	Dev. E	60	4.12		120	100	incomplete
2	PFP-38	H1S4B-06	S4	24.1	Dev. E	800	5.67	59.35	60	100	excellent
2	PFP-39	H2S4B-06	S4	4.35	Dev. E	75	3.36	42.42	240	100	Fair
2	PFP-40	H2S4B-06	S4	4.35	Dev. E	75	3.36	51.45	180	100	good, soft, slightly wet top
2	PFP-41	H2S4B-08	S4	4.92	Dev. E	120	4.73	45.02	150	100	good, soft top
2	PFP-42	H2S4B-08	S4	4.92	Dev. E	120	4.73	48.28	180	100	good/fair, soft top
2	PFP-43	H2S4B-08	S4	4.92	Dev. E	120	4.73		130	100	poor, N/A, incomplete
2	PFP-44	H1S3-15	S3	13.48	Dev. E	600	8.17	62	60	100	excellent, dry
2	PFP-45	H1S2-13	S2	11.87	Dev. E	500	7.82	57.02	75	100	excellent
2	PFP-46	H1S3-15	S3	13.48	Dev. E	600	8.17	58.9	60	100	excellent, dry
2	PFP-47	H1S2-13	S2	11.87	Dev. E	500	7.82	59.24	75	100	excellent
2	PFP-48	H1S3-16	S3	15.89	Dev. E	600	6.82	68.14	55 min - terminated / equipment	100	excellent, dry, solid
2	PFP-49	H1S3-16	S3	15.89	Dev. E	600	6.82	66.55	45	100	excellent, solid
2	PFP-50	H1S3-16	S3	15.89	Dev. E	600	6.82	68.35	45	100	excellent
2	PFP-51	H1S2-14	S2	7.23	Dev. E	500	13.22	55.08	60	100	very good / excellent
2	PFP-52	H1S4B-07	S4	23.83	Dev. E	800	5.74	59.32	45	100	excellent
2	PFP-53	H1S4B-07	S4	23.83	Dev. E	800	5.74	59.08	45	100	excellent
2	PFP-54	H1S4B-07	S4	23.83	Dev. E	800	5.74	58.02	45	100	excellent
2	PFP-55	H1S4B-07	S4	23.83	Dev. E	800	5.74	57.35	45	100	excellent
2	PFP-56	H1S3-17	S3	18.04	Dev. E	600	5.92	69.14	60	100	excellent, crumbly
2	PFP-57	H1S4-03	S4	16.57	Dev. E	500	5.43	63.6	60	100	excellent, dry, sandy
2	PFP-58	H2S4B-08	S4	4.22	Dev. E	120	5.54	53.18	120	100	good, soft top and center
2	PFP-59	H1S4-03	S4	11.81	Dev. E	500	7.86	62.88	60	100	excellent
2	PFP-60	H1S4B-09	S4	23.94	Dev. E	800	5.71	60.56	45	100	excellent
2	PFP-61	H2S4B-08	S4	4.22	Dev. E	120	5.54		19	100	N/A
2	PFP-62	H1S4B-09	S4	23.94	Dev. E	800	5.71	57.69	45	100	excellent

Notes:
Scale "1" = Bench (Hockey pucks)
Scale "2" = Plate & Frame pilot
2.54 = Solids SpG.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.7a - Plate and Frame Filter Press Summary

Slurry ID	Test Number	Feed Solids (%)	Polymer Type	Polymer Dosage (ppm)	Press Time (Minutes)	Polymer Dosage (lb/dry T)	Cake Solids (%)
Plate and Filter Press Summary							
H1S1-12	PFP-28	2.56	Dev E	60	300	4.94	***68.60***
H1S1-14	PFP-30	3.46	Dev E	60	126	3.63	60.70
H1S1-15	PFP-33	5.23	Dev E	60	105	2.38	65.38
					H1S1 Avg.	**3.65**	**64.89**
H1S2-09	PFP-4	10.11	Dev E	500	90	9.93	58.59
H1S2-10	PFP-8	8.31	Dev E	500	60	12.23	58.11
H1S2-11	PFP-12	8.94	Dev E	500	90	11.32	61.22
H1S2-11	PFP-13	8.94	Dev E	500	75	11.32	***63.95***
H1S2-12	PFP-16	12.07	Dev E	500	75	8.22	62.06
H1S2-13	PFP-45	11.87	Dev E	500	75	8.37	57.02
H1S2-13	PFP-47	11.87	Dev E	500	75	8.37	59.24
H1S2-14	PFP-51	7.23	Dev E	500	60	14.15	55.08
					H1S2 Avg.	**10.49**	**59.41**
H1S3-07	PFP-1	14.62	Dev E	600	60	8.00	65.75
H1S3-07	PPF-2	14.62	Dev E	600	30	8.00	61.23
H1S3-07	PFP-3	14.62	Dev E	600	45	8.00	64.23
H1S3-07	PFP-5	14.62	Dev E	600	45	8.00	62.18
H1S3-08	PFP-7	12.33	Dev E	600	45	9.64	62.76
H1S3-08	PFP-9	12.33	Dev E	600	45	9.64	59.91
H1S3-09	PFP-11	9.88	Dev E	600	45	12.22	67.16
H1S3-09	PFP-14	9.88	Dev E	600	45	12.22	63.73
H1S3-09	PFP-15	9.88	Dev E	600	45	12.22	67.37
H1S3-11	PFP-17	14.25	Dev E	600	45	8.23	65.29
H1S3-11	PFP-18	14.25	Dev E	600	45	8.23	63.61
H1S3-13	PFP-19	14.50	Dev E	600	45	8.08	67.80
H1S3-13	PFP-21	14.50	Dev E	600	45	8.08	63.07
H1S3-13	PFP-20	14.50	Dev E	600	45	8.08	65.09
H1S3-15	PFP-44	13.48	Dev E	600	60	8.75	62.00
H1S3-15	PFP-46	13.48	Dev E	600	60	8.75	58.90
H1S3-16	PFP-48	15.89	Dev E	600	55	7.30	68.14
H1S3-16	PFP-49	15.89	Dev E	600	45	7.30	66.55
H1S3-16	PFP-50	15.89	Dev E	600	45	7.30	68.35
H1S3-17	PFP-56	18.04	Dev E	600	60	6.34	***69.14***
					H1S3 Avg.	**8.72**	**64.61**
H1S4-03	PFP-57	16.57	Dev E	500	60	5.81	***63.60***
H1S4-03	PFP-59	11.81	Dev E	500	60	8.41	62.88
					H1S4 Avg.	**7.11**	**63.24**

Exhibit G.3.7a - Plate and Frame Filter Press Summary

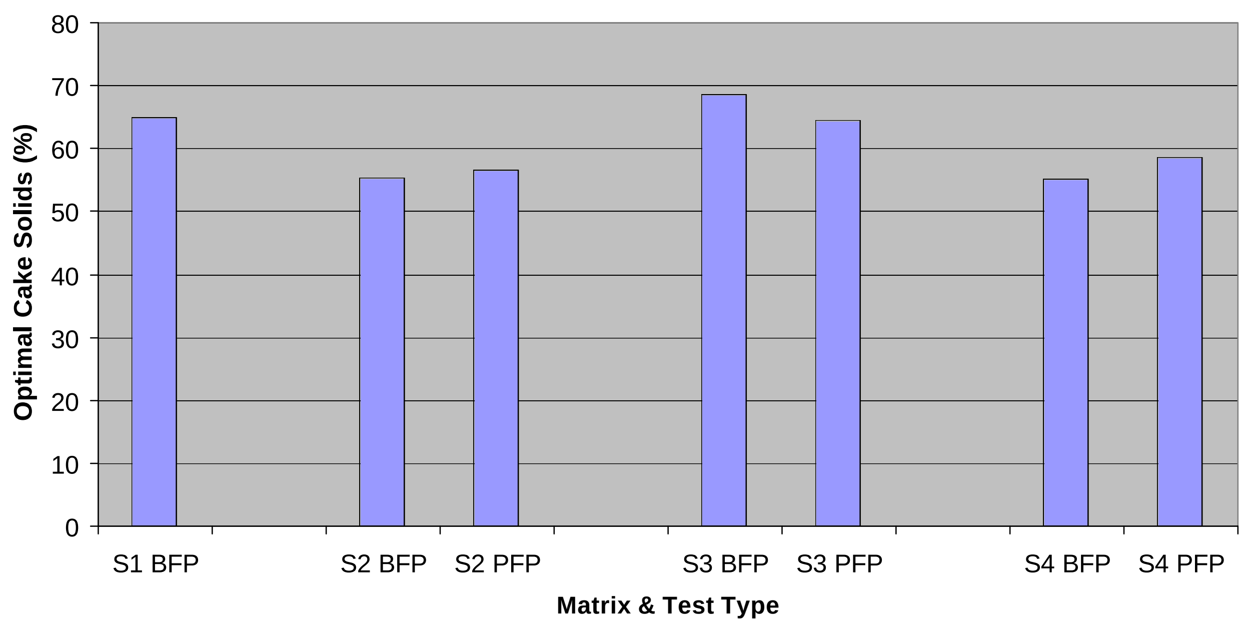
Slurry ID	Test Number	Feed Solids (%)	Polymer Type	Polymer Dosage (ppm)	Press Time (Minutes)	Polymer Dosage (lb/dry T)	Cake Solids (%)
Plate and Filter Press Summary (Cont'd)							
H1S4B-05	PFP-29	24.88	Dev E	800	30	5.84	53.30
H1S4B-05	PFP-31	24.88	Dev E	800	30	5.84	52.72
H1S4B-06	PFP-32	24.10	Dev E	800	60	6.07	58.56
H1S4B-06	PFP-34	24.10	Dev E	800	45	6.07	58.33
H1S4B-06	PFP-35	24.10	Dev E	800	60	6.07	59.74
H1S4B-06	PFP-36	24.10	Dev E	800	60	6.07	59.62
H1S4B-06	PFP-38	24.10	Dev E	800	60	6.07	59.35
H1S4B-07	PFP-52	23.83	Dev E	800	45	6.15	59.32
H1S4B-07	PFP-53	23.83	Dev E	800	45	6.15	59.08
H1S4B-07	PFP-54	23.83	Dev E	800	45	6.15	58.02
H1S4B-07	PFP-55	23.83	Dev E	800	45	6.15	57.35
H1S4B-09	PFP-60	23.94	Dev E	800	45	6.11	***60.56***
H1S4B-09	PFP-62	23.94	Dev E	800	45	6.11	57.69
					H1S4B Avg.	**6.06**	**57.97**
H2S4B-03	PFP-27	3.62	Dev E	75	180	4.34	39.10
H2S4B-06	PFP-39	4.35	Dev E	75	240	3.59	42.42
H2S4B-06	PFP-40	4.35	Dev E	75	180	3.59	51.45
H2S4B-08	PFP-41	4.92	Dev E	120	150	5.06	45.02
H2S4B-08	PFP-42	4.92	Dev E	120	180	5.06	48.28
H2S4B-08	PFP-58	4.22	Dev E	120	120	5.93	***53.18***
					H2S4B Avg.	**4.60**	**46.58**
H1S4A-09	PFP-63	14.12	Dev E	600	60	8.31	69.33
H1S4A-03	PFP-64	12.15	Dev E	600	45	9.79	64.32
H1S4A-03	PFP-65	12.15	Dev E	600	60	9.79	66.52
H1S4A-05	PFP-67	16.30	Dev E	600	45	7.10	77.15
H1S4A-04	PFP-68	15.48	Dev E	600	60	7.52	69.71
H1S4A-05	PFP-69	16.30	Dev E	600	60	7.10	76.84
H1S4A-04	PFP-70	15.48	Dev E	600	60	7.52	70.90
H1S4A-05	PFP-71	16.30	Dev E	600	60	7.10	***78.69***
H1S4A-04	PFP-72	15.48	Dev E	600	60	7.52	76.15
H1S4A-05	PFP-73	16.30	Dev E	600	60	7.10	73.47
H1S4A-04	PFP-74	15.48	Dev E	600	60	7.52	76.96
H1S4A-05	PFP-75	16.30	Dev E	600	60	7.10	74.57
H1S4A-04	PFP-76	15.48	Dev E	600	30	7.52	77.56
H1S4A-06	PFP-77	18.31	Dev E	600	60	6.23	77.34
H1S4A-06	PFP-78	18.31	Dev E	600	60	6.23	74.47
H1S4A-06	PFP-79	18.31	Dev E	600	60	6.23	75.37
H1S4A-06	PFP-80	18.31	Dev E	600	60	6.23	69.88
					H1S4A Avg.	**7.41**	**73.48**
					OVERALL AVG.	**7.47**	**63.35**

Notes:
2.54 =SpG (gm/mL) solids
1.07 =SpG (gm/mL) polymer
1. Dev E is Developmental E polymer from GE Water.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.7b - Comparison of Bench-Scale and Pilot-Scale Filter Press Optimal Results

Scale	Test ID	Matrix	Feed %Solids	Polymer ID	Polymer (lb/dryT)	Cake %Solids	Cake PFP/BFP
1	BFP	S1 BFP	4.1	Dev. E	2.9	64.9	--
1	BFP	S2 BFP	7.0	Dev. E	11.0	55.3	
2	PFP	S2 PFP	7.8	Dev. E	12.9	56.6	**1.02**
1	BFP	S3 BFP	13.2	Dev. E	5.7	68.5	
2	PFP	S3 PFP	13.8	Dev. E	8.9	64.6	**0.94**
1	BFP	S4 BFP	10.6	Dev. E	6.8	55.1	
2	PFP	S4 PFP	22.6	Dev. E	6.7	58.7	**1.07**



Notes:
Scale "1" = Bench (Hockey pucks)
Scale "2" = Plate & Frame pilot
Data collection includes Dev E polymer, 100 psi, and 30-60 min runs.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.8 - Bench-Scale Filter Press of Hydrocyclone Overflows

Test ID	Slurry ID	Feed % Solids	Polymer	Dose (ppm)	Time / Pressure	w/w Dose (#/dryT)	Cake % Solids	Cake Quality
Filter Press of Hydrocyclone Overflows								
BFP OF SS 01	S2-2-HC-15-2 OF SS	10.94	Dev "E"	100	60 min / 125 psi	1.83	N/A	Incomplete
BFP OF SS 02	S2-2-HC-15-2 OF SS	10.94	Dev "E"	300	60 min / 125 psi	5.48	35.42	Poor
BFP OF SS 03	S2-2-HC-15-2 OF SS	10.94	Dev "E"	500	60 min / 125 psi	9.13	38.42	Poor
BFP OF SS 08	S2-2-HC-15-2 OF SS	10.94	Dev "E"	900	60 min / 125 psi	16.44	38.33	Poor
BFP OF SS 11	S2-2-HC-15-2 OF SS	10.94	Dev "E"	1500	60 min / 125 psi	27.40	47.47	Good
BFP OF SS 12	S2-2-HC-15-2 OF SS	10.94	Dev "E"	900	120 min / 125 psi	16.44	48.14	Good
BFP OF SS 04	S3-4-HC-15-1 OF SS	14.45	Dev "E"	1000	60 min / 125 psi	13.51	46.89	OK
BFP OF SS 05	S3-4-HC-15-1 OF SS	14.45	Dev "E"	1400	60 min / 125 psi	18.92	52.80	Very good
BFP OF SS 09	S3-4-HC-15-1 OF SS	14.45	Dev "E"	2000	60 min / 125 psi	27.02	52.65	Excellent
BFP OF SS 13	S3-4-HC-15-1 OF SS	14.45	Dev "E"	1000	120 min / 125 psi	13.51	54.59	Very Good
BFP OF SS 06	S3-4-HC-25-2 OF SS	21.15	Dev "E"	1400	60 min / 125 psi	12.35	46.33	Poor
BFP OF SS 07	S3-4-HC-25-2 OF SS	21.15	Dev "E"	1800	60 min / 125 psi	15.88	47.66	Poor
BFP OF SS 10	S3-4-HC-25-2 OF SS	21.15	Dev "E"	2500	60 min / 125 psi	22.05	51.97	Good
BFP OF SS 14	S3-4-HC-25-2 OF SS	21.15	Dev "E"	1800	120 min / 125 psi	15.88	54.39	Fair
BFP-148	S4-HC-10-OF	4.011	Dev "E"	100	60	5.21	N/A	N/A
BFP-149	S4-HC-10-OF	4.011	Dev "E"	130	60	6.77	N/A	N/A
BFP-150	S4-HC-10-OF	4.011	Dev "E"	220	60	11.45	36.61	N/A
BFP-151	S4-HC-10-OF	4.011	Dev "E"	280	60	14.58	37.41	N/A
BFP-152	S4-HC-10-OF	4.011	Dev "E"	380	60	19.78	48.69	N/A
BFP-153	S4-HC-10-OF	4.011	Dev "E"	450	60	23.43	50.26	N/A
BFP-154	S4-HC-10-OF	4.011	Dev "E"	480	60	24.99	54.39	N/A
BFP-155	S4-HC-10-OF	4.011	Dev "E"	550	60	28.63	54.38	N/A
BFP-156	S4-HC-15-OF	6.31	Dev "E"	400	60	13.05	35	N/A
BFP-157	S4-HC-15-OF	6.31	Dev "E"	500	60	16.31	40.5	N/A
BFP-158	S4-HC-15-OF	6.31	Dev "E"	600	60	19.57	46.36	N/A
BFP-159	S4-HC-15-OF	6.31	Dev "E"	700	60	22.83	46.02	N/A

Notes:
2.54 =SpG (gm/mL) solids
1.07 =SpG (gm/mL) polymer
1. Dev E is Developmental E polymer from GE Water.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.9 - Cake Release Screening Data

BFP Test #	Slurry ID	Polymer ID	Dosage (ppm)	Filter Cloth	Filter Cloth Porosity	Filter Press			
						Time (min)	Total Filtrate Volume (mL)	% Solids (w/w)	Observations
BFP-80	H1S3-06	Dev E	400	85X	0.5-1 CFM	60	253	72.75	v. good/exc. cake, v. good release, no blinding; no sediment in filtrate, but sl. Cloudy at first, then clear. Sl. lt. brown in color.
BFP-79	H1S3-06	Dev E	400	85X/5	4-6 CFM	60	273	70.44	good cake w/ sl.soft top, good release, no blinding, initial filtrate discharge was dirty with sediment, then clear and sl. yellow.
BFP-81	H1S3-06	Dev E	400	855X/10	8-12 CFM	60	163	72.73	good cake, good release, no blinding; initial filtrate was dirty with sediment, very cloudy, then clear.
BFP-82	H1S3-06	Dev E	400	85X/15	15 CFM	60	299	69.16	v. good cake, good release, no blinding; initial filtrate dirty with sediment, remained somewhat cloudy with a lt. brown tinge.
BFP-85	H1S2-07	757	300	85X	0.5-1 CFM	60	362	55.60	good cake, sl. soft top, v. good release, no blinding; Filtrate sl. yellow and clear.
BFP-87	H1S2-07	757	300	85X/5	4-6 CFM	60	330	54.70	good cake, sl. soft top, v. good release, no blinding; Initial filtrate had sediment, then sl. cloudy and lt. brown, then sl. yellow and clear.
BFP-86	H1S2-07	757	300	855X/10	8-12 CFM	60	361	57.26	v. good cake, sl. soft top, excellent release, no blinding; Initial filtrate was dirty and brown with sediment, then sl. yellow and cloudy with sl. sediment.
BFP-88	H1S2-07	757	300	85X/15	15 CFM	60	317	59.24	v.good cake, v.sl.soft top, good release, no blinding; Initial filtrate had sediment, then sl. cloudy and yellow, then got clearer and less yellow.

Exhibit G.3.10 - Multiple Regression of Pooled Filter Press Test Data

203 data sets
Cake = Percent solids
Feed = Initial slurry Percent solids
Dose = Polymer dose in Pounds per dry ton of solids
Fines = 1, 2, 3, or 4 representing S1, S2, S3, or S4 sediment types
Scale = 1 (bench scale hockey pucks) or 2 (Plate & frame tests)

Regression Analysis: Cake versus Fines, Feed, Dose, Scale

```
The regression equation is
Cake = 60.7 - 4.34 Fines + 0.488 Feed + 0.0408 Dose + 2.86 Scale

Predictor     Coef  SE Coef      T      P
Constant    60.705    1.850  32.82  0.000
Fines      -4.3446   0.4810  -9.03  0.000
Feed       0.48789  0.06365   7.67  0.000
Dose       0.04085  0.05843   0.70  0.485
Scale        2.864    1.024   2.80  0.006

S = 6.22183   R-Sq = 38.0%   R-Sq(adj) = 36.7%

Analysis of Variance

Source           DF       SS      MS      F      P
Regression        4   4694.2  1173.6  30.32  0.000
Residual Error  198   7664.8    38.7
Total           202  12359.1
```

Comments:
Overall R-sq of 38% is not a strong relationship. However, analysis of individual predictors is of interest.

The “Fines” factor was the strongest predictor (highest T). The regression equation suggests that S2 sediments produce about 4.3%-points lower cake solids than corresponding S1 sediments, with similar drops for S3 from S2 and S4 from S3.

The Feed solids was the next strongest predictor. The regression equation suggests that a 1% increase in feed solids should produce a 0.5%-point increase in cake solids.

The Dose factor was not statistically significant. The data set includes a variety of different polymers, although most were Poly-DADMACs. Most dosages attempted to seek the optimum, with dosages slightly below and above optimum. The dose/performance relationship increases to the optimum, with falling performance at dosages above the optimum. Therefore, the dose factor would not be expected to follow a linear regression relationship.

It was interesting that the “Scale” factor was statistically significant. The regression equation would suggest that Plate & Frame tests produce cake solids 2.9%-points higher than corresponding hockey puck tests.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.11 - Plate and Frame Filter Press Filtrate Sample Data

Sample ID	Date Collected	Total PCBs (mg/L)	PCB Qualifier	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	pH (pH Units)
PFP-01-5 TO 30	7/27/2004	0.01	J	NA	NA	37.6	NA
PFP-01-5 TO 30-DUP	7/27/2004	NA		NA	NA	40.8	NA
PFP-01-30	7/27/2004	0.014		NA	NA	7.8	NA
PFP-01-30 TO 60	7/27/2004	0.0038		NA	NA	4.6	NA
PFP-04-5 TO 30	7/28/2004	0.038		NA	NA	4.8	NA
PFP-04-30	7/28/2004	0.031		NA	NA	2	NA
PFP-04-30 TO 60	7/28/2004	0.036		NA	NA	2	NA
PFP-04-60	7/28/2004	0.046		NA	NA	2	NA
PFP-04-60 TO 90	7/28/2004	0.037		NA	NA	2	NA
PFP-17-FILTRATE	8/3/2004	0.0048		5.51	NA	5.31	7.01
PFP-17-FILTRATE-DUP	8/3/2004	0.0051		7.14	NA	7.07	7.02
PFP-28-FILTRATE	8/9/2004	0.00052		3.7	3.63	2	NA
PFP-28-FILTRATE-DUP	8/9/2004	0.00043		3.59	3.65	2	NA
PFP-35-FILTRATE	8/10/2004	0.011		12.9	11.6	38.6	NA
PFP-35-FILTRATE-DUP	8/10/2004	0.0087		13.8	12.2	42.4	NA
	Min:	0.00043		3.59	3.63	2	
	Average:	0.0176		7.77	7.77	13.40	
	Max:	0.0460		13.80	12.20	42.40	

Notes:
1. Samples were collected by Blasland, Bouck & Lee, Inc. (BBL), and were submitted to Northeast Analytical Services, Inc. for analysis.
2. U = Indicates the constituent was not detected. The value preceding the U indicates the laboratory quantitation limit.
3. As specified in the Treatability Studies Work Plan (BBL, 2004), data validation was performed on approximately 10% of the analytical data set.
4. NA - Not analyzed.
5. mg/L = milligrams per liter.
6. Laboratory Data Qualifiers
   Organics (PCBs)
   J - Indicates an estimated value.

Exhibit G.3.12 - Belt Filter Press and Centrifuge Summary

Slurry ID	Test Number	Feed Solids (%)	Polymer Type	Polymer Dosage (ppm)	Test Conditions (Cycles at 25 psi for 15 Seconds)	Polymer Dosage (lb/dry T)	Cake Solids (%)
Belt Filter Press Summary							
H1S3-12	BP-4	14.61	2651	800	4	10.68	53.47
H1S3-12	BP-5	14.61	2651	850	4	11.35	56.78
H1S3-12	BP-6	14.61	2651	900	4	12.02	59.53
H1S3-14	BP-13	14.36	4440	1,300	4	17.69	53.21
H1S3-14	BP-14	14.36	4440	1,350	4	18.37	53.61
H1S3-14	BP-15	14.36	4440	1,400	4	19.05	54.28
H1S3-14	BP-16	14.36	4808	1,200	4	16.33	60.61
H1S3-14	BP-17	14.36	4808	1,250	4	17.01	60.72
H1S3-14	BP-18	14.36	4808	1,300	4	17.69	***61.17***
H1S3-14	BP-20	14.36	4808	1,250	8	17.01	59.68
					H1S3 Avg.	**15.7**	**57.3**
H1S4B-03	BP-1	24.84	4808	2,350	4	17.20	50.27
H1S4B-03	BP-2	24.84	4808	2,400	4	17.56	48.59
H1S4B-03	BP-3	24.84	4808	2,450	4	17.93	49.42
H1S4B-04	BP-7	24.90	4440	1,950	4	14.23	43.72
H1S4B-04	BP-8	24.90	4440	2,000	4	14.59	45.91
H1S4B-04	BP-9	24.90	4440	2,050	4	14.96	45.66
H1S4B-04	BP-10	24.90	2651	1,950	4	14.23	***51.19***
H1S4B-04	BP-11	24.90	2651	2,000	4	14.59	49.61
H1S4B-04	BP-12	24.90	2651	2,050	4	14.96	50.02
H1S4B-04	BP-19	24.90	2651	1,950	8	14.23	49.20
H1S4B-04	BP-21	24.90	4440	2,700	4	19.70	48.46
H1S4B-04	BP-22	24.90	4440	2,800	4	20.43	47.77
H1S4B-04	BP-23	24.90	4440	2,900	4	21.16	48.10
					H1S4B Avg.	**16.6**	**48.3**
					OVERALL AVG.	**16.2**	**52.2**

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.3.12 - Belt Filter Press and Centrifuge Summary

Slurry ID	Test Number	Feed Solids (%)	Polymer Type	Polymer Dosage (ppm)	Spin RPM/Time (Minutes)	Polymer Dosage (lb/dry T)	Cake Solids (%)
Centrifuge Summary							
H1S3-08	CF-13	12.33	none	0	3,500/3	0.00	41.33
H1S3-08	CF-16	12.33	none	0	3,500/5	0.00	48.61
H1S3-12	CF-19	14.61	4440	650	3,500/5	8.68	53.05
H1S3-12	CF-20	14.61	4440	700	3,500/5	9.35	50.29
H1S3-12	CF-21	14.61	4440	750	3,500/5	10.01	52.35
H1S3-12	CF-22	14.61	2651	750	3,500/5	10.01	59.30
H1S3-12	CF-23	14.61	2651	800	3,500/5	10.68	***61.20***
H1S3-12	CF-24	14.61	2651	850	3,500/5	11.35	59.04
H1S3-12	CF-25	14.61	4808	1,200	3,500/5	16.02	53.20
H1S3-12	CF-26	14.61	4808	1,250	3,500/5	16.69	55.94
H1S3-12	CF-27	14.61	4808	1,300	3,500/5	17.36	59.05
					H1S3 Avg.	**10.0**	**53.9**
H1S4B-03	CF-01	24.84	4808	2,350	3,500/5	17.20	47.78
H1S4B-03	CF-02	24.84	4808	2,400	3,500/5	17.56	47.95
H1S4B-03	CF-03	24.84	4808	2,450	3,500/5	17.93	47.42
H1S4B-03	CF-04	24.84	4440	1,950	3,500/5	14.27	46.13
H1S4B-03	CF-05	24.84	4440	2,000	3,500/5	14.64	46.54
H1S4B-03	CF-06	24.84	4440	2,050	3,500/5	15.00	46.75
H1S4B-03	CF-07	24.84	2651	1,950	3,500/5	14.27	49.31
H1S4B-03	CF-08	24.84	2651	2,000	3,500/5	14.64	51.97
H1S4B-03	CF-09	24.84	2651	2,050	3,500/5	15.00	***53.24***
H1S4B-03	CF-10	24.84	4808	2,400	3,500/3	17.56	46.97
H1S4B-03	CF-11	24.84	4440	2,000	3,500/3	14.64	45.83
H1S4B-03	CF-12	24.84	2651	2,000	3,500/3	14.64	47.70
H1S4B-03	CF-14	24.84	none	0	3,500/3	0.00	36.48
H1S4B-03	CF-17	24.84	none	0	3,500/5	0.00	38.65
					H1S4B Avg.	**13.4**	**46.6**
H2S4B-01	CF-15	3.37	none	0	3,500/3	0.00	34.43
H2S4B-01	CF-18	3.37	none	0	3,500/5	0.00	***37.89***
					H2S4B Avg.	**0.0**	**36.2**
					OVERALL AVG.	**11.0**	**48.8**

Notes:
2.54 =SpG (gm/mL) solids
1.07 =SpG (gm/mL) polymer
1. Dev E is Developmental E polymer from GE Water.
2. 2651 is Novus CE2651 polymer from GE Water.
3. 4440 and 4808 are polymers from Kemira (formerly Vulcan Chemicals).

Exhibit G.4

Water Treatment System Calculations
Includes:
Equalization Tank
Rapid Mix and Flocculation Tank Clarifier
Multi-Media Filter System
Granular Activated Carbon System

Exhibit G.4.1

Process and Storm Water Treatment, Design Calculations

Equalization Tank

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson River – Process Water Equalization Tank	20437	MMR	8/4/05	1

CALCS. BY MMR ; DATE 8/4/05 CHECKED BY [illegible] ; DATE 8/8/05

1.) Water Treatment plant design flow will be 1000 gpm and Equalization Tank retention time will be 1 hour.

$$= \frac{1000 \text{ gal}}{\text{min}} \times 60 \text{ min retention time} = \boxed{60{,}000 \text{ gal}}$$

Therefore, a 60,000 gallon tank would be required for a 1000 gpm flow rate with a 1 hour retention time.

Rapid Mix and Flocculation Tank

1.) Water treatment plant design flow will be 1000gpm. Flow will be divided into two separate trains at 500gpm a piece entering a Rapid/mix & Flocculation Tank. Each tank consists of two chambers, the first being the Rapid/Mix chamber and the second being a Flocculation chamber. The retention time in chamber 1 will be 3min and the retention time in chamber 2 will be 5min.

Chamber 1 $= 500 \frac{gal}{Min} \times 3 min = 1500 gal$

Chamber 2 $= 500 \frac{gal}{Min} \times 5 min = 2500 gal$

Therefore, chamber 1 of the Rapid/Mix section of the tank will be 1500 gal and chamber 2 of the tank, the flocculation section, will be 2500 gal. Giving a combined total of 4,000 gal for the entire tank.

Clarifier

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson River – Inclined Plate Clarifier	20437	MMR	8/4/05	

CALCS. BY MMR ; DATE 8/4/05 CHECKED BY [illegible] ; DATE 8/8/05

(1.) Water treatment plant design flow will be 1000 gpm. Flow will be divided into two seperate trains at 500 gpm apiece going into the Inclined Plate clarifiers. Each clarifier is designed for 500 gpm of flow and the maximum required hydraulic loading rate is 0.23 gpm/SF Ellis corporation) to 0.25 gpm/SF (Parkson).

Hydraulic Loading Rate

$0.23 \frac{gpm}{SF}$ $\frac{500\ gpm}{0.23 \frac{gpm}{SF}} =$ **2000 SF** required settling area

$0.25 \frac{gpm}{SF}$ $\frac{500\ gpm}{0.25 \frac{gpm}{SF}} =$ **2200 SF** required settling area

Multimedia Filter System

1.) Flow rate entering the Multi Media filters will be divided into two separate trains of 250 gpm apiece. Each vessel will be 108" diameter, which is appoximately 64 square ft (SF).

Per US Filter, the recommended design loading rate is 5 gpm/SF, the recommended maximum loading rate is 9 gpm/SF and the minimum loading rate is 2 gpm/SF

Design Flow

$$\frac{250 \text{ gpm}}{64 \text{ SF}} = \boxed{3.9 \text{ gpm/SF}}$$ when operating in parallel.

Maximum Flow

$$\frac{500 \text{ gpm}}{64 \text{ SF}} = \boxed{7.8 \text{ gpm/SF}}$$ when total flow is going to only one filter (during backwash event)

Minimum Flow

$$64 \text{ SF} \times \frac{2 \text{ gpm}}{\text{SF}} = \boxed{128 \text{ gpm}}$$ – ... drop ... on-line

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - MULTI-MEDIA FILTER System	20437	TEM	8/5/05	2/2

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY SRO ; DATE 8/8/05

② Estimated Backwash Water Volume Generated

Each MULTI-MEDIA FILTER WILL BE BACKWASHED AS DICTATED BY DIFFERENTIAL PRESSURE DROP However, it is assummed that each vessel will be backwashed once per day during normal OPERATIONS.

Hydraulic Loading rate required during backwashing

$$= \frac{15\ gpm}{SF} \times \frac{64\ SF}{Vessel} \cong \frac{1,000\ gpm}{vessel}$$

Recommended Backwash Time ≈ 15 minutes

Required Backwash Water Volume / Vessel = 1,000 x 15

= 15,000 GALLONS

Required backwash water available if backwashing all eight (process water + stormwater) multi-media vessels =

= 8 x 15,000 gallons = **120,000 GALLONS**

Granular Activated Carbon System

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE Hudson River - Granular Activated Carbon	20437	MMR	8/4/05	

CALCS. BY MMR ; DATE 8/4/05 CHECKED BY [illegible] ; DATE 8/8/05

1.) The recommended empty bed contact time for PCB treatment is 20minutes per vessel (us filter Westates Carbon)

Each carbon vessel contains 20,000 lbs of granular activated carbon and a carbon bed volume of 702 ft³.

Therefore:

$$702\ ft^3 \times \frac{7.4805\ gal}{ft^3} = 5251\ gal$$

The maximum allowable flowrate to one 20,000 lbs vessel is:

$$\frac{5251\ gal}{vessel} \times \frac{1}{20 min} = 262\ gpm/vessel$$

Each 500 gpm water treatment train will consist of (2) primary 20,000 lbs granular activated carbon vessel operating in parallel. Each primary vessel will be paired with one 20,000 lbs granular activate carbonvessel operating in series for 100% redundancy.

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
PLANT WATER NEEDS	20437	ORO	8/11/05	

CALCS. BY ______ ; DATE ______ CHECKED BY ______ ; DATE ______

I, Waterfront
- Haul Truck decontamination
  - 5 trucks × 3 trips/hr × 24 hrs = 360 loads × 25 gal = 9,000 gpd.
- NYSCC vehicle washes
  - 3 per shift × 2 × 25 gal = 150 gpd.
- NYSCC vehicle crossing area
  - 3 per shift × 2 × 50 gal = 300 gpd.
- Trommel screen & slurry tank (use process recycle water)

II Thickening & Dewatering
- Polymer makeup ~~& feed~~ - 1,000 gpd × 2 = 2,000 gpd
- Polymer feed dilution - 4 gpm × 2 = 12,000 gpd
- Flocculant makeup - 1,000 gpd × 2 = 2,000 gpd
- Flocculant feed - 4 gpm × 2 = 12,000 gpd
- Dewatering polymer - 2,000 gpd × 4 = 8,000 gpd
- Filter wash water - 5 gpm × 4 = 29,000 gpd
- Misc washdown - 3 gpm = 4,300 gpd

III Water Treatment
- Polymer makeup - 4,000 × 2 = 8,000 gpd
- Misc. washdown - 3 gpm × 3 = 13,000 gal.

IV Railyard Staging
- Haul truck decontamination
  - 5 trucks × 3 trips/hr × 24 hrs = 360 × 25 = 9,000 gpd
  - 2 rolloff trucks × 100 loads × 25 gal = 5,000 gpd
- Misc. washwater - 5 gpm × 5 = 36,000 gpd
- Rail car decontam.
  - 81 + 81 = 162/wk × 50 gal ÷ 6 d/wk = 1,500 gpd

V Admin.
- Misc. decontamination - 5 gpm × 3 = 22,000 gpd

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.2 - Settled Filtrate from Pilot Plate & Frame Filter Press

Sample ID:	H1S1 SETTLED FILTRATE TOP	H1S2 SETTLED FILTRATE TOP	H1S3 SETTLED FILTRATE TOP	H1S4B SETTLED FILTRATE TOP	H2S4B SETTLED FILTRATE TOP
Date Collected:	**9/2/2004**	**9/2/2004**	**9/2/2004**	**9/2/2004**	**9/2/2004**
Total PCBs	0.000080 J	0.00098	0.000040 J	0.0011	0.00033
Total Suspended Solids	1.96 U	2.25 U	1.96 U	13.1	1.96 U
Total TEQs (WHO TEFs)	0.0000000625	0.0000000615	0.0000000266	0.0000000616	0.0000000497
Cadmium	0.00100 U	0.000230 B	0.00100 U	0.000300 B	0.00100 U
Chromium	0.00180 B	0.00240	0.00240	0.00560	0.00200
Copper	0.00190 B	0.00250	0.00240	0.00220	0.00110 B
Lead	0.000180 B	0.000320 B	0.000260 B	0.00250	0.000370 B
Mercury	0.000200 U	0.000200 U	0.000200 U	0.000200 U	0.000200 U

Notes:
1. All results as milligrams per liter (mg/L).
2. This table is condensed from Table 23 of IDR Attachment 4 (Treatability Studies Report).
3. Samples were collected by Blasland, Bouck & Lee, Inc. (BBL), and were submitted to Severn Trent Laboratories, Inc., Pittsburgh; Paradigm Analytical Laboratories; and Northeast Analytical Services, Inc. for analysis.
4. U = Indicates the constituent was not detected. The value preceding the U indicates the laboratory quantitation limit.
5. As specified in the Treatability Studies Work Plan (BBL, 2004), data validation was performed on approximately 10% of the analytical data set.
6. NA - Not analyzed.
7. Laboratory Data Qualifiers:
   Organics (PCBs, PCDD/PCDFs)
      J - Indicates an estimated value.
   Inorganics (TAL Metals)
      B - Indicates an estimated value between the lower calibration limit and the target detection limit.

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.3 - Process Water Filtration & Carbon Adsorption

Sample ID:	WQC	H1S1 MMFIN	H1S1 MMFOUT2	H1S1 BETGAC2	H1S1 GAC2OUT2
Date Collected:		**9/7/2004**	**9/7/2004**	**9/7/2004**	**9/7/2004**
Total PCB	0.0003	0.0000220 J	0.0000125 J	NA	NA
Total PAHs		0.00943 U	0.00926 U	0.00980 U	0.00962 U
Ammonia Nitrogen		0.510	0.410	0.370	0.300
BOD (five day)		2 U	2 U	2 U	2 U
COD		8	8	5U	5U
Nitrate		1.1	0.80	0.20	0.20 U
Nitrite		0.020	0.010	0.010	0.010
Total Organic Carbon		0.966 U	0.966 U	0.966 U	0.966 U
Dissolved Organic Carbon		0.97 U	2.6	0.97 U	0.97 U
Total Kjeldahl Nitrogen		0.680	0.650	0.370	0.330
Total Phosphorous (PO4)		0.0500 U	0.0500 U	0.0500 U	0.0500 U
Total Suspended Solids	50	2.20	0.952 U	1.24	0.952 U
Total TEQs (WHO TEFs)		0.0000000448	0.0000000611	0.0000000625	0.0000000625
Cadmium	0.04	0.00100 U	0.00100 U	0.00100 U	0.00100 U
Chromium	0.21	0.00210	0.00220	0.00140 B	0.00150 B
Copper	0.136	0.0141	0.00590	0.000760 B	0.00190 B
Lead	0.038	0.0181	0.00230	0.000920 B	0.000490 B
Mercury	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S1 MMFOUT6	H1S1 BETGAC6	H1S1 GAC2OUT6
Date Collected:			**9/7/2004**	**9/7/2004**	**9/7/2004**
Total PCB	0.0003		0.0000156 J	0.00000934 U	0.00000934 U
Total PAHs			0.0100 U	0.00926 U	0.00926 U
Ammonia Nitrogen			0.430	0.390	0.410
BOD (five day)			2 U	2 U	2 U
COD			11	5U	5U
Nitrate			0.90	0.20 U	0.20 U
Nitrite			0.010	0.010	0.010 U
Total Organic Carbon			2.62	0.966 U	0.966 U
Dissolved Organic Carbon			2.6	0.97 U	0.97 U
Total Kjeldahl Nitrogen			0.690	0.440	0.330
Total Phosphorous (PO4)			0.0500 U	0.110	0.0500
Total Suspended Solids	50		0.952 U	0.952 U	0.952 U
Total TEQs (WHO TEFs)			0.0000000620	0.0000000509	0.0000000615
Cadmium	0.04		0.00100 U	0.00100 U	0.00100 U
Chromium	0.21		0.00180 B	0.00100 B	0.000950 B
Copper	0.136		0.00650	0.000500 B	0.000680 B
Lead	0.038		0.00180	0.000800 B	0.000550 B
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S1 MMFOUT10	H1S1 BETGAC10	H1S1 GAC2OUT10
Date Collected:			**9/7/2004**	**9/7/2004**	**9/7/2004**
Total PCB	0.0003		0.0000766	NA	NA
Total PAHs			0.00926 U	0.00980 U	0.00926 U
Ammonia Nitrogen			0.400	0.430	0.380
BOD (five day)			2 U	2 U	2 U
COD			7	5U	5U
Nitrate			0.90	0.20 U	0.20 U
Nitrite			0.010	0.010	0.010
Total Organic Carbon			2.60	0.966 U	0.966 U
Dissolved Organic Carbon			2.6	0.97 U	0.97 U
Total Kjeldahl Nitrogen			0.610	0.360	0.340
Total Phosphorous (PO4)			0.0500 U	0.100	0.0900
Total Suspended Solids	50		0.952 U	0.952 U	0.952 U
Total TEQs (WHO TEFs)			0.0000000624	0.0000000625	0.0000000502
Cadmium	0.04		0.00100 U	0.00100 U	0.00100 U
Chromium	0.21		0.00130 B	0.00110 B	0.00100 B
Copper	0.136		0.00780	0.000630 B	0.000480 B
Lead	0.038		0.00190	0.000900 B	0.000670 B
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.3 - Process Water Filtration & Carbon Adsorption

Sample ID:	WQC	H1S2 MMFIN	H1S2 MMFOUT2	H1S2 BETGAC2	H1S2 GAC2OUT2
Date Collected:		**9/14/2004**	**9/14/2004**	**9/14/2004**	**9/14/2004**
Total PCB	0.0003	0.0000562	NA	NA	NA
Total PAHs		0.00926 U	0.00926 U	0.00926 U	0.00943 U
Ammonia Nitrogen		5.75	5.62	5.52	5.03
BOD (five day)		2	2 U	2 U	2 U
COD		14	17	5U	5U
Nitrate		0.20 U	0.20 U	0.20 U	0.20 U
Nitrite		0.020	0.010	0.010 U	0.010 U
Total Organic Carbon		4.13	3.85	0.966 U	0.966 U
Dissolved Organic Carbon		3.8	4.2	0.97 U	0.97 U
Total Kjeldahl Nitrogen		6.23	5.83	5.54	5.07
Total Phosphorous (PO4)		0.0500 U	0.0500 U	0.120	0.0800
Total Suspended Solids	50	5.97	1.00	1.00 U	1.00 U
Total TEQs (WHO TEFs)		0.0000000248	NA	NA	NA
Cadmium	0.04	0.0000900 B	0.00100 U	0.00100 U	0.00100 U
Chromium	0.21	0.00170 B	0.00110 B	0.00160 B	0.00160 B
Copper	0.136	0.0475	0.0152	0.00210	0.00230
Lead	0.038	0.0136	0.00280	0.00140	0.000750 B
Mercury	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S2 MMFOUT6	H1S2 BETGAC6	H1S2 GAC2OUT6
Date Collected:			**9/14/2004**	**9/14/2004**	**9/14/2004**
Total PCB	0.0003		0.0000461	0.00000934 U	0.00000934 U
Total PAHs			0.00926 U	0.00926 U	0.00926 U
Ammonia Nitrogen			5.75	5.55	5.25
BOD (five day)			2 U	2 U	2 U
COD			5U	5U	5U
Nitrate			0.20 U	0.20 U	0.20 U
Nitrite			0.010	0.010 U	0.010 U
Total Organic Carbon			3.89	0.966 U	0.966 U
Dissolved Organic Carbon			3.6	0.97 U	0.97 U
Total Kjeldahl Nitrogen			6.12	5.67	5.38
Total Phosphorous (PO4)			0.0500 U	0.0500	0.110
Total Suspended Solids	50		1.10	1.00 U	1.00 U
Total TEQs (WHO TEFs)			0.0000000466	0.0000000616	0.0000000567
Cadmium	0.04		0.00100 U	0.00100 U	0.00100 U
Chromium	0.21		0.00180 B	0.00150 B	0.00160 B
Copper	0.136		0.0156	0.00260	0.00190 B
Lead	0.038		0.00360	0.00230	0.00170
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S2 MMFOUT10	H1S2 BETGAC10	H1S2 GAC2OUT10
Date Collected:			**9/14/2004**	**9/14/2004**	**9/14/2004**
Total PCB	0.0003		NA	NA	NA
Total PAHs			0.00926 U	0.00926 U	0.00926 U
Ammonia Nitrogen			5.66	5.51	5.36
BOD (five day)			2 U	2 U	2 U
COD			17	5U	5U
Nitrate			0.20 U	0.20 U	0.20 U
Nitrite			0.010	0.010 U	0.010 U
Total Organic Carbon			4.03	0.966 U	0.966 U
Dissolved Organic Carbon			3.5	0.97 U	0.97 U
Total Kjeldahl Nitrogen			6.07	5.78	5.58
Total Phosphorous (PO4)			0.0500 U	0.0700	0.130
Total Suspended Solids	50		1.20	1.20	1.00 U
Total TEQs (WHO TEFs)			NA	NA	NA
Cadmium	0.04		0.00100 U	0.00100 U	0.00100 U
Chromium	0.21		0.00260	0.00110 B	0.00140 B
Copper	0.136		0.0191	0.00380	0.00250
Lead	0.038		0.00560	0.00280	0.00200
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.3 - Process Water Filtration & Carbon Adsorption

Sample ID:	WQC	H1S3 MMFIN	H1S3 MMFOUT2	H1S3 BETGAC2	H1S3 GAC2OUT2
Date Collected:		**9/9/2004**	**9/9/2004**	**9/9/2004**	**9/9/2004**
Total PCB	0.0003	0.0000443	0.0000254 J	NA	NA
Total PAHs		0.00926 U	0.00926 U	0.00926 U	0.00943 U
Ammonia Nitrogen		12.7	12.9	12.6	11.8
BOD (five day)		16	5	2 U	3
COD		19	16	5U	5 U
Nitrate		3.3	3.3	0.30	0.20
Nitrite		2.0	2.1	0.10	0.020
Total Organic Carbon		5.30	5.32	0.966 U	0.966 U
Dissolved Organic Carbon		5.8	5.2	0.97 U	0.97 U
Total Kjeldahl Nitrogen		12.8	12.7	12.0	10.9
Total Phosphorous (PO4)		0.0500 U	0.0500 U	0.130	0.130
Total Suspended Solids	50	3.69	1.37	1.19	1.00 U
Total TEQs (WHO TEFs)		0.0000000625	0.0000000619	0.0000000618	0.0000000620
Cadmium	0.04	0.000110 B	0.00100 U	0.00100 U	0.00100 U
Chromium	0.21	0.00150 B	0.00150 B	0.00110 B	0.00130 B
Copper	0.136	0.0118	0.0347	0.00190 B	0.00110 B
Lead	0.038	0.00630	0.00560	0.00170	0.000510 B
Mercury	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S3 MMFOUT6	H1S3 BETGAC6	H1S3 GAC2OUT6
Date Collected:			**9/9/2004**	**9/9/2004**	**9/9/2004**
Total PCB	0.0003		0.0000199 J	0.00000934 U	0.00000934 U
Total PAHs			0.00926 U	0.00926 U	0.00926 U
Ammonia Nitrogen			13.2	12.8	12.8
BOD (five day)			3	7	3
COD			20	5U	5 U
Nitrate			3.1	0.50	0.20 U
Nitrite			2.0	0.38	0.030
Total Organic Carbon			5.13	0.966 U	0.966 U
Dissolved Organic Carbon			4.7	0.97 U	0.97 U
Total Kjeldahl Nitrogen			12.6	11.9	11.7
Total Phosphorous (PO4)			0.0500 U	0.0800	0.130
Total Suspended Solids	50		1.05 U	1.05 U	1.03 U
Total TEQs (WHO TEFs)			0.0000000621	0.0000000616	0.0000000619
Cadmium	0.04		0.0000770 B	0.00100 U	0.00100 U
Chromium	0.21		0.00160 B	0.00140 B	0.00140 B
Copper	0.136		0.0208	0.00390	0.00130 B
Lead	0.038		0.00460	0.00290	0.00170
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H1S3 MMFOUT10	H1S3 BETGAC10	H1S3 GAC2OUT10
Date Collected:	0.0003		**9/9/2004**	**9/9/2004**	**9/9/2004**
Total PCB			0.0000191 J	NA	NA
Total PAHs			0.00926 U	0.00926 U	0.00926 U
Ammonia Nitrogen			13.1	13.5	12.4
BOD (five day)			6	2 U	6
COD			17	5U	5 U
Nitrate			3.2	0.80	0.20 U
Nitrite			2.1	0.67	0.050
Total Organic Carbon			5.21	0.966 U	0.966 U
Dissolved Organic Carbon			5.1	0.97 U	0.97 U
Total Kjeldahl Nitrogen			12.8	11.9	11.6
Total Phosphorous (PO4)	50		0.0500 U	0.0600	0.100
Total Suspended Solids			1.11	1.60	1.03 U
Total TEQs (WHO TEFs)	0.04		0.0000000625	0.0000000506	0.0000000621
Cadmium	0.21		0.000140 B	0.00100 U	0.00100 U
Chromium	0.136		0.00180 B	0.00160 B	0.00130 B
Copper	0.038		0.0266	0.00190 B	0.00140 B
Lead	0.038		0.00500	0.00530	0.00230
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.3 - Process Water Filtration & Carbon Adsorption

Sample ID:	WQC	H1S4B MMFIN	H1S4B MMFOUT6	H1S4B BETGAC6	H1S4B GAC2OUT6
Date Collected:		**9/15/2004**	**9/15/2004**	**9/15/2004**	**9/15/2004**
Total PCB	0.0003	0.0000419	0.0000326	0.0000174 J	0.00000934 U
Total PAHs		0.00926 U	0.00926 U	0.00926 U	0.00943 U
Ammonia Nitrogen		19.9	19.1	16.6	19.2
BOD (five day)		2	2 U	2 U	2 U
COD		31	29	7	6
Nitrate		0.20 U	0.20 U	0.20 U	0.20 U
Nitrite		0.010	0.010	0.010 U	0.010 U
Total Organic Carbon		9.35	9.13	1.11	0.966 U
Dissolved Organic Carbon		8.2	7.4	0.97 U	0.97 U
Total Kjeldahl Nitrogen		20.8	20.0	18.8	18.3
Total Phosphorous (PO4)		0.0500 U	0.0700	0.110	0.190
Total Suspended Solids	50	13.5	8.30	5.10	2.50
Total TEQs (WHO TEFs)		0.0000000623	0.0000000509	0.0000000512	0.0000000499
Cadmium	0.04	0.000290 B	0.000260 B	0.000120 B	0.0000760 B
Chromium	0.21	0.00440	0.00400	0.00260	0.00230
Copper	0.136	0.0377	0.0605	0.0126	0.00730
Lead	0.038	0.00920	0.0177	0.00860	0.00510
Mercury	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC				GAC2OUT6-DUP
Date Collected:					**9/15/2004**
Total PCB	0.0003				0.0000122 J
Total PAHs					0.00943 U
Ammonia Nitrogen					NA
BOD (five day)					NA
COD					NA
Nitrate					NA
Nitrite					NA
Total Organic Carbon					0.966 U
Dissolved Organic Carbon					0.97 U
Total Kjeldahl Nitrogen					NA
Total Phosphorous (PO4)					NA
Total Suspended Solids	50				2.40
Total TEQs (WHO TEFs)					0.0000000615
Cadmium	0.04				0.00100 U
Chromium	0.21				0.00220
Copper	0.136				0.00890
Lead	0.038				0.00520
Mercury	0.0002				0.0002 U

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.3 - Process Water Filtration & Carbon Adsorption

Sample ID:	WQC	H2S4B MMFIN	H2S4B MMFOUT2	H2S4B BETGAC2	H2S4B GAC2OUT2
Date Collected:		**9/13/2004**	**9/13/2004**	**9/13/2004**	**9/13/2004**
Total PCB	0.0003	0.0000322 J	NA	NA	NA
Total PAHs		0.00926 U	0.00926 U	0.00926 U	0.00943 U
Ammonia Nitrogen		3.83	3.71	3.49	3.49
BOD (five day)		15	11	6	10
COD		7	8	5 U	5 U
Nitrate		2.0	1.9	0.20 U	0.20 U
Nitrite		0.29	0.37	0.070	0.040
Total Organic Carbon		2.83	2.96	0.966 U	0.966 U
Dissolved Organic Carbon		2.8	2.6	0.97 U	0.97 U
Total Kjeldahl Nitrogen		4.47	4.25	4.03	3.56
Total Phosphorous (PO4)		0.0500 U	0.0500 U	0.0120	0.0500 U
Total Suspended Solids	50	3.00	1.20	1.00 U	1.00 U
Total TEQs (WHO TEFs)		0.0000000288	NA	NA	NA
Cadmium	0.04	0.0000730 B	0.00100 U	0.00100 U	0.00100 U
Chromium	0.21	0.00210	0.00220	0.00120 B	0.00110 B
Copper	0.136	0.0616	0.0157	0.00170 B	0.000980 B
Lead	0.038	0.0197	0.00640	0.00280	0.000880 B
Mercury	0.0002	0.0002 U	0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC		H2S4B MMFOUT6	H2S4B BETGAC6	H2S4B GAC2OUT6
Date Collected:			**9/13/2004**	**9/13/2004**	**9/13/2004**
Total PCB	0.0003		0.0000252 J	0.00000934 U	0.00000934 U
Total PAHs			0.00926 U	0.00926 U	0.00926 U
Ammonia Nitrogen			3.70	3.57	3.53
BOD (five day)			16	15	12
COD			8	5 U	6 U
Nitrate			2.2	0.30	0.20 U
Nitrite			0.38	0.22	0.060
Total Organic Carbon			3.20	0.966 U	0.966 U
Dissolved Organic Carbon			2.8	0.97 U	0.97 U
Total Kjeldahl Nitrogen			4.19	3.67	3.54
Total Phosphorous (PO4)			0.0500 U	0.0500	0.140
Total Suspended Solids	50		1.00 U	1.10	1.00 U
Total TEQs (WHO TEFs)			0.0000000624	0.0000000625	0.0000000482
Cadmium	0.04		0.00100 U	0.00100 U	0.00100 U
Chromium	0.21		0.00180 B	0.00240	0.00150 B
Copper	0.136		0.0192	0.00320	0.00210
Lead	0.038		0.00820	0.00440	0.00340
Mercury	0.0002		0.0002 U	0.0002 U	0.0002 U

Sample ID:	WQC			H2S4B BETGAC6-DUP	
Date Collected:				**9/13/2004**	
Total PCB	0.0003			0.00000934 U	
Total PAHs				0.00926 U	
Ammonia Nitrogen				NA	
BOD (five day)				NA	
COD				NA	
Nitrate				NA	
Nitrite				NA	
Total Organic Carbon				0.966 U	
Dissolved Organic Carbon				0.97 U	
Total Kjeldahl Nitrogen				NA	
Total Phosphorous (PO4)				NA	
Total Suspended Solids	50			1.20	
Total TEQs (WHO TEFs)				NA	
Cadmium	0.04			0.00100 U	
Chromium	0.21			0.00140 B	
Copper	0.136			0.00350	
Lead	0.038			0.00470	
Mercury	0.0002			0.0002 U	

Notes:
All results as mg/L
This table is condensed from Table 24 of IDR Attachment 4 (Treatability Studies Report).

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Exhibit G.4.4 - Comparison of DRET Test Results and WQC Substantive Requirements

	Cd	Cr	Cu	Pb	Hg
Max Conc:	0.04	0.21	0.136	0.038	
#/Day Limit:	0.62	18.9	0.75	0.31	
(MGD)	**Concentration Limit at Max. Mass Flow Rate**				
0.1	0.040	0.210	0.136	0.038	0.0002
0.2	0.040	0.210	0.136	0.038	0.0002
0.5	0.040	0.210	0.136	0.038	0.0002
0.661	0.040	0.210	0.136	0.038	0.0002
0.978	0.040	0.210	0.092	0.038	0.0002
1.0	0.040	0.210	0.090	0.037	0.0002
1.86	0.040	0.210	0.048	0.020	0.0002
2.0	0.037	0.210	0.045	0.019	0.0002

DRET Test Results

Sediment Type	Cadmium Unfiltered	Cadmium Filtered	Chromium Unfiltered	Chromium Filtered	Copper Unfiltered	Copper Filtered	Lead Unfiltered	Lead Filtered	Mercury Unfiltered	Mercury Filtered
DRET 1										
S1	0.0021	0.001 U	0.0737	0.00227	0.0422	0.00243	0.0731	0.00063 B	0.000343	0.0002 U
S2	0.0413	0.000343 XB	0.633	0.0054	0.103	0.0035	0.766	0.0165	0.00517	0.0002 U
S3	0.025	0.000297 B	0.347 X	0.00533	0.0726 X	0.00287	0.45	0.0077	0.00263	0.0002 U
S4B	0.0669	0.00025 B	0.719 X	0.00563	0.107 X	0.00237 B	0.997	0.0104	0.00757	0.0002 U
DRET 2										
S1	0.0014	0.001 U	0.0556	0.0038 X	0.0329	0.0033 X	0.0551	0.0030	0.00024	0.0002 U
S2	0.0238	0.0002 B	0.3563	0.0075 X	0.0549	0.0025 X	0.4103	0.0165	0.00303	0.0002 U
S3	0.0256 X	0.0013 B	0.361 X	0.0250 X	0.0701	0.0086	0.4653	0.0315	0.00293	0.000206 UB
S4B	0.0557	0.0009 B	0.633 X	0.0155 X	0.0880	0.0039	0.8473	0.0247	0.00670	0.00022 U

Notes:

1. Concentrations are as mg/L.
2. DRET1 test results are estimated due to temperature as received. Tests were redone as DRET2.
3. DRET test results are average of three replicates.
4. Shading:
   - [blue shading] Indicates DRET concentrations were below Water Quality Certification Substantive Requirements (at maximum concentration, which decreases as flow rate increases).
   - [yellow shading] Indicates flow rate at which concentration limit applies (not mass limit).
5. Laboratory qualifiers: U=not detected at Laboratory Quantitation Limit, B=estimated value and X=method blank contamination.

Exhibit G.5

Processed Material Staging and Load-Out Facilities

Includes:

Waterfront Staging and Load-Out Calculations

Load-out Facility Storage Volume Requirements

Staging/Storage Area Capacities

Rail Car Loading Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Exhibit G.5.1

Processed Material Staging and Load-Out Facilities Design Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Waterfront Staging and Load-Out Calculations

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Waterfront Staging and Loadout	20437	TEM	8/5/05	1/2

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY JRG ; DATE 8/8/05

1) Estimated daily Volume and Load-out Calculations

Per METSIM MATERIAL BALANCE, (TABLE 3-26), MAXIMUM AMOUNT OF Oversize SOLIDS (+3/8") and coarse material (+200 MESH) from Hydrocyclone overflow occurs when processing 4,300 in situ cubic yards of S1 sediment.

Volumes are as follows:

Oversize mater (METSIM stream # 106) ≈ **520 CY/day**

Coarse screen solids (METSIM stream # 114) ≈ **3,000 CY/day**

Debris (+6" material) has been estimated to be approximately **100 CY/dy**

∴ A total maximum volume of ≈ 3600 CY/dy of material must be transported to the staging and load out facility near the rail yard.

Per attached spread sheet, based on a 16 hr work day, two to six trucks per hour (dependant on size) will be required to transport the maximum anticipated waterfront storage volume to the staging and load-out facility (Assumes up to 7 trips per hour per truck)

Work Day Length (hrs)	16
Phase I Material to be Transported Per Day (yd3/day)	3600

	Truck Type		
Data	**Truck A**	**Truck B**	**Truck C**
Capacity (yd3)	5	10	15
Distance (ft)	1600.0	1600.0	1600.0
Speed (ft/s)	14.7	14.7	14.7
Time to Travel Dist. (sec)	109.1	109.1	109.1
Body Hoist (sec)	10	15	20
Accelerate (ft/s)	3	3	3
Decelerate (ft/s)	3	3	3
Time to Accel/Decel (sec)	10	10	10
Turning Around (sec)	60	60	60
Loading and Unloading (sec)	300	300	300
Total Time (sec)	489.1	494.1	499.1
Total Time (min)	8.2	8.2	8.3
Trips in Hour	7.4	7.3	7.2
Amount Transported in an Hour	36.8	72.9	108.2
Oversized Material Separated Per Hour (yd3)			
Phase I (Assuming 3600 Yd3/Day)	225	225	225
Trucks Needed	6	3	2

Note:

This is assuming a 16 hr work day.

The distance is from the waterfront staging area to the Debris and Course Material Staging / Storage area.

The speed is assuming a plant speed of 10 mph.

Equipment times are estimations taken from the Caterpillar Performance Handbook.

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE- Hudson River – Waterfront Staging + Loadout	20437	TEM	8/5/05	2/2

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY GRO ; DATE 8/8/05

② Estimated WATERFRONT MATERIAL Staging Area Calculations

Assuming one-day staging volume required, maximum area at waterfront will be as follows:

Debris – 100 CY MAXIMUM
- assuming a 15' high cone pile, maximum area required ≈ 615 SF ≈ 28'-diameter

Oversize solids (+3/8") – 500 CY MAXIMUM

- assuming a 15' high Cone pile, maximum area required ≈ 3,000 SF ≈ 60'-diameter

Coarse solids (+200 mesh) – 3,000 CY MAXIMUM

- assuming a 15' high cone piles maximum area required = 18,000 SF or (6) 60'-diameter piles

Load-Out Facility Storage Volume Requirements

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - LOAD-OUT FACILITY STORAGE VOLUME REQUIREMENTS	20437	TEM	8/5/05	1/1

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY [illegible] ; DATE 8/8/05

Based on Phase I dredge schedule, the attached spreadsheets calculates peak storage required during the dredging season assuming a specific rail schedule.

Summary of attached Train Scenarios:

Train Scenario	Ramp up wks.	Production wks.	# Trains	Ramp down wks.
1	3-5	6-27	2	-
2	3-6	7-11	2	
		12-17	3	
		18-23	2	24-26
3	3-4	5-19	1,2,3 (alternating)	
		20-26	2	27
4	3-6	7-17	3	
		18-19	2	20-21
5	3-4	5-8	2	
		9-18	3	
		19-20	2	21-24

Phase 1 Train Scenario 1

	Week	Tons Processed	Cum Tons Processed	Unit Trains Shipped	Tons Shipped	Cum Tons Shipped	Storage (tons)	Storage (cy)	Delta Storage (cy)
May	1	5174	5174	0	0	0	5174	3449	3449
	2	2807	7980	0	0	0	7980	5320	1871
	3	11718	19698	1	8505	8505	11193	7462	2142
	4	12611	32309	1	8505	17010	15299	10199	2737
June	5	20646	52954	1	8505	25515	27439	18293	8094
	6	22217	75172	2	17010	42525	32647	21764	3471
	7	18406	93578	2	17010	59535	34043	22695	931
	8	23336	116914	2	17010	76545	40369	26912	4217
	9	26403	143316	2	17010	93555	49761	33174	6262
July	10	30852	174168	2	17010	110565	63603	42402	9228
	11	31929	206097	2	17010	127575	78522	52348	9946
	12	33934	240031	2	17010	144585	95446	63630	11283
	13	31504	271535	2	17010	161595	109940	73293	9663
August	14	21320	292855	2	17010	178605	114250	76166	2873
	15	19033	311888	2	17010	195615	116273	77515	1349
	16	16843	328731	2	17010	212625	116106	77404	-111
	17	20905	349636	2	17010	229635	120001	80001	2597
	18	21535	371171	2	17010	246645	124526	83017	3017
September	19	10610	381781	2	17010	263655	118126	78751	-4267
	20	4320	386101	2	17010	280665	105436	70291	-8460
	21	4754	390855	2	17010	297675	93180	62120	-8171
	22	4307	395162	2	17010	314685	80477	53651	-8469
October	23	3038	398200	2	17010	331695	66505	44337	-9315
	24	0	398200	2	17010	348705	49495	32997	-11340
	25	0	398200	2	17010	365715	32485	21657	-11340
	26	0	398200	2	17010	382725	15475	10317	-11340
	27	0	398200	2	17010	399735	-1535	-1023	-11340
November	28	0	398200		0	399735			1023
	29	0	398200		0	399735			0
	30	0	398200		0	399735			0
	31	0	398200		0	399735			0
December	32	0	398200		0	399735			0
	33	0	398200		0	399735			0
	34	0	398200		0	399735			0
	35	0	398200		0	399735			0

Note - assumes 81-car trains, 105 tons per car (8,505 tons per train).

Phase 1 Train Scenario 2

	Week	Tons Processed	Cum Tons Processed	Unit Trains Shipped	Tons Shipped	Cum Tons Shipped	Storage (tons)	Storage (cy)	Delta Storage (cy)
May	1	5174	5174	0	0	0	5174	3449	3449
	2	2807	7980	0	0	0	7980	5320	1871
	3	11718	19698	1	8505	8505	11193	7462	2142
	4	12611	32309	1	8505	17010	15299	10199	2737
June	5	20646	52954	1	8505	25515	27439	18293	8094
	6	22217	75172	1	8505	34020	41152	27434	9141
	7	18406	93578	2	17010	51030	42548	28365	931
	8	23336	116914	2	17010	68040	48874	32582	4217
	9	26403	143316	2	17010	85050	58266	38844	6262
July	10	30852	174168	2	17010	102060	72108	48072	9228
	11	31929	206097	2	17010	119070	87027	58018	9946
	12	33934	240031	3	25515	144585	95446	63630	5613
	13	31504	271535	3	25515	170100	101435	67623	3993
August	14	21320	292855	3	25515	195615	97240	64826	-2797
	15	19033	311888	3	25515	221130	90758	60505	-4321
	16	16843	328731	3	25515	246645	82086	54724	-5781
	17	20905	349636	3	25515	272160	77476	51651	-3073
	18	21535	371171	2	17010	289170	82001	54667	3017
September	19	10610	381781	2	17010	306180	75601	50401	-4267
	20	4320	386101	2	17010	323190	62911	41941	-8460
	21	4754	390855	2	17010	340200	50655	33770	-8171
	22	4307	395162	2	17010	357210	37952	25301	-8469
October	23	3038	398200	2	17010	374220	23980	15987	-9315
	24	0	398200	1	8505	382725	15475	10317	-5670
	25	0	398200	1	8505	391230	6970	4647	-5670
	26	0	398200	1	8505	399735	-1535	-1023	-5670
	27	0	398200		0	399735			1023
November	28	0	398200		0	399735			0
	29	0	398200		0	399735			0
	30	0	398200		0	399735			0
	31	0	398200		0	399735			0
December	32	0	398200		0	399735			0
	33	0	398200		0	399735			0
	34	0	398200		0	399735			0
	35	0	398200		0	399735			0

Note - assumes 81-car trains, 105 tons per car (8,505 tons per train).

Phase 1 Train Scenario 3

	Week	Tons Processed	Cum Tons Processed	Unit Trains Shipped	Tons Shipped	Cum Tons Shipped	Storage (tons)	Storage (cy)	Delta Storage (cy)
May	1	5174	5174	0	0	0	5174	3449	3449
	2	2807	7980	0	0	0	7980	5320	1871
	3	11718	19698	1	8505	8505	11193	7462	2142
	4	12611	32309	1	8505	17010	15299	10199	2737
June	5	20646	52954	1	8505	25515	27439	18293	8094
	6	22217	75172	2	17010	42525	32647	21764	3471
	7	18406	93578	3	25515	68040	25538	17025	-4739
	8	23336	116914	1	8505	76545	40369	26912	9887
	9	26403	143316	2	17010	93555	49761	33174	6262
July	10	30852	174168	3	25515	119070	55098	36732	3558
	11	31929	206097	1	8505	127575	78522	52348	15616
	12	33934	240031	2	17010	144585	95446	63630	11283
	13	31504	271535	3	25515	170100	101435	67623	3993
August	14	21320	292855	1	8505	178605	114250	76166	8543
	15	19033	311888	2	17010	195615	116273	77515	1349
	16	16843	328731	3	25515	221130	107601	71734	-5781
	17	20905	349636	1	8505	229635	120001	80001	8267
	18	21535	371171	2	17010	246645	124526	83017	3017
September	19	10610	381781	3	25515	272160	109621	73081	-9937
	20	4320	386101	2	17010	289170	96931	64621	-8460
	21	4754	390855	2	17010	306180	84675	56450	-8171
	22	4307	395162	2	17010	323190	71972	47981	-8469
October	23	3038	398200	2	17010	340200	58000	38667	-9315
	24	0	398200	2	17010	357210	40990	27327	-11340
	25	0	398200	2	17010	374220	23980	15987	-11340
	26	0	398200	2	17010	391230	6970	4647	-11340
	27	0	398200	1	8505	399735	-1535	-1023	-5670
November	28	0	398200		0	399735			1023
	29	0	398200		0	399735			0
	30	0	398200		0	399735			0
	31	0	398200		0	399735			0
December	32	0	398200		0	399735			0
	33	0	398200		0	399735			0
	34	0	398200		0	399735			0
	35	0	398200		0	399735			0

Note - assumes 81-car trains, 105 tons per car (8,505 tons per train).

Phase 1 Train Scenario 4

	Week	Tons Processed	Cum Tons Processed	Unit Trains Shipped	Tons Shipped	Cum Tons Shipped	Storage (tons)	Storage (cy)	Delta Storage (cy)
May	1	5174	5174	0	0	0	5174	3449	3449
	2	2807	7980	0	0	0	7980	5320	1871
	3	11718	19698	1	8505	8505	11193	7462	2142
	4	12611	32309	2	17010	25515	6794	4529	-2933
June	5	20646	52954	2	17010	42525	10429	6953	2424
	6	22217	75172	2	17010	59535	15637	10424	3471
	7	18406	93578	3	25515	85050	8528	5685	-4739
	8	23336	116914	3	25515	110565	6349	4232	-1453
	9	26403	143316	3	25515	136080	7236	4824	592
July	10	30852	174168	3	25515	161595	12573	8382	3558
	11	31929	206097	3	25515	187110	18987	12658	4276
	12	33934	240031	3	25515	212625	27406	18270	5613
	13	31504	271535	3	25515	238140	33395	22263	3993
August	14	21320	292855	3	25515	263655	29200	19466	-2797
	15	19033	311888	3	25515	289170	22718	15145	-4321
	16	16843	328731	3	25515	314685	14046	9364	-5781
	17	20905	349636	3	25515	340200	9436	6291	-3073
	18	21535	371171	2	17010	357210	13961	9307	3017
September	19	10610	381781	2	17010	374220	7561	5041	-4267
	20	4320	386101	1	8505	382725	3376	2251	-2790
	21	4754	390855	1	8505	391230	-375	-250	-2501
	22	4307	395162		0	391230	3932	2621	2871
October	23	3038	398200		0	391230	6970	4647	2025
	24	0	398200		0	391230			-4647
	25	0	398200		0	391230			0
	26	0	398200		0	391230			0
	27	0	398200		0	391230			0
November	28	0	398200		0	391230			0
	29	0	398200		0	391230			0
	30	0	398200		0	391230			0
	31	0	398200		0	391230			0
December	32	0	398200		0	391230			0
	33	0	398200		0	391230			0
	34	0	398200		0	391230			0
	35	0	398200		0	391230			0

Note - assumes 81-car trains, 105 tons per car (8,505 tons per train).

Phase 1 Train Scenario 5

	Week	Tons Processed	Cum Tons Processed	Unit Trains Shipped	Tons Shipped	Cum Tons Shipped	Storage (tons)	Storage (cy)	Delta Storage (cy)
May	1	5174	5174	0	0	0	5174	3449	3449
	2	2807	7980	0	0	0	7980	5320	1871
	3	11718	19698	1	8505	8505	11193	7462	2142
	4	12611	32309	1	8505	17010	15299	10199	2737
June	5	20646	52954	2	17010	34020	18934	12623	2424
	6	22217	75172	2	17010	51030	24142	16094	3471
	7	18406	93578	2	17010	68040	25538	17025	931
	8	23336	116914	3	25515	93555	23359	15572	-1453
	9	26403	143316	3	25515	119070	24246	16164	592
July	10	30852	174168	3	25515	144585	29583	19722	3558
	11	31929	206097	3	25515	170100	35997	23998	4276
	12	33934	240031	3	25515	195615	44416	29610	5613
	13	31504	271535	3	25515	221130	50405	33603	3993
August	14	21320	292855	3	25515	246645	46210	30806	-2797
	15	19033	311888	3	25515	272160	39728	26485	-4321
	16	16843	328731	3	25515	297675	31056	20704	-5781
	17	20905	349636	3	25515	323190	26446	17631	-3073
	18	21535	371171	3	25515	348705	22466	14977	-2653
September	19	10610	381781	2	17010	365715	16066	10711	-4267
	20	4320	386101	1	8505	374220	11881	7921	-2790
	21	4754	390855	1	4771	378991	11864	7909	-11
	22	4307	395162	1	8505	387496	7665	5110	-2799
October	23	3038	398200	1	8505	396001	2199	1466	-3645
	24	0	398200	1	8505	404506	-6306	-4204	-5670
	25	0	398200		0	404506			4204
	26	0	398200		0	404506			0
	27	0	398200		0	404506			0
November	28	0	398200		0	404506			0
	29	0	398200		0	404506			0
	30	0	398200		0	404506			0
	31	0	398200		0	404506			0
December	32	0	398200		0	404506			0
	33	0	398200		0	404506			0
	34	0	398200		0	404506			0
	35	0	398200		0	404506			0

Note - assumes 81-car trains, 105 tons per car (8,505 tons per train).

Rail Car Loading Calculations

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

SUBJECT	PROJ. NO.	BY	DATE	SHEET
GE-Hudson River - Rail Car Loading Calculations	20437	TEM	8/5/05	1/1

CALCS. BY TEM ; DATE 8/5/05 CHECKED BY [illegible] ; DATE 8/8/05

The attached spreadsheets were adapted from calculations initially prepared by HDR for loading rail cars (42 at a time) from North and South storage structures simultaneously

Per attached calculations, utilizing two 8.7 CY wheel loaders per storage structure, it is estimated to take < 4 hrs to load 42 trains total

∴ to load one 81-car train it is estimated to take 8 working hrs (not accounting for train movements or time necessary to remove/replace covers.

Loader and Material

Type of loader	988 H Caterpillar			
Bucket Size (volume)	8.7	*yd3*		
Rail Car Capacity	80.76923077	*yd3*	*Assuming the material density to be 1.3 tons/yd3*	

Cycle Time

Pad Location (1st or 2nd)	**1st**			
Average Round Trip Distance North Structures	508.5571429	*ft*		
Average Round Trip Distance South Structures	551.09	*ft*		
Wheel Loader Velocity	10	*mph*	14.66666667	*ft/s*
Time for Distance North Structure	34.67435065	*sec*		
Time for Distance South Structure	37.57431818	*sec*		
Cycle Time to Load and Unload	31.2	*sec*		
Cycle Time for Accel, Decel, and misc	39.77777778	*sec*		
Structure Location (North or South)	**North**			
Total Time Traveled to Load Car	140.3264791	*sec*	2.338774651	*min*
Trips Per Hour	25.65445968	*# of trips / hour*		
Amount Transferred in an Hour	223.1937992	*yd3/hr*		
How Long to Load One Railcar	0.362913308	*hrs*	21.77479848	*min*
How Long to Load 21 Railcars Operating With One Wheel Loader	7.621179467	*hrs*	457.270768	*min*
Operating With 2 Wheel Loaders	3.810589734	*hrs*		

Note:

Density of the material is an estimation based on the data provided in the METSIM reports.

Loader and Material

Type of loader	988 H Caterpillar		
Bucket Size (volume)	8.7	*yd3*	
Rail Car Capacity	80.76923077	*yd3*	*Assuming the material density to be 1.3 tons/yd3*

Cycle Time

Pad Location (1st or 2nd)	**1st**			
Average Round Trip Distance North Structures	508.5571429	*ft*		
Average Round Trip Distance South Structures	551.09	*ft*		
Wheel Loader Velocity	10	*mph*	14.66666667	*ft/s*
Time for Distance North Structure	34.67435065	*sec*		
Time for Distance South Structure	37.57431818	*sec*		
Cycle Time to Load and Unload	31.2	*sec*		
Cycle Time for Accel, Decel, and misc	39.77777778	*sec*		
Structure Location (North or South)	**South**			
Total Time Traveled to Load Car	146.1264141	*sec*	2.435440236	*min*
Trips Per Hour	24.63620298	*# of trips / hour*		
Amount Transferred in an Hour	214.334966	*yd3/hr*		
How Long to Load One Railcar	0.37791314	*hrs*	22.6747884	*min*
How Long to Load 21 Railcars Operating With One Wheel Loader	7.93617594	*hrs*	476.1705564	*min*
Operating With 2 Wheel Loaders	3.96808797	*hrs*		

Note:

Density of the material is an estimation based on the data provided in the METSIM reports.

Distance Calculations for Loading Pad #1

Rail Car Position	Distance Inside Structure	Distance to Loading Pad #1	Distance to Railcar	Total Distance
1	75	125	741.7	941.7
2	75	125	683.4	883.4
3	75	125	625.1	825.1
4	75	125	566.8	766.8
5	75	125	508.5	708.5
6	75	125	450.2	650.2
7	75	125	391.9	591.9
8	75	125	333.6	533.6
9	75	125	275.3	475.3
10	75	125	217	417
11	75	125	158.7	358.7
12	75	125	100.4	300.4
13	75	125	42.1	242.1
14	75	125	100.4	300.4
15	75	125	158.7	358.7
16	75	125	217	417
17	75	125	275.3	475.3
18	75	125	333.6	533.6
19	75	125	391.9	591.9
20	75	125	450.2	650.2
			Average	**551.09**
21	75	125	641.7	841.7
22	75	125	583.4	783.4
23	75	125	525.1	725.1
24	75	125	466.8	666.8
25	75	125	408.5	608.5
26	75	125	350.2	550.2
27	75	125	291.9	491.9
28	75	125	233.6	433.6
29	75	125	175.3	375.3
30	75	125	117	317
31	75	125	58.7	258.7
32	75	125	0.4	200.4
33	75	125	58.7	258.7
34	75	125	117	317
35	75	125	175.3	375.3
36	75	125	233.6	433.6
37	75	125	291.9	491.9
38	75	125	350.2	550.2
39	75	125	408.5	608.5
40	75	125	466.8	666.8
41	75	125	525.1	725.1
			Average	**508.5571429**

Notes:

Each pad holds 41 rail cars and two wheel loaders load the 20/21 railcars that are closest to their respective structure.

Each railcar is 58.3 feet long.

Cycle calculations provided by HDR did not include the distances traveled within the structures and therefore are less than the calculations provided in these worksheets.

Exhibit G.8

Site Work, Roads, Utilities, and Administrative Areas

Includes:

TR-55 Curve Number and Run-Off Depth Calculations

Processing Facility Estimated Stormwater Storage Volumes

Processing Facility Earthwork and Select Fill Summary Table

BBL®

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Exhibit G.8.1

Site Work, Roads, Utilities, and Administrative Areas Design Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

PROCESSING FACILITY SITE

TR-55 Curve Number and Runoff Depth Calculation

TYPE I Stormwater Management Areas

CURVE NUMBER

Hydrologic Soil Type	Cover Description	CN	Area (Acres)[1]
Claverack C & Wallington C	Impervious Areas - Filter Press Building Area	98	3.01
Claverack C & Wallington C	Impervious Areas - Waterfront Area	98	7.01
Claverack C & Wallington C	Impervious Areas - Roadways and Storage Bldgs.	98	26.97
		Total Area	36.99

Total CN X Area 981.96

Weighted Curve No. 98

RUNOFF DEPTH - Q

Return Interval	Rainfall - P (inches)[3]	Runoff Depth - Q (inches)
10	3.9	3.67
25	4.6	4.36
100	5.6	5.36

(1) Areas have been determined from proposed site plan dated 7-05-05
(2) Estimated runoff depth and storage volumes computed using TR-55 analysis for Type I Stormwater Management (contact) areas only.
(3) 24 hour Rainfall amounts from NRCS TR-55 Reference TP-40 Rainfall Maps

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Processing Facility Site
Estimated Stormwater Storage Volumes

Return Interval (Year)	Runoff Depth - Q (Inches)	Area[1] (Sq. Ft.)	Estimated Storage Vol. [2,3] Q X Area (Ft^3)	Estimated Storage Vol. [2,3] (Acre-Feet)	Estimated Storage Vol. [2,3] (Gallons)
10	3.67	1,611,284	492,200	11.3	3,681,700
25	4.36	1,611,284	586,000	13.5	4,383,300
100	5.36	1,611,284	720,100	16.5	5,386,400

(1) Areas have been determined from proposed site plan dated 7-05-05
(2) Estimated runoff depth and storage volumes computed using TR-55 analysis for Type I Stormwater Management (contact) areas only.
(3) Values have been rounded up to the nearest hundred.

PROCESSING FACILITY
EARTHWORK AND SELECT FILL SUMMARY TABLE

	EARTHWORK		SELECT FILL MATERIALS					
LOCATION/DESCRIPTION	Excavation Volume - CY	Fill Volume - CY	Type A (CY)	Type B (CY)	Type C (CY)	Type D (CY)	Type E (CY)	Type F (CY)
Site Grading [1]	17,964	143,952						
Roadways	746	19,004					12,570	
Drainage	2,460							
Sedimentation Basins								
A	7,773							
B	19,260							
C	2,208							
D	1,681							
TOTALS	**52100**	**163000**					**12,570**	
Topsoil Stripping 6"	29900							

Topsoil Stripping Vol = Area of Site Developed x 6 inches = 36.99 Acres X 43560 X .5 / 27 = 29839 CY

NOTES:
1. Topsoil Stripping is not included in Site Grading Cut/Fill Volumes
2. Volume calculations are preliminary and based on the Site Grading and Drainage Plan dated 8-04-05
3. Cut/fill volumes do not include swell/shrinkage factors