

December 19, 2001



Mr. Teddy Le Washington Department of Ecology Post Office Box 47706 Olympia, Washington 98504-7706

Re:

Former Specialty Chemicals Facility

Georgia-Pacific Camas Mill

Camas, Washington

SECOR PN: 015.08716.007

Dear Mr. Le:

At the request of Ms. Julie Raming of Georgia-Pacific Corporation (G-P), SECOR International Incorporated is resubmitting a complete package of documents via certified mail for the former Specialty Chemicals facility at the G-P Camas Mill in Camas, Washington. This package consists of a summary letter, one Preliminary Site Assessment Report, one Site Investigation Report, and a completed Washington Department of Ecology (WDOE) Voluntary Cleanup Program (VCP) application. Based on G-P's records, the \$500 check included with the original April 23, 2001 submittal, was cashed by Ecology on May 19, 2001. As a result, G-P assumes that entry into the Ecology VCP has been accomplished and requests verification from Ecology.

Aside from the attached reports, the summary letter presents a synopsis of the report results along with our conclusions and recommendations for actions to address the identified soil and groundwater impacts at the site. The purpose of this submittal is to facilitate GP's entry into the WDOE VCP for review of our proposal for regulatory disposition of the site.

With regards to future use of the former Specialty Chemicals facility, GP intends the facility be used for industrial purposes only. Also, as mentioned in the summary letter, GP will implement appropriate measures, including adoption of appropriate institutional controls and deed restrictions to control access, prevent exposure, and facilitate proper disposal of impacted subsurface soil and groundwater. GP will incorporate information on the areas of concern as well as maintenance procedures for the adopted institutional controls into a management plan for the facility. Procedures for encountering, handling, and disposing of impacted soil will be discussed with employees and/or contractors involved in subsurface construction activities within the areas of concern.

Mr. Teddy Le December 19, 2001 Page 2

Subsequent to your review of the attached documents, please contact us to discuss your suggestions and comments regarding the site and our proposed recommendations.

Sincerely,

SECOR International Incorporated

Joseph B. Hunt, R.G. Principal Geologist

Heather M. Bartlett, P.E. Principal Engineer

JBH/HMB:ejw

Attachments

Cc:

Ms. Julie Raming/G-P

Mr. Steve Young/G-P Camas Mill $\sqrt{}$

SUMMARY LETTER



April 23, 2001

Mr. Teddy Le Washington Department of Ecology P.O. Box 47706 Olympia, Washington 98504-7706

RE:

Former Specialty Chemicals Facility Georgia-Pacific Camas Mill Camas, Washington SECOR PN: 015.08716.004

Dear Mr. Le:

On behalf of Georgia-Pacific (GP), SECOR International Incorporated (SECOR) is submitting for your review the attached Preliminary Assessment (PA) Report and 2000 Site Investigation (SI) Report for the Former Specialty Chemicals, Inc. facility at the Ft. James Corporation Camas Mill in Camas, Washington. The Camas Mill was recently purchased from Ft. James Corporation by GP. SECOR completed both the PA and SI during Ft. James ownership and has been retained by GP as environmental consultant for the site. GP is submitting the attached reports for Washington Department of Ecology (Ecology) review under the Voluntary Cleanup Program (VCP). The VCP application, including the Request for Assistance/Review Form and the Site Summary, is included as Attachment 1 to this letter. In addition, a \$500 check from GP is enclosed as Attachment 2 to cover the costs of the initial review. A summary of the 2000 SI results is presented below along with GP's proposal for site disposition.

Facility Description

In summary, the former Special Chemicals facility was a former chemical manufacturing complex located east of the intersection of 10th Avenue and Drake Street in Camas, Washington. The site is currently inactive and is located north of the former Fort James Corporation Business Center and Mill. During active operations from the early 1960s until 1999, Specialty Chemicals produced specialty chemicals supporting various types of commercial and industrial applications. These chemicals primarily included thiodiphenol, methylenedioxybenzene (MDB), dimethyl sulfoxide, and purified catechol. Portions of the facility are currently used for warehousing of maintenance parts and for meeting purposes for the mill.

During active operations, process water and stormwater generated at the facility were collected and conveyed through the facility process sewer line to the effluent treatment system prior to permitted NPDES discharge. In addition, on-site wastestream storage areas were either underlain by asphalt or diked with concrete to prevent impact to the native ground surface. Former operational areas and the majority of the remaining facility are surfaced with asphalt and/or concrete.

Geology/Hydrogeology

The facility is underlain by a surficial veneer of fine-grained Quaternary alluvium underlain by Columbia River Basalt as the basement complex. Based on the Geoprobe results, the thickness of the alluvium ranged from depths of 2 to 31 feet below ground surface (bgs). Based on monitoring well installation at the site, hydrogeologic conditions at the site consist of unconfined to confined water-bearing zones in basaltic bedrock at depths of 26 to 41 feet bgs. The variation in hydraulic confinement across the site is likely due to differential continuity between massive, fractured, and/or permeable members; fracture percentage, orientation, and geometry; and the presence of welded zones and/or areas of secondary mineralization. Groundwater flow was oriented in a northeasterly direction across the site, toward Blue Creek Canyon, at a gradient of 0.09 foot/foot. This orientation is likely an artifact of the differential hydraulic head between the wells, but may also be due to the presence of a fractured bedrock regime toward the creek and/or more massive members between the site and the river. Given the predominant east-west strike and north-south dip of basalt toward the river in the Camas area, the presence of the Columbia River as the dominant regional drain, the lack of observable seeps/springs in the west wall of Blue Creek Canyon, and the fact that surface water flow in Blue Creek Canyon is derived from a pipe at the head of the canyon and not a bedrock source, actual net groundwater flow is likely oriented in a southerly direction toward the Columbia River.

2000 SI Summary

The 2000 SI consisted of an August 2000 Geoprobe Investigation and an August/November 2000 Groundwater Investigation. During the August Geoprobe Investigation, 20 Geoprobe locations, GP-1 through GP-20, were drilled on site to facilitate collection and analysis of subsurface soil samples. The August/November 2000 Groundwater Investigation consisted of the installation of five groundwater monitoring wells at selected on-site locations based on the Geoprobe soil results and hydraulic gradient.

The 2000 SI results indicated isolated impacts to soil and groundwater. A brief summary of the results is presented below.

Soil. With regards to soil, two locations, the Central Tank Farm/Wastewater Sump and the area adjacent to the Building 202 Transformer Area, were identified as showing evidence of chemical impact to soil from past on-site operations. In the Central Tank Farm/Wastewater Sump area, concentrations of tetrachloroethene (PCE) and methylene chloride exceeded the Model Toxics Control Act (MTCA) Method A cleanup level, but occurred below the U.S. Environmental Protection Agency (EPA) Region IX Residential Preliminary Remediation Goals (RPRG) for residential sites. In the Building 202 Transformer Area, only methylene chloride exceeded the MTCA Method A soil cleanup level. As with PCE, it also occurred below the EPA RPRG. No other evidence of impact to on-site soil from past on-site operations was identified in the remaining on-site areas.

Mr. Teddy Le April 23, 2001 Page 3

With the exception of arsenic and chromium in soil, soil metal concentrations in each of the boring samples did not exceed the respective MTCA soil cleanup levels or EPA RPRGs. While arsenic did not exceed the MTCA Method A soil cleanup level, it did exceed the MTCA Method B level and both the EPA RPRG and industrial PRG. Chromium in one sample exceeded the MTCA Method A soil cleanup level, but occurred below the EPA RPRG. Given the relative similarity in concentrations, the basaltic bedrock terrane, and based on a comparison with elemental abundances in soil from the Camas, Washington area (as described in the 1984 U.S.G.S. Professional Paper 1270), the detected metals appear to be representative of background concentrations.

Groundwater. The August/November 2000 groundwater monitoring well results indicated the presence of several analytes, including volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), and metals in wells MW-1 through MW-3. Of the detected VOCs, only 1,4-dichlorobenzene, PCE, and trichloroethene occurred above the respective Ecology MTCA Method A or B groundwater cleanup levels. Of the SVOC compounds detected in the wells, only bis(2-ethylhexyl)phthalate occurred above the MTCA Method B level. Polychlorinated biphenyls, TDP, and MDB were not detected at or above the MRLs in the three wells. In addition, no organic compounds were detected in wells MW-4 or MW-5 at or above the MRL's.

Of the detected metals, arsenic occurred at a concentration below the MTCA Method A, but above the MTCA Method B groundwater cleanup levels. As with soil, given the basaltic terrane and the typical presence of heavy metals in groundwater flowing through volcanic terranes, this is likely representative of background conditions.

Conclusions

The former Specialty Chemicals, Inc. facility is currently inactive and located on an industrially-zoned parcel in Camas, Washington. The facility is being used for parts warehousing and business meetings. Current and reasonably likely future land use is projected to remain industrial/commercial. No current groundwater use exists between the facility, and the river and commercial properties located hydraulically downgradient of the facility are supplied with municipal water derived from a natural surface water body. Access to the facility is restricted and the site surface is sealed with an asphalt and/or concrete cap that limits surface recharge and access to subsurface soil.

Although impacts to soil and groundwater were detected on site, the impacts were relatively limited in extent. The site is underlain by an unsaturated, low permeability unconsolidated zone and a likely homogenous basaltic sequence. Soil impacts in the Central Tank Farm and Building 202 Transformer Area appeared to be related to older releases from historical operations at the site and not to active on-site sources. Although selected organic compounds in these areas were detected at concentrations above MTCA cleanup levels, none of the detected concentrations exceeded the EPA RPRGs. In addition, metals detected in soil appear to be representative of background conditions.

The organic groundwater analytical results indicates groundwater impact at the site appears to be limited in terms of contaminant frequency and distribution and is likely the result of releases from historical operations and/or the process water sewer line. Given the relatively low concentrations of the detected chemicals in on-site groundwater, the historical nature of the impact, the lack of evidence of unsaturated zone impacts during drilling, the lack of observable seeps in the exposed rockwall of Blue Creek Canyon, and the potential presence of natural attenuation processes within the water-bearing zone, the potential for groundwater recharge and compound migration beneath and adjacent to the facility and the risk to human health and the environment appears to be low.

Recommendations

Given the 2000 SI soil and groundwater database and aforementioned conclusions, GP proposes the following actions to address impacts at the site. No soil or groundwater cleanup activities are proposed at this time.

- 1. Regarding the chemical impacts to soil within the two on-site areas, GP proposes to maintain the surface cap within the areas as an institutional control. Cap maintenance and specifications will be documented in a written plan that will be submitted and approved by Ecology.
- 2. With regards to impacted on-site groundwater, GP proposes to conduct an annual groundwater monitoring event to continue evaluation of constituent concentrations and extent.

Subsequent to your review of the attachments, please contact Ms. Julie Raming of Georgia-Pacific at (404) 652-6869 or us at (503) 691-2030 to discuss any questions/comments and/or the proposed actions.

Sincerely

SECOR International Incorporated

Joseph B. Hunt, R.G. Principal Geologist

Heather M. Bartlett Principal Engineer

JBH/HMB: lcr Attachments

cc: Ms. Julie Raming/Georgia-Pacific

ATTACHMENT 1
REQUEST FOR ASSISTANCE/REVIEW FORM
AND SITE SUMMARY



Voluntary Cleanup Program

Washington State - Department of Ecology - Toxics Cleanup Program

Request For Assistance/ Review Form

| Have you discuss If yes, what is tha And the approxim Is this a leaking u | t person's Name' ate date?M arch | ?T eddy Le 7, 2001 | epresentative in the | | · · · · · · · · · · · · · · · · · · · |
|---|---|--|--|---|--|
| Please submit the f | following with this s | signed form to | the appropriate Ec | ology office (| see back of form) |
| x Site Summary (Ex. A Check or Mon | • | ade out to "De | χ <i>Α</i> partment of Ecology" | Any other exist | ing reports on this site |
| Applicant complete | tes this section: (f | Note: The applica | ant is responsible for all | billings) | |
| Applicant Name: G | Georgia-Pacific Corpo | oration / Julie B | . Raming Phor | ne: 404-652-68 | 369 |
| Applicant Address | : 133 Peachtree Stre | et | | | |
| City: Atlanta | | State | : Ga Zip: | 30303 | |
| Site Name: Forme | r Fort James Specia | Ity Chemical Co | omplex Alternate Nam | ie: | |
| Site Address: 906 | NW Drake | | | | |
| City: Camas | | State | WA Zip: | 98607 Co | ounty: Clark |
| Site Owner Name: | Georgia-Pacific Cor | poration | | | |
| Site Owner Addres | ss: 401NE Adams St | reet | Phor | ne: 360-834-83 | 322 |
| City: Camas | | State: | WA Zip: | 98607 | |
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Voluntary Cleanup Program

Washington State - Department of Ecology - Toxics Cleanup Program

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| ite Summar | | | |
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| This Summary is a | required componen | t of your request for assi | stance under the Voluntary Cleanup Program |
| Which of the follow | wing apply? | Requesting | assistance on a planned cleanup assistance on an ongoing cleanup. review of a completed investigation. |
| form) or this is a r | revised Site Summa | for Assistance (ECY 020 ry, Please provide this co cumentation review (whic | i-74) previously without a Site Summary (this impleted form to Ecology at least five (5) working thever comes first). |
| A) Site Identifica | ntion: | | |
| • | ormer Ft. James Speci | alty Chemical Site | |
| Alternate Name(| (s) for Site: | | |
| | | | |
| Street Address | of Site: 906 NW Drake | Street | |
| City: Camas | | State: Washington | Zip: 986072042 |
| County: Clark | | UBI Number: | |
| Mailing Address | (if different from above | /e): | |
| City: | | State: | Zip: |
| Township | Range | Section | Quarter-Quarter |
| If Known: Latitude: | Dogree 45 58 | 5778 Minute | Second |
| Longitude: | Degree -122.4 | 409999 Minute | Second |
| Method used to | calculate Latitude cres) is the site? 8 | and Longitude: Refere | enced EPA,s Detail Report/Envirofacts |
| Please attach two | maps to this form. | ***(see attached reports)* | ** |
| highways, an | d streets. (Please n | nark site location.) | on to surrounding bodies of water, cities, |
| A site diagrar etc. | n showing surround | ing cross-streets, labeled | I building outlines, sampling and well locations, |
| B) Person/Orga | nization Making Re | quest for Assistance/R | deview: |
| Name: Julie B. Rar Firm: Georgia Paci | | | |
| _ | 3 Peachtree Street | | |
| City: Atlanta | | State: Georgia | Zip: 30303 |
| Telephone Numbe | r: 404-652-6869 | Extension: | |
| ^c ax Number: 404- | • | e-mail address: jbr | aming@gapac.com |
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| Attorney | | for | | |
| Insurance Carrier | | for | | |
| Other (specify) | | for | | |

C) Release Information:

Date of Release (if known): Date of Discovery: 01/30/01, date of reciept of SECOR Site Investigation Report Drinking Water: Number of Drinking Water Supply Wells within 1/2 mile: 11

Are there any drinking water systems affected? 🔲 yes 🛭 no

If yes, has alternate drinking water been provided? 🔲 yes 🛚 🛱 no

If Drinking Water systems are affected, are the systems public, private, or both? NA

Aquatics: Are there an creeks, streams, ponds, wetlands, or shorelands...

on or adjacent to the site? 🛛 yes 🔲 no Within 1/4 mile of the site? 🖾 yes 📋 no

Where are they located?Blue Canyon Creek is adjacent to the east and the Camas Slough is 500 yards to the south

prior to cleanup, and mark the appropriate medium (i.e. soil) with: C (confirmed and above MTCA); B (confirmed but below MTCA); S General Hazardous Substance Categories: Please complete the chart below. List the contaminants known or suspected at the site (suspected); N/A (not-applicable); O (tested and not present); or U (unknown).

| Contaminant | | | Media: | | | | Date of |
|-------------------------------|--------------------------------|------------------|------------------|------------------|-----|----------|-----------------------|
| | Class (for office Use | Affected Soil | Ground- Water | Surface Water | Air | Sediment | Release (if known) |
| legel(n)ole) | | 9 | (0) | Q. | 9 | 120 | 315//513 |
| 1) 1,4 dichlorobenzene | | ω. | င | N/A | N/A | N/A | n n |
| 2) Tetrachloroethene | | ပ | ပ | N/A | N/A | N/A | ח |
| 3) Trichloroethene | | 0 | C | N/A | N/A | N/A | n |
| 4) bis(2-ethylhexyl)phthalate | euro. | 0 | ၁ | N/A | N/A | N/A |) |
| 5) 1,2-dichlorobenzene | | 8 | В | N/A | N/A | N/A | n |
| 6) Polychorinated biphenyls | | В | 0 | N/A | N/A | N/A | n |
| 7) Acetone | | m | В | N/A | N/A | N/A | n |
| 8) Methylene Chloride | | a | 0 | N/A | N/A | N/A | n |

| 9) Chlorobenzene | | 0 | В | N/A | N/A | N/A | ח |
|----------------------------|--------|----|----|-----|-----|-----|--------|
| 10) Chloraform | | 0 | 8 | N/A | A/N | N/A | n |
| 11) cis-1,2-dichloroethene | . 4 29 | 0 | В | N/A | N/A | N/A | ח |
| 12) Toluene | | 0 | В | N/A | N/A | N/A | n |
| 13) 1,1,1-Trichloroethane | | 0 | 8 | N/A | N/A | N/A | D |
| 14) 1,2,4-Trimethylbenzene | | 0 | #B | N/A | A/N | N/A | ח |
| 15) Xylene | | 0 | В | N/A | N/A | N/A | D |
| 16) 2-Chlorophenol | | 0 | В | N/A | N/A | N/A | , D |
| 17) Methylenedioxybenzene | | ## | 0 | N/A | A/A | N/A | ם |
| 17) Arsenic | | ၁ | ပ | N/A | N/A | N/A | D |
| 18) Barium | | 8 | 8 | N/A | N/A | N/A | ם |
| 19) Cadmium | | æ | 0 | N/A | N/A | N/A | n |
| 20) Chromium | | ပ | В | N/A | N/A | N/A | n |
| 21) Lead | | 83 | 8 | N/A | N/A | N/A | n |
| 22) Mercury | | 8 | 0 | N/A | N/A | N/A | ח |
| 23) Silver | | 0 | 0 | N/A | N/A | N/A | D |
| 24) Selenium | | 80 | В | N/A | ΝΆ | N/A | n |
| | | | | | | | |

^{**}B = No MTCA groundwater cleanup levels currently established. Detection is below EPA Region IX Preliminary Remediation Goal for Tap Water. *** = Although compound was detected, no state or federal soil cleanup level currently exists.

D) Report Information of Assessment or Remediation Work Done to Date

Assessment:

| Has site assessment work been done at this site? yes ⊠ no 🔲 In-progress⊡ |
|---|
| If yes, when? Report rec'd 01/30/01 Were results reported to Ecology? yes 🛭 no 🔲 Date |
| Describe: (list reports in "E" below) |
| |
| Remediation: |

| Has any site cleanup work been done at the site? yes \square no: X in-progress \square If yes, please continue to answer the remaining questions in this section to the best of your ability. |
|---|
| When was the cleanup work done? N/A Were results reported to Ecology? yes ☐ no ☐ date N/A Describe: (list reports in "E" below) N/A |
| Does contamination remain on-site after cleanup activities? yes 🔲 no 🗀 N/A |

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For each contaminant listed in Part C) Release Information (above), please describe the quantity of the contaminant (in pounds) which was removed or treated as a result of the cleanup activities:

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| Contaminant | | 1 | Pounds of Contaminant: | | | |
|------------------------------|-----------------------|----|------------------------|---------|--|---------------------------|
| | Class (for office Use | | Washed | Removed | Treated | Removed Treated Contained |
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| 10) | | | | | | |
| 11) | | | | | | |
| 12) | | | | | | |
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As a result of the cleanup:

How many people are now at reduced risk as a result of the cleanup action? N/A How many cubic feet of contaminated soil was remediated or contained? N/A How many gallons of contaminated soil was remediated or contained? N/A How many acres of land were returned to unrestricted use? N/A How many acres of land were returned to restricted use? N/A

| How meny populate of potential pollution West | e l |
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| arevented as a resultion the desarroll adjuster. | |
| Medicios Treatments Used | |
| Method A | |
| Method B | |
| Method C | |
| Have these levels been met through the site ? Y or N | |
| Destruction or Detoxification | |
| Carbon Adsorption1 | |
| Biological Treatment | |
| Chemical Destruction | |

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| l i in Deration | 7 |
|--|-----------|
| 'Carbon followed by regeneration: use of granular activated carbon followed by landfilling would be classified in these tables as volume reduction | reduction |
| and off-site landfill | |
| Media Transfer | |
| Air stripping/Air Sparging | |
| Aeration/Vapor Extraction | - |
| Thermal Desorption | - |
| Immobilization | |
| Vitrification | |
| Solidification/Stabilization | |
| Reuse/Recycling ² | |
| Specify | |
| For example, reuse of free petroleum product recovered in a pump and treat system. | |
| Separation/Volume Reduction | |
| Solvent Extraction | |
| Soil Washington | |
| Physical Separation ³ | |
| For example, oil/water separators. | |
| Land Disposal/Containment | |
| Containment or On-site Landfill | |
| Off-site Landfill | |
| Institutional Controls | |
| Specify | |
| | |
| Others | |
| Specify Treatment Method | |
| | |

E) Documentation:

Please list titles of all site reports below. Include name of consulting firm and year completed. (If there is not enough room for the entire list, please attach additional page(s) as necessary.)

| TH: | By _k | De(te) |
|--|--|--|
| Preliminary Assessment; Former Fort James Specialty Chemicals, Inc. 906 NW Drake Street Camas, Washington | SECOR International Incorporated | July 26, 2000 |
| 2000 Site Investigation Report Former Fort James Specialty Chemical 906 NW Drake Street Camas, Washington | SECOR International Incorporated | January 17, 2001 |
| used available in a data base? yes no: | aminants treated or removed, or cleanup or ren X If yes, what programming software is use? N/A | |
| F) Property Type: Commercial Indust Property currently being used? yes no: Plans for change in use? yes no If | | ecify) |
| G) Standard Industrial Classification (SIC) | Codes: | |
| List all that apply. If none apply, or if you don (i.e. automotive repair and maintenance, cons | o't know your SIC code, list activities conducted struction equipment storage, etc.). | at the site |
| Former production of specialty chemicals to support | rt various client needs. | |
| H) Dangerous Waste Facilities: | • | |
| Does the facility have a dangerous waste identifyes, what is the number? WAD | ntification number? yes 🔲 no 🔯 | |
| I) Tank Information: | | |
| Investigation. According to Fort James, a 500-gallo of the Building 201 Non-Woven Plant. No information | ks were encountered during the Preliminary Assess n partially buried fuel UST was historically located in on is available on removal of this UST. However, no e reported UST location during the 2000 Site Investig | ı the landscaped bed petroleum residues |
| Complete this table for ALL tanks, whether untanks. | nderground (UST) or aboveground (AST), inclu | ding unregulated |
| (*Unleaded, leaded diesel, bunker-C, waste o (** Tank status: Left in Place, Removed, Clos | | |
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| | | | ' Vas Frag Product Gregoriteral? | | | | |
|------------------|--------|--------|-------------------------------------|---------|---------------|-----------|--|
| ्रामार <u>वि</u> | ASTUST | (SE3:) | Profile | (M) (I) | in Exerveilor | Tenk Sens | |
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J) Owner/Operator History (Please photocopy and attach copies if additional owners and/or operators are known.)

Type (code) of Owner/Operator (for below):

City:

Telephone Number:

Fax Number:

Private (1) Municipal (2) County (3) Federal (4) State (5) Tribal (6) Mixed (7) Other (8) Unknown (9) Public Entitle Acquisition via Bankruptcy (11)

| 1) Current Site Owner: Georgia- Pacific | Type: 1 | |
|--|-------------------------------|----------------------------|
| Street Address: : 401 NE Adams Street | | (3) |
| City: Camas | State: WA | ZIP: 30303 |
| Contact Persons (if different than owne | r, above): Julie B. Raming (G | G-P Environmental Affairs) |
| Street Address: 133 Peachtree street | | |
| City: Atlanta | State: GA | ZIP: 30303 |
| Telephone Number: 404-652-6869 | Extension: | |
| Fax Number: 404-654-4701 | e-mail address: | jbraming@gapac.com |
| Dates of Ownership: January 2001 | to present | |
| | | |
| 2) Current Facility Operator: Georgia-Pa | acific Corporation | Type: 1 |
| Street Address: 401 NE Adams Street | | |
| City: Camas | State: WA | ZIP: 98607 |
| Contact Persons (if different than owne | r, above): Steve Young | |
| Street Address: | | |
| City: | State: | ZIP: |
| Telephone Number: | Extension: | |
| Fax Number: | e-mail address: | |
| Dates of Operation: | to | |
| | | |
| 3) Former Site Owner: Former Fort Jam | nes Specialty Chemical Comp | olex |
| Street Address: 906 NW Drake | | |
| City: Camas | State: WA | ZIP: 98607 |
| Contact Persons (if different than owner | r, above): | |
| Street Address: | | |

| Dates of Ownership: | to | | | VP-44000 A-1411000 | |
|--|----------------|-----------------|-------|--------------------|--|
| | | | | | |
| 4) Former Facility Operator: Same as above | | | Type: | | |
| Street Address: | | | | · | |
| City: | | State: | ZIP: | | |
| Contact Persons (if different than | owner, above): | | | | |
| Street Address: | _ | | | | |
| City: | | State: | ZIP: | , , | |
| Telephone Number: | | Extension: | | | |
| Fax Number: | | e-mail address: | | | |
| Dates of Operation: | to | | | | |

State:

Extension:

e-mail address:

ZIP:

ECY 020-73 (Rev. 02/98) Page 7

K) Other Involved Parties: (Please photocopy and attach copies if additional parties are involved)

| 1) Environmental Consultant: SECOR Inter | rnational Incorporated | | | |
|---|--|--|--|--|
| epresenting: N/A | | | | |
| Firm: N/A | | | | |
| Street Address: 7730 SW Mohawk St. | | | | |
| City: Tualatin | State: OR | ZIP: 97062 | | |
| Telephone Number: 503-691-2030 | Extension: | | | |
| Fax Number:503-692-7074 | e-mail address: jrussell@secor.com | | | |
| | | | | |
| 2) Site Control Person if other than Owner, working hours and is authorized and qualif during normal business hours and has kno | ied to answer questions a | about the site, or a person who is available | | |
| Name: | | | | |
| Relation to site/owner/operator: | | | | |
| Firm: | | | | |
| Street Address: | | | | |
| City: | State: | ZIP: | | |
| Telephone Number: | Extension: | | | |
| Fax Number: | e-mail address: | | | |
| Dates of involvement with site: | to: | 100 400 | | |
| | | | | |
| 3 | VIA CONTRACTOR OF THE CONTRACT | | | |
| 3) Name: | | • | | |
| Relation to site/owner/operator: | | | | |
| Firm: | | | | |
| Street Address: | State: | ZIP: | | |
| City: | Extension: | Coll • | | |
| Telephone Number: | e-mail address: | | | |
| Fax Number: | to: | | | |
| Dates of involvement with site: | υ. | | | |
| | | | | |
| 4) Name: | | | | |
| Relation to site/owner/operator: | | | | |
| Firm: | | | | |
| Street Address: | | | | |
| City: | State: | ZIP: | | |
| Telephone Number: | Extension: | | | |
| Fax Number: | e-mail address: | | | |
| Dates of involvement with site: | to: | | | |

ATTACHMENT 2 GEORGIA PACIFIC CHECK #903081529

Georgia-Pacific



CHASE MANHATTAN BANK USA 1201 MARKET STREET WILMINGTON, DELAWARE 19801

62-26 4845-09

GEORGIA PACIFIC SHARED SERVICES CORPORATION 7016 A. C. SKINNER PARKWAY JACKSONVILLE, FL 32256 1-888-663-3337

VENDOR NUMBER 98160

CHECK NUMBER DATE 3/22/01 903081529

PAY EXACTLY \$******500.00 VOID AFTER 180 DAYS

PAY Five hundred and 00/100 Dollars

TO THE ORDER OF

DEPT OF ECOLOGY PO BOX 5128 LACEY WA 98503-0210

While A. SLK

#0903081529# #031100267# 6301446450 509#

VENDOR NUMBER DATE CHECK NUMBER 98160 3/22/01 903081529

Georgia-Pacific



GEORGIA PACIFIC SHARED SERVICES CORPORATION 7016 A. C. SKINNER PARKWAY JACKSONVILLE, FL 32256 1-888-663-3337

| DATE | INVOICE # | C | ROSS AMOUNT | DISCOUNT | NET AMOUNT | PHONE CONTACT |
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PRELIMINARY SITE ASSESSMENT REPORT





PRELIMINARY ASSESSMENT

Former Specialty Chemicals, Inc. 906 NW Drake Street Camas, Washington

SECOR PN: 015.08716.002

Submitted by: SECOR International Incorporated

for:

Fort James Corporation 349 NW 7th Avenue Camas, Washington 98607

July 26, 2000

Prepared by:

Joseph B. Hunt, R.G. Principal Geologist

Reviewed by:

Steven E. Locke, P.E. Principal Chemical Engineer

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1.0 INTRODUCTION

This report presents the results of a Preliminary Assessment (PA) for the former Specialty Chemicals, Inc. (Specialty Chemicals) facility located at 906 NW Drake Street, east of the intersection of NW 10th Avenue and Drake Street in Camas, Washington. The facility is owned by Fort James Camas Limited Liability Corporation (LLC). This PA is designed to evaluate chemical and waste handling practices and to evaluate potential exposure pathways (surface water, air, groundwater, and direct contact) for any hazardous chemicals that may have been released to the environment from operations at the facility. PAs are intended to generally identify any potential hazards at a site, identify any sites that require immediate action, and establish priorities for any sites requiring in-depth investigations. The PA is not a full investigation or characterization of the site. The scope of this investigation includes review of available file information, interviews, a target survey, and an on-site reconnaissance inspection.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The Specialty Chemicals facility is a former chemical manufacturing complex owned and operated by Fort James Camas LLC. The facility ceased production activities in late 1999. At present, portions of the facility are used for warehousing of maintenance parts and for meetings by the Fort James Camas Mill. Specialty Chemicals is located at 906 NW Drake Street, east of the intersection of 10th Avenue and Drake Street, in Camas, Washington. A site vicinity map is included as Figure 1. The facility occupies an area of approximately five acres. The site is located north of the Fort James Corporation Business Center and Mill. It is bounded to the north by forested land, NW Benton Street, and residential areas; to the west by NW Drake Street and both commercial and residential properties; and to the east by a ravine and Blue Creek.

The facility consists of six main buildings (Buildings 201 through 206) that were formerly used for chemical production and storage, three tank farms used for bulk chemical storage, and a diked drum storage area. An oil and pipe shed formerly located on the complex was used for storage of piping and drummed oil and has been removed. The building designations are as follows:

Building 201: Warehouse and Offices Building 202: Process Engineering Building 203: Thiodiphenol Plant Building 204: Catechol Plant Building 205: Defoamer Plant Building 206: High Pressure Lab

Bulk chemicals were stored and distributed in the three facility tank farms. The bulk tank farms consisted of: (1) Northern Tank Farm of three tanks located north of Building 205 and east of the diked area, (2) Building 205 Tank Farm consisting of four tanks, and (3) Central Tank Farm consisting of seven tanks located northwest of Building 203. The Central Tank Farm also contained a main process water treatment sump, which received process water from the facility floor drain system, centrifuges, and a solvent decanter. The treatment sump discharged via the facility process sewer line to the effluent treatment system at the adjacent Fort James Camas Mill. The facility process sewer is located along the eastern facility boundary adjacent to the ravine. Each of the tank farms is underlain by concrete and surrounded by concrete berming with sufficient freeboard to meet spill prevention and contingency control requirements. A facility plan, which illustrates the on-site buildings, tank farms, and process sewer system, is included as Figure 2.

2.2 OWNERSHIP AND OPERATIONAL HISTORY

2.2.1 Ownership History

Crown Zellerbach Chemical Corporation originally developed the Specialty Chemicals facility from the early 1960s to the early 1970s. In 1986, James River Corporation purchased Crown Zellerbach and assumed ownership and operation of Specialty Chemicals and the adjacent mill. In 1997, James River merged with Fort Howard Corporation to become Fort James Corporation. The land was reportedly undeveloped prior to the construction of the Specialty Chemicals facility.

2.2.2 Operating History

Operations at Specialty Chemicals were conducted from the early 1960s to 1999. The facility was operated as a small-quantity manufacturer of highly valued specialty chemical products for domestic and foreign markets. Primary products included thiodiphenol (TDP), dimethyl sulfone (DMSO₂), methylenedioxybenzene (MDB), and purified catechol. TDP is a chemical intermediate used in the manufacturing of guinea worm larvicide, while DMSO₂, MDB, and catechol are important chemicals used in a variety of specialty manufacturing operations. The products were produced in various buildings on the property. A brief description of the buildings and chemical process history is presented below.

2.2.2.1 Buildings

Building 201. Building 201 was constructed in 1961 and was originally used as a non-woven fabric manufacturing plant. From 1961 through 1999, this building was used as a chemical product storage warehouse and a blending facility for napkin/towel printing inks. A partially buried underground storage tank (UST) of an estimated 500-gallon capacity was formerly located in the landscaped bed adjacent to the front entrance.

Building 202. In the late 1960s, Building 202, the Process Engineering Building, was constructed to manufacture catechol and develop a process that Crown Zellerbach would later utilize at other facilities. Due to foreign competition, the catechol production process was abandoned, and the process building was converted to produce DMSO₂ and MDB and continue with various pilot plant activities, including the production of chlorinated levulinic acid (CLA), methyl thio metacresol (MTMC), and methyl thiophenol (MTP).

Process residuals from Building 202 were at one time stored in drums in an area east of Building 202. A small transformer station is located to the south of the former Building 202 drum storage area.

Building 203. Building 203 was constructed in 1972. The initial product was TDP, which was later supplemented with sulfonyl diphenol (SDP) production from the mid 1970s to the early 1980s. Specific campaigns and customer demands led to the production of other products, including:

- cellobiose octaacetate
- DMSO₂
- MTMC
- thiobis (methyl-tertiary-butyl-phenol), or TB (MTBP)
- thiobis (tertiary-butyl-metacresol), or TB (TBMC)

- thiobis methyl resorcinol, or TB (TBMR)
- thiobis (para-tertiary-octyl-phenol), or TB (PTOP)

The area west of Building 203 was used for the storage of raw materials, products, and process wastes prior to the construction of the diked storage area west of Building 205.

Building 204. Building 204 was constructed in 1974 to produce tertiary butyl catechol (TBC) and to purify technical grade catechol. DMSO₂ was also produced in the building.

Building 205. Building 205, known as the Defoamer Plant, was constructed in the late 1960s to produce synthetic wood pulp. In the late 1970s, Building 205 was converted to manufacture pulp mill defoamers, pitch dispersants, and other blended materials, including anthraquinone slurry and an optical brightener.

<u>Building 206.</u> Building 206, the High Pressure Laboratory, was constructed in 1961 and was utilized to produce purified dimethyl sulfoxide (DMSO).

2.2.2.2 Processes

Table 1 lists the products and raw materials used in each of the buildings and processes. Based on SECOR's file review, no additional raw materials or products were used or produced at the facility. Plant operations typically involved bulk storage of raw materials in the tank farms and conveyance into the specific process streams in each of the buildings. The products used for the pulp and paper industry were produced in the Specialty Chemicals operation from blending or repackaging operations. For example, defoamers and pitch dispersants were produced from raw material blends, inks were produced from dye and water, and anthraquinone and optical brightener were produced from blends of powdered raw materials and water. Other optical brighteners arrived at the facility in finished form and were repackaged and shipped out to various customers in returnable totes.

Chemical intermediates, such as TDP, were manufactured in the plants from batch or semi-batch operations. With the exception of purified catechol, each of these products was produced from a reaction between two or more raw materials. Purified catechol was produced from batch distillation of technical grade catechol. Production of chemical intermediates generally occurred in campaigns lasting from two weeks to six months.

2.2.3 Permits

During active operations, the following environmental permits were issued for the facility:

- National Pollutant Discharge Elimination System (NPDES) Permit No. 100005
- Air Contaminant Discharge Permit No. 26-2026
- Storm Water Permit No. 1200T
- City Waste Water Permit No. 400-012
- Hazardous Waste Generator Permit No. WAD 087458196

2.2.4 Identified Environmental Issues or Potential Issues

Operational Releases/Spills. Operational releases/spills were evaluated through review of written records dating back to 1988 and interviews with former facility personnel who worked at the facility from the early 1960s to the present. These records revealed 15 releases of various chemicals from several sources, including the process buildings, storm sewer, and process sewer. The known release volumes ranged from an estimated quantity of 50 gallons to 1,400 gallons. Table 2 summarizes the available release data. Environmental matrices potentially affected by past on-site spills include subsurface soil and groundwater.

<u>Underground Storage Tanks.</u> Aside from one UST of an estimated 500-gallon capacity located in front of Building 201, there is no evidence that other USTs were present at the facility. The Building 201 tank was partially aboveground. No investigative or remedial data is available on the Building 201 UST. According to an interview with a former Specialty Chemicals employee, the tank has been removed. Environmental matrices potentially affected by past potential on-site releases from the UST include subsurface soil and groundwater.

Raw Material/Product/Waste Material Storage and Handling. The storage of raw material, product, and waste material west of and adjacent to Building 203 presented a potential risk of release. Environmental matrices potentially affected by past on-site releases from this area include subsurface soil and groundwater.

Potential Historical Disposal Practices. Historically, in the 1960s and early 1970s, standard and acceptable disposal practices for tank bottoms and other oily sludges consisted of on-site disposal of the material. There was no visible or reported evidence of such disposal having occurred; however, the potential that such disposal practices may have occurred in the past represents a risk to the surface and groundwater pathways.

2.3 SITE INVESTIGATION HISTORY

Aside from minor sampling efforts to support cleanups of spilled material, no environmental investigation activities have been conducted at the site to date.

2.4 REGULATORY INSPECTION HISTORY

2.4.1 Southwest Air Pollution Control Authority (SWAPCA) Inspections

Routine and unannounced SWAPCA inspections associated with the Specialty Chemicals air discharge permit were conducted at the site from 1994 to 1999. During the inspections, SWAPCA inspectors reviewed emissions, log sheets, process mechanicals, and the TDP and MDB processes to assist in the review of the Notice of Construction to limit the potential to emit. These inspections addressed permit compliance status.

2.4.2 Washington Department of Ecology (Ecology) Inspections

Ecology inspections were conducted at the facility in conjunction with inspections at the adjacent Fort James Mill during 1991, 1993, 1997, 1998, and 2000. The inspections typically consisted of a general facility inspection and walk-through, evaluation of the hazardous waste contingency plan, evaluation of the hazardous waste training program, inspection of containment area sealing, and assessment of cleanups associated with a caustic spill to bare soil (1998) and a release from the defoamer storage tanks (1993).

2.4.3 Preliminary Assessment Site Visit

On May 9, 2000, Mr. Joseph Hunt of SECOR met with Ms. Heather Bartlett of Fort James Corporation to review historical operations and to complete a site walk of the Specialty Chemicals facility. The inspection consisted of reviewing site files, walking the entire facility, verifying past operations and waste storage activities, and refining proposed soil boring locations for the upcoming limited soil and groundwater investigation.

3.0 WASTE CHARACTERISTICS

3.1 POTENTIAL SOURCES OF HAZARDOUS SUBSTANCES

Potential sources of hazardous substances identified at the site include process residual storage and handling, raw material/product storage and handling, UST releases, and process wastewater conveyance. Descriptions of each of these potential sources are presented below.

3.1.1 Process Residual Storage and Handling

Based on review of Fort James Mill correspondence on the Pasco Landfill, the hazardous waste manifests from 1980 to 1998 obtained during the file review, and an evaluation of the raw materials and products produced at the facility, the process-related residuals and wastestreams generated and stored at the site were disposed of at both the Pasco Sanitary Landfill in Pasco, Washington, and Chem-Security Systems, Inc., in Arlington, Oregon. wastestreams were originally stored on site in approximately 160 55-gallon drums in the area west of Building 203 from the early 1960s until 1974 and were disposed of at the Pasco Sanitary Landfill in Pasco, Washington in March 1974. These wastestreams included catechol process derivatives and general facility housecleaning wastes. From 1974 until closure of the facility, facility wastestreams were stored in the diked containment area west of Building 205 and disposed of at the Chem-Security Systems, Inc., in Arlington, Oregon. Wastestreams from the diked containment area west of Building 205 included MDB tar, MTBP residue, TDP tar, glycol ink residue, phenolic distillation residue, waste orthodichlorobenzene, TBC tar, PTOP residue, and MTBP residue. While annual volumes varied somewhat, typical volumes of these waste streams generated on an annual basis included TDP tar (126,000 pounds), phenolic distillation residue (40,000 pounds), MTBP residue (25,000 pounds), orthodichlorobenzene (5,000 pounds), glycol ink residue (3,300 pounds), and MDB tar (900 pounds).

These compounds were typically recovered as process distillation bottoms, contained in U.S. Department of Transportation (DOT)-approved 17H 55-gallon drums, stored in an outside compound adjacent to Building 203 and in the exterior diked storage compound at the northwest corner of the facility, and shipped off site as state dangerous wastes. The product and technical bulletins included in Appendix A summarize the pertinent chemical reactions in terms of raw materials used and products and waste streams produced. Other waste streams included process water and reaction-derived sodium chloride, which were conveyed via the facility process sewer to the effluent treatment system at the adjacent Fort James Mill.

Releases from the drums may have occurred from leakage, mechanical defects, accidents during storage and loading for disposal, and effects due to weather. Such releases would likely impact subsurface soil and groundwater.

3.1.2 Raw Material/Product Storage and Handling

Raw materials and products stored and handled at the facility included acids, caustics, alcohols, various unsubstituted phenols and chlorophenols, halogenated volatile organic compounds, and petroleum lubricants and oils. Products included substituted phenols and cresols, thiobis compounds, dioxybenzenes, substituted sulfoxides, and defoamers.

The bulk of the raw materials were stored at the facility in the aboveground storage tank (ASTs) farms or in smaller tanks within the specific on-site process buildings. As the exterior AST farms were underlain and surrounded by secondary containment structures to meet facility spill prevention, control and countermeasure (SPCC) requirements, releases would have been largely contained and recovered or disposed. Subsurface soil and groundwater may have been impacted by releases from incompetencies within secondary containment, such as cracks or gaps.

Releases during packaging, storage, distribution, or loading of product would have also had the potential to impact subsurface soil and groundwater in the vicinity of the release.

3.1.3 Underground Storage Tank Releases

A partially buried fuel UST of an estimated 500-gallon capacity was formerly located in the landscaped bed adjacent to the front entrance of Building 201. The fuel storage tank was reportedly removed and was in good condition with no apparent holes. No evidence of petroleum release to subsurface soil was reportedly observed during the removal. However, no soil confirmation samples were collected beneath the tank to confirm that observation. As a result of storage tank operations, releases of fuel may have occurred to subsurface soil through fuel overfilling or holes within the distribution piping.

3.1.4 Process Wastewater Conveyance

The main facility wastewater sump in the central tank farm near Building 203 received all process wastewater and stormwater and discharged via the facility process sewer line to the effluent treatment system at the adjacent Fort James Mill. The process sewer line was located along the eastern edge of the facility. A failure in the sump integrity and/or sewer line could have caused impact to subsurface soil and groundwater.

3.2 WASTE CHARACTERISTIC CONCLUSIONS

Environmental impacts at the site may have occurred from past releases of raw materials, product, and process residuals due to storage and handling practices and/or releases from the process wastewater conveyance system and/or fuel from the former Building 201 fuel storage tank. Releases from these sources would likely have impacted subsurface soil and groundwater beneath the facility.

4.0 GROUNDWATER PATHWAY

4.1 REGIONAL GEOLOGY AND HYDROLOGY

Regional geology in the area of the site is represented by surficial unconsolidated Quaternary alluvial deposits of silt, sand, and organic rich clay, with lesser amounts of gravel. These deposits reach thicknesses of up to 300 feet near the banks of the river and rapidly thin northward to depths of 6 to 10 feet. The surficial deposits are underlain in turn by conglomerates of the early Pliocene age Troutdale

Formation (400 feet in thickness), a sedimentary confining unit, the Troutdale sandstone aquifer (100 feet in thickness), a second sedimentary confining unit, the Sand and Gravel aquifer (300 feet in thickness), and the Eocene to Miocene age Columbia River Basalt. The surrounding foothills and mountain ridges consist primarily of Tertiary age volcanic and sedimentary rocks.

The principal regional aquifers in the area occur within the Troutdale conglomerate and sandstone aquifers, the Sand and Gravel aquifer, and the Columbia River Basalt. The unconsolidated Quaternary alluvial deposits also serve as less important water-bearing units where they extend below the water table. The conglomerates and sandstones of the Troutdale Formation are considered to comprise the most productive aquifer in the region. The upper portion of the underlying Columbia River Basalt is also an important water-bearing zone due to its high porosity and fracture characteristics.

Recharge of groundwater to the aquifers in the area occurs primarily by infiltration from precipitation and surface runoff. Discharge from the aquifers in the region is mainly by seepage to the Columbia and Willamette Rivers and by withdrawal of groundwater from wells. Regional groundwater movement is southerly, toward the Columbia River.

4.2 SITE GEOLOGY AND HYDROLOGY

Based on review of area geologic maps and local observation of lithology expressed in Blue Creek Canyon along the eastern boundary of the site, site geologic conditions appear to be represented by a thin surficial veneer of Quaternary alluvium underlain by Columbia River Basalt as the basement complex. The thickness of the alluvium is unknown but is assumed to range from 2 to 10 feet. Based on review of area well logs, water in the basalt underlying the site is assumed to occur at approximately 30 to 40 feet below ground surface. Groundwater gradient in the basalt underlying the site is unknown but assumed to be generally oriented in a southerly direction towards the river. Hydraulic conductivity in the basalt is assumed to be approximately 0.01 meter per day, a standard value for fractured igneous rock.

4.3 GROUNDWATER TARGETS

Based on review of area well logs, a total of six domestic and five irrigation wells exist within the Prune Hill and Lacamas Lake area north of the site. This area would be considered hydraulically upgradient of the site, given the assumed southerly regional groundwater flow direction. The closest domestic well is located approximately 1.25 miles northeast of the site at an elevation of approximately 300 feet. No reported groundwater production exists between the site and the Columbia River. The city of Camas is supplied by water from a municipal system that draws from Jones and Boulder Creeks on Larch Mountain and a municipal well field (City of Camas, 2000).

4.4 GROUNDWATER CONCLUSIONS

Given the location of the site and river, the regional southerly groundwater flow direction, a review of area well logs, the absence of reported groundwater production downgradient of the facility, and the fact that the city of Camas is supplied by surface water and municipal water, no groundwater targets exist downgradient of the facility.

5.0 SURFACE WATER PATHWAY

5.1 HYDROLOGIC SETTING

The site gently slopes in a southerly direction toward the Columbia River and lies outside the 500-year floodplain. Blue Creek flows east of the site through a canyon and is the primary source of groundwater recharge in the immediate vicinity of the site.

The maximum two-year, 24-hour rainfall event is 2.5 inches (NOAA, 2000). Percolation of precipitation occurs primarily within the unpaved portions of the facility.

5.2 SURFACE WATER TARGETS

Surface runoff within the facility is captured by a storm sewer system, which conveys flow to the effluent treatment system at the adjacent Fort James Camas Mill prior to permitted discharge. Surface water within 2 miles of the facility is used for commercial/industrial purposes, recreation, and fishing. A public boat launch is located approximately 2 miles downriver of the site, and no industrial surface water intakes are present, aside from the mill intake, within approximately 2.5 miles downstream (Ecology, 2000).

The Columbia River is a migratory corridor for several anadromous fish species. The most common migratory fish species in the Columbia River are the Chinook and coho salmon, steelhead, and American shad. In addition, six wetlands were identified along the Columbia River within 2 miles downriver from the site (FEMA, 2000).

5.3 SURFACE WATER CONCLUSIONS

The two primary avenues by which chemical substances from the site could reach surface water are through storm sewer and process water system releases and groundwater migration. During active operations, the storm drainage system at the facility was engineered such that surface runoff that may have contacted chemical substances was routed through the effluent treatment system at the adjacent Fort James Mill prior to being discharged to the Columbia River under the restrictions of the Mill's NPDES permit. Combined with the fact that the majority of the site surface is covered by asphalt and concrete, and the fact that the Specialty Chemicals facility is topographically upgradient from the mill and the river, surface water impact from surface runoff is an unlikely event.

Similarly, process water from Specialty Chemicals operations was routed through the effluent treatment system at the mill prior to discharge to the Columbia River under NPDES permit specifications. While releases to groundwater from the storm sewer system, the central wastewater sump, and/or the process water sewer may have occurred during active operations, typical lithologic and structural heterogeneties within the volcanic sequence underlying the site likely could serve to limit significant vertical and lateral migration to adjacent Blue Creek and the river. If impacts did occur to the creek or river in the past, the effects of dispersion and dilution, combined with a relatively low waste volume and flow, would have likely contributed negligible effects to surface water receptors. As a result, no significant impacts to Blue Creek or the Columbia River are anticipated via this pathway.

6.0 AIR PATHWAY

As the facility is no longer active, the air pathway was not evaluated.

7.0 DIRECT CONTACT

7.1 PHYSICAL CONDITIONS

Potential sources of chemical substances may be present in soil and groundwater beneath the site. Consequently, sources available for direct contact would be limited primarily to impacted subsurface soil due to past releases as a result of a spill or failure of a product container or pipeline. Public access to the facility is restricted.

7.2 DIRECT CONTACT TARGETS

Given the assumptions that groundwater is present within the basaltic bedrock beneath the site, is not accessible, and is not utilized hydraulically downgradient of the facility, direct contact via this pathway is not considered valid to any receptor. However, direct contact with potentially impacted, unsaturated zone soil between the site surface and bedrock is considered a valid pathway for on-site construction worker and trench worker targets. As the majority of the site surface is covered with asphalt/concrete, direct contact to impacted soil by occasional on-site workers and/or trespassers is not considered to be a valid pathway. Site workers are trained in health and safety procedures to reduce direct contact risks to appropriate regulatory standards.

7.3 DIRECT CONTACT CONCLUSIONS

Current information does not indicate that releases of chemical substances have occurred within or outside the facility boundaries in areas available to the public for direct contact. The potential for direct contact by on-site trench or construction workers exists, but given the fact that the facility is currently inoperative, current risk via this pathway is low. Also, should construction or trench work be conducted on site in the future, the potential risks to site workers would be limited by the use of appropriate health and safety practices. Therefore, SECOR concludes that the direct contact pathway does not present a threat to human health or the environment.

8.0 SUMMARY AND CONCLUSIONS

This PA was designed to investigate chemical and waste handling practices and evaluate potential exposure pathways (surface water, air, groundwater, and direct contact) for hazardous chemicals that may have been released to the environment from operations at the Specialty Chemicals facility.

The Specialty Chemicals facility is a former chemical manufacturing complex located east of the intersection of 10th Avenue and Drake Street in Camas, Washington. The site is located north of the Fort James Corporation Business Center and Mill. During active operations from the early 1960s until 1999, Specialty Chemicals produced specialty chemicals supporting various types of commercial and industrial applications. These chemicals primarily included thiodiphenol, methylene dioxybenzene, and purified catechol. Portions of the facility are currently used for warehousing of maintenance parts and for meeting purposes for the Fort James Camas Mill.

During active operations, process water and stormwater generated at the facility were collected and conveyed through the facility process sewer line to the effluent treatment system prior to permitted discharge. In addition, waste stream storage areas were either underlain by asphalt or diked with concrete to prevent impact to the native ground surface. The operational areas and the majority of the remaining facility are surfaced with asphalt and/or concrete.

Geologic and hydrogeologic information within the area of the site indicates the presence of a basaltic basement complex, groundwater depths ranging from 40 to 60 feet below ground surface, and groundwater flow oriented in a southerly direction, with eventual discharge to the Columbia River. Given the likely differentiated nature of the volcanic sequence underlying the site, the extent of lateral and vertical migration of compounds released to groundwater is currently unknown. Potentially, impacted groundwater could be confined within massive or welded members of the formation or may have migrated to the Columbia River. Any potential discharge of impacted groundwater to the river would be subject to significant dispersion and dilution by the large volume of fresh river water. In addition, based on a review of area well logs, there are currently no downgradient users of groundwater between the facility and the river.

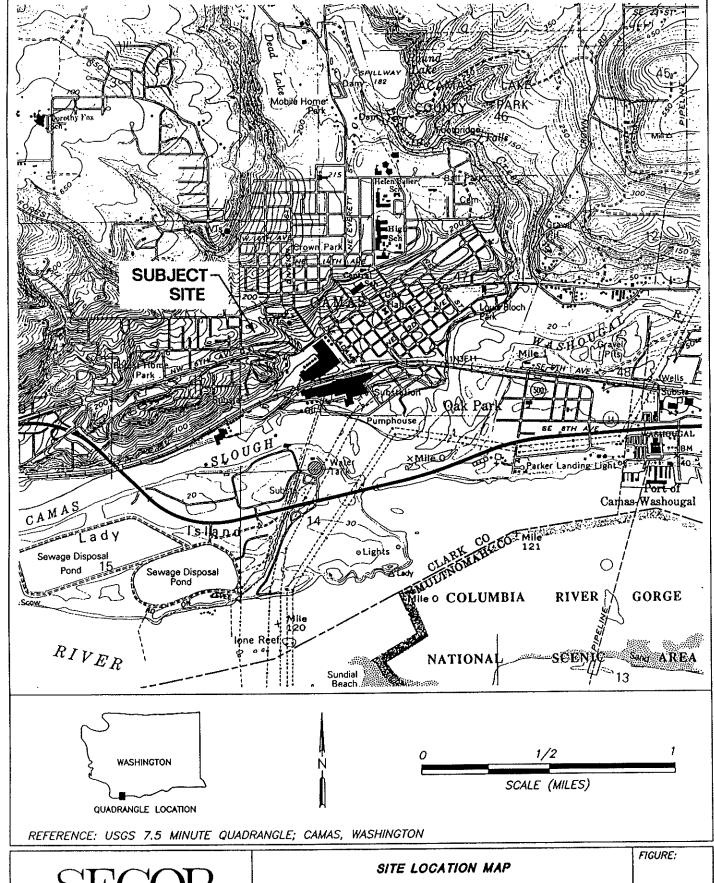
The potential environmental impacts from the chemicals used and produced and the waste streams generated and stored at the site are limited to historical releases from on-site operations/processes and from past on-site storage activities. As a result, the environmental media/pathways that would likely be directly impacted include subsurface soil and groundwater. Environmental media/pathways that may be indirectly impacted would include surface water and either associated recreational or withdrawal uses and direct contact to on-site construction and/or trench workers. However, such impacts are considered unlikely.

Current information reviewed indicates that releases of chemical substances have occurred within the facility boundaries during past operations. Soil and groundwater investigative activities are planned to assess the potential for environmental impact at the site during the summer of 2000.

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FIGURES



International Incorporated 015

FORT JAMES CORPORATION

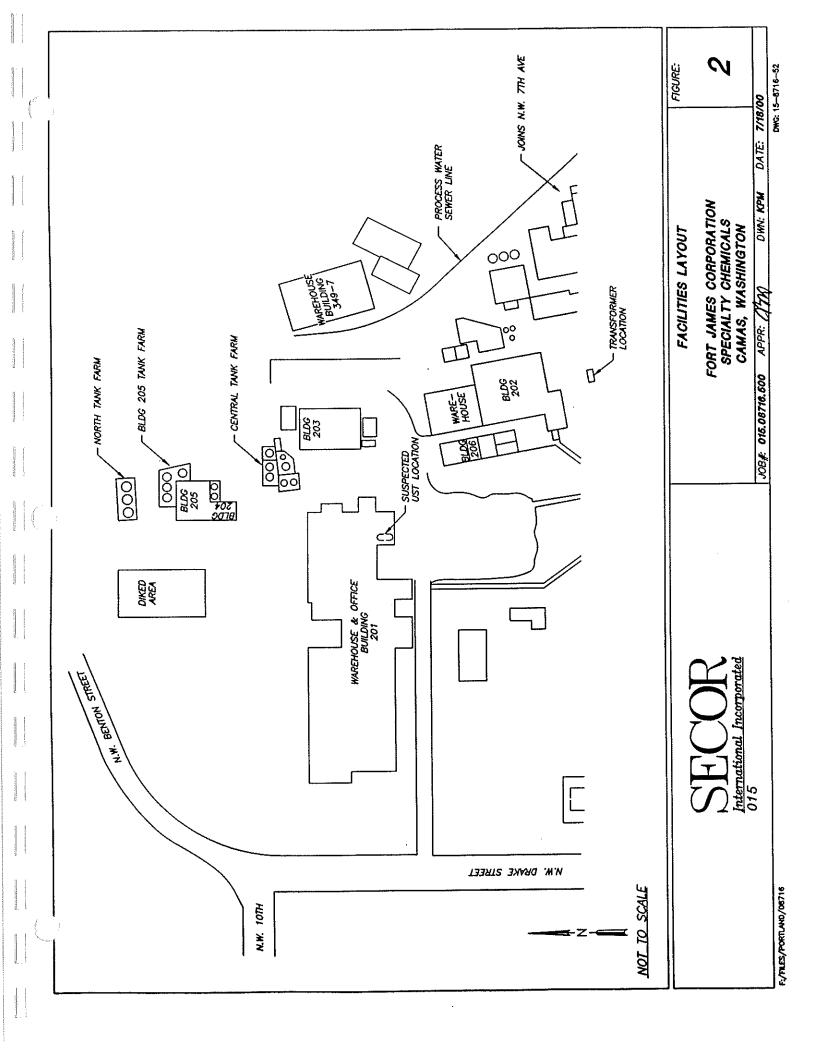
SPECIALTY CHEMICALS CAMAS, WASHINGTON

DWN: KPM

DATE: 07/18/00

APPR: / JOB#: 015.08718.500

DWG: 15-87614-5(1)



TABLES

Table 2. Historical Release Summary
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| Dete | Material | Fertimated Volume | Media | Canse | Remedial Action |
|----------|--|--|--------------------------|--|--|
| ם ה | Spilled | Estimated Former | Impacted | 20112 | |
| 11/88 | CZ 777 pitch dispersed | Unknown | Blue Creek | Storm sewer discharge to Blue Creek. | Not stated. |
| 3/89 | HCI | <11 lbs | Atmosphere | Unknown | None |
| 04/19/90 | Mercaptan Or dimethylsulfide | No estimate | Atmosphere | Mixture of 4', 4', triobis-tect-butyl-m-cresol and other chemicals overheated due to a steam controller failure. Vacuum exhaust released noncondensible gases to atmosphere, which produced odor. | Engineering study to be conducted. The distillation column was fitted with a caustic scrubber and a small carbon absorption column. In addition, hydrogen peroxide was added to the still to oxidize the mercaptans. |
| 06/80 | DMSO | Small | Ground | Not stated. | DMSO cleaned up. |
| 02/91 | Hydraulic fluid | | | Hydraulic line broke. | Hydraulic fluid cleaned up. |
| 04/21/92 | Wastewater w/ dilute TDP | <100 gal Max phenol 11 lbs Max cyclohexane 4 lbs | Gravel in parking lot | Partial plug in the process sewer caused wastewater to overflow in manhole and flow onto a gravel parking lot inside mill. | Noticed problem – reduced wastewater flow and cleaned out lines. Ground air-dried. |
| 11/02/92 | Hydrogen chloride | 44 Ibs | Atmosphere | Malfunctioning scrubber liquor pump at a caustic scrubber. | The inoperative pump was restarted. |
| 1992 | Process water | Unknown | Blue Creek/ Soil | Leaks in process sewer. | Soil was excavated and tested. |
| 1995 | None | None | Soil | Process sewer line inspected. No release found. | None |
| 1995 | Sewage | Bare ground/Blue Creek | 1400 gal | Caused by flooding - heavy rainfall. | None |
| 02/08/96 | Wastewater w/ thiodiphenol (TDP) | Not stated | Soil | Age and settlement caused the failure of a 4-inch vitrified clay elbow and sewer pipe connecting a floor drain in the Specialty Chemical TDP plant w/ process sewer. | Floor drain rebuilt with stainless steel pipe. Crystallized TDP and sand to be shipped to disposal facility. |
| 07/16/96 | Dimethyl sulfide | <35 lbs | Atmosphere | Hot MDB distillation residue was placed in steel drums for disposal. Drums were later observed venting dimethyl sulfide, a decomposition product of dimethyl sulfoxide. Dimethyl sulfoxide is used as a solvent in the manufacture of MDB. | Operator observed condition, completed proper notifications, and sprayed cold water on the drums. Emissions ceased when drums cooled. Modified operation procedures to increase pH of distillation process. |

1 of 2

Table 2. Historical Release Summary
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| | | | | | | |
|---------------------|---|---|--|--|---------------------------------|--|
| Remedial Action | Operating personnel noticed emission and promptly curtailed the reaction rate. | Operating personnel noticed spillage and promptly shut off the pump. The contaminated process water received 1° and 2° wastewater treatment. | Cleaned up solution within containment. | Leak termination and soil cleanup. Contaminated soil washed with water. | Cleaned up solution. | Old pipe sealed/holes filled. |
| Cause | Shipment of sulfur dichloride being processed showed unusual chemical properties. | A hose connected to the system that pumps heptane to the heptane storage tank was left open, spraying heptane against the TDP building and onto the asphalt. Heptane then drained to the process sewer. | TDP w/ phenol spilled into a containment area. Over-pressurization of drum split the barrel. | Caustic leakage from pump seals and piping drips accumulated in storage containment. Open drain valve in containment allowed overflow to bare ground. | Drum punctured with a forklift. | Former process sewer line abandoned 20-30 yrs prior. |
| Media Impacted | Atmosphere | To wastewater treatment | Atmosphere | Ground (soil) | | None |
| Estimated Volume | <3 lbs | <110 gal | Unknown | <25 gals | 50 gal | Not Applicable |
| Material Spilled | Chlorine (gas) | Heptane | TDP w/ phenol | Caustic, 50% sodium hydroxide | Sulfur monochloride | None |
| Date | 06/01/97 | 03/14/98 | 86/90 | 08/14/98 | 10/98 | 1996/98 |

APPENDIX A PRODUCT AND TECHNICAL BULLETINS

Preliminary Assessment
Fort James Corporation/Specialty Chemicals, Inc.
906 NW Drake Street, Camas, Washington
SECOR PN: 015.08716.002
July 26, 2000

TECHNICAL BULLETIN



Organizallerbeigh

Shamisen reclusis Enisten Canas Washington 98807

CrownZellerbach

Chemical Products Division



4, 4'-Thiodiphenol

(TDP)

INTRODUCTION

High purity 4,4'-thiodiphenol (often abbreviated TDP) is now available for the first time in commercial quantities from Crown Zellerbach, Chemical Products Division. It is a white crystalline material ideally suited for monomer or chemical intermediate uses.

This brochure is intended to provide a background of knowledge in the chemistry of TDP and to review some of the applications that have been suggested in the literature.

As time passes, our knowledge of TDP will be increasing and we would welcome an opportunity to discuss synthesis problems and new or related technology with you.

April 1975

Second Printing January 1977

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| RIDI IOCDADUV | |

| Appearance | white crystals | |
|---|----------------------------------|-------------|
| Molecular weight | 218.28 | |
| Thermodynamic freezing point, °C (4) | 152.4 | |
| Molal freezing point constant, °C (4) | 9.5 | |
| Density (solid) (2) | 1.385 | |
| grams/cubic centimeter at 25°C | 11 0.7 | |
| Refractive index (3) (crystals) | n_{D}^{25} 1.688 | |
| | $\int_{D}^{25} n_{D}^{25}$ 1.608 | |
| Heat of fusion (4), calories/gram | approx. 38 | |
| Acid dissociation constants (5)(31) | pKa ₁ 10.3 | |
| (50% ag. ethanol, 25°C) | pKa ₂ 11.1 | |
| Polarographic half-wave potential (6) | E 1/2 0.85 V | |
| Spectra | Absorbance | Extinction |
| | Peaks | Coefficient |
| Tilder and all all all all all all all all all al | (nm) | (log€) |
| Ultraviolet in 6% aq. EtOH (5) | (neutral) 231.2 | 4.16 |
| | (neutral) 248.6 | 4.16 |
| " in math = = 1 (0) | (alkaline) 265.0 | 4.39 |
| In memanor (2) | (neutral) 233.0 | 4.16 |
| (see curve) | (neutral) 251.0 | 4.18 |
| Visible in 96% H ₂ SO ₄ (7) | 840 | 1400 |
| | 520 | 500 |
| Infrared (9)(36) (see curve) | | |
| Electron spin resonance in 96% H ₂ SO ₄ (7) | | |
| | | |

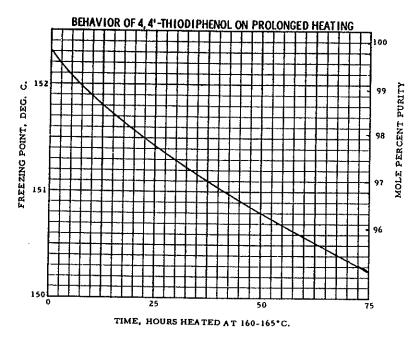
Solubilities of 4,4'-Thiodiphenol (TDP)

| • | <u>25 °C</u> | eight Percent 60°C | (2) <u>80°C</u> |
|--------------------|--------------|-----------------------|--------------------|
| Acetic acid | 15 | 30 | > 30 |
| Acetone | > 30 | | - |
| Acetonitrile | > 30 | - | |
| Benzene | - | < 1 | 2.5 |
| Chloroform | - | <1 | |
| Cyclohexane | - | < 1 | < 1 |
| Cyclohexene | insol. | 1 | 1.5 |
| Dimethyl disulfide | 1 | 6.5 | 30(100°C) |
| Dimethyl sulfide | 12 | _ | _ |
| Dimethyl sulfone | - | - | > 30 |
| Dimethyl sulfoxide | > 30 | - | - |
| Ethanol | > 30 | ••• | |
| Ethyl acetate | > 30 | - | - |
| Ethylene glycol | > 30 | | - |
| Ethyl ether | > 30 | | - |
| Petroleum ether | _ | insol. | - |
| Toluene | - | < 1 | |
| Trichloroethylene | - | - . | insol. |
| Water | - | <1 | 5(100°C) |

Stability

Crystalline 4,4'-thiodiphenol has been stored for several weeks exposed to the air and to normal laboratory lighting. No measurable degradation has taken place.

High temperature storage has resulted in slow degradation. A 40-gram sample of polymer-grade 4,4'-thiodiphenol was held under nitrogen at 160-165°C for 72 hours. The sample was 80 mm deep and had a 25 mm diameter surface. It was cooled periodically with thorough stirring to determine the freezing point. Change in freezing point is plotted below, along with a molal purity calculated by Raoult's Law.



At high temperatures and in the presence of a strong base, 4,4'-thiodiphenol has been reported to isomerize and to polymerize (56). The following results were obtained by heating a mixture of 0.025 mol. of 4,4'-thiodiphenol, 0.05 mol. of phenol, and 0.01 mol. of NaOH under nitrogen at 180°C.

| Time, | Total Recovery | Ison | ers four | nd, % |
|-------|----------------|------|----------|-------|
| hours | <u></u> % | 2,2' | 2,4' | 4,4' |
| 5 | 95 | 21 | 63 | 16 |
| 24 | 95 | 42 | 47 | 10 |

Dilute alkaline solutions of 4,4'-thiodiphenol are relatively stable when refluxed with exposure to air. After 2-3 hours there was little effect. After eight hours a small loss in product and reduction in melting point was obtained. Presence of iron increased the degradation under these conditions.

4,4'-Thiodiphenol can be easily handled under customary reaction conditions. It is stable to air and light and decomposes only slowly at high temperatures. As a precaution against oxidation, heated 4,4'-thiodiphenol should be protected from air by a blanket of nitrogen or other inert gas.

REACTIONS WITH THE SULFUR GROUP

The <u>sulfoxide</u> of 4,4'-thiodiphenol (TDP) is readily prepared (I). A laboratory procedure is available in the Appendix.

HO
$$\longrightarrow$$
 S- \bigcirc OH + H₂O₂ \longrightarrow HO \bigcirc S \bigcirc OH \bigcirc

The <u>sulfone</u> can be prepared in a similar fashion with a catalyst (1). It is available in commercial quantities from Crown Zellerbach in high 4,4'-isomer purity.

HO-
$$\left\langle O\right\rangle$$
-S- $\left\langle O\right\rangle$ -OH + 2H₂O₂ $\xrightarrow{\text{catalyst}}$ HO- $\left\langle O\right\rangle$ -S- $\left\langle O\right\rangle$ -OH

4,4'-Sulfonyldiphenol m.p. 247+°C

m.p. 195°C (dec.)

After being incorporated into a polymer backbone, TDP can be oxidized to the sulfone. The polymer was dissolved in chloroform and treated with hydrogen peroxide in acetic acid or aqueous potassium permanganate (51).

$$\left. \left\{ \circ \left\langle \circ \right\rangle \cdot s \cdot \left\langle \circ \right\rangle \cdot s \circ_2 \cdot \left\langle \circ \right\rangle \right\} \right]_n \left\{ \left\langle \circ \right\rangle \cdot s \circ_2 \right\}_{2n}$$

REACTIONS WITH PHENOLIC HYDROXYL GROUPS

Ethers

Ethers are readily formed, i.e.: the dimethyl ether (m.p. 46.3°C) (1) and the diethyl ether (8).

NaO-ONa +
$$2C_2H_5Br \longrightarrow C_2H_5O$$
-OC₂H₅

4,4'-Thiodiphenol diethylether m.p. 55°C

Ethers (cont.)

Cyclic ether systems have been prepared from $Br(CH_2)_n Br$ where n = 6.8.10 although aliphatic dihalides usually give polymers (10).

$$NaO- \bigcirc -S- \bigcirc -ONa + Br(CH_2)_n Br \longrightarrow \bigcirc -S- \bigcirc -O(CH_2)_n$$

TDP reacts with chloroacetic acid to form the biscarboxymethyl ether (57).

HO-
$$\left(\right)$$
-S- $\left(\right)$ -OH + 2 CICH₂COOH $\xrightarrow{\text{base}}$ HOOCCH₂-O- $\left(\right)$ -S- $\left(\right)$ -O-CH₂COOH

4,4'-Thiodiphenol bis(carboxymethyl) ether m.p. 200-201°C

The reaction of TDP and diethyl-3-nitrophthalate results in the formation of a bis aryl ether (89).

TDP + 2
$$\stackrel{R}{\longrightarrow}$$
 NO₂ $\stackrel{NaOH}{\longrightarrow}$ $\stackrel{R}{\longrightarrow}$ O $\stackrel{R}{\longrightarrow}$ S $\stackrel{R}{\longrightarrow}$ O $\stackrel{R}{\longrightarrow}$ R = -COOCH₂CH₃

<u>Hydroxyethylation</u>

TDP reacts with 2 moles of ethylene carbonate to produce the symmetrical hydroxyethyl ether in high yield (58). When TDP was reacted with ethylene oxide a mixture of homologs was produced (58).

HO-
$$\langle O \rangle$$
-S- $\langle O \rangle$ -OH + 2 $CH_2CH_2OC=O \longrightarrow HOCH_2CH_2-O-\langle O \rangle$ -S- $\langle O \rangle$ -O- CH_2CH_2OH

4,4'-Thiodiphenol-bis(2-hydroxyethyl ether) m.p. 102.8°C

Glycidyl Ethers

The diglycidyl ether of TDP has been made by reacting it with epichlorohydrin (59) and this compound has been noted in several references (60,61,62,63).

$$HO- \underbrace{\bigcirc} -S - \underbrace{\bigcirc} -OH + 2 \underbrace{CH_2-CHCH_2Cl} \xrightarrow{Base} \underbrace{CH_2-CHCH_2-O} -\underbrace{\bigcirc} -S - \underbrace{\bigcirc} -O-CH_2CH-CH_2CH$$

Esterification

Esters of 4,4'-thiodiphenol are readily made with phosphorus halides (11) or carboxylic acid anhydrides (1).

$$\begin{array}{c} \text{Ac}_2\text{O} \\ \text{CH}_3\text{CO} \\ \text{O} \\ \text{S} \\ \text{O} \\ \text{O} \\ \text{S} \\ \text{O} \\ \text{O} \\ \text{CH}_3\text{O} \\ \text{O} \\ \text{O} \\ \text{CH}_3\text{O} \\ \text{O} \\ \text{O} \\ \text{CH}_3\text{O} \\ \text{O} \\ \text$$

Phosphonic, phosphinic and (thio)phosphoric acid esters have been prepared by reacting TDP with the corresponding phosphorus halide (64).

TDP reacts at room temperature with N, N-bis(2-chloroethyl) carbamyl chloride in pyridine to give the carbamate (65).

Bis (4, 4'-diformyloxyphenyl) sulfide has been claimed as a composition of matter (66).

Bis(4-benzoyloxyphenyl) sulfide has been prepared from TDP and benzyl chloride in aqueous alkali (55).

REACTION ON THE AROMATIC RINGS

Alkylation

TDP has been alkylated with styrene to give 4,4'-thiobis-[2,6-bis(alpha-methyl-benzyl)phenol](72) and with cyclohexene to give 4,4'-thiobis(2-cyclohexyl-phenol) (73).

Halogenation

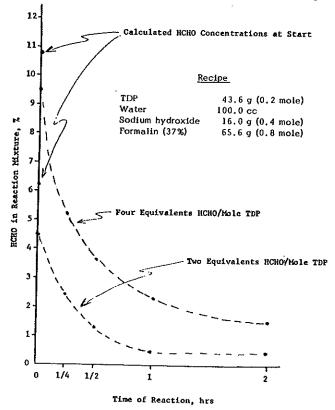
The reaction of 4,4'-thiodiphenol with chlorine results in cleavage to form p-chlorophenol and other chlorinated phenols (52). Bromine reacts with TDP in carbon disulfide to produce, tetrabromo-4,4'-thiodiphenol (67,137).

Nitration

Direct nitration of TDP with concentrated nitric acid does not appear to be possible in good yield as a mixture of nitration and oxidation products resulted (1). Nitration should occur after the sulfur has been oxidized to the sulfoxide (53) or sulfone (54).

Formaldehyde Reactions

The di- and tetramethylol derivatives of TDP have been prepared by reactions with formalin in aqueous caustic at 60°C using the recipe below. The graph illustrates the rate of disappearance of formalin with respect to time (1):



The rate and products from the reaction of TDP with formaldehyde in an alkaline medium were studied by paper chromatography (68). Using sulfuric acid catalysis, TDP, 4-phenolsulfonic acid, and formaldehyde were reacted to form a resin (69). Other references to the reaction of TDP with formaldehyde include: (70,71).

Polycarbonate Polymers

TDP reacts with phosgene (13,74,75) and with diphenyl carbonate (13) to give homopolycarbonate polymers. The homopolycarbonate has a glass transition temperature of 103°C and a melting temperature of 213°C. Thermogravimetric analysis comparing homopolymers of TDP and 4,4'-isopropylidenediphenol are located in the Appendix.

$$HO- \underbrace{\bigcirc}_{S}-S- \underbrace{\bigcirc}_{OH} \xrightarrow{COCl_2} \underbrace{\bigcirc}_{NaOH} \underbrace{\bigcirc}_{O}-S- \underbrace{\bigcirc}_{OC}$$

In a similar manner, phosgene has been reacted with mixtures of TDP and other bisphenols to give copolymers (76,77). In one copolymer the presence of TDP contributed to oxidative stability (14).

$$NaO - ONa + NaO - OS - ONa + \frac{COCi_2}{O} - OCO - OC$$

High molecular weight linear polycarbonates can be prepared from the bishydroxyethyl or bishydroxypropyl ether derivatives of TDP or chlorinated TDP and diphenyl carbonate (78).

Linear polycarbonates from bis(hydroxyethoxy) TDP and di-n-butylcarbonate have been reported (79).

An anhydrous process for preparing polycarbonate resins consists of self-condensing TDP bis(chloroformate) in the presence of a catalyst (80).

A novel polycarbonate has been claimed wherein TDP is attached to amide groups in a copolymer using formaldehyde to give a structure which can be modified with additional TDP and phosgene (81,82).

A maleimide-terminated TDP polycarbonate has been suggested (83).

The physical properties of some TDP polycarbonate resins can be improved by irradiation (84) or by post stretching (85).

Polyes ters

A homopolyester has been prepared from TDP and terephthaloyl chloride as have copolymers containing mixtures of TDP and 4,4'-isopropylidenediphenol (75). The homopolymer is insoluble in a variety of solvents however, as the percentage of TDP decreased in the copolymers, the solubility increased. Thermogravimetric analysis for these polymers are located in the Appendix. Polyesters from TDP or mixtures of TDP and other bisphenols and dibasic acid dichlorides have also been reported (86).

Copolyesters of TDP and mixtures of isophthalic and terephthalic acids have also been noted (92).

A yield of 90-96 percent sulfur containing polyphosphites was obtained by polyester interchange of esters of diphenylphosphorous acid with TDP (87). The following polyarylene-aryl phosphite has also been reported (47):

A mixture of TDP, dimethyl terephthalate, ethylene glycol and poly(oxyethyl-ene)glycol were heated for several hours to give a polyester (25). In some-what similar fashion, polyoxyethylene bis(4-hydroxyphenyl)thioether has been heated with phthalic anhydride (88) and subsequentially combined with polyoxyethylene sucrose.

Imido-substituted polyesters have been prepared from TDP, p-maleimido benzoyl chloride and isophthaloyl chloride (90).

Poly(ester-amide) copolymers derived from TDP, aromatic dicarboxylic acids and aromatic amino acids have been found to exhibit improved solvent resistance, stress crack resistance and also increased stiffness, tensile strength, hardness and heat distortion temperature (91).

Polyurethanes

TDP has been reacted with formaldehyde to form a polyol which was subsequently reacted with a polyisocyanate to form a urethane (71). A TDP glycidyl ether has been suggested as a catalyst for a polyurethane foam synthesized from a polycarboxylic acid or anhydride and an organic polyisocyanate (61).

POLYMERS

Polyarylene Ether Sulfone Polymers

4,4'-Thiodiphenol has been reacted with a variety of halogen compounds to produce polymers however, interestingly, $Br(CH_2)_nBr$ (n=6,8,10) and TDP can form cyclic ethers (10).

An aromatic polyether consisting of TDP and 4,4'-dichlorodiphenyl sulfone has been prepared by solution condensation (94,51). This same reaction has been carried out with the addition of a cross-linking agent such as 1,3,5-tris-(4-hydroxyphenoxy)-2,4,6-trichlorobenzene (95).

A high-molecular weight, soluble, thermoplastic, polyphenyl ether sulfone has been prepared from TDP, hexachlorobenzene, and dichlorodiphenyl sulfone (96). Other complex sulfone containing polymers using TDP as part of the structure have been claimed (97,98).

TDP has been reacted with bis(chloromethylphenyl) ether (100) and has been suggested as a comonomer with bis(chloromethyl)durene (101) to form polymers.

Epoxy Resins

The diglycidyl ether of TDP has been used to prepare an epoxy resin having a high dielectric loss factor (59).

A process has been claimed for directly producing a modified polyolefin composition having improved adhesiveness. This composition is obtained by polymerizing an acrylic or methacrylic ester of the monoglycidyl ether of TDP in the presence of the solid polyolefin (62,63).

The polyglycidyl ether of TDP has been suggested as a curing agent for polyepoxide resins (93).

Miscellaneous Polymers

Polymer compositions, i.e. polyesteramides, polyamides, polyurethanes, having an increased melt viscosity have been prepared by admixing the carbonic acid-TDP reaction product with the polymer to give a composition subsequently melted and formed into a shaped article (102).

POLYMERS

An alternating copolymer prepared from the disodium salts of TDP and bis(4-mercaptophenyl)methane and 4,4'-dichlorobenzophenone is reported to have high heat resistance and good chemical and water resistance and good physical and electrical properties (24).

Hydrophilic, heat-resistant poly(vinyl chloride) compounds containing poly-(ethylene oxide) and TDP have been prepared (103).

A linear polyarylene disulfimide sulfone has been prepared by reacting a mixture of TDP and an alkali metal salt of bis-hydroxyaryl disulfimide in an aprotic solvent with polychlorodiphenyl sulfones (98).

Polymer Applications

Several of the above polymers have been suggested for use in a variety of applications which include the following:

| Adhesives | (59,60,62,63,70,106,107) |
|---------------|------------------------------------|
| Cross-linking | (93, 95, 102, 105) |
| Fibers | (14, 25, 70, 79, 85, 101, 131) |
| Films | (14,78,83,84,86,92,95,101,103,131) |
| Flammability | (95,96) |
| Foam | (61) |
| Insulators | (95,101) |
| Laminates | (83) |
| Moldings | (14,60,79,83,90,92,101) |
| Resins | (69,70,100) |
| | |

MISCELLANEOUS APPLICATIONS

The utility of 4,4'-thiodiphenol (TDP) is almost universally dependent on its reaction as a chemical intermediate or monomer to produce other products. These synthesized materials containing TDP have suggested applications which include the following:

Accelerator

Accelerators for the vulcanization of fluoroelastomers have been prepared from TDP, guanidine and amidine (105).

Adhesives and Binders

Several types of polymeric adhesives containing TDP have been reported:

An acrylic ester of TDP has been reacted with an olefin polymer to produce a modified polyolefin composition having good adhesiveness characteristics (62,63).

A binding, adhesive, and cement mass is prepared by reacting TDP, phosgene, and epichlorohydrin all at the same time (60). An adhesive for the construction industry has been prepared from the diglycidyl ether of TDP and a hardening agent (59). An improved epoxy resin adhesive is prepared from a urethane-modified epoxy resin and a biphenol coupling agent like TDP (106).

An adhesive composition for bonding textile fibers to rubber is prepared in a liquid, two-stage condensation resin by reacting TDP with formaldehyde in the presence of acidic or basic catalyst (70).

Polyarylene polyether polymers containing sulfide linkage have been considered in adhesive and binding applications (107).

<u>Animal Feed Supplement</u>

TDP has been observed to be a growth promoter in animals. As an example, lambs fed two milligrams per head per day showed a rate of weight gain of 18.5% (46).

Antioxidants, Inhibitors, and Stabilizers

TDP, its salts, derivatives, and reaction products have been evaluated as antioxidants, inhibitors, and stabilizers in a variety of applications. As a constituent in polyesters and polycarbonates, it contributes to oxidative stability (14).

MISCELLANEOUS APPLICATIONS

Antioxidants, Inhibitors, and Stabilizers (cont.)

The antioxidant, inhibitor, and stabilizer properties are best described in the following literature references:

| Polyacetals | (41,108) |
|-----------------------------|---------------------------------------|
| Polycarbonate | (109) |
| Polyethers | (110) |
| Polyester | (111) |
| Polyolefins | (35, 37, 38, 112, 113, 114, 115, 116, |
| | 117,118,119,120) |
| Polyethylene | (112,114,115,119) |
| Polypropylene | (35,37,38,113,114,115,117,120,139) |
| Polyvinyl chloride | (39,40,47,121,139) |
| Polystyrene | (117) |
| Vinyl and vinylidene resins | (122) |
| Rubber | (26,27,28,29,30,32,33,34,48,49, |
| | 50,122,123,124,138) |
| Butadiene | (26,27,28,29) |
| GRS | (30,49,122) |
| GR-8 | (32,33,34) |
| Lubricating oil | (43,44,45,125,126,127) |

Biological Activity

4,4'-Thiodiphenol has received considerable attention as a reactant in the field of fungicides, germicides, insecticides, larvicides, etc. The following references will be helpful:

| Fungicide | (15,16,17,128) |
|--------------|------------------------|
| Insecticides | (128, 129, 130) |
| Germicide | (16,17,18,19,20,21,22) |
| Larvicides | (12,130) |
| Parasiticide | (23,64) |
| Pesticides | (11,23,64) |
| Bactericide | (18, 21, 22, 23) |
| Biocides | (128, 129, 130) |

Coatings

A three component polyester consisting of TDP, a polybasic carboxylic aromatic acid and a bis o-amino phenol or thiophenol has been coated onto a substrate or formed into a film (131). An imide-substituted polyester useful in coatings or varnishes has been suggested by combining an imido substituted polyester with an organic polymer containing the residuum of TDP (90).

A resinous product obtained by reacting TDP, phosgene and epichlorohydrin has been described as being suitable as a coating agent (60).

MISCELLANEOUS APPLICATIONS

Color Formation

A method for producing dark colored marks from colorless materials (duplicating) utilizes the reaction of TDP with heterocyclic oxygen. When a transfer web with a coating containing a bis(p-aminophenyl)phthalide is brought into contact with a second web containing TDP a dark colored material is produced (133,134).

<u>Pharmaceutical</u>

4.4'-Thiodiphenol or its salts are useful as hypolipidemic agents in mammals (132).

<u>Varnish</u>

TDP has been heated to 325° in a vacuum with resin acids to produce a product soluble in benzene and linseed oil which is useful for making varnishes (42).

Determination of 4,4'-Thiodiphenol (TDP) Purity by Freezing Point

The TDP content (analysis or assay) is derived from the freezing point and the freezing point constant, using the relationship that 0.1°C freezing point depression equals 0.23 mole percent impurity. The graph, on the following page, describes this relationship.

Equipment

- 1. Air circulating oven.
- 2. A 25x200 mm test tube for the TDP sample fitted with a 2 hole stopper and containing a thermometer and stirrer. The stirrer is a stainless steel wire inserted vertically in the upright tube. The bottom is formed into a horizontal loop enclosing the thermometer shaft.
- 3. Thermometer ASTM 35C, range 90-170°C in 0.2°C division. Calibrated by comparison with a factory-calibrated thermometer between 151.5-152.5°C. Any correction is recorded and used.
- 4. An air jacket made from a 40x200 mm tube with a stopper to center the sample tube.
- 5. A stirred Carbowax bath at about 165°C. A 300 ml tall form beaker is adequate.
- 6. A stirred Carbowax bath at about 140°C. Both baths may be heated and agitated by magnetic stirrer hot plates.

Test Procedure

- 1. Place about 50 grams of TDP in a 50 mm crystallizing dish and cover with two layers of clean cheesecloth.
- 2. Heat in a circulating oven at 125°C for 60 minutes.
- 3. Remove, cool to room temperature in a dessicator and store in a clean dry sealed flask or bottle. This product should have a water content of 0.02-0.04%. A portion may be used for a water measurement by the Karl Fischer procedure.
- 4. Place approximately 25 g of the TDP in a clean dry 25x200 mm test tube. Insert the stopper containing the thermometer and stirrer by pushing the thermometer into the sample, letting the stirrer loop sit atop the sample. Immerse the tube in the 165°C bath. When the TDP has melted and its temperature is 158-160°C remove the tube from the

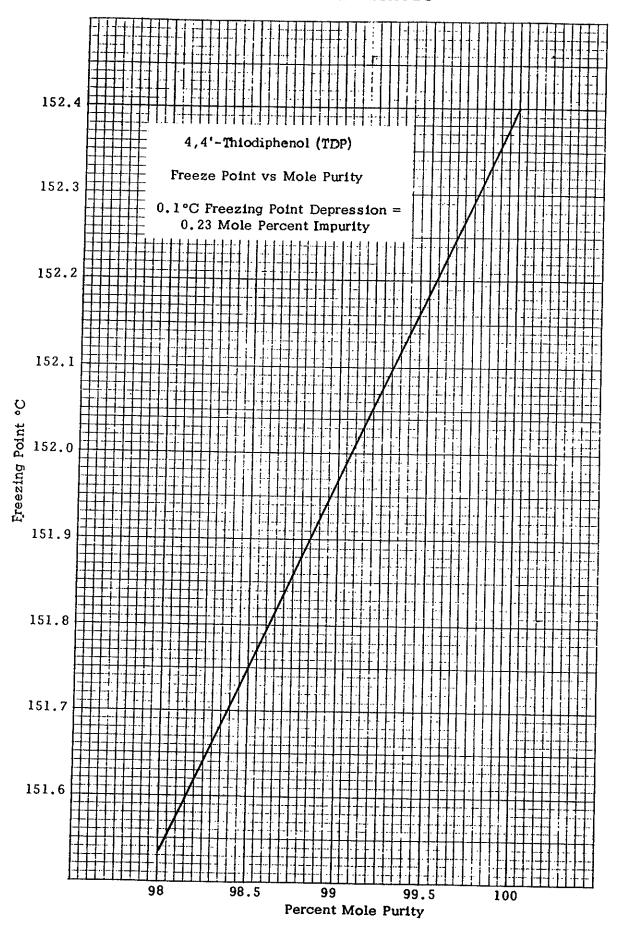
Determination of 4,4'-Thiodiphenol (TDP) Purity by Freezing Point (cont.)

bath, wipe, and place the tube in its air jacket in the 140°C bath. Stir slowly by an up and down motion of the stirrer as the temperature of the melt falls. Wipe a film of melt onto a spot on the tube wall just above the body of the melt. The film will freeze before the main body of the melt has reached the freezing point and seed crystals can be knocked into the melt as the temperature reaches the anticipated freezing point.

5. Observe the temperature closely from the initiation of freezing and for 2 to 4 minutes after. Normally the sample will supercool slightly and then the temperature will rise to a plateau and remain there for several minutes. This plateau is recorded as the observed freezing point.

Results

- 1. Apply any thermometer correction to the observed freezing point and report the adjusted freezing point to the nearest 0.1°C. (See Note 1).
- 2. The graph on the following page shows the relationship between the freezing point and the percent mole purity for 4,4'-thiodiphenol.
 - (Note 1). For some purposes it may be desirable to know the Freezing Point of the TDP as received. If so, omit procedures 1, 2, and 3 above.



Water Content of 4,4'-Thiodiphenol (TDP)

The amount of water in 4,4'-thiodiphenol can be determined by Karl Fischer titration. Since TDP is not hygroscopic, this is typically in the range of 0.2-0.4 percent as received. The graph shows the relationship between the weight percent of water and the mole percent of water.

Equipment and Reagents

- 1. Beckman Model KF-2 Aquameter or equivalent titration assembly.
- 2. Pyridine-SO₂-methanol

Mix 300 ml C.P. pyridine and 300 ml anhydrous methanol. Bubble in 60 grams of SO₂. This can be done with the solution on a platform balance to weigh directly the SO₂ added.

- 3. Anhydrous methanol
- 4. Karl Fischer Reagent, an equal-volume mixture of:

Karl Fischer Reagent - Stabilized. Harleco #3786 or equivalent. Solvent mixture diluent. Harleco* #3796 or equivalent.

5. Water-methanol standard

1 ml = 1 mg water

Water standard, Harleco #3797 or equivalent may be used. It is the preferred standard where the analytical balance is inadequate and may be more convenient in other instances. It is Sodium Tartrate Dihydrate, $Na_2C_4H_4O_6 \cdot 2H_2O$, 15.66% water.

In use, add approximately 0.05 g to the Standardization solution, weighing to the nearest 0.0001 g.

Water equivalence =
$$\frac{\text{(wt. tartrate)(0.1566)}}{\text{ml Karl Fischer Reagent}}$$

A weighed amount of pure water can be used but this is generally less convenient.

* Harleco
Division American Hospital Supply
480 Democrat Road
Gibbstown, New Jersey 08027

Water Content of 4,4'-Thiodiphenol (TDP) (cont.)

Test Procedure

1. <u>Standardization of Reagents</u>

The Karl Fischer solution must be standardized at least weekly. Add 20 ml of anhydrous methanol and 5 ml of the pyridine-SO₂-methanol solution to the titration bottle. Add Karl Fischer Reagent dropwise from a microburette to the endpoint. Accurately pipette 20.0 ml of the water-methanol standard (a weighed amount of pure water may be used) into the titration bottle and titrate with Karl Fischer reagent to the endpoint. Record the volume of titrant used in the second titration and calculate its water equivalence.

Water equivalence = $\frac{\text{grams of water titrated}}{\text{ml of Karl Fischer Reagent}}$

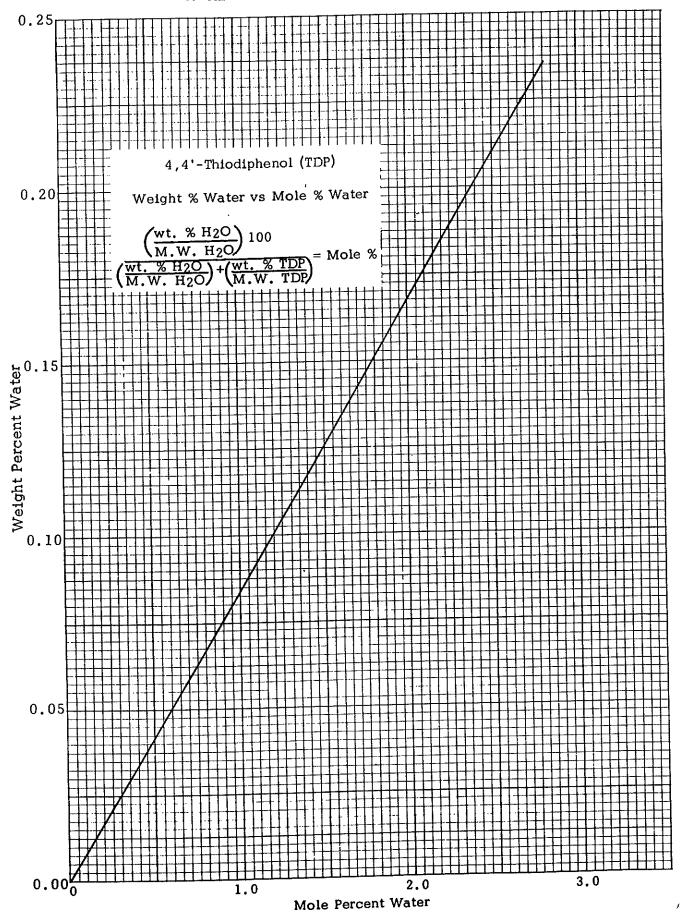
2. Determination of Water

Add 20 ml of anhydrous methanol and 5 ml of the pyridine-SO₂-methanol solution to a clean titration bottle. Add Karl Fischer Reagent dropwise to the endpoint. Weigh about 3 g TDP sample in a weighing boat to 0.0001 g. When TDP of extremely low water content (about 0.05 percent or less) is to be analyzed, the sample size should be increased. Add to titration bottle and reweigh empty boats. Titrate with Karl Fischer Reagent to the endpoint. Record the volume of titrant used in the second titration and calculate the water content of the TDP.

Results

Weight % of Water = $\frac{\text{ml Karl Fischer Reagent x Water Equivalence x 100}}{\text{Weight TDP}}$

Mole Percent Water - To determine the mole percent water, consult the graph on the following page.



Analysis of 4,4'-Thiodiphenol (TDP) by Gas Chromatograph

Background

Though intended for use with purified TDP, this procedure can be modified to include crude products and process streams. Our current polymer grade TDP shows only phenol and 2,4'-thiodiphenol. Other preparations may have impurities which require procedure modifications.

The phenols are converted to trimethylsilyl ethers and analyzed by GLC using a flame ionization detector. Phenol is determined by comparison with prepared standards. The 2,4'-isomer is estimated by internal normalization of peak areas.

The procedure is given in terms of equipment in use in Crown Zellerbach laboratories. Other equipment of equivalent function can be used.

Equipment and Reagents

Perkin-Elmer Model No. 900 Gas Chromatograph with Flame Ionization Detector. The column is 6 ft x 1/8 inch OD stainless steel, packed with 3% SE-30 silicone on Gas Chrom Q, 100/120 mesh.

Autolab System IV Computing Integrator

Small (I to 4 ml) Septum Closure Vials

Microliter Syringe

Anhydrous ethyl ether N, O-bis-(trimethylsilyl)-acetamide (BSA) Phenol - an analytical reagent grade Purified 4,4'-thiodiphenol (TDP) - a material which shows no extraneous peaks when tested by the procedure

Chromatograph Operating Conditions

Temperatures:

Column - 90°C for 2 minutes, then programmed to

230°C at 20°C/minute and held at 230°C for 10

minutes

Inlet:

230°C

Manifold: 250°C

Carrier Gas:

Helium, 30 ml/minute at column outlet

Detector Gases:

Hydrogen - 19-1/2 psig (~40 ml/minute)

Air - 50 psig (~460 ml/minute)

Set up integrator system.

Analysis of 4,4'-Thiodiphenol (TDP) by Gas Chromatograph (cont.)

<u>Preparation of Sample</u>

Place about 60 mg of the TDP to be tested in a septum-sealed vial. Add 0.2 ml of ethyl ether and cap the vial. Add 0.2 ml of BSA through the septum with a needle and syringe. Warm the solution for 5-10 minutes on a hot plate (50-70°C). Inject one microliter into the chromatograph and set the temperature programming and integrator in action.

Record retention times and peak areas for non-solvent peaks.

Nominal retention times:

| Phenol | 160 seconds |
|----------|-------------|
| 2,4'-TDP | 660 seconds |
| 4,4'-TDP | 710 seconds |

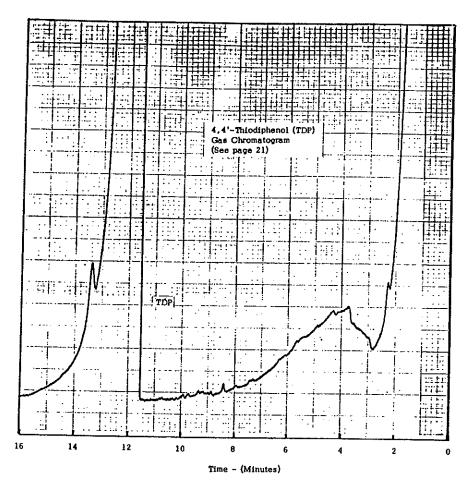
<u>Preparation of Standards</u>

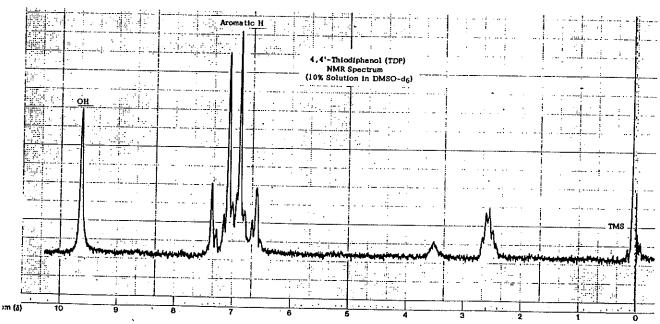
Into a small polyseal capped bottle, weigh approximately 0.006 gram (all weighings to 0.0001 gram) of phenol and 6 grams of purified TDP. Add 20 ml of ethyl ether. Cap the bottle and swirl to effect solution. 0.2 ml of this solution is transferred to a small septum closure vial and silylated and chromatographed as described in <u>Preparation of Sample</u>.

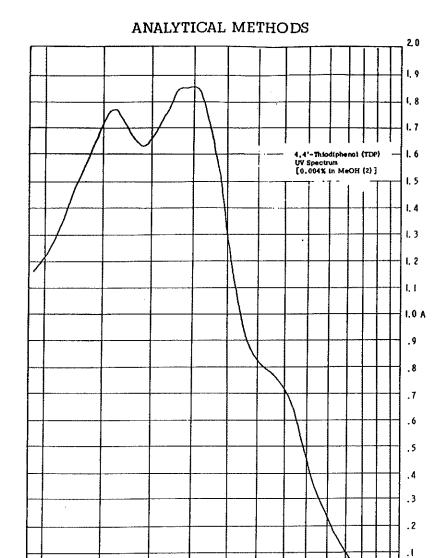
Calculations

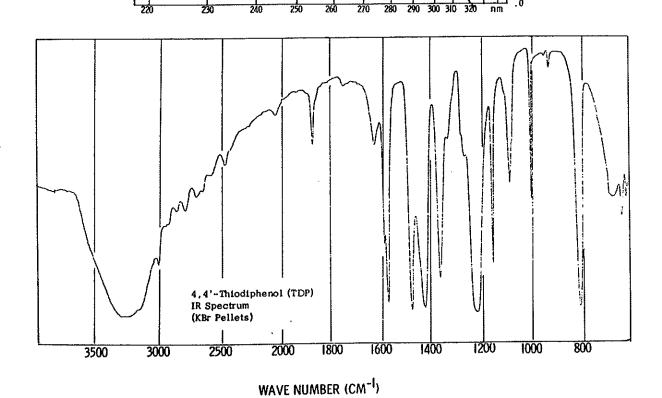
% Phenol = (TDP peak area of std)(phenol peak area of test sample)(% phenol in std)
(phenol peak area of std)(TDP peak area of test sample)

$$% 2,4-Thiodiphenol = \frac{(2,4 peak area)(100)}{(sum of peak areas excluding solvents)}$$









TOXICITY AND HANDLING

TOXICITY

Studies of 4,4'-thiodiphenol show it to be low in toxicity. It can, however, cause severe eye burn.

Acute Oral Toxicity LD50

3,362 mg/kg

(Albino Rats)

Acute Dermal Toxicity LD50

>10,250 mg/kg

(Albino Rabbits)

Eye Irritation

Extremely irritating

(Albino Rabbits) (88.0/110.0)

Primary Skin Irritation
(Albino Rabbits)

Minimally irritating

(0.2/8.0)

Other toxicity studies have been reported in the literature (135,136).

HANDLING

Care should be used in handling 4,4'-thiodiphenol. It is a phenolic material and the same precautions should be employed when handling TDP as when handling other phenolic materials. With the exception of eye irritation, TDP is less toxic than phenol.

First Aid: In case of contact, immediately flush exposed area with plenty of water for at least 15 minutes. Call a physician.

APPENDIX

Some synonyms of 4,4'-thiodiphenol (TDP):

4, 4'-monothiobisphenol

4, 4'-thiobisphenol

bis(4-hydroxyphenyl) sulfide

4, 4'-dihydroxydiphenyl sulfide

4, 4'-dihydroxydiphenyl monosulfide

4,4'-dihydroxyphenyl sulfide

p-hydroxyphenyl thioether

bis hydroxyphenyl thioether

bis(p-hydroxyphenyl) sulfide

4, 4'-diphenol sulfide

Preparation of 4,4'-Sulfinyldiphenol

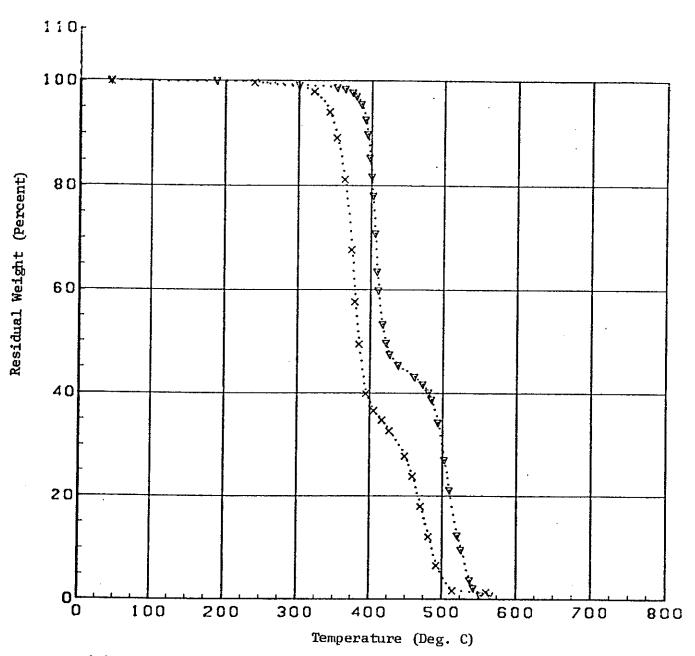
In a 600 ml beaker were placed 109 g (0.5 mole) 4,4'-thiodiphenol and 150 ml glacial acetic acid. The temperature was raised to about 80°C, when the thiodiphenol dissolved. Hydrogen peroxide, 34 g of 50% aqueous (0.5 mole) was added dropwise over one-half hour while maintaining the same temperature. In some cases, the product sulfoxide will separate before the hydrogen peroxide addition has been completed. When addition was complete, the reaction product or slurry was warmed to 90°C, held there for one-half hour and 200 cc hot water was added. The product separated as colorless crystals, was filtered, washed well with water to give 105 g melting at 188°C with decomposition. The yield was 90%. The reported melting point is 194-195°C.

APPENDIX

POLYCARBONATE

(Phosgene and Indicated Monomer)

Thermogravimetric Analysis
Dynamic Scan in Air
Scan Rate 2.5 Degrees Centigrade per Minute



X4,4'-Isopropylidenediphenol (BPA)

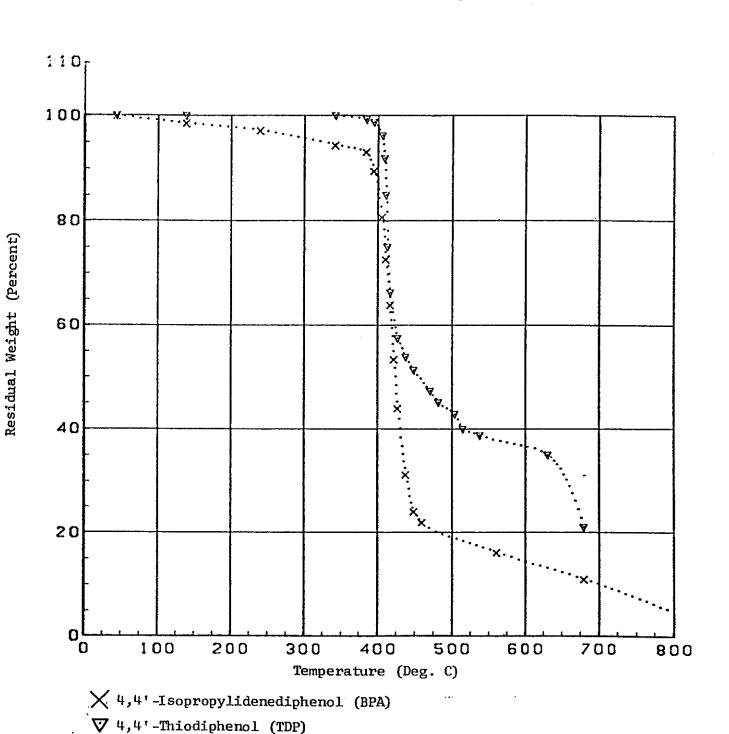
△ 4,4'-Thiodiphenol (TDP)

APPENDIX

POLYCARBONATE

(Phosgene and Indicated Monomer)

Thermogravimetric Analysis Dynamic Scan in N_2 Scan Rate 2.5 Degrees Centigrade per Minute

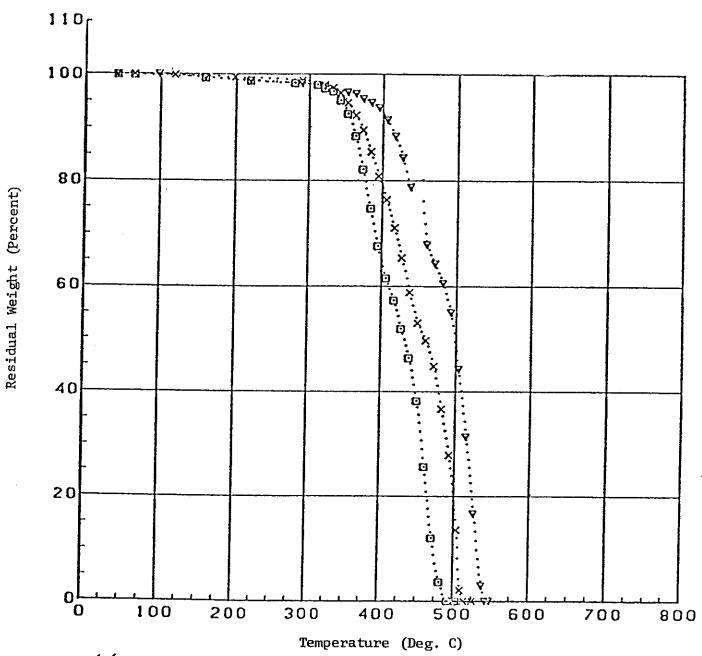


APPENDIX

POLYESTER

(Terephthalic Acid and Indicated Monomer)

Thermogravimetric Analysis
Dynamic Scan in Air
Scan Rate 2.5 Degrees Centigrade per Minute



X 4,4'-Isopropylidenediphenol (BPA)

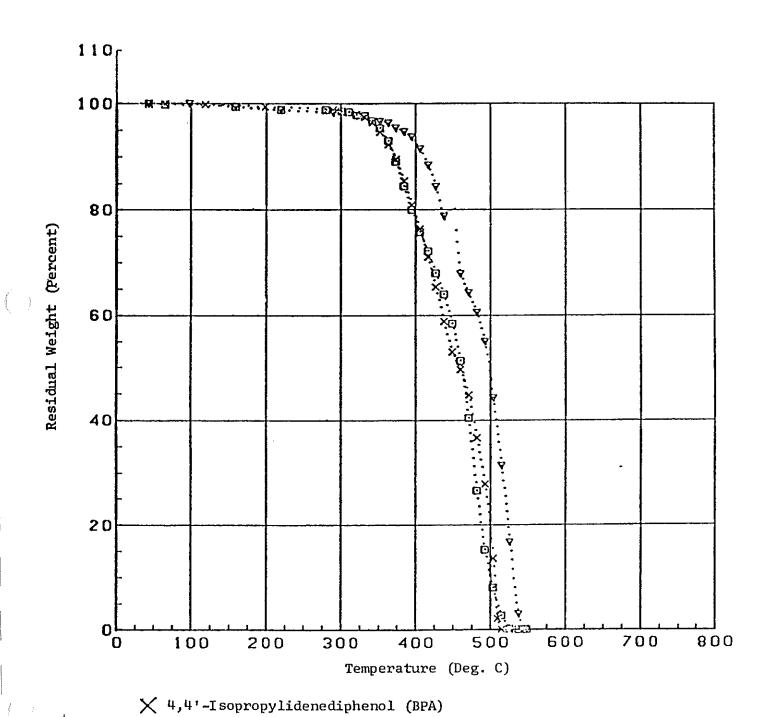
▼ 4,4'-Thiodiphenol (TDP)

BPA (90%) - TDP (10%)

APPENDIX POLYESTER

(Terephthalic Acid and Indicated Monomer)

Thermogravimetric Analysis
Dynamic Scan in Air
Scan Rate 2.5 Degrees Centigrade per Minute



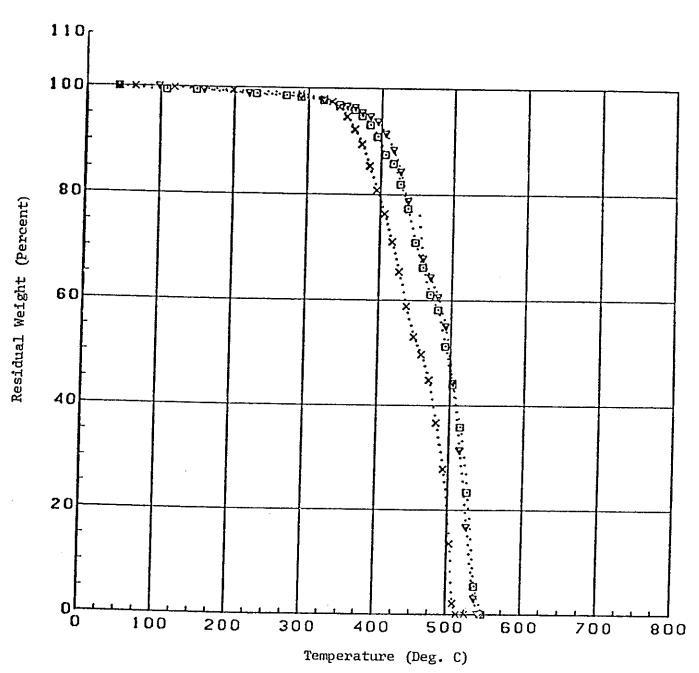
√ 4,4'-Thiodiphenol (TDP)

■ TDP (20%) - BPA (80%)

APPENDIX POLYESTER

(Terephthalic Acid and Indicated Monomer)

Thermogravimetric Analysis
Dynamic Scan in Air
Scan Rate 2.5 Degrees Centigrade per Minute



X 4,4'-Isopropylidenediphenol (BPA)

♥ 4,4'-Thiodiphenol (TDP)

TDP (50%) - BPA (50%)

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444DIHYDROXYDIPHENYL SULFONE TECHNICAL BULLETIN

FORT JAMES SPECIALTY CHEMICALS

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DIHYDROXYDIPHENYL SULFONE (DDS)

This bulletin presents a review of the literature relative to the properties, reactions, and applications of dihydroxydiphenyl sulfone (DDS). There are many references describing dihydroxydiphenyl sulfone in general and where it was obvious that an isomer mixture was employed, the work was not included in this publication; therefore, the information included in this bulletin should be applied to high purity dihydroxydiphenyl sulfone.

DDS is a crystalline material having a melting point of 242 - 248° C. It is soluble in polar solvents such as, acetone, methanol, and dimethyl sulfoxide (DMSO), slightly soluble in water and essentially soluble in chlorinated solvents, and aliphatic or aromatic hydrocarbons. The majority of reactions noted occur on the hydroxyl groups and the products are generally oligomers or polymers.

The staff at Fort James would welcome an opportunity to discuss chemical reactions or potential applications with you, and we are willing to provide a limited amount of technical assistance leading towards commercial use for DDS.

Revised June 1998

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PHYSICAL PROPERTIES

| Appearance Molecular weight Melting point, °C Molal freezing po | | 2 | an / wh 250.3 242 - 24 16.6 | • | stals |
|---|-------------------------------------|-----------|--------------------------------------|--------------|--------------------------------|
| Heat of fusion | Kcal per mole * calories/gram * | | 3.1 32.4 | - | |
| Acid dissociation (50% aq. ethan | constants (202)(203) * ol, 25°C) | | Kal Ka2 | 8.52 9.42 | |
| SPECTRA | | Pe | rbance aks m) | | Extinction Coefficient (log €) |
| Ultraviolet in 6% | aq. EtOH (202) * | (neutral) | 234.8 260.5 | | 4.14 4.28 4.26 4.48 |

Solubilities of Dihydroxydiphenyl Sulfone (DDS) *

| | grams per 100 grams Solvent | | |
|------------------------|-----------------------------|-------------|------------------|
| Solvent | 25'°C | <u>75°C</u> | <u>Indicated</u> |
| Acetone | 113 | _ | |
| Benzene | 0 | 0 | ·_ |
| Carbon disulfide | 0 | - | _ |
| Carbon tetrachloride | 0 | 0 | |
| Chloroform | 0 | - | 0 @ 55 °C |
| Dimethyl disulfide | 0 | 0 | 0 @ 55 *C |
| Dimethyl formamide | 129 | > 200 | |
| Dimethyl sulfide | 0 | 7 200 | _ |
| Dimethyl sulfoxide | > 120 | > 120 | _ |
| Ethyl acetate | 34 | - 120 | 34 @ 60°C |
| Ethyl ether | 0 | | 34 @ 60 -C |
| 2-Ethyl-1-hexanol | 10 | 56 | _ |
| n-Hexane | 0 | J0 | 1 @ 60°C |
| Isopropanol | 29 | 83 | 1 @ 60 -0 |
| Methanol | 87 | - | 90 @ 60°C |
| Methylene chloride | 0 | _ | 30 @ 60 -0 |
| Methyl isobutyl ketone | 24 | 42 | - |
| N-Methyl pyrrolidone-2 | 75 | > 120 | _ |
| Phenol | 75 | 5 | 5 @ 45°C |
| Pyridine | 36 | > 200 | 3 @ 43 0 |
| Sulfolane | - | 44 | - 42 @ 27°C |
| Tetralin | 0 | 1 1 | 42 @ 27 0 |
| Trichloroethylene | 0 | 0 | _ |
| Water, distilled | 4 | 5 | _ |
| Water + | 52 | 5 I | |
| Xylene | 0 | 0 | _ |
| Aylene | U | U | - |

⁺Containing 1% NaHCO $_{3'}$ 1% Na $_2$ CO $_3$ and 2% NaOH.

^{*} Values for 100% 4,4' isomer.

REACTIONS TO FORM ESTERS

The dianion of dihydroxydiphenyl sulfone (DDS) reacts with a variety of compounds to form esters and polyesters. The polymer reactions will be discussed in a special section appearing later in this bulletin.

From Acid Chlorides

DDS reacts with chloroacetyl chloride to give a 99% yield of di-(4-chloroacet-oxyphenyl)sulfone (1).

DDS + C1CH₂COCl
$$\longrightarrow$$
 C1CH₂COO- \bigcirc -SO₂- \bigcirc -OOCCH₂C1

bis-(4-chloroacetoxyphenyl)sulfone m.p. 150-160°C

The synthesis of 4,4'-diacetoxydiphenyl sulfone from DDS has been reported (2,3).

Acryloyl chloride, methacrylyl chloride, or propionyl chloride react with DDS to give the corresponding diesters (4,5).

DDS +
$$CH_2$$
: $CHCOCI$ \longrightarrow CH_2 ; $CHCOO$ \longrightarrow $-SO_2$ \longrightarrow $-OOCHC$: CH_2

4,4'-diacryloyloxysulfonyldiphenol m.p. 103-106°C

DDS +
$$CH_3CH_2COC_1$$
 \longrightarrow CH_3CH_2COO \longrightarrow $-SO_2$ \longrightarrow $-OOCCH_2CH_3$

4,4'-dipropionyloxysulfonyldiphenol m.p. 99-100°C

DDS +
$$CH_2$$
: $CCC1$ \longrightarrow CH_2 : $CCOO$ - CH_3 \longrightarrow CH_3

4,4'-dimethacryloyloxysulfonyldiphenol m.p. 154-155°C

REACTIONS TO FORM ESTERS (cont)

From Acid Chlorides (cont)

DDS has reacted with trimellitic anhydride monoacid chloride in pyridine to give a bisesteranhydride monomer (6).

DDS reacts with o-aminobenzoyl chloride to form the diester (7). The reaction of 4-hydroxy-3,5-ditert-butyl-benzoyl chloride proceeds in a similar manner (8).

From Anhydrides

Acrylic anhydride or methacrylic anhydride react with DDS to give the corresponding diesters reported above (5).

From Chloroformates

DDS reacts at room temperature in pyridine with chloroformyl-bis-(betachloro-ethyl)amine to give the carbamate (9).

$$DDS + (C1CH2CH2)2NCC1 \longrightarrow \left[(C1CH2CH2)2NC-O-\left(\right) \right]_{2}^{O} SO_{2}$$

Alkenyl chloroformates react with DDS to give the bis ethers (10).

4,4'-bis-(allylcarbonato) sulfonyldiphenol m.p. 75-76°C

From Sulfonyl Chlorides

Two moles of 2-diazo-1-naphthol-5-sulfonyl chloride react with one mole of DDS in a dioxane-water mixture to form the diester (11), viz.

DDS +
$$R-SO_2C1 \longrightarrow R-SO_2-O-CO$$
- SO_2-F

REACTIONS TO FORM ESTERS (cont)

From Phosphorus Compounds

DDS reacts with O,O-dimethyl and O,O-diethylphosphorochloridothioate to give the corresponding O,O,O',O'-tetraalkyl O,O'-sulfonyldi-p-phenylene phosphorothioates (12,13). Yields for the dimethyl and diethyl phosphorothioates of 65.3 and 72 percent respectively have been reported (14).

DDS + C1P(OR)₂
$$\longrightarrow$$
 (RO)₂P-O- \bigcirc -SO₂- \bigcirc -O-P(OR)₂

$$R = -CH_3 \text{ or } -CH_2CH_3$$

REACTIONS TO FORM ETHERS

Alkyl Ethers

Several 4,4'-dialkoxydiphenylsulfones have been prepared (15).

| 4,4'-(dimethoxydiphenyl)sulfone | m.p. | 129-130°C |
|-------------------------------------|------|-----------|
| 4,4'-(diethoxydiphenyl)sulfone | m.p. | 164°C |
| 4,4'-(di-n-propoxydiphenyl)sulfone | m.p. | 142-143°C |
| 4,4'-(di-isopropoxydiphenyl)sulfone | m.p. | 157°C |
| 4,4'-(di-n-butoxydiphenyl)sulfone | m.p. | 92.5°C |
| 4,4'-(di-n-amyloxydiphenyl)sulfone | m.p. | 86.5°C |

DDS salts react with methyl chloroacetate or ethyl chloroacetate to form ethers (16).

DDS +
$$CH_3OOCCH_2C1 \longrightarrow CH_3OOCCH_2O \longrightarrow -SO_2 \longrightarrow -OCH_2COOCH_3$$

m.p. 151-152°C

DDS +
$$CH_3CH_2OOCCH_2CI$$
 \longrightarrow $CH_3CH_2OOCCH_2-O-\bigcirc$ $-SO_2-\bigcirc$ $-O-CH_2COOCH_2CH_3$ m.p. 87°C

Mono ethers of DDS have been prepared by reacting the monopotassium salt of DDS with excess quantities of alpha, omega-dibromo alkanes. Heating a dilute amyl alcohol solution of the mono ethers in the presence of potassium carbonate gave the cyclic ethers (17).

REACTIONS TO FORM ETHERS (cont)

Aromatic Ethers

DDS disodium salt reacts with 4-nitrophthalonitrile to give the bisaromatic ether (204).

$$DDS + \bigvee_{NO_2} CN \xrightarrow{NaOH} NC \longrightarrow O \longrightarrow SO_2 \longrightarrow O \longrightarrow CN$$

4,4'-bis-(3,4-dicyanophenoxy)diphenylsulfone m.p. 229-230°C

In a similar manner, 4-chloro-N-butylphthalimide reacts with DDS disodium salt to give the bis ether (18).

DDS +
$$RN \xrightarrow{C} C_1 \longrightarrow RN \xrightarrow{C} C_2 \longrightarrow C_2 \longrightarrow C_2 \longrightarrow C_2 \longrightarrow C_3 \longrightarrow C_4 \longrightarrow C_4 \longrightarrow C_5 \longrightarrow C_5 \longrightarrow C_5 \longrightarrow C_6 \longrightarrow$$

Hydroxy Alkyl Ethers

DDS reacts with ethylene oxide to give the bis hydroxyethyl ether (19).

DDS +
$$H_2C$$
 CH_2 $NaOH$ $MeOH$ M

bis-(4-beta-hydroxyethoxyphenyl)sulfone m.p. 184°C

Propylene oxide ethers have also been reported (20,21).

Glycidyl Ethers

DDS reacts with epichlorohydrin in the presence of caustic to form the bis glycidyl ether (22,23). Some resinous products of higher molecular weight may also be formed, especially when the ratio of epichlorohydrin to DDS is close to the stoichiometric amount (24).

DDS +
$$CH_2$$
-CHCH $_2$ Cl \longrightarrow CH_2 CHCH $_2$ -O-CHCH $_2$ -CHCH $_2$ -CHCH $_2$ -O-CHCH $_2$ -CHCH $_2$ -CHCHCH $_2$ -CHCH $_$

bis-(4-glycidyloxyphenyl)sulfone m.p. 162-176°C

REACTIONS TO FORM ETHERS (cont)

Ethers from Tosylates

DDS reacts with methyl p-(beta-p-toluenesulfonyloxyethoxy)benzoate to produce the bis ether (25).

REACTIONS ON THE AROMATIC RINGS

Reactions with Formaldehyde

Several methylol derivatives have been prepared by reacting DDS with formaldehyde and a catalyst (26). The compounds include:

Pure methylol derivatives of DDS can be prepared by reducing the corresponding carboxylic acids with LiAlH4. The derivatives were separated by chromatography on polyamide powder (27).

Conduising DDS with formaldehyde in acid medium results in the formation of methylene bridges between two or more DDS units (28). Similar reactions have been run under alkaline conditions (29).

DDS has been combined with a variety of other aromatic compounds by way of formaldehyde condensation reactions. These are described in detail in the Applications Section of this bulletin under Tanning.

<u>Nitration</u>

An aqueous slurry of DDS when treated with concentrated nitric acid gives a dinitro derivative (30,31).

DDS +
$$HNO_3 \longrightarrow HO \longrightarrow -SO_2 \longrightarrow -OH$$

3,3'-dinitro-dihydroxydiphenyl sulfone m.p. 238.5-240°C

REACTIONS ON THE AROMATIC RINGS (cont)

Nitration (cont)

Nitration in mixed acid gives the tetranitro derivative (30).

The determination of tetranitro-dihydroxydiphenyl sulfone impurity in the dinitro compound has been studied using potentiometric titrations (32).

Amination

Amino derivatives of DDS have been obtained by reducing nitro compounds. As an example, 3,3'-diamino-dihydroxydiphenyl sulfone, with a melting point of 238-238.5°C, has been obtained by hydrogenation 3,3'-dinitro-dihydroxydiphenyl sulfone using a platinum oxide catalyst in pyridine (31).

<u>Halogenation</u>

DDS is brominated in methanol to give the tetrabromo derivative (33).

DDS +
$$Br_2$$
 \xrightarrow{MeOH} $HO-SO_2$ \xrightarrow{Br} $-OH$

3,3',5,5'-tetrabromo-dihydroxydiphenyl sulfone m.p. 278-279°C (30)

Sulfonation

Sulfonation of the ring occurs ortho to the hydroxyl to give either the monosulfonate or the symmetrical disulfonate (30).

DDS +
$$H_2SO_4$$
 \longrightarrow $HO-SO_2-SO_2-OH$

m.p. 155-157°C

DDS, acetic acid anhydride and sulfuric acid monohydrate when mixed and heated form sulfonated DDS (34,35).

REACTIONS ON THE AROMATIC RINGS (cont)

Sulfonation (cont)

DDS and 98% sulfuric acid are mixed and heated at 110-120°C until a product entirely soluble in water is obtained (36,37).

When DDS is added portion-wise to stirred chlorosulfonic acid the monosulfonic or disulfonic acid or a mixture of the two can be obtained (37).

REACTIONS AT THE SULFONE GROUP

Desulfurization

The disodium salt of DDS was added to hot NaOH and the mixture was heated for one hour at 385-408°C to give 2,2'-biphenol (38).

$$NaO-O$$
- SO_2-ONa $NaOH$ O O

In a similar manner, the dipotassium salt of DDS can be added to hot KOH at 300°C and the mixture heated for twenty minutes at 303-328°C to give a mixture of 2,2'-, 2,4'-, and 4,4'-dihydroxybiphenyl (39).

MISCELLANEOUS APPLICATIONS

The utility of dihydroxydiphenyl sulfone (DDS) is derived from its ability to react as a chemical intermediate or monomer to form new materials. New products containing DDS have been used in a variety of applications which are described on the following pages.

Adhesives

Low molecular weight polycarbonate polymers prepared from DDS and phosgene react with epichlorohydrin to give terminal epoxide groups. Subsequent reaction with phthalic anhydride produced a cross-linked, insoluble, nonmelting adhesive (40).

The reaction product of DDS, cyanuric acid and epichlorohydrin is a resin softening at 46°C with an epoxide equivalent of 168 that is useful as an adhesive (41).

The diglycidyl ether of DDS can react with 4,4'-diaminodiphenylsulfone to form an adhesive (42).

A B-stage epoxy resin, stable at room temperature for extended periods of time, has been reported. It is prepared by combining an DDS epoxy resin having an epoxy equivalent of 210 with cocoguanamine which is derived from a mixture of C₈-C₁₈ acids in coconut oil (43).

Adhesives and infusible molding compounds are prepared by a two step process in which DDS is treated with an excess of aliphatic polyepoxides to form an intermediate reaction product. This is further reacted with DDS or other polyhydric phenols (44).

A threefold improvement in tensile shear strength at 250°F was obtained when DDS was substituted for 4,4'-isopropylidenediphenol in an epoxy adhesive formulation. The room temperature shear strengths were comparable (45).

DDS is added to polyamides, prepared from carboxylic acids and hexamethylenediamine, to form adhesives for wood, leather and other substances (46).

Methylol derivatives of DDS react with phenolic materials to form thermosetting resin adhesives (47).

Antioxidants and Stabilizers

Diphenyl pentaerythritol diphosphite, DDS, and diphenyl phosphite when heated form a polymeric material useful as a stabilizer (48).

A low molecular weight epoxy resin prepared using DDS is effective as a heat and light stabilizer for polyvinyl chloride and vinyl chloride copolymers. This is more effective than the corresponding product prepared from 4,4'-isopropylidenediphenol (49).

Antioxidants and Stabilizers (cont)

Linear polyesters of terephthalic acid and ethylene glycol are thermally stabilized by the addition of 0.01-0.5 weight percent DDS (50).

DDS dianion reacts with o-aminobenzoyl chloride to form an ultraviolet light stabilizer for polyethylene and poly(vinyl chloride) (7). In a similar manner, the DDS diester of 4-hydroxy-3,5-di-t-butyl benzoyl chloride stabilizes polypropylene, rubber, polystyrene or polyacetal resins against oxidation or light (8). A number of other substituted benzoyl chlorides react with DDS to form heat and light stabilizers for polymers (51).

Polymeric malonates useful for stabilizing polymers, cellulose materials, proteins, fats, oils and waxes are prepared by reacting DDS dihydroxyethyl ether with bis-(3,5-di-t-butyl-4-hydroxybenzyl) malonic acid diethyl ester (52).

Biological Activity

<u>Bactericides</u>: DDS is bacteriostatic in concentrations above 0.025 percent toward E. coli and Streptococci in vitro (53). The growth of bacillus Calmette Guerin (BCG) was inhibited by DDS and this inhibition was not reversed by the addition of p-aminobenzoic acid (54).

Mice were given 5-20 mg quantities of an DDS mixture containing its isomer, by mouth and then a lethal dose of an endotoxin was injected intraperitoneally. The dihydroxydiphenylsulfone mixture offered some protection against the endotoxins of Meningococcus and Aertrychi bacillus but did not protect against Staphylococcus endotoxin (55).

<u>Fungicides:</u> The condensation product of DDS, formaldehyde and a NaHSO₃ solution has been suggested for use as a fungicide (56). As a fungicide, DDS was less active than 4,4'-thiodiphenol or 4,4'-sulfinyldiphenol (57).

<u>Pesticides:</u> O,O,O',O'-tetramethyl-O,O'-sulfonyldi-p-phenylene phosphoro-thioate and O,O,O',O'-tetraethyl-O,O'-sulfonyldi-p-phenylene phosphorothioate have been suggested for use in controlling insect pests (13) as have other DDS-phosphoric acid esters (58).

The antiparasitic activities of some thiophosphoric acid esters of DDS have been reported (14).

<u>Catalyst</u>

High temperature resistant cellular polymers are prepared in a one step procedure by reacting a polycarboxylic acid or anhydride with an organic polyisocyanate using the diglycidyl ether of DDS as a catalyst (59).

Polycarbonates are obtained by the reaction of DDS and an aryl bis(chloroformate) in the presence of a catalyst consisting of the Be sait of DDS. The catalyst

MISCELLANEOUS APPLICATIONS

Catalyst (cont)

can be made in situ by adding a salt of beryllium to the reaction mixture or by heating a Be salt with dissolved DDS (60).

Coatings

Polymers containing DDS have been suggested for use in a variety of coating applications:

| Polymer Composition | Reference |
|----------------------|----------------------|
| Epoxy resin | 22,40,41,45,61,62,63 |
| Polyarylethersulfone | 64,65,66 |
| Polycarbonate | 40,67,68 |
| Polyester | 69,70,71,72,73,74,75 |
| Miscellaneous | 76,77 |

Color Formation

A method for producing dark colored marks from colorless materials (duplicating) utilizes the reaction of DDS with heterocyclic oxygen. When a transfer web with a coating containing a bis(p-aminophenyl)phthalide triphenylmethane group is brought into contact with a second web containing DDS, a dark colored material is produced (78,79).

Coupling, Cross-Linking or Curing Agents

Improved epoxy resin adhesives are prepared by reacting a liquid epoxy resin, modified with a small amount of urethane, with DDS, a coupling agent (80).

DDS is used as a cross-linking agent along with guanidine and amidine accelerators for the vulcanization of highly fluorinated elastomer stocks (81). In a similar manner, DDS has been used as a cross-linking agent for vulcanization of hexafluoropropylene-vinylidene fluoride copolymers (82) and other fluoroelastomers (83).

Thermosetting resin powders which can be molded to form products characterized in tensile measurement, by high elongation to break, high tensile strength and modulus and high glass transition temperature are prepared from a mixture of a prepolymer consisting essentially of glycidyl methacrylate, methyl methacrylate and methacrylonitrile or acrylonitrile and DDS as a cross-linking agent (84).

DDS, condensed with formaldehyde, forms a water insoluble resin which is an excellent cross-linking agent for polyvinyl alcohol films to make them water insoluble (85).

Coupling, Cross-Linking or Curing Agents (cont)

A primary or secondary amine is reacted with formaldehyde and then reacted with DDS under reflux to give a tetrasubstituted Mannich base which can be used to cure epoxy resins (86).

A DDS derivative, 4,4'-bis(acryloyloxy)diphenyl sulfone, has been used as a cross-linking monomer in preparing modified polystyrene (87).

Deemulsifier

DDS is oxypropylated to a molecular weight of 1-5,000 and then esterified with dicarboxylic acids of eight or less carbon atoms to give a surface active agent useful for breaking petroleum emulsions (20,21).

Dyeing of Fibers

A synthetic tanning agent consisting of the acid condensed resin of DDS and for-maldehyde and a mixture of naphthalene-2- and naphthalene-1-sulfonic acids is used as a dyeing assistant for nylon (88).

A condensate of DDS, beta-naphthalene-sulfonic acid and formaldehyde is mixed with formic acid and $K_2Cr_2O_7$ to form a resist. This is useful in multiple dyeing or contrast dyeing for obtaining more than two colors on polyamide, or especially wool (89). In a somewhat similar process wool, silk and polyester fibers are treated with the condensation product of DDS, formaldehyde and beta-naphthalenesulfonic acid and subsequently woven together with untreated fibers. When this material is dyed or printed with a mixture of an acid and dispersed dye, a multiple colored product is produced (90).

In the process of dyeing and printing of polyamide fibers with reactive dyestuffs, a post treatment for the purpose of fixing still unreacted residual dyestuff to the fibers is used. This consists of introducing the freshly dyed fibers to an aqueous solution of the condensation product of DDS, naphthalenesulfonic acid and formaldehyde (91,92).

A resin prepared by sulfonating DDS with sulfuric acid in acetic anhydride, then reacting the product with formaldehyde followed by neutralization is used to improve the fastness properties of dyes on polyamide fibers or fabrics (35).

A resin that gives improved wet fastness to textile colors on nylon 66 is prepared from alkaline DDS, formaldehyde and butane sultone, then acidified to give a product containing alkanesulfonic acid groups (93).

Aryl ether sulfonic acids (anisolesulfonic acid), DDS, and formaldehyde are condensed in aqueous acid at 90-110°C and the product is useful as a leather tanning agent and for improving the wet fastness of ionic dyes on polyamides (94).

Dyeing of Fibers (cont)

DDS, formaldehyde and HCl are condensed for 2 hours after which dimethylol urea dimethyl ether and a sulfanilic acid are added. The resulting resin is useful as a lake former for basic dyes (95).

DDS is heated with sodium sulfite and aqueous formaldehyde for 10 hours at 15 °C, then acidified and treated with dimethylol urea, 2-naphthol-6-sulfonic acid and formaldehyde to give a condensation product which can be used as a dye dispersant in dyeing plastics (96).

The tetraazo component of a diazo dyestuff may be prepared by reaction of nitrobenzenesulfonyl chloride with DDS in the presence of an acid acceptor (97).

A polyurethane especially suited for manufacturing of fibers having improved dyeing and moisture regain properties can be formed mixing DDS, toluene-2,4-disocyanate and polyethylene glycol (98).

Electroplating

White, uniform, fine grained lead-tin alloy coatings were electroplated on to brass at low current densities from baths containing lead and tin tetrafluoroborates, DDS, and a surfactant (99). DDS and its 2,4'-isomer have been used as an additive in tin and tin alloy plating baths where it provides a smooth, dense, and fine crystalline deposit (100).

Electrostatic Compositions

Electrostatic compositions comprising a toner containing a coloring agent and a polyester resin have been reported. The polyester is produced from an alkylene oxide derivative of DDS and a dicarboxylic acid (101). A dry electrostatic toner composition is prepared from a colorant and a polycarbonate resin binder. The latter consists of DDS, neopentylglycol and phosgene (102).

Epoxy Resins

DDS and epichlorohydrin react to form a useful diglycidyl ether. It reacts with 4,4'-diaminodiphenyl sulfone (42), guanamine (43) or DDS (44) to form resins.

An epoxy resin having high functionalities and exhibiting improved elevated temperature performance was prepared by reacting the glycidyl polyether of 2,2-bis(4-hydroxyphenyl)propane and 1,1,2,2-tetrakis(hydroxyphenyl)ethane and adding DDS (103). In a somewhat similar manner, DDS was added to its diglycidyl ether (23,104) or to bis(4-glycidyloxyphenyl)sulfone having an epoxy equivalent of about 185 (105) to give resins.

A mixture of DDS, cyanuric acid, epichlorohydrin, and benzyltrimethylammonium chloride was heated for several hours, cooled and neutralized with NaOH. The

Epoxy Resins (cont)

product had a softening point of 46°C, a chlorine content of 4.3% and an epoxy equivalent of 168 (41).

DDS, epibromohydrin, and high molecular weight polyamides react to form hard-enable compounds containing epoxy groups (106).

A polyhydric alcohol was prepared from equal molar quantities of DDS and another bisphenol and epichlorohydrin in the presence of NaOH. Limited esterification of these soluble epoxide resins with unsaturated acids produces drying compounds useful for coating and film forming applications (63).

DDS diglycidyl ether reacts with poly(2,6-dialkyl-1,4-phenylene) oxide resin to form a new resin having significantly reduced melt viscosity and improved processing characteristics, as well as increased stiffness and rigidity (107).

A resin prepared from DDS and triglycidyl cyanurate can be used to prepare a film that becomes hard after one-half hour at 150°C (108).

Flame-Resistant Compositions

It has been found that copolycarbonates based on bisphenols and nuclear halogenated bisphenols with the same halogen content are more flame-resistant and, at the same time, have a substantially lower tendency to drip, when 0.1-10.0 mole percent DDS is added to the condensation mixture when preparing these products (109).

Flame-resistant polymeric phosphonates were obtained by condensing DDS, phlo. glucinol and phenylphosphonic dichloride to give a hard, very pale yellow, resinous solid (73).

A fireproof, thermoplastic polyester-polyaryl phosphonate composition was prepared by incorporating the DDS-phenyldihalophosphine oxide oligomer into a polyester (110).

DDS, phenylphosphorous dichloride and 1,6-hexanediol bischloroformate react to form a flame-resistant polymer having a reduced viscosity of 0.52 and melting at 200-210°C (111).

N, N-dialkylamidophosphonyl dichlorides react with DDS or mixtures of DDS and hydroquinone to give extrudable or injection moldable flameproof polymers (112, 113).

A mixture of DDS, diphenyl pentaerythritol diphosphite and diphenyl phosphite were heated distilling off phenol to give a polymer having self-extinguishing characteristics (48).

Flame-Resistant Compositions (cont)

DDS, a dihalodiphenyl sulfone and hexachlorobenzene can condense to form a modified poly(phenyl ether sulfone) having flame-resistant properties (65). In an analogous manner, 1,2,4,5-tetrachlorobenzene (114) or 1,3,5-tris(4-hy-droxyphenoxy)-2,4,6-trichlorobenzene (115) have been used.

Halogenated DDS has been used as a flame retardant in polyethylene and polypropylene (33).

Ion Exchange Resins

A cation exchange resin is prepared by reacting DDS, formaldehyde, and an alkaline sulfiting agent, such as sodium sulfite, to make a water insoluble material. The resin may be used in purification of water and sugar syrups, removal of heavy metal ions from food, beverage and pharmaceutical products, etc. (116,117).

<u>Inks</u>

Flexographic printing ink consisting of alcoholic or aqueous alcoholic solutions of conventional basic dyes have been modified by adding the product resulting from the condensation of DDS, salicylic acid and formaldehyde (118).

An offset printing ink is prepared by condensing DDS and formaldehyde using acid catalysis for two hours followed by the addition of salicylic acid and the dimethyl ether of dimethyl urea. Further heating produced a yellow powder soluble in several solvents (119).

Fibers and Films

Several varieties of polymers containing DDS have been suggested for use in films or fibers. The references noted in the table by polymer type will be helpful:

| | <u>Fibers</u> | Films |
|---------------------------------------|--------------------|---------------------------------------|
| Polyesters | 25,71,120,121 | 6,72,127,128 |
| Polyesters contain- ing phosphorus | 110,111,113 | 71,111,112 |
| Polyurethanes | 98 | 98,129 |
| Poly(arylene ether sulfones) | 23,65,76,122 | 65,76,115,122,130 |
| Polycarbonates | 67,123,124,125,126 | 67,68,117,123,124,125, 126,131,132 |
| Miscellaneous | | 63,94,107,134 |

Phenol Formaldehyde Resins

As a bisphenol, DDS will condense with formaldehyde in a manner similar to the phenol-formaldehyde condensation reactions. Details regarding these DDS reactions are contained in the Tanning Section beginning on page 20.

DDS or its hydroxymethyl derivative can be condensed with a phenol-formaldehyde resin to give a thermosetting composition having increased heat resistance (135).

Polyesters

A variety of polyesters have been prepared from DDS and other monomers. The following diacid halide reactions have been reported:

- 1. Terephthaloyl chloride (136)
- 2. Isophthaloyl chloride (137)
- 3. A mixture of 1 and 2 (72,75,127,128)
- 4. The diacid chloride of 4,4'-dicarboxydiphenyl ether (137,138)
- 5. Glutaryl dichloride (139)
- 6. A mixture of 2- and 5-tert-butylisophthaloyl halide (140)

Copolyester drawn fibers made from ethylene glycol, dimethylterephthalate and 1-12 percent DDS have been reported to have high shrinkage in boiling water (120). An ethylene glycol-dimethyl terephthalate-4,4'-sulfonyldiphenol copolymer had a higher crimpability than polyesters prepared from poly(ethylene terephthalate), poly(ethylene terephthalate/isophthalate), or poly(ethylene terephthalate/sebacate) (121).

DDS, pnenylphosphorous dichloride and 1,6-hexanediol bischloroformate have been condensed to give a polymer melting at 200-210°C and having an inherent viscosity of 0.52 (111). Phenyldichlorophosphine oxide reacts with DDS to give a polymer melting at 120°C (110). Similarly, DDS and N,N-diethylamidophosphonyl dichloride react to give a nonflammable polymer (112).

High molecular weight linear aromatic polyesters are prepared by reacting DDS disodium salt with diphenylether-4,4'-disulfonylchloride. A film cast from methylene chloride had a softening temperature of 140-142°C (141).

$$\left\{ so_2 - \left(\right) - o - \left(\right) - so_2 - o - \left(\right) - so_2 - o - \left(\right) - o \right\}_n$$

In a similar manner, 1,3-propanedisulfonyl chloride reacts with DDS to give a polymer melting at 235-237 °C (142).

Polyesters (cont)

N-Arylamide-ester polymers suitable for electric wire insulating enamels have been prepared by reacting DDS, N, N'-diphenyl-p-phenylenediamine and isophthaloyl chloride. The polymer is reported to have a high melting point, exceptional heat resistance and high solubility in organic solvents (143).

Poly(ester-amide) copolymers derived from DDS, aromatic dicarboxylic acids and aromatic amino acids have been found to exhibit improved solvent resistance, stress cracking resistance and also increased stiffness, tensile strength, hardness and heat distortion temperature (144).

Incorporating DDS in a polyester reaction of tris(2-hydroxyalkyl)isocyanurate and a polycarboxylic acid reduces a gel formation and provides a thermal oxidatively stable polyester with excellent adhesion properties (69).

Poly(imidocarbonic esters) can be prepared when DDS and 2,2-bis(4-cyanato-phenyl)propane are mixed in a solvent with alkaline catalysis. The resulting product is a greasy material that melts at 124-125°C (145).

A polybenzoxazole polyester polymer has been prepared from DDS, a polybasic aromatic carboxylic acid and 4,4'-dihydroxy-3,3'-diaminodiphenyl sulfone. The ester reactions occur first followed by a curing step to form the oxazole ring (71).

Polycarbonates

The DDS diamion reacts with phosgene (131,132,146,147) or diphenyl carbonate (67,68) to form a polycarbonate.

DDS +
$$COC1_2 \longrightarrow \left\{ \begin{array}{c} O - \left(\begin{array}{c} O \\ \end{array} \right) - SO_2 - \left(\begin{array}{c} O \\ \end{array} \right) \\ 0 \end{array} \right\}_n$$

Copolycarbonates from DDS, 4,4'-isopropylidene diphenol and phosgene have been reported (148,149,150). A copolycarbonate of DDS, 4,4'-isopropylidene diphenol, bis-2-(3,5,3',5'-tetrachloro-4,4'-dihydroxydiphenyl)propane and phosgene is reported to have flame-resistant properties (109). A mixture of DDS, 4,4'-isopropylidene diphenol, carbonic acid and a diamine, such as piperazine, react to form a polycarbonate having enhanced resistance to solvent stress cracking (151).

Polycarbonates (cont)

Other copolycarbonates have been prepared from mixtures of DDS and the following monomers:

4,4'-Thiodiphenol (152)
Bis(4-hydroxyphenyl)ether (153)
1,6-Hexanediol (154)
Polycaprolactone glycol (126)

Dihydroxydiphenyl sulfone bis (chloroformate) can self-condense using a metal oxide catalyst to form a polycarbonate (155).

The dichloroformates noted below react with DDS to produce polycarbonates:

2-Butyne-1,4-diol dichloroformate (156)

Phenolphthalein dichloroformate (157)

Dihydroxydiphenyl sulfone dichloroformate (60)

2,6-Bis (chloroformyl-9-oxabicyclo [3.3.1] nonane (123)

Neopentyl bischloroformate (102)

A derivative of DDS, 2,2'-(sulfonyl-bis(p-phenyleneoxy))diethanol reacts with di-n-butyl carbonate to form a polycarbonate having a melting range of 145-155°C (124).

Some physical properties, such as tensile strength and elongation, of DDS polycarbonates can be improved by irradiation (158).

Polycarbonate compositions with at least one chemically combined aliphatically unsaturated imido radical have been prepared from DDS, phosgene and p-male-imidobenzoic acid (133).

Polyarylene Ether Sulfones

The DDS diamion reacts with 4,4'-dihalodiphenyl sulfones to form polyarylene ether sulfone polymers (159,160,161).

$$DDS + CI \longrightarrow \left\{ O \longrightarrow SO_2 - \left\{ O \bigcirc SO_2 - \left\{ O \longrightarrow SO_2 - \left\{ O \bigcirc SO_2 - \left\{ O O\right) - \left\{ O O\right) - \left\{ O O\right)$$

DDS condenses with 3,3',4,4'-tetrachlorodiphenyl sulfone (130) and many perchloro aromatic monomers (162).

The disodium salts of DDS and resorcinol react with decachlorobiphenyl in dimethyl sulfoxide to give a resin useful as a molding compound (163).

Polyarylene Ether Sulfones (cont)

A high-molecular, soluble, thermoplastic, modified polyphenyl ether sulfone having increased flame resistance is prepared by reacting DDS with a mixture of dichlorodiphenyl sulfone and hexachlorobenzene (65,66). In a similar fashion, tetrahalobenzenes have been used (114,164).

DDS has been reacted with 4,4'-bis(4-chlorophenyl sulfone)-diphenyl ether or 4,4'-bis(4-chlorophenyl sulfone)-diphenyl to form new polyarylene ether sulfone polymers (165).

DDS, 4,4'-dichlorodiphenyl sulfone and pentachloropyridine condense to form a prepolymer useful in preparing thermosetting resins (166).

Polyurethanes

The diglycidyl ether of DDS is reacted with an organic polyisocyanate in the presence of a tert-amine catalyst and a blowing agent to form a high temperature resistant, low flame spread cellular polymer (167).

The reaction product of DDS and formaldehyde under acid catalysis is combined chemically with a polyisocyanate to form a thermally stable polyurethane foam (168).

A polyurethane polymer, especially suited for fibers having improved dyeing and moisture regain properties can be formed by reacting an arylene disocyanate, a polyethylene ether glycol and DDS. Increasing the amount of DDS increased the melting point (98).

Polyethers of DDS, such as the bis(hydroxyethyl ether), have been condensed with dimethylol urea in the presence of an acid catalyst with continuous water removal to form viscous syrups suitable for the preparation of urethanes (169).

The bis(chlorocarbonic acid ester) of DDS has been reacted with N, N'-dimethyl-N, N'-dialkyldiamino phenyl compounds to produce urethane molding materials suitable for films and foils (129).

Miscellaneous Polymers

A linear polymer useful as a pigment can be prepared by reacting DDS with bis-(cyclopentadienyl) titanium dichloride (170). This polymer has also been useful in coatings and molding compounds (77).

DDS reacts with dianilinodiphenylsilane to form a polymer with a softening temperature of 130-135°C and which can be formed into films and fibers (122). Of six poly (oxyary-lenesilanes) studied, diphenyldiphenoxysilane-dihydroxydiphenyl sulfone copolymer had the highest resistance to oxidative thermal degradation (171).

Miscellaneous Polymers (cont)

DDS reacts with 2-diphenylamino-4,6-dichloro-S-triazine to give a polymer with a softening temperature of 303°C (172). Other DDS reactions with substituted S-triazine ring compounds have been reported (173).

The disodium salt of DDS is dissolved in dimethyl sulfoxide and sulfuryl fluoride is bubbled into the solution. A high molecular weight aryl sulfate polymer is produced (134). Polysulfonate polymers from DDS and 1,3-propanedisulfonyl chloride and 1,4-cyclohexane disulfonyl chloride have been reported (142).

DDS, bis-(4-hydroxyphenyl)-disulfimide sodium and 3,4,4'-trichlorodiphenylsulfone condense in dimethyl sulfoxide with base catalysis to form a polymer melting within a range of 251-270°C (174).

Plasticizers

A polymer prepared from one mole adipic acid, one mole of hexamethylenediamine and two moles of epsilon-caprolactam are greatly improved by the incorporation of a plasticizer such as DDS (175). The reaction product of DDS and diphenyl pentaerythritol diphosphite has been suggested as a plasticizer (48).

Molding Materials

DDS has been used as a monomer to prepare a variety of polymeric molding materials. References by polymer type are as follows:

Epoxy (23,40,41,42,43,44,45,61,84,103,104,176)
Polycarbonate (40,67,124,131,132,133)
Polyester (70,112,128,177)
Polyurethane (98,129)
Polyarylene ether sulfone (66)
Formaldehyde resin (47,178)
Miscellaneous (76,77,134)

<u>Printing Plates</u>

DDS has been condensed with 2 moles of 2-diazo-1-naphthol-5-sulfonyl chloride in dioxane/pyridine and applied to a roughened aluminum plate to form a light-sensitive base layer for use in the graphic industry (11). Other related DDS compounds have also been reported (179,180).

A poly(arylene ether sulfone) polymer, prepared from DDS and 4,4'-dichlorodiphenyl sulfone has been suggested as a base stock for printing plates (181).

Tanning

DDS is heated with naphthalenesulfonic acid and formaldehyde at 120°C for 2.5-15 hours followed by neutralization with NaOH to form a tanning substance.

This penetrates into hides more slowly than does naphthalene or phenol tanning substances, but produces a much softer leather (182, 183).

The condensation product of DDS, hydroxy carboxylic acids (salicylic acid) and formaldehyde using HCl catalysis gives products useful in the tanning industry (184).

DDS condenses with formaldehyde and sodium bisulfite to give a polymer product soluble in water at pH 2.2. The resulting material is useful as a tanning agent (56).

DDS, alkali lignin and boric acid were heated in dioxane forming a clear solution. The dioxane was distilled off and the residue taken up in benzene which was also distilled off. The residue was dissolved in aqueous caustic and then precipitated with sulfuric acid to give a tanning agent for sheepskin (185).

A tanning material has been prepared by heating a suspension of DDS in aqueous hydrochloric acid containing urea. Formaldehyde is added and the heating continued to form an insoluble material which is removed, washed and then heated with naphthalene sulfonic acid (186).

A mixture of DDS and sulfonated biphenyls will condense with formaldehyde to form a tanning agent (187).

DDS is first sulfonated by heating with chlorosulfonic acid and then reacted with formaldehyde to produce a tanning agent (188,189).

Sulfonated DDS when condensed with formaldehyde and urea under acidic conditions give products which impart light stability and plumpness to leather (36,190).

DDS can be heated with a mixture of glycolic acid and concentrated sulfuric acid to form a tanning agent (191).

DDS and the compounds below have been condensed with formaldehyde to form tanning agents.

Naphthalene sulfonic acid (182)
Sulfonated biphenyls (187)
Hydroxy carboxylic acids (184)
Sodium bisulfite (56)
Sulfonated isomeric bis(hydroxymethoxyphenyl) sulfone (192)
Lignin sulfonic acid solutions (193)
Sulfonated xylenes (194)
p-Phenol sulfonic acid (195)
Salicylic acid and o-hydroxybiphenyl mixture (196)
Anisole sulfonic acid (94)
Ethanolamine (197)
Biphenyl-4-sulfonic acid (198)
4-Hydroxybiphenyl-4'-sulfonic acid (199)

Varnish

The ester reaction product of DDS and dimeric unsaturated drying oil acids, i.e., soya oil acids, are valuable in varnishes and drying compounds as they improve resistance to alkali, water, and chemicals and improve hardness, flexibility, and other properties (200).

A new plastic composition suitable for varnishes is prepared from a mixture of DDS, an amine, and a polyepoxide. Variations in properties can be obtained by varying the proportions of the ingredients (176). Similar compounds are also prepared from DDS, an amide derived from ammonia and soybean oil acids, and a polyepoxide (61).

Vulcanizing Agents

A mixture of DDS, hexafluoropropylene-vinylidene fluoride copolymer, magnesia, calcium hydroxide, carbon black, and a quaternary ammonium compound were vulcanized at 250-350°C to give rubber gaskets, diaphragms and hoses (82). Other fluoroelastomers have been vulcanized with the DDS dianion (83) or mixtures of DDS and either pentasubstituted guanidine or N,N,N'-substituted amidine (81).

Wax

DDS and octadecyl glycidyl ether when heated in the presence of KOH form a hard wax which can be emulsified in water and used as a polishing agent (210).

TOXICITY AND HANDLING

TOXICITY

Studies of dihydroxydiphenyl sulfone (DDS) show it to be low in toxicity. It may be somewhat initating to eyes or skin.

Acute Oral Toxicity LD50

4,556 mg/kg

(Albino Rats)

Acute Dermal Toxicity LD50

> 10,250 mg/kg

(Albino Rabbits)

Eye Irritation

Moderately Irritating

(Albino Rabbits)

(29.7/110.0)

Primary Skin Irritation (Albino Rabbits)

Minimally Irritating (0.5/8.0)

HANDLING

Care should be used in handling dihydroxydiphenyl sulfone (DDS). The same precautions should be employed when handling DDS as when handling similar phenolic materials. DDS is less toxic than phenol.

First Aid: In case of contact, immediately flush exposed area with plenty of water for at least 15 minutes. Call a physician.

| CHEMICAL NAME | 4,4'-Dihydroxydiphenyl sulfone | FORT JAMES |
|-----------------|--------------------------------|--|
| SYNONYMS | p,p'-Dihydroxydiphenyl sulfone | SPECIALTY CHEMICALS 4TH AND ADAMS STREET |
| TRADENAME | 4,4DDS | CAMAS, WASHINGTON 98607 |
| CHEMICAL FAMILY | Phenol, Sulfone | PHONE: (360) 834-8134 |

FORM ULA

I. PHYSICAL DATA

| BOILING POINT | °C °F | MELTING POINT | 247-249°C 477-480°F | |
|---|---|---|---------------------|--|
| VAPOR PRESSURE | - mm Hg | SPECIFIC GRAVITY (H ₂ O = 1) | - | |
| VAPOR DENSITY (AIR = 1) | _ | EVAPORATION RATE (= 1) | - | |
| SOLUBILITY IN WATER % BY WEIGHT | 4.0 | MOLECULAR WEIGHT | 250.3 | |
| SOLUBILITY IN OTHER SOLVENTS | poluble in methanol, ethel, declone, insomble in benzene. | | | |
| APPEARANCE AND ODOR White crystalline solid, odorless | | | | |

II. SPECIAL PROTECTION INFORMATION

| EYE PROTECTION | Goggles advised. |
|---------------------------|-------------------------------------|
| RESPIRATORY PROTECTION | Respirator in dusty areas. |
| SKIN PROTECTION | Rubber gloves advised. |
| VENTILATION | General ventilation to remove dust. |

III. PHYSIOLOGICAL EFFECTS AND HEALTH INFORMATION

| THRESHOLD LIMIT VALUE (TLV) | Not known | Acute oral (rats) 4,556 mg/kg (slightly toxic) LD50 Acute dermal (rabbits) 10,250 mg/kg (relatively harmless) | |
|-----------------------------|------------|---|-----------|
| EYE IRRITATION | Moderately | SKIN IRRITATION | Minimally |
| EFFECTS OF OVER EXPOSURE | - | OTHER | - |

IV. EMERGENCY AND FIRST AID PROCEDURES

| EYE CONTACT | Wash thoroughly with water for 15 minutes. |
|--------------|--|
| SKIN CONTACT | Wash with water and soap. |
| INHALATION | Get medical attention. |
| INGESTION | Get medical attention. |

V. FIRE PROTECTION INFORMATION

| FLASH POINT (Test Method) | °C °F Unknown | AUTOIGNITIO Unknow | | °C | °F |
|--|---------------------------------|-----------------------|-------|----|----|
| FLAMMABLE LIMITS Unknow | • | LOWER | UPPER | | |
| EXTINGUISHING MEDIA | Water, foams, CO2 | , powder. | - | | |
| SPECIAL FIRE FIGHTING PROCEDURES | _ | | | | |
| UNUSUAL FIRE HAZARDS | SO ₂ formed on burni | ing. | | | |

VI. REACTIVITY DATA

| STABILITY (THERMAL, | STABLE | х | CONDITIONS |
|--|--|---|------------|
| LIGHT, ETC.) | UNSTABLE | | TO AVOID |
| HAZARDOUS POLYMERIZATION | MAY OCCUR | | CONDITIONS |
| | WILL NOT OCCUR | х | TO AVOID |
| INCOMPATIBILITY (MATERIALS TO AVOID) | Strong oxidizing agents. | | |
| HAZARDOUS DECOMPOSITION PRODUCTS | Phenolic byproducts may result from heating. | | |

VII. SPILL OR LEAK PROCEDURES

| PRECAUTIONS IF MATERIAL IS RELEASED OR SPILLED | Can be cleaned up by vacuum. Aqueous caustic will dissolve. |
|--|---|
| WASTE DISPOSAL METHODS | Burn in chemical incinerator. |

VIII. SPECIAL PRECAUTIONS

| HANDLING AND | |
|--------------|------------------|
| | Prevent dusting. |
| STORING | |

IX. SHIPPING REGULATIONS

No special labeling or handling required.

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CrownZellerbach

Chemical Products Division



4,4'-SULFONYLDIPHENOL (SDP)

This bulletin presents a review of the literature relative to the properties, reactions, and applications of 4,4'-sulfonyldiphenol (SDP). There are many references describing dihydroxydiphenyl sulfones in general and where it was obvious that an isomer mixture was employed, the work was not included in this publication.

SDP is a high purity white crystalline material having a melting point of 248.5°C. It is soluble in polar solvents such as, acetone, methanol, and dimethyl sulfoxide (DMSO), slightly soluble in water and essentially soluble in chlorinated solvents, and aliphatic or aromatic hydrocarbons. The majority of reactions noted occur on the hydroxyl groups and the products are generally oligomers or polymers.

The staff at Crown Zellerbach would welcome an opportunity to discuss chemical reactions or potential applications with you and is willing to provide appropriate technical assistance leading towards a commercial use for SDP.

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PHYSICAL PROPERTIES

| Appearance Molecular weight Melting point, °C Molal freezing point constant, °C | | white cr 250.3 248.5 16.6 | rystals |
|---|--------------------------------------|------------------------------------|--------------|
| Heat of fusion | Kcal per mole calories/gram | 8.1 32.4 | |
| Acid dissociatio (50% aq. etha | n constants (202)(203) nol, 25°C) | pKal pKa2 | 8.52 9.42 |
| SPECTRA | | Absorbance | Extin |

| SPECTRA | Absorbance | Extinction |
|----------------------------------|------------------|-------------------|
| | Peaks | Coefficient |
| | <u>(nm)</u> | $(\log \epsilon)$ |
| Ultraviolet in 6% aq. EtOH (202) | (neutral) 234.8 | 4.14 |
| | 260.5 | 4.28 |
| | (alkaline) 258.7 | 4.26 |
| | 297.0 | 4.48 |

Solubilities of 4,4'-Sulfonyldiphenol (SDP)

| | gra | grams per 100 grams Solvent | | |
|------------------------|-------|-----------------------------|------------------|--|
| Solvent | 25'°C | <u>75 °C</u> | <u>Indicated</u> | |
| Acetone | 110 | | | |
| - 4 | 113 | _ | - | |
| Benzene | 0 | 0 | - | |
| Carbon disulfide | 0 | - | - | |
| Carbon tetrachloride | 0 | 0 | - | |
| Chloroform | 0 | - | 0 @ 55°C | |
| Dimethyl disulfide | 0 | 0 | _ | |
| Dimethyl formamide | 129 | > 200 | _ | |
| Dimethyl sulfide | 0 | ₩ | ••• | |
| Dimethyl sulfoxide | > 120 | > 120 | _ | |
| Ethyl acetate | 34 | _ | 34 @ 60°C | |
| Ethyl ether | 0 | - | <u>-</u> | |
| 2-Ethyl-I-hexanol | 10 | 56 | _ | |
| n-Hexane | 0 | _ | 1 @ 60°C | |
| Isopropanol | 29 | 83 | | |
| Methanol | 87 | - | 90 @ 60°C | |
| Methylene chloride | 0 | - | - | |
| Methyl isobutyl ketone | 24 | 42 | | |
| N-Methyl pyrrolidone-2 | 75 | > 120 | | |
| Phenol | _ | 5 | 5 @ 45°C | |
| Pyridine | 36 | > 200 | _ | |
| Sulfolane | _ | 44 | 42 @ 27°C | |
| Tetralin | 0 | 1 | - | |
| Trichloroethylene | 0 | 0 | - | |
| Water, distilled | 4 | 5 | - | |
| Water* | 52 | 51 | _ | |
| Xylene | 0 | 0 | - | |
| ₹ | - | - | | |

^{*} Containing 1% NaHCO3, 1% Na2CO3 and 2% NaOH

REACTIONS TO FORM ESTERS

The diamion of 4,4'-sulfonyldiphenol (SDP) reacts with a variety of compounds to form esters and polyesters. The polymer reactions will be discussed in a special section appearing later in this bulletin.

From Acid Chlorides

SDP reacts with chloroacetyl chloride to give a 99% yield of di-(4-chloroacet-oxyphenyl)sulfone (1).

$$SDP + ClCH_2COCl \longrightarrow ClCH_2COO - SO_2 - OOCCH_2Cl$$

bis-(4-chloroacetoxyphenyl)sulfone m.p. 150-160°C

The synthesis of 4,4'-diacetoxydiphenyl sulfone from SDP has been reported (2,3).

Acryloyl chloride, methacrylyl chloride, or propionyl chloride react with SDP to give the corresponding diesters (4,5).

$$\texttt{SDP} + \texttt{CH}_2 : \texttt{CHCOCl} \longrightarrow \texttt{CH}_2 : \texttt{CHCOO} - \bigcirc \bigcirc -\texttt{SO}_2 - \bigcirc \bigcirc -\texttt{OOCHC} : \texttt{CH}_2$$

4,4'-diacryloyloxysulfonyldiphenol m.p. 103-106°C

$$SDP + CH_3CH_2COC1 \longrightarrow CH_3CH_2COO \longrightarrow -SO_2 \longrightarrow -OOCCH_2CH_3$$

4,4'-dipropionyloxysulfonyldiphenol m.p. 99-100°C

4,4'-dimethacryloyloxysulfonyldiphenol m.p. 154-155°C

REACTIONS TO FORM ESTERS (cont)

From Acid Chlorides (cont)

SDP has reacted with trimellitic anhydride monoacid chloride in pyridine to give a bisesteranhydride monomer (6).

SDP reacts with o-aminobenzoyl chloride to form the diester (7). The reaction of 4-hydroxy-3,5-ditert-butyl-benzoyl chloride proceeds in a similar manner (8).

From Anhydrides

Acrylic anhydride or methacrylic anhydride react with SDP to give the corresponding diesters reported above (5).

From Chloroformates

SDP reacts at room temperature in pyridine with chloroformyl-bis-(betachloro-ethyl)amine to give the carbamate (9).

$$SDP + (C1CH_2CH_2)_2NCC1 \longrightarrow \left[(C1CH_2CH_2)_2NC-O - \left(\begin{array}{c} O \\ \parallel \\ 2 \end{array} \right)_2 SO_2 \right]$$

Alkenyl chloroformates react with SDP to give the bis ethers (10).

$$SDP + CH_2:CHCH_2OCOCI \longrightarrow CH_2:CHCH_2OCOO \longrightarrow -SO_2 \longrightarrow -OOCOCH_2CH:CH_2$$

4,4'-bis-(allylcarbonato) sulfonyldiphenol m.p. 75-76°C

From Sulfonyl Chlorides

Two moles of 2-diazo-1-naphthol-5-sulfonyl chloride react with one mole of SDP in a dioxane-water mixture to form the diester (11), viz.

$$SDP + R-SO_2C1 \longrightarrow R-SO_2-O-O-SO_2-R$$

REACTIONS TO FORM ESTERS (cont)

From Phosphorus Compounds

SDP reacts with O,O-dimethyl and O,O-diethylphosphorochloridothioate to give the corresponding O,O,O',O'-tetraalkyl O,O'-sulfonyldi-p-phenylene phosphorothioates (12,13). Yields for the dimethyl and diethyl phosphorothioates of 65.3 and 72 percent respectively have been reported (14).

$$SDP + CIP(OR)_2 \longrightarrow (RO)_2P - O - O - P(OR)_2$$

$$R = -CH_3 \text{ or } -CH_2CH_3$$

REACTIONS TO FORM ETHERS

Alkyl Ethers

Several 4,4'-dialkoxydiphenylsulfones have been prepared (15).

| 4,4'-(dimethoxydiphenyl)sulfone | |
|--|----------------|
| to the transfer of the transfe | m.p. 129-130°C |
| 4,4'-(diethoxydiphenyl)sulfone | m.p. 164°C |
| 4,4'-(di-n-propoxydiphenyl)sulfone | m.p. 142-143°C |
| 4,4'-(di-isopropoxydiphenyl)sulfone | m.p. 157°C |
| 4,4'-(di-n-butoxydiphenyl)sulfone | m.p. 92.5°C |
| A Al-Idi m amalaa 11 1 1 1 | m.p. 92.5 C |
| 4,4'-(di-n-amyloxydiphenyl)sulfone | m.p. 86.5°C |

SDP salts react with methyl chloroacetate or ethyl chloroacetate to form ethers (16).

$$SDP + CH_3OOCCH_2Cl \longrightarrow CH_3OOCCH_2O \longrightarrow -SO_2 \longrightarrow -OCH_2COOCH_3$$

$$m.p. 151-152 \circ C$$

$$SDP + CH_3CH_2OOCCH_2CI \longrightarrow CH_3CH_2OOCCH_2-O$$

$$-SO_2 - O-CH_2COOCH_2CH_3$$
m.p. 87°C

Mono ethers of SDP have been prepared by reacting the monopotassium salt of SDP with excess quantities of alpha, omega-dibromo alkanes. Heating a dilute amyl alcohol solution of the mono ethers in the presence of potassium carbonate gave the cyclic ethers (17).

REACTIONS TO FORM ETHERS (cont)

Aromatic Ethers

SDP disodium salt reacts with 4-nitrophthalonitrile to give the bisaromatic ether (204).

$$SDP + NO_2 \xrightarrow{CN} CN \xrightarrow{NaOH} NC \xrightarrow{NC} O \xrightarrow{CN} CN$$

4,4'-bis-(3,4-dicyanophenoxy)diphenylsulfone m.p. 229-230°C

In a similar manner, 4-chloro-N-butylphthalimide reacts with SDP disodium salt to give the bis ether (18).

$$SDP + RN \xrightarrow{0} C1 \longrightarrow RN \xrightarrow{0} C1$$

Hydroxy Alkyl Ethers

SDP reacts with ethylene oxide to give the bis hydroxyethyl ether (19).

Propylene oxide ethers have also been reported (20,21).

Glycidyl Ethers

SDP reacts with epichlorohydrin in the presence of caustic to form the bis glycidyl ether (22,23). Some resinous products of higher molecular weight may also be formed, especially when the ratio of epichlorohydrin to SDP is close to the stoichiometric amount (24).

$$SDP + CH_2-CHCH_2CI \longrightarrow CH_2CHCH_2-O-CO-SO_2-O-CHCH-CH_2$$

bis-(4-glycidyloxyphenyl)sulfone m.p. 162-176°C

m.p. 184°C

REACTIONS TO FORM ETHERS (cont)

Ethers from Tosylates

SDP reacts with methyl p-(beta-p-toluenesulfonyloxyethoxy)benzoate to produce the bis ether (25).

REACTIONS ON THE AROMATIC RINGS

Reactions with Formaldehyde

Several methylol derivatives have been prepared by reacting SDP with formaldehyde and a catalyst (26). The compounds include:

Pure methylol derivatives of SDP can be prepared by reducing the corresponding carboxylic acids with LiAlH4. The derivatives were separated by chromatography on polyamide powder (27).

Condensing SDP with formaldehyde in acid medium results in the formation of methylene bridges between two or more SDP units (28). Similar reactions have been run under alkaline conditions (29).

SDP has been combined with a variety of other aromatic compounds by way of formaldehyde condensation reactions. These are described in detail in the Applications Section of this bulletin under Tanning.

Nitration

An aqueous slurry of SDP when treated with concentrated nitric acid gives a dinitro derivative (30,31).

$$SDP + HNO_3 \longrightarrow HO \longrightarrow SO_2 \longrightarrow OH$$

3,3'-dinitro-4,4'-sulfonyldiphenol m.p. 238.5-240°C

REACTIONS ON THE AROMATIC RINGS (cont)

Nitration (cont)

Nitration in mixed acid gives the tetranitro derivative (30).

$$SDP + HNO_3 \xrightarrow{H_2SO_4} HO \xrightarrow{NO_2} SO_2 \xrightarrow{NO_2} OH$$

The determination of tetranitro-4,4'-sulfonyldiphenol impurity in the dinitro compound has been studied using potentiometric titrations (32).

Amination

Amino derivatives of SDP have been obtained by reducing nitro compounds. As an example, 3,3'-diamino-4,4'-sulfonyldiphenol, with a melting point of 238-238.5°C, has been obtained by hydrogenating 3,3'-dinitro-4,4'-sulfonyldiphenol using a platinum oxide catalyst in pyridine (31).

Halogenation

SDP is brominated in methanol to give the tetrabromo derivative (33).

$$SDP + Br_2 \xrightarrow{MeOH} HO \xrightarrow{Br} SO_2 \xrightarrow{Br} OH$$

Sulfonation

Sulfonation of the ring occurs ortho to the hydroxyl to give either the monosulfonate or the symmetrical disulfonate (30).

SDP +
$$H_2SO_4$$
 \longrightarrow HO- SO_2 - SO_2 -OH

m.p. 155-157°C

SDP, acetic acid anhydride and sulfuric acid monohydrate when mixed and heated form sulfonated SDP (34,35).

REACTIONS ON THE AROMATIC RINGS (cont)

Sulfonation (cont)

SDP and 98% sulfuric acid are mixed and heated at 110-120°C until a product entirely soluble in water is obtained (36,37).

When SDP is added portion-wise to stirred chlorosulfonic acid the monosulfonic or disulfonic acid or a mixture of the two can be obtained (37).

REACTIONS AT THE SULFONE GROUP

Desulfurization

The disodium salt of SDP was added to hot NaOH and the mixture was heated for one hour at 385-408°C to give 2,2'-biphenol (38).

$$NaO-O$$
- ONa ON

In a similar manner, the dipotassium salt of SDP can be added to hot KOH at $300\,^{\circ}$ C and the mixture heated for twenty minutes at $303-328\,^{\circ}$ C to give a mixture of 2,2'-, 2,4'-, and 4,4'-dihydroxybiphenyl (39).

MISCELLANEOUS APPLICATIONS

The utility of 4,4'-sulfonyldiphenol (SDP) is derived from its ability to react as a chemical intermediate or monomer to form new materials. New products containing SDP have been used in a variety of applications which are described on the following pages.

Adhesives

Low molecular weight polycarbonate polymers prepared from SDP and phosgene react with epichlorohydrin to give terminal epoxide groups. Subsequent reaction with phthalic anhydride produced a cross-linked, insoluble, nonmelting adhesive (40).

The reaction product of SDP, cyanuric acid and epichlorohydrin is a resin softening at 46°C with an epoxide equivalent of 168 that is useful as an adhesive (41).

The diglycidyl ether of SDP can react with 4,4'-diaminodiphenylsulfone to form an adhesive (42).

A B-stage epoxy resin, stable at room temperature for extended periods of time, has been reported. It is prepared by combining an SDP epoxy resin having an epoxy equivalent of 210 with cocoguanamine which is derived from a mixture of C₈-C₁₈ acids in coconut oil (43).

Adhesives and infusible molding compounds are prepared by a two step process in which SDP is treated with an excess of aliphatic polyepoxides to form an intermediate reaction product. This is further reacted with SDP or other polyhydric phenols (44).

A threefold improvement in tensile shear strength at 250°F was obtained when SDP was substituted for 4,4'-isopropylidenediphenol in an epoxy adhesive formulation. The room temperature shear strengths were comparable (45).

SDP is added to polyamides, prepared from carboxylic acids and hexamethylenediamine, to form adhesives for wood, leather and other substances (46).

Methylol derivatives of SDP react with phenolic materials to form thermosetting resin adhesives (47).

<u>Antioxidants and Stabilizers</u>

Diphenyl pentaerythritol diphosphite, SDP, and diphenyl phosphite when heated form a polymeric material useful as a stabilizer (48).

A low molecular weight epoxy resin prepared using SDP is effective as a heat and light stabilizer for polyvinyl chloride and vinyl chloride copolymers. This is more effective than the corresponding product prepared from 4,4'-isopropylidenediphenol (49).

MISCELLANEOUS APPLICATIONS

Antioxidants and Stabilizers (cont)

Linear polyesters of terephthalic acid and ethylene glycol are thermally stabilized by the addition of 0.01-0.5 weight percent SDP (50).

SDP dianion reacts with o-aminobenzoyl chloride to form an ultraviolet light stabilizer for polyethylene and poly(vinyl chloride) (7). In a similar manner, the SDP diester of 4-hydroxy-3,5-di-t-butyl benzoyl chloride stabilizes polypropylene, rubber, polystyrene or polyacetal resins against oxidation or light (8). A number of other substituted benzoyl chlorides react with SDP to form heat and light stabilizers for polymers (51).

Polymeric malonates useful for stabilizing polymers, cellulose materials, proteins, fats, oils and waxes are prepared by reacting SDP dihydroxyethyl ether with bis-(3,5-di-t-butyl-4-hydroxybenzyl) malonic acid diethyl ester (52).

Biological Activity

<u>Bactericides:</u> SDP is bacteriostatic in concentrations above 0.025 percent toward E. coli and Streptococci in vitro (53). The growth of bacillus Calmette Guerin (BCG) was inhibited by SDP and this inhibition was not reversed by the addition of p-aminobenzoic acid (54).

Mice were given 5-20 mg quantities of an SDP mixture containing its isomer, by mouth and then a lethal dose of an endotoxin was injected intraperitoneally. The dihydroxydiphenylsulfone mixture offered some protection against the endotoxins of Meningococcus and Aertrychi bacillus but did not protect against Staphylococcus endotoxin (55).

<u>Fungicides:</u> The condensation product of SDP, formaldehyde and a NaHSO₃ solution has been suggested for use as a fungicide (56). As a fungicide, SDP was less active than 4,4'-thiodiphenol or 4,4'-sulfinyldiphenol (57).

<u>Pesticides:</u> O,O,O',O'-tetramethyl-O,O'-sulfonyldi-p-phenylene phosphoro-thioate and O,O,O',O'-tetraethyl-O,O'-sulfonyldi-p-phenylene phosphorothioate have been suggested for use in controlling insect pests (13) as have other SDP-phosphoric acid esters (58).

The antiparasitic activities of some thiophosphoric acid esters of SDP have been reported (14).

Catalyst

High temperature resistant cellular polymers are prepared in a one step procedure by reacting a polycarboxylic acid or anhydride with an organic polyisocyanate using the diglycidyl ether of SDP as a catalyst (59).

Polycarbonates are obtained by the reaction of SDP and an aryl bis(chloroformate) in the presence of a catalyst consisting of the Be salt of SDP. The catalyst

MISCELLANEOUS APPLICATIONS

Catalyst (cont)

can be made in situ by adding a salt of beryllium to the reaction mixture or by heating a Be salt with dissolved SDP (60).

Coatings

Polymers containing SDP have been suggested for use in a variety of coating applications:

| Polymer Composition | Reference |
|----------------------|----------------------|
| Epoxy resin | 22,40,41,45,61,62,63 |
| Polyarylethersulfone | 64,65,66 |
| Polycarbonate | 40,67,68 |
| Polyester | 69,70,71,72,73,74,75 |
| Miscellaneous | 76,77 |

Color Formation

A method for producing dark colored marks from colorless materials (duplicating) utilizes the reaction of SDP with heterocyclic oxygen. When a transfer web with a coating containing a bis(p-aminophenyl)phthalide triphenylmethane group is brought into contact with a second web containing SDP, a dark colored material is produced (78,79).

Coupling, Cross-Linking or Curing Agents

Improved epoxy resin adhesives are prepared by reacting a liquid epoxy resin, modified with a small amount of urethane, with SDP, a coupling agent (80).

SDP is used as a cross-linking agent along with guanidine and amidine accelerators for the vulcanization of highly fluorinated elastomer stocks (81). In a similar manner, SDP has been used as a cross-linking agent for vulcanization of hexafluoropropylene-vinylidene fluoride copolymers (82) and other fluoroelastomers (83).

Thermosetting resin powders which can be molded to form products characterized in tensile measurement, by high elongation to break, high tensile strength and modulus and high glass transition temperature are prepared from a mixture of a prepolymer consisting essentially of glycidyl methacrylate, methyl methacrylate and methacrylonitrile or acrylonitrile and SDP as a cross-linking agent (84).

SDP, condensed with formaldehyde, forms a water insoluble resin which is an excellent cross-linking agent for polyvinyl alcohol films to make them water insoluble (85).

Coupling, Cross-Linking or Curing Agents (cont)

A primary or secondary amine is reacted with formaldehyde and then reacted with SDP under reflux to give a tetrasubstituted Mannich base which can be used to cure epoxy resins (86).

An SDP derivative, 4,4'-bis(acryloyloxy)diphenyl sulfone, has been used as a cross-linking monomer in preparing modified polystyrene (87).

<u>Deemulsifier</u>

SDP is oxypropylated to a molecular weight of 1-5,000 and then esterified with dicarboxylic acids of eight or less carbon atoms to give a surface active agent useful for breaking petroleum emulsions (20,21).

Dyeing of Fibers

A synthetic tanning agent consisting of the acid condensed resin of SDP and for-maldehyde and a mixture of naphthalene-2- and naphthalene-1-sulfonic acids is used as a dyeing assistant for nylon (88).

A condensate of SDP, beta-naphthalene-sulfonic acid and formaldehyde is mixed with formic acid and $K_2Cr_2O_7$ to form a resist. This is useful in raiple dyeing or contrast dyeing for obtaining more than two colors on polyamide, or especially wool (89). In a somewhat similar process wool, silk and polyester fibers are treated with the condensation product of SDP, formaldehyde and beta-naphthalenesulfonic acid and subsequently woven together with untreated fibers. When this material is dyed or printed with a mixture of an acid and dispersed dye, a multiple colored product is produced (90).

In the process of dyeing and printing of polyamide fibers with reactive dyestuffs, a post treatment for the purpose of fixing still unreacted residual dyestuff to the fibers is used. This consists of introducing the freshly dyed fibers to an aqueous solution of the condensation product of SDP, naphthalenesulfonic acid and formaldehyde (91,92).

A resin prepared by sulfonating SDP with sulfuric acid in acetic anhydride, then reacting the product with formaldehyde followed by neutralization is used to improve the fastness properties of dyes on polyamide fibers or fabrics (35).

A resin that gives improved wet fastness to textile colors on nylon 66 is prepared from alkaline SDP, formaldehyde and butane sultone, then acidified to give a product containing alkanesulfonic acid groups (93).

Aryl ether sulfonic acids (anisolesulfonic acid), SDP, and formaldehyde are condensed in aqueous acid at $90-110\,^{\circ}\text{C}$ and the product is useful as a leather tanning agent and for improving the wet fastness of ionic dyes on polyamides (94).

Dyeing of Fibers (cont)

SDP, formaldehyde and HCl are condensed for 2 hours after which dimethylol urea dimethyl ether and a sulfanilic acid are added. The resulting resin is useful as a lake former for basic dyes (95).

SDP is heated with sodium sulfite and aqueous formaldehyde for 10 hours at 15 °C, then acidified and treated with dimethylol urea, 2-naphthol-6-sulfonic acid and formaldehyde to give a condensation product which can be used as a dye dispersant in dyeing plastics (96).

The tetraazo component of a diazo dyestuff may be prepared by reaction of nitrobenzenesulfonyl chloride with SDP in the presence of an acid acceptor (97).

A polyurethane especially suited for manufacturing of fibers having improved dyeing and moisture regain properties can be formed mixing SDP, toluene-2,4-disocyanate and polyethylene glycol (98).

Electroplating

White, uniform, fine grained lead-tin alloy coatings were electroplated on to brass at low current densities from baths containing lead and tin tetrafluoroborates, SDP, and a surfactant (99). SDP and its 2,4'-isomer have been used as an additive in tin and tin alloy plating baths where it provides a smooth, dense, and fine crystalline deposit (100).

Electrostatic Compositions

Electrostatic compositions comprising a toner containing a coloring agent and a polyester resin have been reported. The polyester is produced from an alkylene oxide derivative of SDP and a dicarboxylic acid (101). A dry electrostatic toner composition is prepared from a colorant and a polycarbonate resin binder. The latter consists of SDP, neopentylglycol and phosgene (102).

Epoxy Resins

SDP and epichlorohydrin react to form a useful diglycidyl ether. It reacts with 4.4'-diaminodiphenyl sulfone (42), guanamine (43) or SDP (44) to form resins.

An epoxy resin having high functionalities and exhibiting improved elevated temperature performance was prepared by reacting the glycidyl polyether of 2,2-bis(4-hydroxyphenyl)propane and 1,1,2,2-tetrakis(hydroxyphenyl)ethane and adding SDP (103). In a somewhat similar manner, SDP was added to its diglycidyl ether (23,104) or to bis(4-glycidyloxyphenyl)sulfone having an epoxy equivalent of about 185 (105) to give resins.

A mixture of SDP, cyanuric acid, epichlorohydrin, and benzyltrimethylammonium chloride was heated for several hours, cooled and neutralized with NaOH. The

Epoxy Resins (cont)

product had a softening point of 46°C, a chlorine content of 4.3% and an epoxy equivalent of 168 (41).

SDP, epibromohydrin, and high molecular weight polyamide react to form hard-enable compounds containing epoxy groups (106).

A polyhydric alcohol was prepared from equal molar quantities of SDP and another bisphenol and epichlorohydrin in the presence of NaOH. Limited esterification of these soluble epoxide resins with unsaturated acids produces drying compounds useful for coating and film forming applications (63).

SDP diglycidyl ether reacts with poly(2,6-dialkyl-1,4-phenylene) oxide resin to form a new resin having significantly reduced melt viscosity and improved processing characteristics, as well as increased stiffness and rigidity (107).

A resin prepared from SDP and triglycidyl cyanurate can be used to prepare a film that becomes hard after one-half hour at 150°C (108).

<u>Flame-Resistant Compositions</u>

It has been found that copolycarbonates based on bisphenols and nuclear halogenated bisphenols with the same halogen content are more flame-resistant and, at the same time, have a substantially lower tendency to drip, when 0.1-10.0 mole percent SDP is added to the condensation mixture when preparing these products (109).

Flame-resistant polymeric phosphonates were obtained by condensing SDP, phloroglucinol and phenylphosphonic dichloride to give a hard, very pale yellow, resinous solid (73).

A fireproof, thermoplastic polyester-polyaryl phosphonate composition was prepared by incorporating the SDP-phenyldihalophosphine oxide oligomer into a polyester (110).

SDP, phenylphosphorous dichloride and 1,6-hexanediol bischloroformate react to form a flame-resistant polymer having a reduced viscosity of 0.52 and melting at 200-210°C (111).

N, N-dialkylamidophosphonyl dichlorides react with SDP or mixtures of SDP and hydroquinone to give extrudable or injection moldable flameproof polymers (112, 113).

A mixture of SDP, diphenyl pentaerythritol diphosphite and diphenyl phosphite were heated distilling off phenol to give a polymer having self-extinguishing characteristics (48).

1

Flame-Resistant Compositions (cont)

SDP, a dihalodiphenyl sulfone and hexachlorobenzene can condense to form a modified poly(phenyl ether sulfone) having flame-resistant properties (65). In an analogous manner, 1,2,4,5-tetrachlorobenzene (114) or 1,3,5-tris(4-hydroxyphenoxy)-2,4,6-trichlorobenzene (115) have been used.

Halogenated SDP has been used as a flame retardant in polyethylene and polypropylene (33).

Ion Exchange Resins

A cation exchange resin is prepared by reacting SDP, formaldehyde, and an alkaline sulfiting agent, such as sodium sulfite, to make a water insoluble material. The resin may be used in purification of water and sugar syrups, removal of heavy metal ions from food, beverage and pharmaceutical products, etc. (116,117).

<u>Inks</u>

Flexographic printing ink consisting of alcoholic or aqueous alcoholic solutions of conventional basic dyes have been modified by adding the product resulting from the condensation of SDP, salicylic acid and formaldehyde (118).

An offset printing ink is prepared by condensing SDP and formaldehyde using acid catalysis for two hours followed by the addition of salicylic acid and the dimethyl ether of dimethyl urea. Further heating produced a yellow powder soluble in several solvents (119).

Fibers and Films

Several varieties of polymers containing SDP have been suggested for use in films or fibers. The references noted in the table by polymer type will be helpful:

| | <u>Fibers</u> | Films |
|---------------------------------------|--------------------|---------------------------------------|
| Polyesters | 25,71,120,121 | 6,72,127,128 |
| Polyesters contain- ing phosphorus | 110,111,113 | 71,111,112 |
| Polyurethanes | 98 | 98,129 |
| Poly(arylene ether sulfones) | 23,65,76,122 | 65,76,115,122,130 |
| Polycarbonates | 67,123,124,125,126 | 67,68,117,123,124,125, 126,131,132 |
| Miscellaneous | | 63,94,107,134 |

Phenol Formaldehyde Resins

As a bisphenol, SDP will condense with formaldehyde in a manner similar to the phenol-formaldehyde condensation reactions. Details regarding these SDP reactions are contained in the Tanning Section beginning on page 20.

SDP or its hydroxymethyl derivative can be condensed with a phenol-formaldehyde resin to give a thermosetting composition having increased heat resistance (135).

Polyesters

A variety of polyesters have been prepared from SDP and other monomers. The following diacid halide reactions have been reported:

- 1. Terephthaloyl chloride (136)
- 2. Isophthaloyl chloride (137)
- 3. A mixture of 1 and 2 (72,75,127,128)
- 4. The diacid chloride of 4,4'-dicarboxydiphenyl ether (137,138)
- 5. Glutaryl dichloride (139)
- 6. A mixture of 2- and 5-tert-butylisophthaloyl halide (140)

Copolyester drawn fibers made from ethylene glycol, dimethylterephthalate and 1-12 percent SDP have been reported to have high shrinkage in boiling water (120). An ethylene glycol-dimethyl terephthalate-4,4'-sulfonyldiphenol copolymer had a higher crimpability than polyesters prepared from poly(ethylene terephthalate), poly(ethylene terephthalate/isophthalate), or poly(ethylene terephthalate/seba-cate) (121).

SDP, phenylphosphorous dichloride and 1,6-hexanediol bischloroformate have been condensed to give a polymer melting at 200-210°C and having an inherent viscosity of 0.52 (111). Phenyldichlorophosphine oxide reacts with SDP to give a polymer melting at 120°C (110). Similarly, SDP and N,N-diethylamidophosphonyl dichloride react to give a nonflammable polymer (112).

High molecular weight linear aromatic polyesters are prepared by reacting SDP disodium salt with diphenylether-4,4'-disulfonylchloride. A film cast from methylene chloride had a softening temperature of 140-142°C (141).

$$\left\{ so_2 \cdot \left(\right) \cdot so_2 \cdot o \cdot \left(\right) \cdot so_2 \cdot \left(\right) \cdot o \right\}_n$$

In a similar manner, 1,3-propanedisulfonyl chloride reacts with SDP to give a polymer melting at 235-237°C (142).

Polyesters (cont)

N-Arylamide-ester polymers suitable for electric wire insulating enamels have been prepared by reacting SDP, N, N'-diphenyl-p-phenylenediamine and isophthaloyl chloride. The polymer is reported to have a high melting point, exceptional heat resistance and high solubility in organic solvents (143).

Poly(ester-amide) copolymers derived from SDP, aromatic dicarboxylic acids and aromatic amino acids have been found to exhibit improved solvent resistance, stress cracking resistance and also increased stiffness, tensile strength, hardness and heat distortion temperature (144).

Incorporating SDP in a polyester reaction of tris(2-hydroxyalkyl)isocyanurate and a polycarboxylic acid reduces a gel formation and provides a thermal oxidatively stable polyester with excellent adhesion properties (69).

Poly(imidocarbonic esters) can be prepared when SDP and 2,2-bis(4-cyanato-phenyl)propane are mixed in a solvent with alkaline catalysis. The resulting product is a greasy material that melts at 124-125°C (145).

A polybenzoxazole polyester polymer has been prepared from SDP, a polybasic aromatic carboxylic acid and 4,4'-dihydroxy-3,3'-diaminodiphenyl sulfone. The ester reactions occur first followed by a curing step to form the oxazole ring (71).

<u>Polycarbonates</u>

The SDP diamion reacts with phosgene (131,132,146,147) or diphenyl carbonate (67,68) to form a polycarbonate.

$$SDP + COCl_2 \longrightarrow \left\{ \begin{array}{c} O - \left(\begin{array}{c} O \\ \end{array} \right) - SO_2 - \left(\begin{array}{c} O \\ \end{array} \right) \\ m.p. 200-210 \, ^{\circ}C \end{array} \right\}$$

Copolycarbonates from SDP, 4,4'-isopropylidene diphenol and phosgene have been reported (148,149,150). A copolycarbonate of SDP, 4,4'-isopropylidene diphenol, bis-2-(3,5,3',5'-tetrachloro-4,4'-dihydroxydiphenyl)propane and phosgene is reported to have flame-resistant properties (109). A mixture of SDP, 4,4'-isopropylidene diphenol, carbonic acid and a diamine, such as piperazine, react to form a polycarbonate having enhanced resistance to solvent stress cracking (151).

Polycarbonates (cont)

Other copolycarbonates have been prepared from mixtures of SDP and the following monomers:

4,4'-Thiodiphenol (152)
Bis(4-hydroxyphenyl)ether (153)
I,6-Hexanediol (154)
Polycaprolactone glycol (126)

4,4'-Sulfonyldiphenol bis(chloroformate) can self-condense using a metal oxide catalyst to form a polycarbonate (155).

The dichloroformates noted below react with SDP to produce polycarbonates:

2-Butyne-1,4-diol dichloroformate (156)
Phenolphthalein dichloroformate (157)
4,4'-Sulfonyldiphenol dichloroformate (60)
2,6-Bis(chloroformyl-9-oxabicyclo[3.3.1] nonane (123)
Neopentyl bischloroformate (102)

A derivative of SDP, 2,2'-(sulfonyl-bis(p-phenyleneoxy))diethanol reacts with di-n-butyl carbonate to form a polycarbonate having a melting range of 145-155°C (124).

Some physical properties, such as tensile strength and elongation, of SDP polycarbonates can be improved by irradiation (158).

Polycarbonate compositions with at least one chemically combined aliphatically unsaturated imido radical have been prepared from SDP, phosgene and p-male-imidobenzoic acid (133).

Polyarylene Ether Sulfones

The SDP diamion reacts with 4,4'-dihalodiphenyl sulfones to form polyarylene ether sulfone polymers (159,160,161).

$$SDP + Cl \longrightarrow -SO_2 \longrightarrow -SO_2 - SO_2 - S$$

SDP condenses with 3,3',4,4'-tetrachlorodiphenyl sulfone (130) and many perchloro aromatic monomers (162).

The disodium salts of SDP and resorcinol react with decachlorobiphenyl in dimethyl sulfoxide to give a resin useful as a molding compound (163).

Polyarylene Ether Sulfones (cont)

A high-molecular, soluble, thermoplastic, modified polyphenyl ether sulfone having increased flame resistance is prepared by reacting SDP with a mixture of dichlorodiphenyl sulfone and hexachlorobenzene (65,66). In a similar fashion, tetrahalobenzenes have been used (114,164).

SDP has been reacted with 4,4'-bis(4-chlorophenyl sulfone)-diphenyl ether or 4,4'-bis(4-chlorophenyl sulfone)-diphenyl to form new polyarylene ether sulfone polymers (165).

SDP, 4,4'-dichlorodiphenyl sulfone and pentachloropyridine condense to form a prepolymer useful in preparing thermosetting resins (166).

Polyurethanes

The diglycidyl ether of SDP is reacted with an organic polyisocyanate in the presence of a tert-amine catalyst and a blowing agent to form a high temperature resistant, low flame spread cellular polymer (167).

The reaction product of SDP and formaldehyde under acid catalysis is combined chemically with a polyisocyanate to form a thermally stable polyurethane foam (168).

A polyurethane polymer, especially suited for fibers having improved dyeing and moisture regain properties can be formed by reacting an arylene diisocyanate, a polyethylene ether glycol and SDP. Increasing the amount of SDP increased the melting point (98).

Polyethers of SDP, such as the bis(hydroxyethyl ether), have been condensed with dimethylol urea in the presence of an acid catalyst with continuous water removal to form viscous syrups suitable for the preparation of urethanes (169).

The bis(chlorocarbonic acid ester) of SDP has been reacted with N, N'-dimethyl-N, N'-dialkyldiamino phenyl compounds to produce urethane molding materials suitable for films and foils (129).

Miscellaneous Polymers

A linear polymer useful as a pigment can be prepared by reacting SDP with bis-(cyclopentadienyl) titanium dichloride (170). This polymer has also been useful in coatings and molding compounds (77).

SDP reacts with dianilinodiphenylsilane to form a polymer with a softening temperature of 130-135°C and which can be formed into films and fibers (122). Of six poly(oxyarylenesilanes) studied, diphenyldiphenoxysilane-4,4'-sulfonyldiphenol copolymer had the highest resistance to oxidative thermal degradation (171).

Miscellaneous Polymers (cont)

SDP reacts with 2-diphenylamino-4,6-dichloro-S-triazine to give a polymer with a softening temperature of 303°C (172). Other SDP reactions with substituted S-triazine ring compounds have been reported (173).

The disodium salt of SDP is dissolved in dimethyl sulfoxide and sulfuryl fluoride is bubbled into the solution. A high molecular weight aryl sulfate polymer is produced (134). Polysulfonate polymers from SDP and 1,3-propanedisulfonyl chloride and 1,4-cyclohexane disulfonyl chloride have been reported (142).

SDP, bis-(4-hydroxyphenyl)-disulfimide sodium and 3,4,4'-trichlorodiphenylsulfone condense in dimethyl sulfoxide with base catalysis to form a polymer melting within a range of 251-270 °C (174).

Plasticizers

A polymer prepared from one mole adipic acid, one mole of hexamethylenediamine and two moles of epsilon-caprolactam are greatly improved by the incorporation of a plasticizer such as SDP (175). The reaction product of SDP and diphenyl pentaerythritol diphosphite has been suggested as a plasticizer (48).

Molding Materials

SDP has been used as a monomer to prepare a variety of polymeric molding materials. References by polymer type are as follows:

Epoxy (23,40,41,42,43,44,45,61,84,103,104,176)
Polycarbonate (40,67,124,131,132,133)
Polyester (70,112,128,177)
Polyurethane (98,129)
Polyarylene ether sulfone (66)
Formaldehyde resin (47,178)
Miscellaneous (76,77,134)

Printing Plates

SDP has been condensed with 2 moles of 2-diazo-1-naphthol-5-sulfonyl chloride in dioxane/pyridine and applied to a roughened aluminum plate to form a light-sensitive base layer for use in the graphic industry (11). Other related SDP compounds have also been reported (179,180).

A poly(arylene ether sulfone) polymer, prepared from SDP and 4,4'-dichlorodiphenyl sulfone has been suggested as a base stock for printing plates (181).

<u>Tanning</u>

SDP is heated with naphthalene sulfonic acid and formal dehyde at $120\,^{\circ}\text{C}$ for 2.5-15 hours followed by neutralization with NaOH to form a tanning substance.

MISCELLANEOUS APPLICATIONS

This penetrates into hides more slowly than does naphthalene or phenol tanning substances, but produces a much softer leather (182,183).

The condensation product of SDP, hydroxy carboxylic acids (salicylic acid) and formaldehyde using HCl catalysis gives products useful in the tanning industry (184).

SDP condenses with formaldehyde and sodium bisulfite to give a polymer product soluble in water at pH 2.2. The resulting material is useful as a tanning agent (56).

SDP, alkali lignin and boric acid were heated in dioxane forming a clear solution. The dioxane was distilled off and the residue taken up in benzene which was also distilled off. The residue was dissolved in aqueous caustic and then precipitated with sulfuric acid to give a tanning agent for sheepskin (185).

A tanning material has been prepared by heating a suspension of SDP in aqueous hydrochloric acid containing urea. Formaldehyde is added and the heating continued to form an insoluble material which is removed, washed and then heated with naphthalenesulfonic acid (186).

A mixture of SDP and sulfonated biphenyls will condense with formaldehyde to form a tanning agent (187).

SDP is first sulfonated by heating with chlorosulfonic acid and then reacted with formaldehyde to produce a tanning agent (188, 189).

Sulfonated SDP when condensed with formaldehyde and urea under acidic conditions give products which impart light stability and plumpness to leather (36,190).

SDP can be heated with a mixture of glycolic acid and concentrated sulfuric acid to form a tanning agent (191).

SDP and the compounds below have been condensed with formaldehyde to form tanning agents.

Naphthalene sulfonic acid (182) Sulfonated biphenyls (187)

Hydroxy carboxylic acids (184)

Sodium bisulfite (56)

Sulfonated isomeric bis(hydroxymethoxyphenyl) sulfone (192)

Ligninsulfonic acid solutions (193)

Sulfonated xylenes (194)

p-Phenolsulfonic acid (195)

Salicylic acid and o-hydroxybiphenyl mixture (196)

Anisolesulfonic acid (94)

Ethanolamine (197)

Biphenyl-4-sulfonic acid (198)

4-Hydroxybiphenyl-4'-sulfonic acid (199)

Varnish

The ester reaction product of SDP and dimeric unsaturated drying oil acids, i.e., soya oil acids, are valuable in varnishes and drying compounds as they improve resistance to alkali, water, and chemicals and improve hardness, flexibility, and other properties (200).

A new plastic composition suitable for varnishes is prepared from a mixture of SDP, an amine, and a polyepoxide. Variations in properties can be obtained by varying the proportions of the ingredients (176). Similar compounds are also prepared from SDP, an amide derived from ammonia and soybean oil acids, and a polyepoxide (61).

<u>Vulcanizing Agents</u>

A mixture of SDP, hexafluoropropylene-vinylidene fluoride copolymer, magnesia, calcium hydroxide, carbon black, and a quaternary ammonium compound were vulcanized at 250-350°C to give rubber gaskets, diaphragms and hoses (82). Other fluoroelastomers have been vulcanized with the SDP dianion (83) or mixtures of SDP and either pentasubstituted guanidine or N,N,N'-substituted amidine (81).

Wax

SDP and octadecyl glycidyl ether when heated in the presence of KOH form a hard wax which can be emulsified in water and used as a polishing agent (210).

TOXICITY AND HANDLING

TOXICITY

Studies of 4,4'-sulfonyldiphenol (SDP) show it to be low in toxicity. It may be somewhat irritating to eyes or skin.

Acute Oral Toxicity LD50

4,556 mg/kg

(Albino Rats)

Acute Dermal Toxicity LD50

> 10,250 mg/kg

(Albino Rabbits)

(Albino Rabbits)

Eye Irritation

Moderately Irritating

(29.7/110.0)

Primary Skin Irritation (Albino Rabbits)

Minimally Irritating

(0.5/8.0)

HANDLING

Care should be used in handling 4,4'-sulfonyldiphenol (SDP). The same precautions should be employed when handling SDP as when handling similar phenolic materials. SDP is less toxic than phenol.

First Aid: In case of contact, immediately flush exposed area with plenty of water for at least 15 minutes. Call a physician.

MATERIAL SAFETY DATA SHEET

| CHEMICAL NAME | 4,4'-Sulfonyldiphenol | CROWN ZELLERBACH CORPORATION |
|-----------------|--------------------------------|------------------------------|
| SYNONYMS | p,p'-Dihydroxydiphenyl sulfone | CHEMICAL PRODUCTS DIVISION |
| TRADENAME | 4-SDP | CAMAS, WASHINGTON 98607 |
| CHEMICAL FAMILY | Phenol, Sulfone | PHONE: (206) 834-4444 |

FORM ULA

I. PHYSICAL DATA

| BOILING POINT | °C °F | MELTING POINT | 247-249°C 477-480°F | |
|---------------------------------|--|---|---------------------|--|
| VAPOR PRESSURE | - mm Hg | SPECIFIC GRAVITY (H ₂ O = 1) | - | |
| VAPOR DENSITY (AIR = 1) | - | EVAPORATION RATE (= 1) | · | |
| SOLUBILITY IN WATER % BY WEIGHT | 4.0 | MOLECULAR WEIGHT | 250.3 | |
| SOLUBILITY IN OTHER SOLVENTS | Soluble in methanol, ether, acetone, insoluble in benzene. | | | |
| APPEARANCE AND ODOR | White crystalline | solid, odorless | | |

II. SPECIAL PROTECTION INFORMATION

| EYE PROTECTION | Goggles advised. |
|----------------|-------------------------------------|
| RESPIRATORY | Respirator in dusty areas. |
| PROTECTION | Acophator in dusty dreas. |
| SKIN | D. L |
| PROTECTION | Rubber gloves advised. |
| VENTILATION | General ventilation to remove dust. |

III. PHYSIOLOGICAL EFFECTS AND HEALTH INFORMATION

| THRESHOLD LIMIT VALUE (TLV) | Not known | Acute oral (rats) 4,556 mg/kg (slightly to: LD50 Acute dermal (rabbits) 10,250 mg/k (relatively harmless) | | |
|-----------------------------|-----------|---|-----------|--|
| EYE IRRITATION Moderately | | SKIN IRRITATION | Minimally | |
| EFFECTS OF OVER EXPOSURE | - | OTHER | - | |

IV. EMERGENCY AND FIRST AID PROCEDURES

| EYE CONTACT | Wash thoroughly with water for 15 minutes. |
|--------------|--|
| SKIN CONTACT | Wash with water and soap. |
| INHALATION | Get medical attention. |
| INGESTION | Get medical attention. |

V. FIRE PROTECTION INFORMATION

| FLASH POINT (Test Method) | °C °F Unknown | AUTOIGNITION TEMP. Unknown | | | °C | °F |
|--|---------------------------------|----------------------------|--|-------|----|----|
| FLAMMABLE LIMITS Unkno | | LOWER | | UPPER | | |
| EXTINGUISHING MEDIA | Water, foams, CO ₂ | , powder. | | | | |
| SPECIAL FIRE FIGHTING PROCEDURES | _ | | | | | |
| UNUSUAL FIRE HAZARDS | SO ₂ formed on burni | ng. | | | | |

VI. REACTIVITY DATA

| STABILITY | STABLE | X | CONDITIONS |
|--|--|-------------|------------|
| (THERMAL, LIGHT, ETC.) | UNSTABLE | | TO AVOID |
| HAZARDOUS | MAY OCCUR | | CONDITIONS |
| POLYMERIZATION | WILL NOT OCCUR | Х | TO AVOID |
| INCOMPATIBILITY (MATERIALS TO AVOID) | Strong oxidizi | ing agents. | |
| HAZARDOUS DECOMPOSITION PRODUCTS | Phenolic byproducts may result from heating. | | |

VII. SPILL OR LEAK PROCEDURES

| PRECAUTIONS IF MATERIAL IS RELEASED OR SPILLED | Can be cleaned up by vacuum. Aqueous caustic will dissolve. |
|---|---|
| WASTE DISPOSAL METHODS | Burn in chemical incinerator. |

VIII. SPECIAL PRECAUTIONS

| HANDLING AND | Prevent dusting. |
|--------------|------------------|
| STORING | rievent dusting. |

IX. SHIPPING REGULATIONS

No special labeling or handling required.

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locations surrounding the existing concrete containment pad. Soil samples collected from each of these borings were analyzed for VOCs by EPA Method 8260B, acid extractable/base neutral semivolatile organic compounds (SVOCs) by EPA Method 8270C, Resource Conservation and Recovery Act (RCRA) metals by EPA Method 6010/7000, total petroleum hydrocarbons (TPH) by Northwest Series Method NWTPH-HCID, and quantification of petroleum hydrocarbons as gasoline, diesel, or oil. The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Borings GP1 through GP4. Geoprobe borings GP1 through GP4 were drilled on the north, northwest, southwest, and south sides of the pad, respectively. The borings were drilled to maximum depths of 2.5 feet bgs (GP1), 3.5 feet bgs (offset GP1B), 3.2 feet bgs (offset GP1C), 3.5 feet bgs (GP2), 7.5 feet bgs (offset GP2B), 4.3 feet bgs (offset GP2C), 14 feet bgs (GP3), and 19 feet bgs (GP4). Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of sandy silt, silty sand, and sandy silt, with gravel to the deepest boring completion depth. Boring refusal was likely due to basaltic bedrock. The field screening results did not indicate evidence of chemical impact in any of the soil samples collected from the borings. As a result, soil samples were collected from the aforementioned terminal boring depths in each of the boreholes for chemical analysis.

Analytical Results for Diked Storage Area. All organic and inorganic analytical results were below the applicable Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A and B soil cleanup standards. The organic analytical results showed no compounds detected at or above the laboratory method reporting limits (MRLs) for the TPH, VOC, and SVOC analytical suites. In addition, metal concentrations occurred below the applicable MTCA Method A and B soil cleanup standards. Mercury and silver were not detected at any of the four boring locations. All other metals, including arsenic, barium, cadmium, chromium, lead, and selenium, are likely representative of background conditions.

2. Building 205 (Defoamer)

Building 205 (Defoamer) Area Description and Chemicals of Concern. Building 205 operated as a defoamer and utilized raw materials, including fats, alcohols, oils, silica, sodium hydroxide, talc, and waxes. Manufactured products included defoamer, felt wash, pitch dispersant, and synthetic oils, among others. SECOR observed deterioration, etching, and staining of the concrete adjacent to the western side of the building. Chemicals of concern in this area include TPH and, potentially, metal leaching from releases of caustic in the area of the concrete etching. To evaluate subsurface soil in this area, Geoprobe borings GP5 through GP7C were drilled at locations surrounding Building 205 and the associated tank farm. Soil samples collected from each of these borings were analyzed for RCRA metals by EPA Method 6010/7000, for TPH by Northwest Series Method NWTPH-HCID, and for quantification of petroleum hydrocarbons as gasoline, diesel, or oil. The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Borings GP5 through GP7C. Geoprobe borings GP5 through GP7C were drilled adjacent to the northwest corner of Building 205, east and south of the Building 205 Tank Farm, and southwest of the junction between Buildings 204 and 205. The borings were drilled to maximum depths of 4.5 feet bgs (GP5), 2 feet bgs (offset GP5B), 5.6 feet bgs (offset GP5C), 17.5 feet bgs (GP6), 3 feet bgs (GP7), 2.5 feet bgs (offset GP7B), and 6 feet bgs (offset GP7C). Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of sand and silt with gravel to the deepest boring completion depth.

Boring refusal was likely due to basaltic bedrock. Field screening results did not indicate evidence of chemical impact in any of the soil samples collected. As a result, soil samples were collected from the aforementioned terminal boring depths in each borehole for chemical analysis. The soil sample from the GP7C boring was selected from the GP7 boring suite due to the deepest terminal boring depth.

Analytical Results for Building 205 (Defoamer) Area. All organic and inorganic analytical results were below the applicable MTCA Method A and B soil cleanup standards. The organic analytical results showed no TPH detected at or above the MRL. Cadmium and silver were not detected at or above the MRLs. All other metals, including arsenic, barium, chromium, lead, mercury, and selenium, are likely representative of background conditions.

3. Building 204 (Catechol Plant)

Building 204 (Catechol Plant) Area Description and Chemicals of Concern. Building 204 operated as a catechol plant and utilized raw materials including catechol, cresol, and hydrogen peroxide. Manufactured products included catechol, dimethyl sulfoxide, and tertiary butyl cresol. The chemical of concern in this area is cresol, based on its Ecology MTCA Method B soil cleanup level. To evaluate subsurface soil in this area, Geoprobe boring GP8 was drilled adjacent to and south of Building 204. Soil samples collected from this boring were analyzed for acid extractable SVOCs by EPA Method 8270C. The Geoprobe boring drilled in this area and the sample analytical results are described below.

Geoprobe Boring GP8. Geoprobe boring GP8 was drilled to a maximum depth of 31.5 feet bgs. Stratigraphic conditions in the boring indicated the presence of unconsolidated deposits of silt with sand, silty sand, and sand with silt and gravel at the boring completion depth. Boring refusal was likely due to basaltic bedrock. Field screening results did not indicate evidence of chemical impact in soil samples collected from the boring. As a result, the soil sample from the terminal boring depth was submitted for chemical analysis.

Analytical Results for Building 204 (Catechol Plant). All analytical results were below the applicable MTCA Method A and B soil cleanup standards. The organic analytical results showed no TPH or SVOCs at or above the MRLs.

4. Building 203 Tank Farm/Wastewater Sump

Building 203 Tank Farm/Wastewater Sump Area Description and Chemicals of Concern. This area includes the Building 203 Tank Farm and the plant wastewater treatment sump. The primary raw material stored in the tank farm was phenol. Chemicals of concern passing through the plant process wastewater sump likely included VOCs, phenols, PAHs, TPH, and metals. As a result, chemicals of concern in this area include VOCs, SVOCs, TPH, and metals. To evaluate subsurface soil in this area, Geoprobe borings GP9 and GP10 were drilled in the vicinity of the tank farm and sump. Soil samples collected from each of these borings were analyzed for VOCs by EPA Method 8260B, acid/base neutral extractable SVOCs by EPA Method 8270C, RCRA metals by EPA Method 6010/7000, TPH by Northwest Series Method NWTPH-HCID, and quantification of petroleum hydrocarbons as gasoline, diesel, or oil. The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Borings GP9 and GP10. Geoprobe borings GP9 and GP10 were drilled adjacent to and east of the Building 203 wastewater sump and south of the Building 203 Tank Farm, respectively. The borings were drilled to maximum depths of 27.5 feet bgs (GP9) and 21.5 feet bgs (GP10). Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of silty sand, gravelly silt, and gravel with sand and silt. Both gravelly sand and clayey gravelly silt were observed at the boring completion depths. Boring refusal was likely due to basaltic bedrock. Field screening results from the 12-foot sample in boring GP9 indicated a PID response of 30.1 parts per million (ppm). No field screening response was detected in the samples collected from boring GP10. Soil samples were collected for chemical analysis from depths of 12 and 27.5 feet bgs in GP9 and 21.5 feet bgs in GP10.

Analytical Results for Building 203 Tank Farm/Wastewater Sump. With the exception of the VOC tetrachloroethene (PCE), the organic analytical results showed that concentrations of TPH, SVOCs, and VOCs were not detected at or above the MRLs. PCE was detected in samples GP9 at 12 feet bgs and GP10 at concentrations of 2.95 milligrams per kilogram (mg/Kg) and 0.250 mg/Kg, respectively. The concentration in GP9 at 12 feet bgs occurred above the MTCA Method A soil cleanup level of 0.500 mg/Kg.

In addition to the organic results, all metal concentrations were below the applicable MTCA Method A and B soil cleanup standards, with the exception of chromium. Chromium slightly exceeded the MTCA standard of 100 mg/Kg at a concentration of 116 mg/Kg in GP10. This concentration is less than the United States Environmental Protection Agency (USEPA) Region IX Residential Preliminary Remediation Goal (PRG) of 210 mg/Kg and below background levels established in the 1972 U.S. Geological Survey Professional Paper 1272 entitled Element Concentrations in Soils and Surficial Materials in the Conterminous United States. Therefore, the identified chromium concentrations in GP9 and GP10 appear to be representative of background conditions. Cadmium, mercury, and silver were not detected at or above the MRLs. All other metals, including arsenic, barium, lead, and selenium, are likely representative of background conditions.

5. Building 203 (Thiodiphenol [TDP] Plant)

Building 203 (TDP Plant) Area Description and Chemicals of Concern. Building 203 formerly operated as a TDP manufacturing plant. Raw materials of concern used in the TDP manufacturing process in Building 203 included cresol, methylene chloride, phenol, and PCE. As a result, chemicals of concern in this area include VOCs, phenolic SVOCs, and TDP. To evaluate subsurface soil in this area, Geoprobe borings GP11 through GP13 were drilled adjacent to Building 203. Soil samples collected from each of these borings were analyzed for VOCs by EPA Method 8260B, acid extractable SVOCs by EPA Method 8270C, and TDP by EPA Method 8270C with tentatively identified compounds (TICs). The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Borings GP11 through GP13. Geoprobe borings GP11 and GP12 were drilled adjacent to and east of the Building 203 wastewater sump. Geoprobe boring GP13 was drilled south of the Building 203 Tank Farm. The borings were drilled to maximum depths of 10.5 feet bgs (GP11), 14.5 feet bgs (GP12), 6.5 feet bgs (GP13 and offset GP13B), and 6.3 feet bgs (GP13C). Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of silty gravelly sand and silt with gravel to the deepest boring completion depth. Boring refusal was likely due to basaltic bedrock. Field screening results

from the soil samples collected from the borings did not indicate a detectable impact. As a result, soil samples were collected from the aforementioned terminal boring depths in each borehole for chemical analysis.

Analytical Results for Building 203 (TDP Plant). All analytical results were below the applicable MTCA Method A and B soil cleanup standards. Organic analytical results showed that TPH, VOCs, SVOCs and TDP were not detected at or above the MRLs.

6. Building 202 (Methylenedioxybenzene [MDB] Plant) - East Storage Area

Building 202 (MDB Plant) - East Storage Area Description and Chemicals of Concern. This area includes a former drum storage area east of Building 202 that was used to store Building 202 process residuals and others. As a result, chemicals of concern in this area include VOCs and phenolic SVOCs as chlorophenol, cresol, phenol, and methylene chloride; oil; and RCRA metals. To evaluate subsurface soil in this area, Geoprobe boring GP14 was drilled adjacent to and west of the former storage area. The soil sample collected from this boring was analyzed for VOCs by EPA Method 8260B, acid extractable SVOCs by EPA Method 8270C, RCRA metals by EPA Method 6010/7000, TPH by Northwest Series Method NWTPH-HCID, and quantification of petroleum hydrocarbons as gasoline, diesel, and oil. The Geoprobe boring drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Boring GP14. Geoprobe boring GP14 was drilled to a depth of 8 feet bgs. Offsets GP14B and GP14C were drilled to depths of 7 feet bgs. Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of clayey silt, silt with gravel, and silt to the deepest boring completion depth. Boring refusal was likely due to basaltic bedrock. Visual field screening results from soil samples did not indicate a detectable impact despite PID readings ranging from 22.8 to 25.4 ppm. As a result, the terminal soil sample was collected at a depth of 8 feet bgs for chemical analysis.

Analytical Results for Building 202 (MDB Plant) - East Storage Area. All organic and inorganic analytical results were below the applicable MTCA Method A and B soil cleanup standards. The organic analytical results showed that TPH, VOCs, and SVOCs were not detected at or above the MRLs. Metal concentrations also occurred below the applicable MTCA Method A and B soil cleanup standards. Arsenic, cadmium, lead, mercury, silver, and selenium were not detected at or above the MRLs. All other metals, including barium and chromium, are likely representative of background conditions.

7. Building 202 (MDB Plant)

Building 202 (MDB Plant) Area Description and Chemicals of Concern. This area includes Building 202 as the former MDB plant. Chemicals of concern used in the MDB Plant included chlorophenol, cresol, phenol, and methylene chloride. As a result, chemicals of concern in this area include VOCs and phenols. To evaluate subsurface soil in this area, Geoprobe borings GP15 and GP16 were drilled adjacent to and east of Building 202. Soil samples collected from each of these borings were analyzed for VOCs by EPA Method 8260B and acid extractable SVOCs by EPA Method 8270C. The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Borings GP15 and GP16. Geoprobe borings GP15 and offsets GP15B and GP15C were drilled to maximum depths of 7.5 feet bgs, 7.5 feet bgs, and 6.7 feet bgs, respectively. GP16 and offsets GP16B and GP16C were drilled to depths of 2.7 feet bgs, 2.5 feet bgs, and 2.5 feet bgs, respectively. Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of silt with gravel to gravelly silt and silt to the deepest boring completion depth. Boring refusal was likely due to basaltic bedrock. Field screening results from the soil samples collected from the borings did not indicate a detectable impact. As a result, soil samples were collected from the terminal boring depths in each borehole for chemical analysis.

Analytical Results for Building 202 (MDB Plant). All analytical results were below the applicable MTCA Method A and B soil cleanup standards. The organic analytical results showed that TPH, VOCs, and SVOCs were not detected at or above the MRLs.

8. Building 202 (MDB Plant) - Transformers

Building 202 (MDB Plant) – Transformers Area Description and Chemicals of Concern. This area includes the small transformer station located south of the Building 202 East Storage Area. The chemical of concern in this area is polychlorinated biphenyls (PCBs). To evaluate subsurface soil in this area, Geoprobe GP17 was drilled adjacent to and north of the transformers. Soil samples collected from this boring were originally scheduled for analysis of PCBs only by EPA Method 8082. However, based on significantly high field screening PID readings and odor in the GP17 boring samples, the samples were also analyzed for VOCs by EPA Method 8260B, acid extractable SVOCs by EPA Method 8270C, and methylenedioxybenzene (MDB) by EPA Method 8260B with TICs. Offset borings GP17B and GP17C were drilled to the north of GP17 by distances of 1.5 and 3 feet, respectively, to further assess depth to bedrock and the extent of the field screening impact to soil. The Geoprobe borings drilled in this area and the sample analytical results for each of the borings are described below.

Geoprobe Boring GP17. Geoprobe boring GP17 and offsets GP17B, and GP17C were drilled to maximum depths of 9 feet bgs, 7.5 feet bgs, and 11.5 feet bgs, respectively. Stratigraphic conditions in the borings indicated the presence of unconsolidated deposits of silt, sand, and gravel to the deepest boring completion depth. Boring refusal was likely due to basaltic bedrock. Field screening results from the soil samples from boring GP17 indicated significant PID impact of 82.8 to 792 ppm at a depth interval between 3 and 6 feet bgs. The PID reading at the boring completion depth was only 7 ppm. In the remaining two borings, field screening did not indicate impact to soil, although the terminal soil sample in GP17C did exhibit a PID reading of 17.1 ppm. Compared with the shallower PID hits, this was not considered as representative of a significant soil impact. As a result, soil samples were collected for chemical analysis from GP17 and GP17C at depths of 6 feet bgs and 11.5 feet bgs, respectively.

Analytical Results for Building 202 (MDB Plant) - Transformers. With the exception of methylene chloride, all analytical results were below the applicable MTCA Method A and B soil cleanup standards. Methylene chloride was detected at a concentration of 0.75 mg/Kg in sample GP17@6 (collected at 6 feet bgs), slightly above the MTCA Method A standard of 0.5 mg/Kg. In addition to methylene chloride, the organic analytical results indicated the presence of several VOCs and PCBs in sample GP17@6, including acetone (5.13 mg/Kg), 1,2-dichlorobenzene (50.1-946 mg/Kg), 1,4-dichlorobenzene (1.1 mg/Kg), and PCB as Aroclor 1248 (0.289 mg/Kg). In sample GP17C@11.5, only 1,2-dichlorobenzene was

detected at a concentration of 382 mg/Kg. In addition, MDB was identified by the laboratory as the tentatively-identified compounds (TIC) 1, 3-benzodioxole at an estimated concentration of 31 mg/Kg. The remaining constituents occurred at concentrations below the respective Ecology MTCA Method B standards. Currently, no state or federal soil cleanup standard exists for MDB.

9. Building 206 (High Pressure Laboratory)

Building 206 (High Pressure Laboratory) Area Description and Chemicals of Concern. Dimethyl sulfoxide was both the raw material and manufactured product at this location. However, SECOR assumes other chemicals may have been used in the testing processes that occurred in this building. As a result, chemicals of concern at this location include VOCs, phenols, PAHs, and metals. To evaluate subsurface soil in this area, borings GP18 and GP19 were manually drilled with an electric rotohammer on the west side of Building 206. Soil samples collected from each of these borings were analyzed for VOCs by EPA Method 8260B, acid/base neutral extractable SVOCs by EPA Method 8270C, and RCRA metals by EPA Method 6010/7000. The borings drilled in this area and the sample analytical results for each of the borings are described below.

Rotohammer Borings GP18 and GP19. Boring GP18 and offsets GP18B and GP18C were drilled to depths of 1.5 feet bgs. Boring GP19 and offsets GP19B and GP19C were drilled to a depth of 1 foot bgs. Stratigraphic conditions were represented by sandy silt with gravel in each of the borings. Boring refusal was due to basaltic bedrock. Field screening results from the soil samples collected from the borings did not indicate detectable impacts. As a result, soil samples were collected from the terminal boring depths in each boring suite for chemical analysis.

Analytical Results for Building 206 (High Pressure Laboratory). All organic and inorganic analytical results were below the applicable MTCA Method A and B soil cleanup standards. The organic analytical results showed that concentrations of TPH, VOCs, and SVOCs were not detected at or above the MRLs. The metal analytical results indicated that silver was not detected at or above the MRL. All other metals, including arsenic, barium, cadmium, lead, mercury, and selenium, occurred at concentrations that are likely representative of background conditions.

10. Building 201 (Non-Woven Plant)

Building 201 (Non-Woven Plant) Area Description and Chemicals of Concern. This building was originally used as a non-woven fabric manufacturing plant and was used as a chemical product storage warehouse and a blending facility for napkin/towel printing inks. A partially buried UST of an estimated 500-gallon capacity was formerly located in the landscaped bed adjacent to the front entrance. As a result, petroleum hydrocarbons were the primary chemicals of concern at this location. To evaluate subsurface soil in this area, three hand auger borings, including GP20 and offsets GP20B and GP20C, were completed within the landscaped bed to depths of 5.5 feet bgs. Refusal was due to fill material with gravel. One composite soil sample collected from the borings was analyzed for TPH by Northwest Series Method NWTPH-HCID and quantification of petroleum hydrocarbons as gasoline, diesel, or oil.

Hand Auger Boring GP20. Stratigraphic conditions in the bed were represented by silt with gravel. Field screening results from the soil samples collected from this boring did not indicate detectable impacts. As a result, the soil sample from the terminal boring depth was collected for chemical analysis.

Analytical Results for Building 201 (Non-Woven Plant). All analytical results were below the applicable MTCA Method A and B soil cleanup standards. The analytical results showed that TPH was not detected at or above the MRL.

4.4 GROUNDWATER ASSESSMENT

Based on the results of the PA, two phases of groundwater assessment were conducted at the site by SECOR during August 22-25 and November 9-10, 2000, to evaluate on-site groundwater conditions. During the August 2000 event, three on-site groundwater monitoring wells (W-1 through W-3) were installed and sampled. Well W-1 was located approximately 20 feet south of the Building 203 Central Tank Farm, well W-2 was located east of Building 202 at the GP15 boring location, and well W-3 was located along the eastern facility entrance adjacent to the office building. Subsequent to review and evaluation of the August 2000 groundwater hydraulic and chemical data from the three on-site wells, two additional on-site wells, W-4 and W-5, were installed during the November 2000 event and sampled to further delineate the identified groundwater impacts in wells W-1 through W-3. Well W-4 was located adjacent to Blue Creek Canyon by the eastern facility fence line just south of the Warehouse Building 349-7. Well W-5 was completed in NW 7th Avenue, adjacent to the office building at the eastern end of the complex. Each of the five wells was completed in basaltic bedrock. The well locations are illustrated on Figure 3. SECOR subcontracted with Environmental West Exploration, Inc. of Spokane, Washington for well drilling services. The groundwater fieldwork and sampling methodologies and analytical results are presented below.

4.4.1 Groundwater Field Work/Sampling Methodologies

Prior to drilling, each well location was cleared of active utilities by a private utility locator. Subsequently, each of the monitoring wells was drilled with an air rotary rig to the depth of the first encountered water-bearing zone in basaltic bedrock, and completed. No water-bearing zones were encountered in the unsaturated zone deposits overlying the basalt. The depth of the first water-bearing zone in each of the five wells was approximately 41 feet bgs (W-1), 26 feet bgs (W-2), 35 feet bgs (W-3), 20 feet bgs (W-4), and 25 feet bgs (W-5). During drilling, the cuttings were continuously field-screened by SECOR for the presence of dense nonaqueous phase liquids or other impacts. No nonaqueous phase liquids were encountered during the drilling activities. After reaching the first water-bearing zone depth, water levels in the boreholes were allowed to equilibrate to static head prior to additional drilling within the zone to establish the well completion depth and screened interval. Based on static head observations within the boreholes, the well completion depths occurred at 47 feet bgs (W-1), 30 feet bgs (W-2), 28 feet bgs (W-3), 25 feet bgs (W-4), and 30 feet bgs (W-5). Screened intervals in the wells ranged from 37-47 feet bgs (W-1), 20-30 feet bgs (W-2), 13-28 feet bgs (W-3), 10-25 feet bgs (W-4), and 15-30 feet bgs (W-5).

Wells W-1 and W-2 were constructed of 2-inch diameter Schedule 40 polyvinyl chloride casing and 10 feet of 0.010 machine-slotted well screen. Fifteen feet of screen was used in well W-3 due to confined hydraulic conditions at that location. Due to the lower topographic elevation and the possibility for seasonal water level changes at the W-4 and W-5 location, 15 feet of screen was also installed in the water-bearing zone at those locations. Subsequent to insertion of the well casing and screen into the borehole, a 10/20-size sand pack was installed in the borehole annulus

from the borehole bottom to approximately 2 feet above the top of the screened section. The sand pack was wetted with deionized water, and the well was surged with a surge block to facilitate compaction of the sand pack. After compaction, a 1-foot-thick bentonite seal was placed atop the sand pack to seal the screened interval. The remainder of the borehole annulus was filled with a 95% bentonite/5% concrete grout to within 1 foot of the ground surface. A flush-mounted traffic-rated well monument was placed atop the grout and cemented in place approximately 1 inch above the ground surface. A concrete apron was formed around the well monuments to minimize surface water influx during storm events. A locking compression-fitted well cap was placed on each of the well casings for security purposes. Well parameter and construction data were recorded in the project logbook and on a well construction log. The well construction logs are included in Appendix C.

Subsequent to construction, each of the wells was developed through removal of ten well casing volumes of groundwater to remove fines from the well screen and maximize hydraulic efficiency. After a 24-hour time period from development, static water levels were measured in each of the wells to enable calculation of groundwater elevations, hydraulic gradient, and flow direction. After static water levels were measured, each of the wells was purged of three casing volumes of groundwater with a dedicated Teflon bailer to remove oxidized water and induce flow of unoxidized formation water into the casing. Groundwater parameters, including pH, specific conductance, and temperature, were recorded with each casing volume to evaluate the adequacy of the purge. Each of the wells was then sampled with a dedicated bailer. Sampler gloves were changed between each well to minimize cross-contamination. Groundwater samples were placed into laboratory-prepared containers and immediately transferred to insulated coolers with water ice for transport to the project laboratory, North Creek Analytical, Inc. of Beaverton, Oregon, under standard chain-of-custody control. Well sampling data were also recorded in the project logbook and on groundwater field sampling data sheets.

Each of the wells was surveyed by a surveyor registered in the state of Washington. The datum used for elevation control was the 1929 National Geodetic Vertical Datum. Benchmarks of known elevation were used, and all circuits were closed. Vertical elevations were surveyed to an accuracy of 0.01 foot.

All non-dedicated drilling equipment was decontaminated prior to and between each well with a high-pressure detergent wash and rinse. Pending receipt of the groundwater analytical data, the drill cuttings/fluids were placed in U.S. Department of Transportation (DOT)-approved 17H 55-gallon drums and placed in the diked area compound for storage. At the request of Fort James, development water from each of the wells was placed into the wastewater sump in the Central Tank Farm for processing in the Fort James Mill Effluent Treatment System.

4.4.2 Site Hydrogeology

Hydrogeologic conditions at the site consisted of water-bearing zones in basaltic bedrock at depths of 26 to 41 feet bgs. Basalt horizons at the site ranged from approximately 20 to 25 feet bgs, with a cinder zone from approximately 10 to 20 feet bgs in well W-2. Observations of static head in each of the well boreholes indicated relatively unconfined conditions in wells W-2, W-4 and W-5; semiconfined conditions in well W-1; and confined conditions in well W-3. The variation in hydraulic confinement across the site is likely due to differential continuity between massive, fractured, and/or permeable members; fracture percentage, orientation, and geometry; and the presence of welded zones and/or areas of secondary zeolitic mineralization. Based on calculation of groundwater elevations from the three on-site wells, groundwater flow was oriented in a northeasterly direction across the site, toward Blue Creek Canyon, at a gradient of

0.09 foot/foot. Table 6 summarizes the groundwater elevation data from the August and November 2000 monitoring events. Figures 4 and 5 illustrate the respective groundwater gradients. The observed orientation is likely an artifact of the differential hydraulic head between the three wells, but may also be due to the presence of a fractured bedrock regime toward the creek and/or more massive members between the site and the river. Given the predominant eastwest strike and north-south dip of basalt toward the river in the Camas area, the presence of the Columbia River as the dominant regional drain, the lack of observable seeps/springs in the west wall of Blue Creek Canyon, and the fact that surface water flow in Blue Creek Canyon is derived from a pipe at the head of the canyon and not a bedrock source, actual net groundwater flow is likely oriented in a southerly direction toward the Columbia River.

4.4.3 Groundwater Analytical Methods/Results

4.4.3.1 August 2000 Event

Based on evaluation of the potential on-site source areas/buildings and the area geologic and hydrogeologic conditions, the chemicals of concern selected during the August 2000 event at well locations W-1 through W-3 included the combination of chemicals of concern identified for the soil-boring program. These chemicals include chlorophenol, phenol, methylene chloride, PCE, PAHs, TDP, TPH, PCBs, metals, and acid/caustic. As a result, the groundwater samples collected from wells W-1 through W-3 were analyzed for VOCs by EPA Method 8260B; acid/base neutral extractable SVOCs by EPA Method 8270C; TDP by EPA Method 8270C with TICs (MW-2 and MW-3 only); MDB by EPA Method 8260B with TICs; TPH by Ecology Method WTPH-HCID with quantification as petroleum hydrocarbons as gasoline, diesel, or oil; RCRA metals by EPA Method 6010/7000; and acidity/alkalinity by EPA Method 305.1/310.1. The laboratory data report for the August 2000 event is included as Appendix D.

Organic Results. Of the detected compounds, 1,4-dichlorobenzene, PCE, trichloroethene (TCE), and bis(2-ethylhexyl)phthalate occurred above the respective Ecology MTCA Method A or B groundwater cleanup levels. The organic groundwater analytical results indicated the presence of several analytes, including TPH as gasoline (TPH-G), VOCs, and SVOCs. PCBs, TDP, and MDB were not detected at or above the MRLs. Table 7 summarizes the organic groundwater analytical results. Based on the laboratory data report, the TPH-G concentration of 732 micrograms per liter (μg/L) was attributed to biogenic interference due to the presence of non-petroleum peaks and elution patterns. Detected VOCs included chlorobenzene (11.1 μg/L), chloroform (1.15 μg/L), 1,2-dichlorobenzene (74.4-76.6 μg/L), 1,4-dichlorobenzene (2.51 μg/L), cis-1,2-dichloroethene (2.39 μg/L), PCE (2.32-23.6 μg/L), toluene (1.94 μg/L), 1,1,1-trichloroethane (2.71 μg/L), TCE (17.5 μg/L), 1,2,4-trimethylbenzene (1.22 μg/L), and ortho xylene (1.1 μg/L). SVOC compounds detected in the wells included 2-chlorophenol (11 μg/L) and bis(2-ethylhexyl)phthalate (10.1-22 μg/L). A brief description of the results for each well is presented below.

W-1. Well W-1 generally exhibited the greatest VOC compound distribution and concentrations, with seven detected VOCs. The VOC compound 1,4-dichlorobenzene was detected at 2.51 μ g/L, compared with the MTCA Method B groundwater cleanup level of 1.82 μ g/L. PCE was detected at 23.6 μ g/L, compared with the MTCA Method B groundwater cleanup level of 0.858 μ g/L. All metals occurred below the MTCA Method A or B cleanup levels for well W-1.

W-2. Well W-2 contained one SVOC compound, bis(2-ethylhexyl)phthalate, at a concentration of 10.1 μ g/L, which exceeded the MTCA Method B cleanup level of 6.25 μ g/L. Other detectable concentrations below the cleanup levels included TPH-G, three of the seven VOCs, and two SVOCs.

W-3. Well W-3 was nondetectable at or below the MRLs for all organic compounds except trichloroethene and bis(2-ethylhexyl)phthalate. Trichloroethene was detected at a concentration of 17.5 μg/L, compared with the MTCA Method A and B cleanup levels of 5 μg/L and 3.98 μg/L, respectively. In addition, bis(2-ethylhexyl)phthalate was detected at 22 μg/L, compared with the MTCA Method B cleanup level of 6.25 μg/L.

Inorganic Results. The inorganic groundwater analytical results indicated the presence of arsenic (0.00268 milligrams per liter [mg/L]), chromium (0.00344 mg/L), and selenium (0.00133 mg/L) in well W-2 only and barium (0.00362-0.0625 mg/L) in wells W-1 through W-3. Lead, mercury, and silver were not detected in any of the samples at or above the laboratory MRLs. Of the detected metals, barium, chromium, and selenium generally occurred at least one order of magnitude below the respective Ecology MTCA Method A or B groundwater cleanup levels. Arsenic occurred at a concentration below the MTCA Method A, but above the MTCA Method B, groundwater cleanup levels. Given the basaltic terrane and the typical presence of metals in groundwater flowing through volcanic terranes, this is likely representative of background conditions. Table 8 summarizes the inorganic groundwater analytical results.

4.4.3.2 November 2000 Event

Based on evaluation of the August 2000 groundwater data, the November 2000 groundwater samples from wells W-4 and W-5 were analyzed for VOCs and SVOCs by EPA Methods 8260B and 8270C. The laboratory analytical data report from the November 2000 event is included in Appendix E.

Organic Results. All organic groundwater analytical results were below the applicable MTCA Method A and B groundwater cleanup standards. The organic groundwater analytical results indicated the presence of VOCs in the groundwater sample from W-4 only. Detected VOCs included acetone (11.4 μ g/L), chlorobenzene (3.36 μ g/L), and 1,2-dichlorobenzene (8.46 μ g/L). No SVOC compounds were detected in either of the wells at or above the laboratory MRLs. Table 7 summarizes the organic groundwater analytical results.

5.0 SUMMARY OF FINDINGS

5.1 ORGANIC COMPOUNDS IN SOIL

Two areas of the site were identified as exceeding the applicable MTCA Method A or B soil cleanup levels. These areas include the Central Tank Farm/Wastewater Sump (GP9 and GP10) and the Building 202 Transformer Area (GP17). Concentrations of PCE in GP9 (12 feet bgs) and methylene chloride in GP17 (6 feet bgs) exceeded the MTCA Method A cleanup level. Even though these concentrations exceed the MTCA levels, the concentrations are below the USEPA Region IX PRGs for residential sites. No other evidence of impact to the soil from past on-site operations was identified in this investigation.

In the Central Tank Farm/Wastewater Sump area, PCE occurred in both GP9 and GP10 at depths ranging from 12 to 21.5 feet bgs. The detected PCE concentration of 2.95 mg/Kg in GP9 at 12 feet bgs exceeds the MTCA Method A soil cleanup level. However, PCE was not detected above the laboratory MRL in

the boring from the terminal depth of 27.5 feet bgs in GP9. PCE was detected at 0.25 mg/Kg in the sample from 21.5 feet bgs in GP10.

Acetone, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and methylene chloride were detected in the soil sample from the Transformer area boring GP17 at a depth of 6 feet bgs. MDB and PCBs (Aroclor 1248) were also detected in the sample from 6 feet bgs in GP17. Field screening of soil samples also indicated elevated PID readings from the 3- to 6-foot sample interval in this boring. In the sample from 11.5 feet bgs in GP17, 1,2-dichlorobenzene was the only VOC detected. No SVOCs or PCBs were detected in the 11.5-foot sample. Of the compounds detected in the GP17 samples, only the concentration of methylene chloride (0.75 mg/Kg in the 6-foot bgs sample) exceeds the MTCA Method A soil cleanup level.

5.2 INORGANIC COMPOUNDS IN SOIL

With the exception of arsenic and chromium, soil metal concentrations in each of the boring samples did not exceed the respective MTCA soil cleanup levels or residential USEPA Region IX PRGs. While arsenic did not exceed the MTCA Method A soil cleanup level, it did exceed the MTCA Method B level and both the USEPA Region IX residential and industrial PRGs. Chromium in the sample from boring GP10 exceeded the MTCA Method A soil cleanup level, but occurred below the USEPA residential PRG. Given the relative similarity in concentrations, the basaltic bedrock terrane, and based on a comparison with elemental abundances in soil from the Camas, Washington area (as described in the 1984 U.S.G.S. Professional Paper 1270), the detected metals appear to be representative of background concentrations.

5.3 GROUNDWATER

Of the detected organic compounds, only 1,4-dichlorobenzene, PCE, TCE, and bis(2-ethylhexyl)phthalate occurred above the respective Ecology MTCA Method A or B groundwater cleanup levels in wells W-1 through W-3. Detectable concentrations in groundwater from these three wells included TPH-G, several halogenated VOCs, SVOCs, and metals. In wells W-1 through W-3, all organic compounds were below the MTCA Method A or B groundwater cleanup levels. Well W-5 had no detectable compounds at or above the laboratory MRLs. Well W-4 had detectable concentrations of acetone, chlorobenzene, and 1,2-dichlorobenzene below the respective MTCA levels.

The metals detected in groundwater in wells W-1 through W-3, given the relative similarity in concentrations and the basaltic bedrock terrane, appear to be representative of background concentrations. Although arsenic exceeded the MTCA Method B cleanup level, none of the remaining inorganic compound concentrations exceeded the respective MTCA Method A or B groundwater cleanup levels and, as such, are not considered a concern. Given the volcanic terrane, arsenic is also likely representative of background conditions.

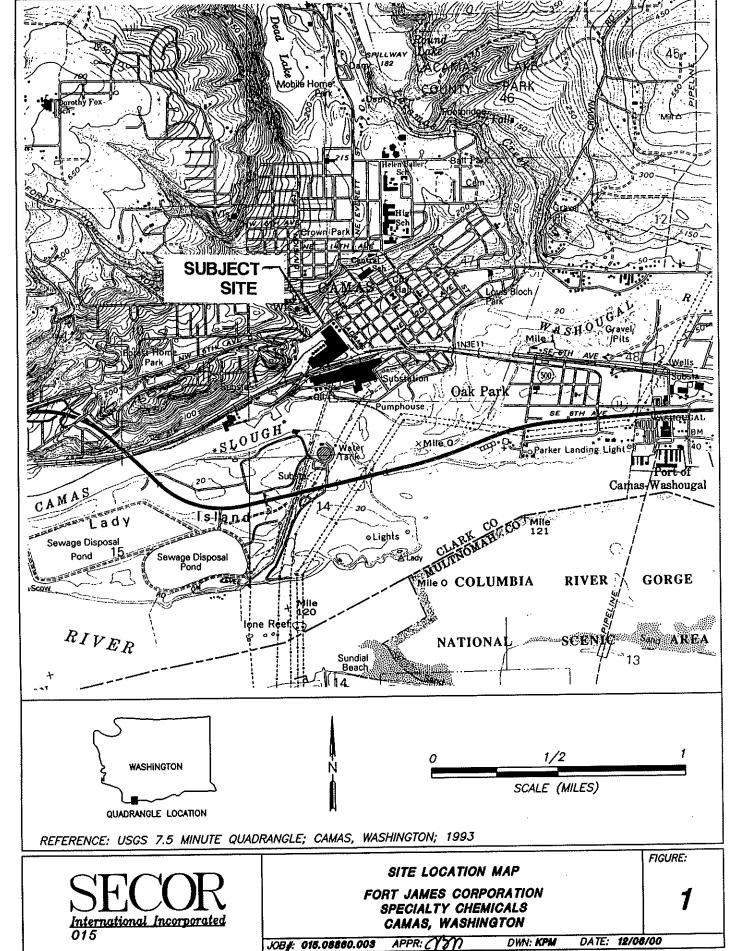
6.0 CONCLUSIONS

Two locations at the former Fort James Specialty Chemical facility have been identified as showing evidence of chemical impact to soil from past on-site operations. The facility is currently inactive, and no extensive subsurface soil impacts were identified. The site surface is generally sealed with an asphalt and/or concrete cap that limits surface recharge. The site is underlain by an unsaturated, unconsolidated zone and a likely homogenous basaltic sequence with no apparent sedimentary members. Based on all of these factors, the potential for groundwater recharge and compound migration beneath and adjacent to the facility is minimized, and the risk to human health and the environment appears to be low. Areas of soil impact that were identified included areas near the Central Tank Farm/Wastewater Sump and adjacent to the Building 202 Transformer Area. Soil impacts in these areas appear to be related to older releases from historical operations at the site and not to active on-site sources. For example, the isolated impact

identified in shallow soil in the Building 202 Transformer Area was the result of a break in the process water sewer line at that location in 1973. Due to the shallow depth and accessibility of the sewer line, repairs were conducted and the pit was backfilled. Based on the Geoprobe boring data from that location, the impact occurred at a depth of 3 to 6 feet bgs and appears to be limited in lateral and vertical extent. There is no evidence of additional releases to soil in the area since the event. Although selected compounds at the Central Tank Farm/Wastewater Sump and adjacent to the Building 202 Transformer Area were detected at concentrations above MTCA Method A cleanup levels, none of the detected concentrations exceeded USEPA Region IX PRGs for residential sites.

Based on the organic groundwater analytical results, groundwater impact at the site appears to be limited in terms of contaminant frequency and distribution, and is likely the result of releases from historical operations and/or the process water sewer line. Well W-1, adjacent to Building 203, exhibits both the greatest number and highest concentrations of VOCs in groundwater, despite the fact that the corresponding soil boring data from GP10 through GP12 indicated only the presence of PCE in subsurface soil. The distribution of compounds in well W-2 may be due to former raw material (chlorophenol) usage, waste storage, and process water releases in and adjacent to Building 202. The presence of TCE in well W-3 may be due to past releases from the process water sewer line and likely chemical transformation from PCE. The presence of bis(2-ethylhexyl)phthalate in W-3 also may be due to a process water sewer line release. The presence of acetone and chlorobenzenes in well W-4 indicates either a past release from the process water sewer line near that location or hydraulically downgradient migration toward Blue Creek Canyon from the former operational areas of the facility. Contaminant concentrations at W-4 are lower than concentrations at hydraulically upgradient locations nearer to the facility, possibly indicating natural attenuation processes occurring within the water-bearing zone. Given the relatively low concentrations of the chemicals at these locations, the historical nature of the impact, the lack of evidence of unsaturated zone impacts during drilling, the lack of observable seeps in Blue Creek Canyon (which is located adjacent to the well), and the potential presence of natural attenuation processes within the water-bearing zone, further groundwater evaluation is not recommended at this time.

FIGURES



F:/FILES/PORTLAND/FORT JAMES

DWG: 15-8860-003(1)

EXECUTIVE SUMMARY

SECOR International Incorporated conducted the 2000 Site Investigation (SI) at the former Fort James Specialty Chemicals facility located in Camas, Washington. SECOR was retained by Fort James Corporation (Fort James) to complete the investigation. SI activities were based on the results of the Preliminary Assessment (PA), as described in a report dated July 26, 2000.

Specialty Chemicals is located at 906 NW Drake Street, east of the intersection of 10th Avenue and Drake Street, in Camas, Washington. The Specialty Chemicals facility is a former chemical manufacturing complex owned and operated by Fort James Camas, LLC. The facility ceased production activities in late 1999. At present, portions of the facility are used for warehousing of maintenance parts and for meetings by the Fort James Camas Mill.

The facility consists of six main buildings (Buildings 201 through 206) that were formerly used for chemical production and storage, three tank farms used for bulk chemical storage, and a diked drum storage area. In addition, an oil and pipe shed formerly located on the complex was used for storage of piping and drummed oil and has been removed.

The SI was completed in two phases. The first phase in August 2000 included drilling 20 soil borings at locations that correlated with the buildings or bulk storage areas where chemical products or raw materials had been historically used and stored. These borings were completed to assess subsurface soil physical and chemical conditions in these areas of potential concern. Based on the soil boring analytical results, three groundwater monitoring wells were installed during the event to evaluate groundwater quality near the Central Tank Farm, south of Building 202, and near the process sewer line at the southeastern end of the facility. The second phase of the SI included installation of two additional groundwater monitoring wells in November 2000. These wells were completed to further evaluate groundwater conditions in hydraulically downgradient directions across the site.

During the initial August 2000 SI phase, 20 Geoprobe locations were drilled on site to facilitate collection and analysis of subsurface soil samples. Those locations where the original terminal Geoprobe boring depth was 10 feet below ground surface (bgs) or less were redrilled at two offset locations spaced approximately 1.5 feet apart. These locations included GP1, GP2, GP5, GP7, GP13, GP14, GP15, GP16, GP17, GP18, GP19, and GP20. Offset drilling was also conducted as necessary to validate boring refusal and bedrock depth and to evaluate the potential for random shallow obstructions (i.e., cobbles).

Based on the results of the August 2000 Geoprobe Investigation, two areas of the site were identified as exceeding the applicable Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A or B soil cleanup levels. These areas include the Central Tank Farm/Wastewater Sump (GP9 and GP10) and the Building 202 Transformer Area (GP17). Concentrations of tetrachloroethene (PCE) in GP9 (12 feet bgs) and methylene chloride in GP17 (6 feet bgs) exceeded the MTCA Method A cleanup level. Even though these concentrations exceed the MTCA levels, the concentrations are below the United States Environmental Protection Agency (USEPA) Region IX Residential Preliminary Remediation Goals (PRGs) for residential sites. No other evidence of impact to the soil from past on-site operations was identified in this investigation.

Acetone, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and methylene chloride were detected in the soil sample from the Transformer area boring GP17 at a depth of 6 feet bgs. Methylenedioxybenzene (MDB) and polychlorinated biphenyls (PCBs) (Aroclor 1248) were also detected in the sample from 6 feet bgs in GP17. Field screening of soil samples also indicated elevated photoionization detector (PID) readings from the 3- to 6-foot sample interval in this boring. In the sample from 11.5 feet bgs in GP17,

1,2-dichlorobenzene was the only volatile organic compound (VOC) detected. No semi-volatile organic compounds (SVOCs) or PCBs were detected in the 11.5-foot sample. Of the compounds detected in the GP17 samples, only the concentration of methylene chloride (0.75 milligrams per kilogram [mg/Kg] in the 6-foot bgs sample) exceeds the MTCA Method A soil cleanup level.

With the exception of arsenic and chromium, soil metal concentrations in each of the boring samples did not exceed the respective MTCA soil cleanup levels or residential USEPA Region IX PRGs. While arsenic did not exceed the MTCA Method A soil cleanup level, it did exceed the MTCA Method B level and both the USEPA Region IX residential and industrial PRGs. Chromium in the sample from boring GP10 exceeded the MTCA Method A soil cleanup level, but occurred below the USEPA residential PRG. Given the relative similarity in concentrations, the basaltic bedrock terrane, and based on a comparison with elemental abundances in soil from the Camas, Washington area (as described in the 1984 U.S.G.S. Professional Paper 1270), the detected metals appear to be representative of background concentrations.

In addition to the Geoprobe investigation, two phases of groundwater assessment were conducted at the site by SECOR during August 22-25 and November 9-10, 2000, to evaluate on-site groundwater conditions. During the August 2000 event, three on-site groundwater monitoring wells (W-1 through W-3) were installed and sampled. Well W-1 was located approximately 20 feet south of the Building 203 Central Tank Farm, well W-2 was located east of Building 202 at the GP15 boring location, and well W-3 was located along the eastern facility entrance adjacent to the office building. Subsequent to review and evaluation of the August 2000 groundwater hydraulic and chemical data from the three on-site wells, two additional on-site wells, W-4 and W-5, were installed during the November 2000 event and sampled to further delineate the identified groundwater impacts in wells W-1 through W-3. Well W-4 was located adjacent to Blue Creek Canyon by the eastern facility fence line just south of the Warehouse Building 349-7. Well W-5 was completed in NW 7th Avenue, adjacent to the office building at the eastern end of the complex. Each of the five wells was completed in basaltic bedrock.

Of the detected organic compounds, only 1,4-dichlorobenzene, PCE, trichloroethene (TCE), and bis(2-ethylhexyl)phthalate occurred above the respective Ecology MTCA Method A or B groundwater cleanup levels in wells W-1 through W-3. Detectable concentrations in groundwater from these three wells included TPH-G, several halogenated VOCs, SVOCs, and metals. In wells W-1 through W-3, all organic compounds were below the MTCA Method A or B groundwater cleanup levels. Well W-5 had no detectable compounds at or above the laboratory method reporting limits (MRLs). Well W-4 had detectable concentrations of acetone, chlorobenzene, and 1,2-dichlorobenzene below the respective MTCA levels.

The metals detected in groundwater in wells W-1 through W-3, given the relative similarity in concentrations and the basaltic bedrock terrane, appear to be representative of background concentrations. Although arsenic exceeded the MTCA Method B cleanup level, none of the remaining inorganic compound concentrations exceeded the respective MTCA Method A or B groundwater cleanup levels and, as such, are not considered a concern. Given the volcanic terrane, arsenic is also likely representative of background conditions.

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REACTIONS OF CATECHOL

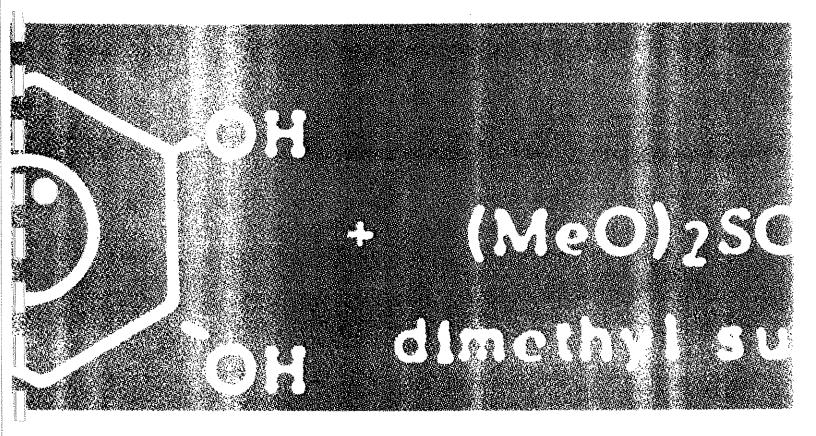




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| 7 - | 2 m. n. 4m. 1 | · | | E+ | Pthysl | |
| AC | Acetyl | | | Et | Ethyl | |
| Ar | Aryl | | | Me | Methyl | |
| Bu | Butyl | | | Ph | Phenyl | |
| Bz | Benzoyl | | | Pr | Propyl | |

INTRODUCTION

Catechol (orthodihydroxybenzene) as made by Fort James is a white crystal or flake, with a very low odor level and purity ranging from 99.0% to 99.8%, depending on grade. Detailed information on various grades is available, including toxicology and handling instructions. Also available is a literature review of applications for catechol.

The availability of uniformly pure catechol, and the low projected prices for large volumes, have stimulated interest in its potential as a chemical intermediate. This bulletin is intended to help the research chemist synthesize profitable new products from catechol.

PROPERTIES OF CATECHOL

Catechol takes part in a wide variety of chemical reactions, showing essentially three types of activity. It functions as:

- 1. a benzenoid,
- 2. a phenol, and
- an orthodihydric phenol.

Information of interest to the research chemist concerning physical and chemical properties will be found in our Product Information Bulletins on the various grades.

ETHERIFICATION

Both mono- and diethers of catechol can be prepared readily by the usual methods. However, it is often difficult to confine the etherification to the monoether stage.

111

OH +
$$2(MeO)_2SO_2$$
 + $3NaOH$ H_2O OMe OMe $90-93\%$ (2)

catechol monohydroxyethyl ether

catechol 3-chloro-2-hydroxypropyl diether

dicyclohexyl-18-crown-6-polyether

<u>ALKYLATION</u>

Catechol can be alkylated by all of the common agents which alkylate phenol (olefins, alcohols, alkyl halides). The usual Friedel-Crafts catalysts, like sulfuric acid, boron trifluoride or aluminum chloride, can be used in the alkylation. Mono-substitution usually occurs in the para- or 4-position of catechol, while di-substitution occurs in the 3,5-positions.

With the appropriate catalyst, it is also possible to obtain substitution in the 3- or 3,6-positions in catechol.

ESTERIFICATION

As any phenol, catechol can be esterified easily to form catechol diesters. Careful control of pH or preparation of intermediates is necessary to make monoesters in good yield.

Carbonates

Carbonate esters of catechol are easily prepared from phosgene or ethyl chloroformate.

chloroformate

94%

The reaction of catechol carbonate with alkyl alcohols gives alkyl catechol carbonates, while reaction with aliphatic amines gives wrethane derivatives.

Reaction of catechol carbonate with phosphorus pentachloride gives the dichloromethylene ether of catechol which is very useful in the synthesis of unusual aromatic carboxylic acids (ArCO₂H).

Phosphates

Catechyl phosphorus trichloride (CPT) reacts with oxygen-containing compounds as a halogen transfer agent. With carbonyl compounds CPT gives gem dichlorides or chloro-olefins. With carboxylic acids it gives acid chlorides while with esters it gives acid chlorides, and the alkyl chloride. Acid amides are dehydrated to nitriles and wrethanes and thiourethanes give the isocyanates. Amines may be converted into isothiocyanates (20). Catechyl phosphorus tribromide gives many similar reactions (21).

$$(CH_2)_n \qquad + \qquad CH_2 \qquad + \qquad CH_2)_n \qquad CH_2$$

$$CH_2 \qquad + \qquad CH_2 \qquad + \qquad$$

2PhCH₂NH₂ + CS₂
$$\longrightarrow$$
 PhCH₂NH-C-S H₂N-CH₂Ph \longrightarrow PhCH₂N=C=S (20) benzylamine benzylisothiocyanate

When catechyl phosphorus trichloride is treated with acetic anhydride, a nearly quantitative yield of acetyl chloride may be obtained. Distillation of the residue gives 88% catechyl phosphorus oxychloride, a very useful phosphorylating agent which has been used to phosphorylate adenosine, uridine and thymidine as well as hindered alcohols like <u>t</u>-butyl alcohol (23).

Miscellaneous Esters

Catechol can also form thiophosphates and borates.

tri-o-phenylene bisborate

NITRATION

Catechol has been nitrated under various conditions to yield the 3- and 4-nitrocatechols as well as the 3,4- and 3,5-dinitrocatechols. Direct nitration gives variable yields of the products with a complex workup required (26), while nitration of the monobenzenesulfonates gives good yields with a simple workup (27).

OH +
$$7NaNO_2$$
 + $5H_2SO_4$ H_2O NO_2 NO2 NO2 24%

$$OH \longrightarrow OSO_2Ph \longrightarrow OSO_2Ph \longrightarrow OSO_2Ph \longrightarrow OH \longrightarrow OH$$

$$OSO_2Ph \longrightarrow OSO_2Ph \longrightarrow OSO_2Ph$$

$$OSO_2Ph \longrightarrow OSO_2Ph \longrightarrow OSO_2Ph$$

$$OSO_2Ph \longrightarrow OSO_2Ph \longrightarrow OSO_2Ph$$

$$OSO_2Ph \longrightarrow OSO_2Ph$$

The nitrocatechols are reduced readily to form the aminocatechols (28)(29)(30).

In nitrations of catechol involving nitrite, the nitrous acid is believed to play the double role of dehydrogenating (or oxidizing) agent and nucleophile. Wanzlick has verified that nitration proceeds by way of an intermediate obenzoquinone (31).

<u>SULFONATION</u>

Catechol reacts with concentrated sulfuric acid or sulfamic acid to give the 4-catechol sulfonic acid or its ammonium salt.

Chlorosulfonic acid gives the catechol 3,5-disulfonic acid or acid chloride (33), while reaction of the preformed o-benzoquinone with hydroxymethane sulfonate gives 3,3',4,4'-tetrahydroxydiphenyl sulfone (34).

<u>HALOGENATION</u>

Chlorination

Catechol can be chlorinated with gaseous chlorine or sulfuryl chloride. 4-Chlorocatechol is the major isomer in each case, while excess halogen produces the 4,5-dichlorocatechol (37).

Excess chlorine in acetic acid will chlorinate catechol to form the tetrachloro-catechol together with a small amount of tetrachloro-o-benzoquinone (red) (38). A large excess of chlorine will give hexachloro-3- and 4-cyclohexene-1,2-diones (39).

Bromination

One cannot isolate monobromocatechol by the action of bromine on catechol because polybromination occurs. However, dioxane dibromide gives 4-bromocatechol in excellent yield.

The 4,5-dibromocatechol can be made from either bromine (41) or thionyl bromide (42), while the 3,4,5-tribromo- and the tetrabromocatechol must be made with bromine.

OH +
$$Br_2$$
 or $SOBr_2$ Br OH Br_2 OH Br_3 Br OH Br_4 Br_5 OH Br_5 OH Br_7 OH

<u>Iodination</u> and Fluorination

The iodo- and fluorocatechols are prepared in the usual manner from diazonium salts of aminocatechol diethers or diesters (44)(45). Tetrafluorocatechol can be prepared from hexafluorobenzene (46).

F + 10NaOH ethylene glycol F
$$\stackrel{F}{\longrightarrow}$$
 $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{F}{\longrightarrow}$ $\stackrel{GH_2CH_2OH}{\longrightarrow}$ $\stackrel{GH_2CH_2OH$

ACYLATION

Catechol undergoes Friedel-Crafts acylation by acid chlorides, carboxylic acids, or anhydrides with the usual catalysts. Substitution usually occurs in the 4-position (47). The 4-acetylcatechol diacetate has been used as an intermediate in the synthesis of norepinephrine (48).

Fries Rearrangement

The Fries rearrangement has also been used extensively to prepare acylated catechols. Rearrangement can be performed on the appropriate monoester or diester or on a monoester formed in situ (50) without isolation. Again, substitution in the 4-position predominates. Small amounts of 3-acylcatechols are also formed in these rearrangements. Both epinephrine and norepinephrine have been prepared from 4-chloroacetylcatechol (51).

$$CH_{3}(CH_{2})_{4}CO_{2}H + SOCI_{2} \longrightarrow \begin{bmatrix} CH_{3}(CH_{2})_{4}COCI \end{bmatrix} \xrightarrow{OH} + 3AICI_{3} \\ CS_{2} & HO \xrightarrow{CO(CH_{2})_{4}CH_{3}} \\ 4-caproylcatechol \end{bmatrix}$$

$$OCO(CH_{2})_{6}CH_{3}$$

When the Fries reaction is carried out photochemically, much more substitution in the 3-position results.

Exclusive 3-substitution can be obtained if desired by reaction of the appropriate aldehyde with Grignard reagents. These aldehydes are not available from catechol.

Alkylated catechols can be obtained from the acyl catechols by Clemmensen or catalytic reduction.

CARBONYLATION

Catechol can be carbonylated by the action of carbon dioxide on its alkali metal salts or by alkali metal bicarbonates. Carbonylation occurs in either the 3-position to give pyrocatechuic acid or in the 3,6-positions to give 2,3-dihydroxyterephthalic acid.

Protocatechuic acid, the 4-isomer, is not available directly from catechol. It is best obtained by the caustic fusion of vanillin.

OH
OMe
$$+ 7KOH + 3H_2O \xrightarrow{air} CO_2H$$
99%
$$(56)$$

ALDEHYDE FORMATION

In the Reimer-Tiemann reaction, catechol reacts with chloroform and sodium hydroxide in a suitable solvent to give a mixture of proto- and pyrocatechuic aldehydes.

CONDENSATION WITH CARBONYL COMPOUNDS

<u>Acetone</u>

Catechol condenses with excess acetone in the presence of mixed acetic and concentrated hydrochloric acids to form 4,4',6,6'-tetrahydroxy-3,3,3'3'-tetramethylspiroindane (58)(59).

Reaction with excess catechol and a smaller amount of concentrated hydrochloric acid gives a much different result:

<u>Formaldehyde</u>

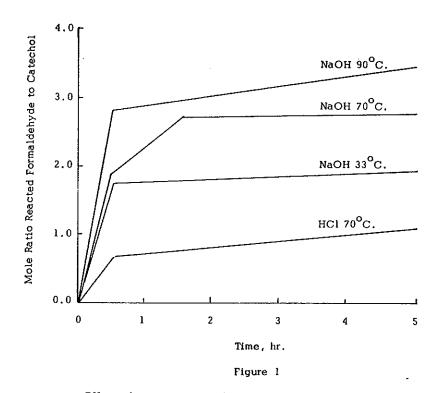
Catechol reacts with formaldehyde under both acidic and basic conditions to give catechol methylols, their dimers and trimers with catechol, and finally high molecular weight condensation products. In aqueous hydrochloric acid, the initial methylols are the 2,3- and 3,4-dihydroxybenzyl alcohols (61).

The only dimethylol tends to be the 3,5-isomer (62), while the two-ring components are the 3,4,3',4'- and 3,4,2',3'-tetrahydroxydiphenylmethanes. None of the 2,3,2',3'-isomer is present (61).

Catechol has been reported to condense 2.3 times as fast as phenol with for-maldehyde in aqueous solution in the presence of hydrochloric acid between 20 and 90°C (66).

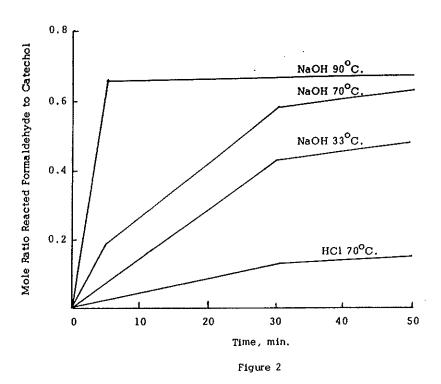
In sodium hydroxide solution, catechol condenses with formaldehyde to form initially the 3-methylol and then the 3,6-dimethylol (64)(65).

With a molar catechol/formaldehyde/NaOH ratio of 1.0/3.0/0.6 at a 40% solids level, catechol is consumed about 2.6 times faster than phenol (66). At a ratio of 1.0/0.8/0.4 and the same solids level, catechol is consumed 3.2 times faster. With a molar phenolic/formaldehyde/NaOH ratio of 1.0/2.0/0.8 at a 7% solids level at 65°C, catechol consumes formaldehyde at the same rate as resorcinol at 25°C (36). The graphs shown in Figures 1 and 2 illustrate the rapid formation of catechol methylols.



Effect of temperature on the uptake of formaldehyde by catechol at a mole ratio of catechol/formaldehyde/NaOH or HCl of 1.0/4.0/0.6 at a 7% solids level.

At this low solids level, acid catalyzed methylol formation is at best one-tenth as rapid as the base catalyzed reaction, while at the 40% solids level, the acid catalyzed reaction is more rapid (36)(66). Also at the low solids level under base catalysis, phenol and catechol consume formaldehyde at the same rate (36).



Effect of temperature on the uptake of formaldehyde by catechol at a mole ratio of catechol/formaldehyde/NaOH or HCl of 1.0/0.8/0.4 at a 7% solids level.

pH Dependence

The amount of formaldehyde which condenses with catechol is at a minimum at pH 4.5 as shown in Figure 3. Consumption is accelerated by an increase or decrease in pH (67).

The reaction kinetics of the acid-catalyzed catechol condensation have been reported (68). Also the molecular weight distribution and chromatographic characteristics of these resins have been studied (61)(69)(70)(71)(72)(73). In sodium hydroxide solution, the reaction kinetics have been determined (74), but little has been reported concerning the molecular weight distribution (75).

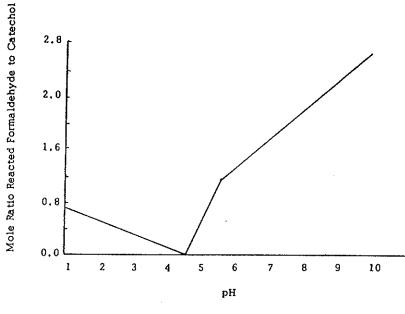


Figure 3

Effect of pH on Formaldehyde Uptake by Catechol in Aqueous Solution at $100^{\rm O}$ for 3 hrs. at a Mole Ratio of Catechol/Formaldehyde of 1.0/4.0.

AMINO- AND CHLOROMETHYLATION

Like most other phenols, catechol and its derivatives undergo the Mannich (aminomethylation) reaction. On the basic side, the products are ortho isomers either to the hydroxy group or, if no free hydroxy groups are present, to an ether group.

The use of two molar equivalents of morpholine and formaldehyde gives the 3,6-dimorpholinomethylcatechol in 74% yield; excess reagents give the 3,4,6-trimorpholinomethylcatechol in good yield (77). These aminobenzyl compounds and the benzyl halides derived from them are useful as pharmaceutical intermediates.

$$\begin{array}{c|c}
\hline
OH & (1) & Ac_2O \\
\hline
OH & (2) & 30\% & HBr
\end{array}$$

$$\begin{array}{c|c}
CH_2Br \\
75\%
\end{array}$$
(76)

3-bromomethylcatechol diacetate

3-morpholinomethylcatechol

2,3-dihydroxyphenylethylamine

The Mannich reaction under acidic conditions gives mainly <u>para</u> substitution (78).

1,3,5-triisopropylhexahydrotriazine

2-ethoxy-4-isopropylaminomethylphenol

Phenols, especially diphenols like catechol, are highly activated toward electrophiles like the chloromethylation reagents. In order to avoid polychloromethylation and other side reactions, the hydroxyl groups should be protected as ethers or esters. As described previously, these esters and ethers are prepared readily from catechol.

Chloromethylation of catechol derivatives occurs readily in the presence of formaldehyde and hydrochloric acid to give para-substituted products.

Treatment of the catechol benzyl chlorides with hexamethylenetetramine $((CH_2)_6N_4)$ gives aldehydes like piperonal (81)(82), together with some halide dimerization products.

With veratrole, trimerization occurs in the halomethylation reaction to give an unusual 9-membered ring compound.

OXIDATION

Catechols can be oxidized to orthobenzoquinones in excellent yield by a number of different oxidizing agents.

Both catalytic (88) and photochemical oxidations (89) have also been reported. Certain plant enzymes oxidize catechol to 3,4,3',4'-tetrahydroxydiphenyl (90). Under more vigorous conditions, catechol is oxidized to muconic acid and finally to degradation products.

OH +
$$Ni_2O_{3.3}$$
 + $NaOH$ H_2O CO_2H (91)

OH nickel oxide muconic acid

HYDROGENATION

Catechol can be hydrogenated with a nickel catalyst at high hydrogen pressures and at high temperature to give the dihydroxycyclohexanes.

OH + N1
$$\frac{\text{H}_2/20 \text{ a tm}}{\text{EtOH, 175°C}}$$
 OH Cis and trans 95-100%

MISCELLANEOUS RING SUBSTITUTION REACTIONS

Azo Coupling

Catechol readily couples with aryldiazonium salts to give azo dyes.

OH + Al₂(
$$SO_4$$
)₃ + PhN₂Cl $\xrightarrow{H_2O}$ HO OH OH OH OH (93)

Cyanation

Cyanogen reacts with catechol in water to give the 3-cyanocatechol.

Thiocyanation

Thiocyanation gives a fair yield of unspecified thiocyanocatechol.

Mercaptocatechol

A route to 4-mercaptocatechols is the addition of thiourea to the corresponding orthobenzoquinone formed <u>in situ</u> (96).

<u>CATECHOLBORANE</u>

1,3,2-Benzodioxaborole (catecholborane) is made easily from catechol and borane in tetrahydrofuran (97). It is an excellent monohydroborating reagent.

This reagent readily reacts with olefins at 100°C, to give the corresponding alkyl borole from which alkaneboronic acids and esters (97) as well as monoalkylboranes and mixed organoboranes can be derived (98).

Catecholborane reacts with acetylenes at 70°C. to give stereospecific <u>cis</u> addition with the boron atom being attached at the less hindered carbon atom of the triple bond (99). From the resulting alkenyl boroles, the corresponding alkeneboronic esters and acids, <u>cis</u> olefins, and aldehydes and ketones can be obtained.

The alkenylboroles are also very useful for the preparation of alkenylmercuric salts (100), as well as <u>trans-l-alkenyl</u> iodides (101) and <u>cis-l-alkenyl</u> bromide and internal vinyl bromides (102).

CATECHOL COMPLEXES

Metals and Rare Earths

Catechoi and catechol derivatives, especially pyrocatechol violet (pyrocate-cholsulfonephthalein I), are useful analytical reagents for the following metals and ions: aluminum, bismuth, cadmium, chromium, copper, gallium, hafnium, indium, iron, lanthanum, lead, magnesium, manganese, molybdenum, nickel, palladium, tantalum, thallium, tin,titanium, tungsten, vanadium, zinc, zirconium, fluoride and fluorine, chromate and borate (103).

Almost all of the analytical procedures involving catechol are related to its ability to complex or chelate with both metals and ions. This complexing ability is portrayed in the following table.

Metal Ion + Catechol ← Catechol-Metal Ion Complex

| <u>Metal</u> | $Catechol = H_2L$ | Log of Equilibri | um Constant | Reference |
|---|-------------------|--|---|--------------------------|
| H ⁺¹ Al ⁺³ | | $K_1=12.89$ $[AlL_1]^{+1}$ $[AlL_2]^{-1}$ $[AlL_3]^{-3}$ | K ₁₂ =9.45 K = 16.27 K = 13.48 | 104 105 105 |
| As ⁺³ B ⁺³ | í | [AsOL] -1 (BOL) -1 | K = 9.00 K = 2.04 K = 3.89 | 105 106 106 |
| Be ⁺² Cd ⁺² Co ⁺² | | [BeL] [CdL] | K = 4.15 K = 13.42 K = 10.8 K = 8.31 | 106 107 109 110 |
| Cu ⁺² | | [CuLH] ⁺¹ [CuL] [CuL2] ⁻² | K = 5.35 K = 13.88 K = 10.43 | 111 111 111 |
| Mn ⁺² Mo ⁺⁶ Ni ⁺² | | [MoO ₂ L ₂] ⁻² | K = 14.3 K = 7.61 K = 4.05 K = 8.42 | 112 112 113 110 |
| Si ⁺⁴ Sn ⁺⁴ Ti ⁺⁴ W ⁺⁶ | | $[SiL_3]^{-2}$ $[SnL]^{+2}$ $[Ti(OMe)_{2L}]$ $[WO_{2L_2}]^{-2}$ | K = 18.1 K = 26.5 | 114 114 114 |
| Zn ⁺² | | [0545] | K = 0.33 K = 9.00 | 115, 116 110 |

Metal Ion + Catechol Catechol-Metal Ion Complex (cont'd)

| Metal Rare Earth Metals | Log of Equilibri | um Constant | Reference |
|---|---|--|--|
| La ⁺³ Pr ⁺³ Nd ⁺³ Sm ⁺³ Eu ⁺³ Gd ⁺³ Dy ⁺³ Ho ⁺³ Er ⁺³ Tm ⁺³ Yb ⁺³ Lu ⁺³ | | <pre>K = 9.46 K = 10.31 K = 10.50 K = 1.06 K = 11.17 K = 11.20 K = 11.34 K = 11.42 K = 11.43 K = 11.67 K = 11.31</pre> | 117 117 117 117 117 117 117 117 117 117 |
| <u>Ion</u> | | • | |
| Cl ⁻ Br ⁻ I ⁻ ClO ₄ | $\begin{bmatrix} \text{ClH}_2\text{L} \end{bmatrix}^{-1} \\ \begin{bmatrix} \text{BrH}_2\text{L} \end{bmatrix}^{-1} \\ \begin{bmatrix} \text{IH}_2\text{L} \end{bmatrix}^{-1} \\ \begin{bmatrix} \text{ClO}_4\text{H}_2\text{L} \end{bmatrix}^{-1} \end{bmatrix}$ | <pre>K = 2.62 K = 2.27 K = 1.45 K = 1.05</pre> | 118 118 118 118 |

More detailed information concerning stability constants of catechol complexes has been published recently (119). Thorium (120), niobium (121), uranium (122), tantalum (123), germanium (IV) (124), and iron (III) (125) complexes with catechol have also been studied.

Most of the complexes mentioned previously have been binary complexes (i.e., one ion, one ligand). However, many mixed ligand complexes of catechol have been prepared (126)(127)(128)(129)(130).

Catechol/Formaldehyde Polymers

Catechol-formaldehyde polymers have been used to absorb specifically a number of metal ions from solution (131)(132)(133)(134). These resins are also capable of removing SiO_2 from solution (135)(136). Free catechol can etch silicon crystals at room temperatures (137). Catechol-containing solutions on the basic side are capable of dissolving SiO_2 from glassware (36).

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| -MORPHOLINOMETHYLCATECHOL | VINYL BROMIDES |
| trioning and the state of the s | |

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Revised: June 1998

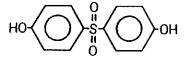


Fort James Specialty Chemicals

| 4,4'-DIHYDROXYDIPHENYL SULFONE (DDS) 1 |
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| 4,4'-THIODIPHENOL (TDP) |
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| 4,4'-THIOBIS (2 METHYL RESORCINOL) |

4,4'-DIHYDROXYDIPHENYL SULFONE (DDS)

Also called: 4,4'-sulfonyldiphenol or bisphenol-S CAS Registry Number 80-09-1



SHIPPING SPECIFICATIONS

| | High Grade | Technical |
|------------------------------|------------------|-----------|
| 4,4'-DDS, % min. by G.C. | 99.5 | 93+ |
| 2,4'-isomer, % max. | | 6 |
| Phenol, % max. | | 1.0 |
| Water (Karl Fischer), % max. | 0.5 | 1.0 |
| Melting Point °C, min. | 247.0 | 243 |
| Shipped in fiber drum with | n polyethylene l | iners |

SUGGESTED USES

DDS

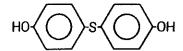
Monomer or chemical intermediate for: Agricultural Chemicals —Antioxidants—Flame retardants—Stabiliz Textile chemicals—Specialty chemicals

LITERATURE

4,4'-DIHYDROXYDIPHENYL SULFONE TECHNICAL BULLETIN— Contains physical and chemical properties, survey of the literature, suggested applications and safety and handling information.

4,4'-THIODIPHENOL (TDP)

Monomer, chemical intermediate CAS Registry Number 2664-63-3



SHIPPING SPECIFICATIONS

| TDP | Technical | Polymer Gr |
|---------------------------------|-----------|--------------|
| % min. by G.C. | 99.7 | 99,9 |
| Melting point, °C, min. | 151.2 | 151.7 |
| Water (Karl Fischer), % max. | 2.0 | 0.5 |
| Shipped in fiber drun | 1 | hylona ligar |

SUGGESTED USES

TDP

Monomer or chemical intermediate for: Polycarbonates—Polyesters—Polyethers—Polyst Polyurethanes—Epoxy resins—Larvicide Intermed

LITERATURE

4,4'-THIODIPHENOL (TDP) TECHNICAL BULLETII physical and chemical data and suggested uses.

4,4'-THIOBIS (6-TERTIARY-BUTYL META-CRESOL) [1B(1BNIC)]

CAS Registry Number 96-69-5

SHIPPING SPECIFICATIONS

| TB (TBMC) | |
|--|-----|
| Melting Point, °C, min. | 160 |
| Water (Karl Fischer) % Max. | 0.5 |
| Color Absorbance 20% in methanol, 420 nm | 0.2 |

Shipped in fiber drums with polyethylene liner.

SUGGESTED USES

TB(TBMC)

Monomer, chemical intermediate for antioxidants, UV absorber, stablizer.

4,4°-THIOBIS (2-METHYL-6-TERTIARY-BUTYL PHENOL) [TB(MTBP)]

Also called 4,4'-Thiobis (6-tert-butyl-o-cresol) CAS Registry Number 96-66-2

$$\begin{array}{c} \text{CH}_3 \\ \text{OH} \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array} \begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 \\ \\ \text{CH}_3 \end{array} \begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$$

SHIPPING SPECIFICATIONS

| TB(MTBP) | |
|--|-------|
| Melting Point, °C, min. | 122.7 |
| Water % max | 0.5 |
| Shipped in fiber drum with polyethylene liner. | |

SUGGESTED USES

TB(MTBP)

Monomer or intermediate for antioxidants, UV absorbers, stabilzers

2,2'-THIOBIS (PARA-TERTIARY-OCTYL PHENOL) [TB(PTOP)]

Also called: 2,2' Thiobis (4-t-octyl phenol) CAS Registry number 3294-03-9

SHIPPING SPECIFICATIONS

| 2,2' TB (PTOP), % Min. By G.C. | 96 |
|---|------|
| Color, transmission 2.35% in Toluene/Butylamine 420 nm. | 70 |
| Shipped as wet cake (H2O) or as dry po in fiber drums with polyethylene liner. | wder |

SUGGESTED USES

TB(PTOP) Monomer or intermediate for antioxidants, UV absorbers, stabilizers. CATECHOL

Also called: pyrocatechol, o-dihydroxybenzene, pyrocatechin CAS Registry Number 120-80-9



SHIPPING SPECIFICATIONS

Catechol available in two grades, Purified (XP) and Technical

| 99.5 | 99.0 |
|-------|---|
| | |
| 103.5 | 103.0 |
| 0.3 | *************************************** |
| | |

SUGGESTED USES

CATECHOL TECHNICAL GRADE

General Synthesis for:

Rubber Chemicals—Resins—Antioxidant—Adhesives—Insecticid.

Electroplating—Flavors and Fragrances

CATECHOL XP GRADE

General Synthesis for:

Photographic Chemicals—Pharmaceutical Synthesis—Facsimile

Paper—Dyes

LITERATURE

REACTIONS OF CATECHOL—35 pages. Gives important reactions of catechol.

APPLICATIONS OF CATECHOL—60 pages. Review of catechol application literature.

1,2-METHYLENEDIOXYBENZENE (MDB)

Also called: 1,3-benzodioxole or 1,3-dioxaindane CAS Registry Number 274-09-9



SHIPPING SPECIFICATIONS

| MDB | |
|--------------------------------------|------|
| % min. by G.C. | 99.2 |
| Color absorbance @ 420 nm, max. | 0.05 |
| Appearance—clear colorless liquid | |
| Shipped in lined steel drums | |

SUGGESTED USES

MDB Intermediate for manufacture of: Pharmaceuticals—Flavors and Fragrances—Dyes Antibacterial compounds

LITERATURE

Product Information Bulletin

A highly polar aprotic solvent CAS Registry Number 67-71-0



SHIPPING SPECIFICATIONS

| DIMETHYL SULF | ONE |
|---|------|
| % min. by G.C. | 99.5 |
| Melting Point, °C, min. | 107 |
| Water, % max. | 0.2 |
| Ash, % max. | 0.1 |
| Shipped in fiber drums with polyethylene liner. | |

Very low toxicity - very high thermal stability - stable in the presen acids and bases

SUGGESTED USES

DMSO₂

High temperature solvent and reaction medium for:
Displacement and polymerization reactions—Friedel-Crafts a... n
reactions—Intermediate for synthesis—Extraction solvent for olefil
and dienes

LITERATURE

DIMETHYL SULFONE TECHNICAL BULLETIN Gives physical and chemical data and suggested uses.

4+10000 (2 METITE HEOOTONOC) (10M)

Also called: 4,4' Thiobis (2 Methyl 1,3 Benzendiol) or 2,2',4,4' Tetrahydroxy-3,3'-Dimethyldiphenyl sulfiide CAS Registry Number 28341-66-4

SHIPPING SPECIFICATIONS

| TBMR | |
|----------------------------|--------|
| TBMR % Min. By G.C. | 97 |
| G.C. Assay, 2-MR% Max. | 0.2 |
| Residual Solvent % Max. | 0.5 |
| Color, Absorbance @ 425 nm | 0.0015 |

SUGGESTED USES

TBMR Photographic Coupler



Figure & Adams Street Flamos, Washington 98607 Prione (300) 834-8134 FAX = 36/0/834-8278

Information is the present of p_i and p_i and p_i and p_i and p_i and p_i are expressed or implies p_i togation p_i and p_i are p_i and p_i and p_i are p_i and p_i and p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i and p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are p_i are p_i and p_i are p_i are p_i and p_i are p_i and p_i are

DIMETHYL SULFONE TECHNICAL BULLETIN

FORT JAMES
SPECIALTY CHEMICALS
Allycard Adams-Streat
Camas, Washington 95507 USIA.
Protice (850) 382-3484



Dimethyl Sulfone

High purity dimethyl sulfone is available in commercial quantities from Fort James Specialty Chemicals. It is a white crystalline material ideally suited for use as a high temperature reaction solvent.

Our knowledge of dimethyl sulfone is always increasing and we would welcome an opportunity to discuss synthesis problems and new or related technology with you.

Revised June 1998

Technical and Use Information

on

DIMETHYL SULFONE (DMSO2)

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DIMETHYL SULFONE (DMSO2)

(Methylsulfonylmethane, Methyl Sulfone)

PHYSICAL PROPERTIES

Molecular weight 94.13

| Physical state | white, crystalline |
|---|--------------------|
| Melting point at 760 mm. Hg | 109°C. (228°F.) |
| Boiling point at 760 mm. Hg | 238°C. (460°F.) |
| Specific gravity (26°C.) | 1.450 - 1.455 |
| Density (grams per cc.) D 4 | 1.1702 |
| Index of refraction (20°C.) | 1.4226 |
| Flash point (Cleveland Open Cup) | 143°C. (290°F.) |
| Solubility parameter | 14.5 |
| Standard heat of formation | -108.3 kcal./mole |
| Heat of sublimation (25°C.) at 760 mm. Hg | 18.4 kcal./mole |
| Heat of combustion (25°C.), constant volume | -428.29 kcal./mole |
| Specific heat (121°C.), liquid | 0.53 cal./gm./°C. |
| Dipole moment (20°C.) | 4.25 Debye |
| | |

^{*}International Union of Chemistry

| | Acid | S | |
|---|------------------------------|---|------------------------------|
| Acetic Adipic Anisic Benzoic Caprylic | sol. sol. sol. sol. | Fumaric Malonic Succinic Terephthalic | mod. sol. sol. sol. sl. sol. |
| | Anhyo | drides | |
| Benzoic Phthalic Succinic | sol. sol. | | |
| - | Alcohols an | d Glycols | |
| Butyl alcohol Cyclohexanol Ethylene glycol Ethylene glycol monomethyl ether | sol. sol. sol. | Glycerol 1,5-Pentanediol Propylene glycol Triethylene glycol | sol. sol. sol. |
| | Pheno | ols | |
| Catechol Naphthol Phenol o-Phenylphenol | sol. sol. sol. | Phloroglucinol Pyrogallol Resorcinol | sol. sol. sol. |
| _ | Ethers | 3 | |
| Amyl Ethylene glycol dimethyl ether | sol. | | |
| | Esters | S | |
| Amyl acetate Benzyl salicylate Benzyl succinate Butyl hexanoate | sol. sol. sol. sol. | Methyl hexanoate Methyl stearate Monacetin Triacetin | sol. v. sl. sol. sol. sol. |

SOLVENT CHARACTERISTICS OF DIMETHYL SULFONE ABOVE M. P. 109°C, - cont'd

| | An | nines | |
|--|--|---|--|
| Aniline Benzylamine Carbazole Dicyclohexylamine N,N-Dimethylaniline Diphenylamine | sol. sol. sol. sol. sol. sol. | Hexamethylenetetramine Propylenediamine Pyridine Tetraethylenepentamine Triethylamine Triethylenetetramine | decomposes sol. sol. sol. sol. sol. |
| | Hydro | carbons | |
| Biphenyl Mineral oil Naphthalene | sol. in sol. sol. Halogenated | l Compounds | |
| Pentachlorobenzene Pentachlorophenol | sl. sol. | 1,1,2,2,-Tetrabromoethane 1,2,4-Trichlorobenzene Trichlorocumene | sol. |
| Anthraquinone Benzil Benzophenone Diisobutylketone | sol. sol. sol. | | |
| | Sa | lts | |
| Ammonium chloride Calcium chloride Chromous chloride Cobaltous acetate Cobaltous chloride Copper sulfate Ferric chloride Manganous chloride Nickelous chloride | v.sl.sol. insol. sol. sol. insol. sol. very sol. decomp. | Potassium bromide Potassium chloride Potassium ferricyanide Potassium iodide Sodium acetate Sodium bromide Sodium iodide Sodium stearate Uranyl nitrate | sl. sol. insol. sol. v. sl. sol. sl. sol. insol. very sol. |
| | Other Con | npounds | |
| Acetamide Benzaldehyde Butyraldehyde 3,4-Dimethoxyphenyl- acetonitrile | sol. sol. sol. | Nitrobenzene p-Phenylnitrobenzene Propionamide | sol. sol. sol. |

SOLVENT CHARACTERISTICS OF DIMETHYL SULFONE ABOVE M. P. OF 109 C. - cont'd

Resins and Polymers

| No. 1 - 1410 (-1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 | |
|--|-----------------|
| Amrez 1410 (phenol-formaldehyde) | insol. |
| Bakelite (phenol-formaldehyde), advanced | insol. |
| Butylmethacrylate polymer | insol. |
| Epon Resin #1007 | sol. |
| Expandable polystyrene | \dots insol. |
| GRS Rubber | insol. |
| Isobutylmethacrylate polymer | sl. sol. |
| Melamine | sl. sol. |
| Melamine-formaldehyde (Parez 607) | insol. |
| Methylmethacrylate polymer (Plexiglas) | sol. |
| Mylar | softens; insol. |
| Nylon | insol. |
| Paraffin | insol. |
| Piccopale 70 | sl. sol. |
| Polyacrylamide 50 | insol. |
| Polyacrylamide 100 | insol. |
| Polyacrylonitrile | sol. |
| Polyamide Resin #94 | sl. sol. |
| Polybutylene 64 | insol. |
| Polyethylene, partially oxidized | sl. sol. |
| Polyvinyl alcohol 51-05 | v. sl. sol. |
| Polyvinyl butyral resin (Vinylite XYHL) | decomposes |
| Polyvinylidene chloride (Saran) | softens, insol. |
| Polyvinylpyrrolidone | decomposes |
| Rosin | sol. |
| Rosin amine D | sl. sol. |
| Rosin amine D acetate | sl. sol. |
| Urea-formaldehyde (Uformite) | insol. |
| | |

SOLUBILITY OF DIMETHYL SULFONE IN WATER AND ORGANIC SOLVENTS

<u>Water</u>

The solubility of DMSO2 in water has been determined:

```
At 26°C - 33.9 parts per 100 parts water
At 66°C - 237.8 parts per 100 parts water
At 88°C - >1000.0 parts per 100 parts water
```

The limit of solubility at 88°C.was not reached. Upon cooling this latter solution began to crystallize and at room temperature no free water was observed.

SOLUBILITY OF DIMETHYL SULFONE IN WATER AND ORGANIC SOLVENTS - cont'd

Organic Solvents

| Solvent | Grams of DMSO2 Dissolved per 100 ml of Solvent at 25°C. | Grams of DMSO2 Dissolved per 100 ml of Solvent |
|------------------------|---|--|
| Acetic acid, glacial | 21.2 | |
| Acetone | 15.36 | |
| Benzene | 2.2 | 6.6 @ 75 ⁰ C. |
| Butyl cellusolve | 12.2 | |
| Carbon tetrachloride | insol. | |
| Chloroform | 9.4 | |
| Cyclohexane | trace | 4.7 @ 75 ⁰ C. |
| Diethyl ether | trace | _ |
| Diethylene glycol | insol | v.s. @ 76 ^o C. |
| Dimethyl formamide | 31.3 | |
| Dimethyl sulfide | 7.03 | |
| Dimethyl sulfoxide | 48.5 | |
| Dioxane | 12.4 | - 0 |
| Ethyl alcohol | insol | v.s. @ 65-70°C. |
| Formaldehyde, 37% | 32.4 | - 0 |
| Isopropyl alcohol | 1.03 | 4.52 @ 55°C. |
| Methyl alcohol | 7.78 | 67.6 @ 60°C. |
| Methyl ethyl ketone | 10.0 | 22.8 @ 65 ⁰ C. |
| Methyl isobutyl ketone | 1.93 | 8.8 @ 60°C. |
| 2-Nitropropane | 7.62 | 43.6 @ 70 ⁰ C. |
| Petroleum ether | insol. | |
| Tetrahydrofuran | 3.18 | 10 @ 52°C. |
| Toluene | .6 | 3 @ 92°C. |
| Xylene | .36 | 2.4 @ 90°C. |

CHEMICAL REACTIONS OF SULFONES

1. Grignard Reagents of Sulfones

Lamar Field and J. W. McFarland. J. Am. Chem. Soc. <u>75</u>, 5582-6, (1953). C.A.: <u>49</u>, 933h (1955).

Wm. E. Truce and K. R. Buser. J. Am. Chem. Soc. <u>76</u>, 3577-9 (1954). C.A.:49, 12268f (1955).

2. The Metalation of Dialkyl Sulfones

Wm. E. Truce and K. R. Buser. J. Am. Chem. Soc. <u>76</u>, 3577-9 (1954). C.A.:<u>49</u>, 12268f (1955).

3. Resinous Compositions from Sulfones and Formaldehyde

E. M. Evans and H. T. Hookway. U. S. Patent 2, 543, 237, Feb. 27, (1951). C.A.: 45, 4485c (1951).

4. Cyanoethylation of Sulfones

H. A. Bruson and T. W. Riener. J. Am. Chem. Soc. 70, 214-7 (1948). C.A.:42, 223lg (1948).

5. The Preparation of $oldsymbol{eta}$ -Oxo Sulfones by the Claisen Condensation

Wm. E. Truce and Robert H. Knospe. J. Am. Chem. Soc. 77, 5063-7 (1955). C.A.:50, 8592f (1956).

6. The Reduction of Sulfones to Sulfides

F. G. Bordwell and W.H. McKellin. Journal American Chemical Society 73, 2251-3 (1951). LiAlH₄ at 35°C. in ether or in boiling (92°C.) EtOBu treated with 2-6 gram quantities of sulfones mixed with solvent gave corresponding sulfides. For DMSO2, 3 moles of LiAlH₄ to 1 mole of DMSO2 at 35°C. and 12 hours gave only trace of Me₂S. Some sulfones gave fair yield of sulfide and others none. The striking differences in ease of reduction of the various sulfones is discussed. C.A.:46, 1537b (1952).

USES FOR DIMETHYL SULFONE

Solvent Applications

Spinning Solutions Containing Polyvinyl Chloride or its Copolymers

E. Heisenberg and J. Kleine to Vereinigte Glanzstoff-Fabriken A.-G. U. S. Patent 2,617,777, November 11, 1952. Solutions of 15-25% polyvinyl chloride that can be spun at room temperature either by a dry or a wet process to give threads with a tenacity of 2.5-3 gram per denier and 15-25% elongation are obtained by dissolving the PVC in tetrahydrofuran containing 10-50% by weight of a sulfone, sulfoxide, sulfonic acid ester, or sulfinic acid ester which is a solvent for polyacrylonitrile. Such a solution has been made using 120 grams PVC in 60 grams DMSO2 and 600 grams tetrahydrofuran. C.A.:47, 4625c (1953).

2. Solvent for Polyacrylonitrile

R. C. Houtz to E. I. du Pont de Nemours & Co. U. S. Patent 2,404,717, July 23, 1946. General formulas are given of compounds which it is claimed are useful as solvents for polyacrylonitrile. Dimethyl sulfone is among the examples of compounds cited. C.A.:41, 479c (1947).

3. Solvent Action of Organic Substances on Polyacrylonitrile

E. E. Walker. Journal Applied Chemistry (London) 2, 470-81 (1952). All solvents for polyacrylonitrile are highly polar. Most of the best solvents have very high values for cohesive energy density in the neighborhood of 220-230 cal./cc., which is approximately that of polyacrylonitrile. The value in calories per cc. for the cohesive energy density of dimethyl sulfone is 212 as determined from the boiling point. C. A.:47, 9254b (1953).

4. Solutions of Synthetic Linear Condensation Polymers in Dimethyl Sulfone

G. E. Ham to The Chemstrand Corporation. U. S. Patent 2,811,497, October 29, 1957. A method of making threads, filaments and coatings of synthetic linear condensation polymers (from group consisting of polyamides, polyesters, and polyurethanes) by dissolving same in molten dimethyl sulfone at 140-260°C. One example tells that 7 parts of solid DMSO2 added to 1 part poly(ethylene terephthalate) and heated to 230° results in complete solution of polymer in DMSO2 giving a mixture suitable for extrusion into coagulating bath for making fibers or for casting films. C.A.:52, 2452c (1958).

- Solubility of Cellulose in Mixtures of Nitrogen Tetroxide with Organic Compounds
 - W. F. Fowler, Jr., C. C. Unruh, P. A. McGee and W. O. Kenyon. Journal American Chemical Society 69, 1636-40 (1947). It is reported that dimethyl sulfone containing 93% by weight of N2O4 will dissolve cellulose. The article gives qualitative description of solubility characteristics. C.A.:41, 6043f (1947).
- 6. Recovery of Organic Isocyanates

A. Bloom, H. B. Freyermuth and J. B. Normington to General Aniline & Film Corporation. U. S. Patent 2,884,360, April 28, 1959. Teaches method for recovering an organic isocyanate from crude mixture by distilling isocyanate from the mixture in the presence of about 25 to 300% (based on weight of isocyanate) of member of group consisting of dialkyl, diaryl, and alkylaryl sulfones which are liquid under the conditions of the distillation. It is claimed the addition of such sulfones increases yield of isocyanate. C.A.:53, 18912i (1959).

7. Solvent Extraction

T. D. Nevitt to Standard Oil Company (Indiana). U. S. Patent 2,831,039, April 15, 1958. Dimethyl sulfone is disclosed as an effective agent for the selective separation of aromatic from paraffinic hydrocarbons boiling in the gasoline range. Diluents or cosolvents such as water, dimethyl sulfoxide and others (in proportion of 1% to around 15% by weight, based on the DMSO2) are said to increase the selectivity of the solvent mixture for aromatic compounds. Extraction is carried out at a temperature between 0°C. and around 150°C. C.A.:52, 12384f (1958).

- 8. Solutions of Vinylidene Cyanide Interpolymer
 - B. F. Goodrich Company. British Patent 809, 346, February 25, 1959. Vinylidene cyanide interpolymers such as vinylidene cyanide-vinyl acetate are reported to be soluble in DMSO2 warmed to its melting point. C.A.:53, 9729g (1959).
- 9. An Improved Process for the Nitrilation of 6-Halohexanoic Acid Esters
 - B. T. Freure and H. J. Decker to Union Carbide Corporation. U. S. Patent 3,024,266, March 6, 1962. Using an inert polar solvent (dimethyl sulfone is cited) as the medium for nitrilation of 6-halohexanoic acid esters is reported to give greater yields than those obtained using other solvents. C.A.: 57, 12329h (1962).

USES FOR DIMETHYL SULFONE - Solvent Applications - cont'd

10. Olefin Polymerization Using Catalysts Containing Organic Sulfur Compounds

H. W. Coover, Jr. and F. B. Joyner to Eastman Kodak Company. U. S. Patent 3,026,311, March 20, 1962. DMSO2 is polymerization medium for forming high density, crystalline polymers from alpha olefins using selected catalysts in reaction vessel at temperatures of 50° to 150°C. and 30 to 1000 psi. C.A.:56, 1567g (1962).

11. Dimethyl Sulfone as a Reaction Solvent for the Preparation of Aromatic Fluorides

L. D. Starr and G. C. Finger (Illinois State Geological Survey, Urbana, Illinois). Chemistry and Industry 1962, 1328 (1962). DMSO2 is reported to be the preferred reaction medium for preparing compounds such as 4-fluoronitrobenzene. The DMSO2 enables the use of higher temperatures which greatly increases the reaction rate. C.A.:57, 12358i (1962).

12. Preparation of Cyanuric Acid

T. R. Hopkins and W. C. Francis to Spencer Chemical Company. U. S. Patent 3,065,233, November 20, 1962. Heating urea and/or urea condensation products in dimethyl sulfone to temperatures of at least 175°C. gives cyanuric acid in high yields in a relatively short reaction time. Cyanuric acid is especially useful as an intermediate for trichloroisocyanuric acid and related compounds which are active components of dry bleach compositions.

Fuel Additive Applications

1. Anti-Icing Additive

Shell Research Limited. Belgian Patent 571,402, March 23, 1959. Tells of the use of 0.1% to 0.5% DMSO2 (or dimethyl sulfoxide) as anti-icing agent with I.C.E. or gas turbine fuels boiling in the gasoline or kerosene range and having a cold test temperature of less than -34°C.

2. Fuels for Internal-Combustion Engines or Gas Turbines

D. S. Penny to Shell Research Limited. British Patent 807,010, January 7, 1959. Addition to engine fuels of 0.1% to 0.5% by weight of DMSO2 (or dimethyl sulfoxide) prevents ice formation in the fuel and fuel lines. If desired, 0.1% to 0.5% of a neutral organic solvent such as isopropyl alcohol may also be added along with anti-knock agents, scavengers, spark-plug antifoulants, combustion modifiers, oxidation inhibitors, metal deactivators, or rust inhibitors. C.A.:53, 10374i (1959).

USES FOR DIMETHYL SULFONE - Fuel Additive Applications - cont'd

 Improvement of Diesel Fuels Through the Addition of Sulfoxides and Sulfones

A. Farkas to Union Oil Company of California. U. S. Patent 2,493,284, January 3, 1950. It is claimed that addition of 0.1% to 5% by volume of sulfoxides and/or sulfones with lower alkyl, phenyl, or benzyl radicals, or sulfur-containing heterocyclic compounds give diesel fuels improved ignition characteristics. Such ignition accelerators may be added to the fuel or formed in situ by addition of oxidizing agents to sulfur-containing compounds either present in or previously added to the fuel. C.A.:44, 3709h (1950).

Other Applications

1. Stabilization of Chlorinated Hydrocarbons

Fred W. Starks to E. I. du Pont de Nemours & Co. U. S. Patent 2,945,070, July 12, 1960. DMSO2 among sulfones mentioned as stabilizer for chlorinated hydrocarbons particularly trichlorethylene and perchlorethylene. C.A.:54, 25395d (1960).

2. "-Suggested Applications - General -"

U. S. Patents 2,870,215 and 216 issued January 20, 1959 to H. R. Davis, Jr. and D. P. Sorensen assigned to M. W. Kellogg Company which teaches methods for preparing the sulfones tells also of uses for organic sulfones. DMSO2 is a good solvent for a variety of chemicals compounds such as polyacrylonitrile as well as other polymers. It appears especially useful as an extraction solvent for separating aromatic hydrocarbons from aliphatic hydrocarbons. Sulfones are of interest as heat transfer agent (based on their thermal stability) also as chemical intermediates in the preparation of metal complexes useful for electroplating, azo dyes, etc. Some sulfones are useful medicinally as hypnotics. Others have been claimed to be good as paper impregnators in capacitors, an ingredient in dielectric fluids. Additional applications stated are as insecticides, bactericides, intestinal antiseptics, tanning agents. C.A.:53, 11416i (1959).

3. Sulfur Dioxide Recovery (for example in combination with a solvent or another sulfone)

Similar to use for diethyl and other sulfones mentioned in U. S. Patent 2,368,545, January 30, 1945. G. W. Hooker, et al to The Dow Chemical Co. C.A.: 39, 54213 (1945).

4. As Analytical Procedure Standard (as the Schöniger sulfur procedure)

Wolfgang Schöniger. Mikrochimica Acta 1956, Heft 1-6, pages 869-76. C.A.:50, 9223d (1956).

- 5. A variety of potential applications have been additionally suggested for DMSO2 including:
 - a. Plasticizer
 - b. Polymerization medium (particularly at temperatures above 109°C.)
 - c. Co-solvent
 - d. Heat-sensitive solvent (such as latent solvent for adhesives)
 - e. Antigelling agent for aqueous protein solutions

TOXICITY

Within our knowledge no adverse physiological effects or allergies have been reported from the use of dimethyl sulfone. However its toxicological and physiological properties have not been fully explored and reasonable care should be used in the handling and application of DMSO2.

An independent testing laboratory reports as follows on the studies concerning the acute intragastric toxicity of DMSO2 in rats:

"Under conditions of this experiment (oral injections of a 40% suspension of dimethyl sulfone in distilled water without revision for 6 days) dimethyl sulfone was found to be relatively non-toxic since a dose of 20 g./kg. body weight failed to kill any of the animals."

Pathological studies of tissues after autopsy confirmed that they were normal.

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SITE INVESTIGATION REPORT





2000 SITE INVESTIGATION REPORT

Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington

SECOR PN: 015.08860.002

Submitted by: SECOR International Incorporated

for:

Fort James Corporation 349 NW 7th Avenue Camas, Washington 98607

January 17, 2001

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1.0 INTRODUCTION

This report presents the results of the 2000 Site Investigation (SI) conducted at the former Fort James Specialty Chemicals facility located in Camas, Washington. SECOR International Incorporated was retained by Fort James Corporation (Fort James) to complete the investigation. SI activities were based on the results of the Preliminary Assessment (PA), as described in a report dated July 26, 2000. The SI was completed in accordance with the August 1, 2000 Site Investigation Workplan and the October 6, 2000 Scope of Work/Cost Estimate for Phase II Well Installation Activities approved by Fort James.

Specialty Chemicals is located at 906 NW Drake Street, east of the intersection of 10th Avenue and Drake Street, in Camas, Washington. A site vicinity map is included as Figure 1. The facility occupies an area of approximately 5 acres. The site is located north of the Fort James Corporation Business Center and Mill. It is bounded to the north by forested land, NW Benton Street, and residential areas; to the west by NW Drake Street and both commercial and residential properties; and to the east by a ravine and Blue Creek Canyon.

The facility consists of six main buildings (Buildings 201 through 206) that were formerly used for chemical production and storage, three tank farms used for bulk chemical storage, and a diked drum storage area. An oil and pipe shed formerly located on the complex was used for storage of piping and drummed oil and has been removed. Figure 2 illustrates the facility layout.

2.0 FACILITY BACKGROUND

2.1 OPERATIONS HISTORY

The Specialty Chemicals facility is a former chemical manufacturing complex owned and operated by Fort James Camas, LLC. The facility ceased production activities in late 1999. At present, portions of the facility are used for warehousing of maintenance parts and for meetings by the Fort James Camas Mill.

Each of the buildings and their historical uses are described below:

Building 201. Building 201 was constructed in 1961 and was originally used as a non-woven fabric manufacturing plant. From 1961 through 1999, this building was used as a chemical product storage warehouse and a blending facility for napkin/towel printing inks. A partially buried underground storage tank (UST) of an estimated 500-gallon capacity was formerly located in the landscaped bed adjacent to the front entrance.

Building 202. In the late 1960s, Building 202, the Process Engineering Building, was constructed to manufacture catechol and develop a process that Crown Zellerbach would later utilize at other facilities. Due to foreign competition, the catechol production process was abandoned. The process building was converted to produce sulfonyl bismethane (DMSO₂) and methylenedioxybenzene (MDB), and to accommodate various pilot plant activities, including the production of chlorinated levulinic acid (CLA), methyl thio metacresol (MTMC), and methyl thiophenol (MTP).

Process residuals from Building 202 were at one time stored in drums in an area east of Building 202. A small transformer station is located near the southeast corner of the former Building 202 drum storage area.

Building 203. Building 203 was constructed in 1972. The initial product was thiodiphenol (TDP), which was later supplemented with sulfonyl diphenol (SDP) production from the mid-1970s to the early 1980s. Specific campaigns and customer demands led to the production of other products, including:

- cellobiose octaacetate
- DMSO₂
- MTMC
- thiobis (methyl-tertiary-butyl-phenol), or TB (MTBP)
- thiobis (tertiary-butyl-metacresol), or TB (TBMC)
- thiobis methyl resorcinol, or TB (TBMR)
- thiobis (para-tertiary-octyl-phenol), or TB (PTOP)

The area west of Building 203 was used for the storage of raw materials, products, and process wastes prior to the construction of the diked storage area west of Building 205.

<u>Building 204.</u> Building 204 was constructed in 1974 to produce tertiary butyl catechol (TBC) and to purify technical grade catechol. DMSO₂ was also produced in the building.

<u>Building 205.</u> Building 205, known as the Defoamer Plant, was constructed in the late 1960s to produce synthetic wood pulp. In the late 1970s, Building 205 was converted to manufacture pulp mill defoamers, pitch dispersants, and other blended materials, including anthraquinone slurry and an optical brightener.

Building 206. Building 206, the High Pressure Laboratory, was constructed in 1961 and was utilized to produce purified dimethyl sulfoxide (DMSO).

Bulk Chemical Storage. Bulk chemicals were stored and distributed in a diked storage area and the three facility tank farms. The diked storage area consists of a concrete-lined and bermed structure that is surrounded by cyclone fencing with a movable locking gate. The bulk tank farms consisted of: (1) the Northern Tank Farm of three tanks located north of Building 205 and east of the diked area, (2) the Building 205 Tank Farm consisting of four tanks, and (3) the Central Tank Farm consisting of seven tanks located northwest of Building 203. The Central Tank Farm also contained a main process water treatment sump, which received process water from the facility floor drain system, centrifuges, and a solvent decanter. The treatment sump discharged via the facility process water sewer line to the effluent treatment system at the adjacent Fort James Camas Mill. The process water sewer line is located along the eastern facility boundary adjacent to the ravine. Each of the tank farms is underlain by concrete and surrounded by concrete berming, with sufficient freeboard to meet spill prevention and contingency control requirements. A facility plan, which illustrates the locations of on-site buildings, tank farms, and the process water sewer line, is included as Figure 2.

2.2 PROCESS HISTORY

Table 1 lists the products and raw materials used in each of the buildings and processes. Based on SECOR's file review, no additional raw materials or products were used or produced at the facility. Plant operations typically involved bulk storage of raw materials in the tank farms and conveyance into the specific process streams in each of the buildings. The products used for the pulp and paper industry were produced in the Specialty Chemicals operation from blending or repackaging operations. For example, defoamers and pitch dispersants were produced from raw material blends, inks were produced from dye and water, and anthraquinone and optical brightener were produced from blends of powdered raw materials and water. Other optical brighteners arrived at the facility in finished form and were repackaged and shipped out to various customers in returnable totes.

Chemical intermediates, such as TDP, were manufactured in the plants from batch or semi-batch operations. With the exception of purified catechol, each of these products was produced from a reaction between two or more raw materials. Purified catechol was produced from batch distillation of technical grade catechol. Production of chemical intermediates generally occurred in campaigns lasting from two weeks to six months.

3.0 REGIONAL GEOLOGY/HYDROLOGY

Regional geology is represented by surficial unconsolidated Quaternary alluvial (Qal) deposits of silt, sand, and organic-rich clay, with lesser amounts of gravel. These deposits reach thicknesses of up to 300 feet near the banks of the Columbia River and rapidly thin northward to depths of 6 to 10 feet. The surficial deposits are underlain in turn by conglomerates of the early Pliocene age Troutdale Formation (400 feet in thickness), a sedimentary confining unit, the Troutdale sandstone aquifer (100 feet in thickness), as second sedimentary confining unit, the Sand and Gravel aquifer (300 feet in thickness), and the Eocene to Miocene age Columbia River Basalt (CRB). The surrounding foothills and mountain ridges consist primarily of Tertiary age volcanic and sedimentary rocks. In the immediate vicinity of the site, the Qal deposits are directly underlain by older consolidated volcanic rocks consisting of basaltic, and pyroclastic members of the CRB.

The principal regional aquifers in the area occur within the Troutdale conglomerate and sandstone aquifers, the Sand and Gravel aquifer, and the CRB. The unconsolidated Qal deposits also serve as less important water-bearing units where they extend below the water table. The conglomerates and sandstones of the Troutdale Formation are considered to comprise the most productive aquifer in the region. The upper portion of the underlying CRB is also an important water-bearing zone due to its high porosity and fracture characteristics.

Recharge of groundwater to the aquifers in the area occurs primarily by infiltration from precipitation and surface runoff. Discharge from the aquifers in the region is mainly by seepage to the Columbia and Willamette Rivers and by withdrawal of groundwater from wells. Regional groundwater movement is southerly, toward the Columbia River.

4.0 SITE INVESTIGATION ACTIVITIES

4.1 OBJECTIVES

Based on SECOR's completion of the PA and discussions with Fort James personnel, the following two objectives were identified for the SI:

- Determine if evidence of a release is observed in on-site soil and groundwater samples.
- Determine the need for further action to assess the appropriateness of remedial action or additional investigation.

4.2 SCOPE OF WORK

As a part of the site investigation activities, a total of 20 soil borings were drilled, sampled, and analyzed for chemical constituents in August 2000. The boring locations were selected based on the history and location of historical manufacturing activities and storage locations of chemical products, raw materials and generated process residuals. The data was used to assess physical and chemical subsurface conditions in the soil. The soil boring locations are identified on Figure 3.

Three groundwater monitoring wells were installed based on the August 2000 soil boring analytical results. These wells were used to monitor groundwater quality near the Central Tank Farm, south of Building 202, and near the process sewer line at the southeastern end of the facility. Two additional groundwater monitoring wells were installed in November 2000 to further evaluate groundwater conditions in hydraulically downgradient directions across the site. The groundwater monitoring well locations are shown on Figure 3.

Both soil and groundwater samples collected from the borings and wells were analyzed for chemical constituents based on the major chemicals that had been used, stored, or manufactured in each area. Tables 2 and 3 summarize the sampling and analysis strategies for soil and groundwater at the site.

4.3 GEOPROBE SOIL INVESTIGATION

To evaluate on-site subsurface soil conditions, a Geoprobe investigation was conducted by SECOR during August 1-3, 2000. SECOR subcontracted with GeoTech Explorations, Inc. of Tualatin, Oregon for Geoprobe drilling services. Twenty Geoprobe locations were drilled on site to facilitate collection and analysis of subsurface soil samples. Those locations where the original terminal Geoprobe boring depth was 10 feet below ground surface (bgs) or less were redrilled at two offset locations spaced approximately 1.5 feet apart. These locations included GP1, GP2, GP5, GP7, GP13, GP14, GP15, GP16, GP17, GP18, GP19, and GP20. Offset drilling was conducted to validate boring refusal and bedrock depth and to evaluate the potential for random shallow obstructions (i.e., cobbles).

4.3.1 Soil Sampling/Field Work Methodologies

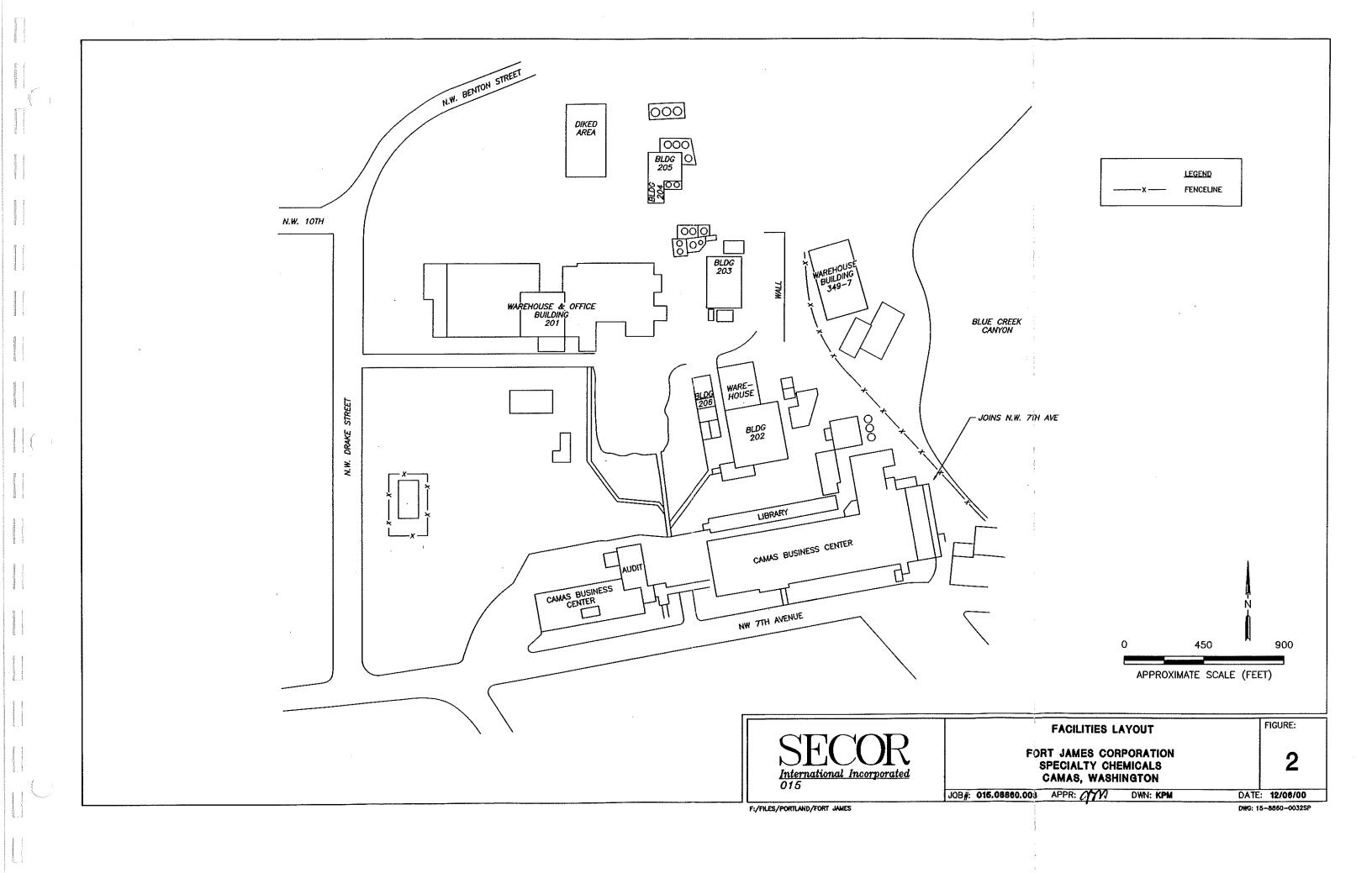
At each sample location, a private utility locator was used to evaluate the locations of underground utilities prior to initiating drilling activities. During each boring, continuous soil samples were field-screened via visual observation and photoionization detector (PID) evaluation. PID evaluation was accomplished by placing soil from the bottom of the sampler into a resealable plastic bag, allowing it to equilibrate for a period of 5 minutes, inserting the PID probe through the seal, and obtaining the reading. Soil in the sampler was classified according to the Unified Soil Classification System. Field screening and soil classification data were recorded in the project logbook and on soil boring logs. The soil boring log for each Geoprobe boring is included in Appendix A.

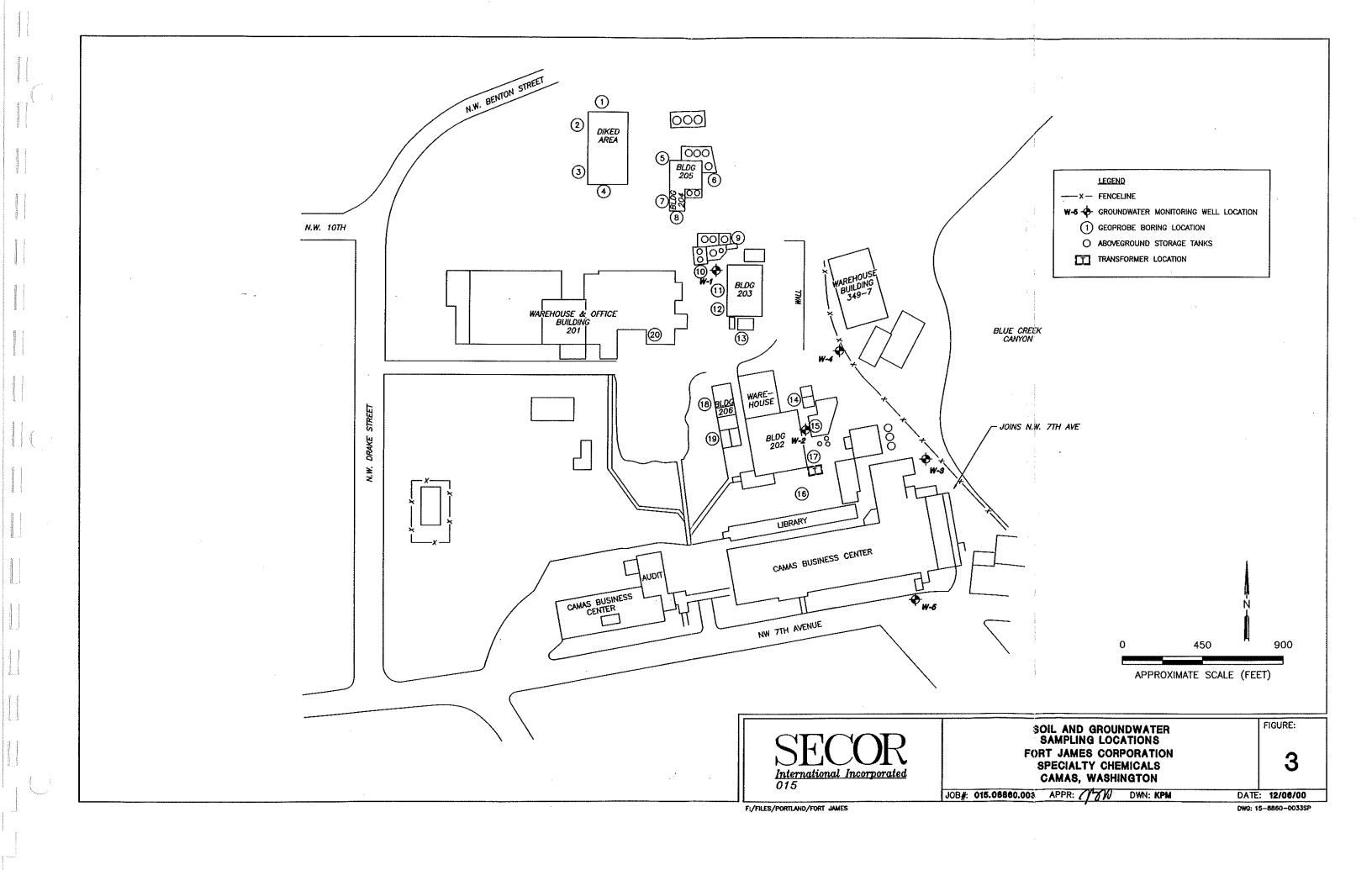
4.3.2 Soil Analytical Results

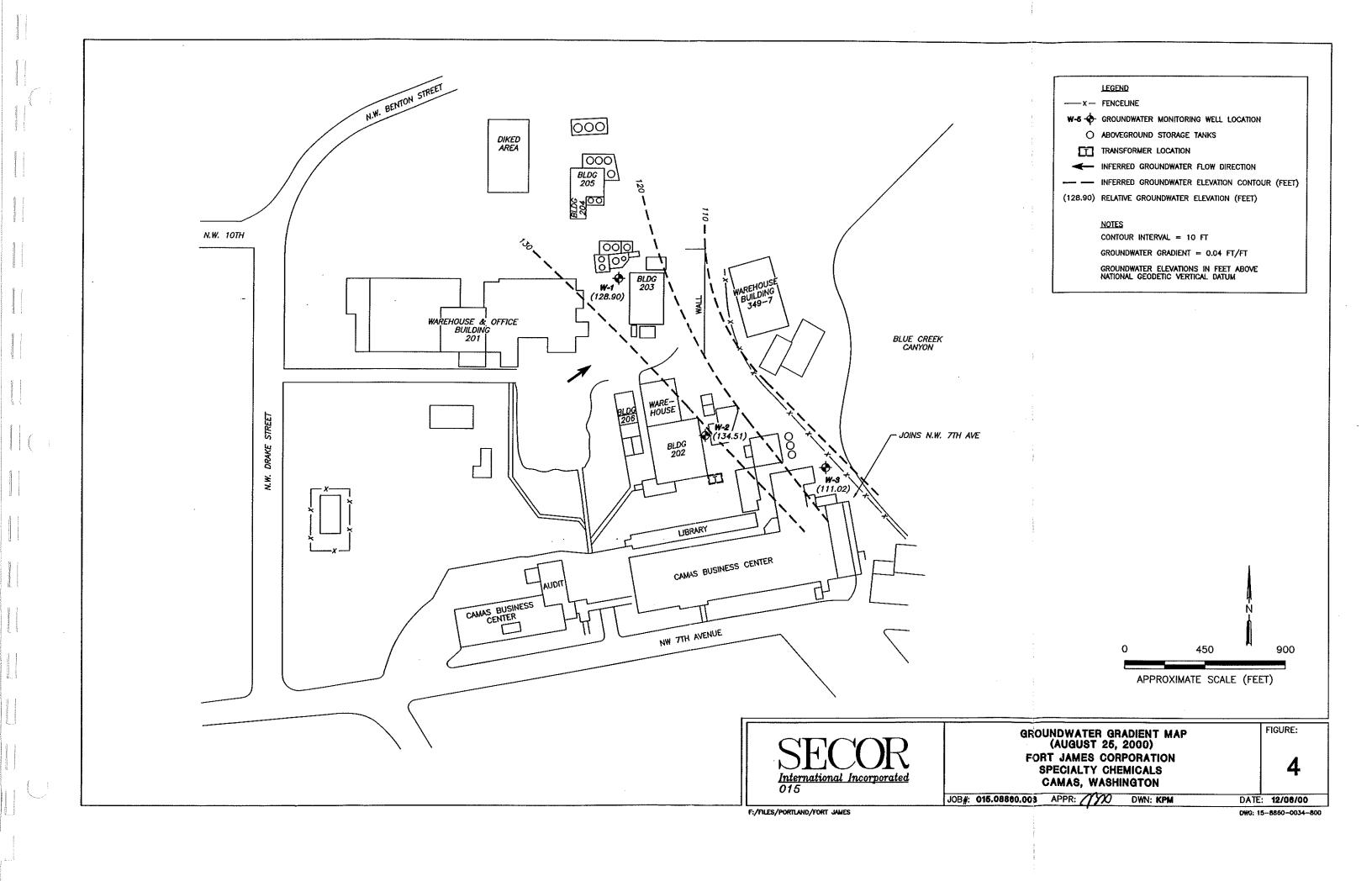
A discussion of each of the potential on-site source areas/buildings, chemicals of concern, and analytical results from each boring location is presented below. Tables 4 and 5 summarize the soil sample analytical results. The laboratory analytical data report is included in Appendix B.

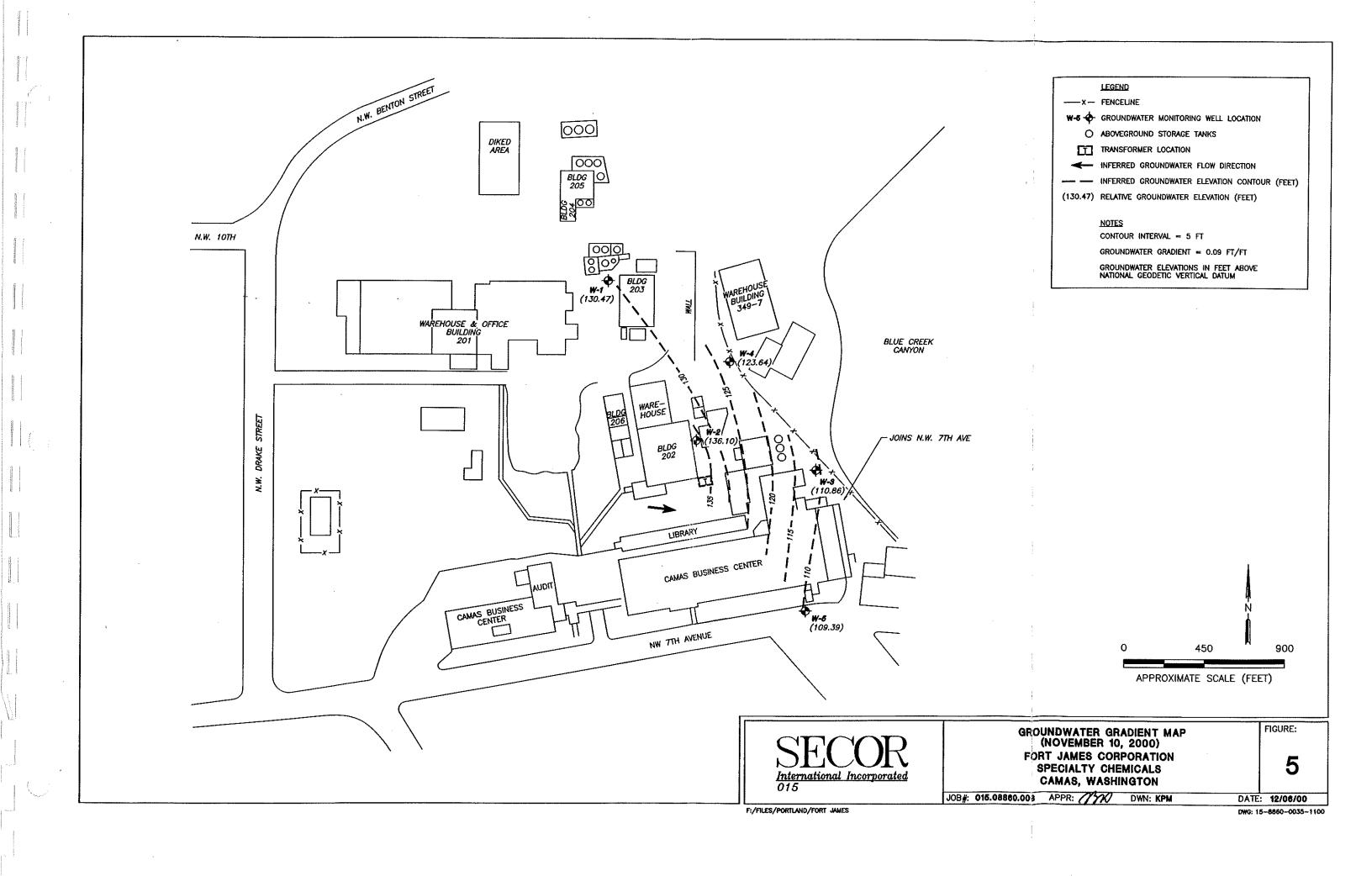
1. Diked Storage Area

Diked Storage Area Description and Chemicals of Concern. The diked storage area was formerly used for the storage of products and process residuals from the facility manufacturing processes, including drummed hazardous and non-hazardous waste and product intermediaries later reused in the process. A separate hydrogen peroxide tank with secondary containment was also present inside the fenced storage area. The chemicals of concern in this area include a combination of the chemical suites used and manufactured on site and include aromatic and halogenated volatile organic compounds (VOCs), phenols, polycyclic aromatic hydrocarbons (PAHs), metals, and petroleum hydrocarbons. To evaluate subsurface soil in this area, Geoprobe borings GP1 through GP4 were drilled at four separate









TABLES

Table 1. Major Chemicals Used, Stored, or Manufactured 2000 Site Investigation Former Specialty Chemicals, Inc. Fort James Corporation Camas, Washington

| Building | Chemical Ma | terials ^a | |
|----------|---|---|---|
| No. | Products | Raw M | 1aterials |
| 201 | Originally a non-woven fabric manufacturing plant; late and a blending facility for napkin/towel printing inks. | er a warehouse for the store | age of chemical products |
| 202 | catechol chlorinated levulinic acid (CLA) methyl thio metacresol (MTMC) methyl thiophenol (MTP) methylene dioxybenzene (MDB) sulfonyl bismethane (DMSO ₂) | barium sulfate chlorophenol cresol hydrogen peroxide methyl mercaptan phenol | chlorine copper chloride dimethyl sulfoxide isopropyl alcohol methylene chloride sodium hydroxide |
| 203 | CBOA (cellobiose octaacetate) DMSO ₂ MTMC SDP (sulfonyl diphenol) TB (TBMC) (thiobis metacresol) TB (TBMR) (thiobis methyl resorcinol) TB (PTOP) (thiobis tetramethylbutyl phenol TDP (thiodiphenol) TB (MTBP) thiobis (methyl-tertiary-butyl phenol) | cellulose cresol ethyl acetate hydrochloric acid methanol methylene chloride PTOP sulphur dichloride sulphuric acid | chlorine cyclohexane heptane isopropyl alcohol methyl butyl cresol phenol sodium hydroxide sulphur monochloride tetrachloroethylene |
| 204 | catechol ${ m DMSO}_2$ ${ m TBC}$ (tertiary butyl cresol) | catechol Dowtherm A hydrogen peroxide | cresol DMSO ₂ isobutylene |
| 205 | defoamer felt wash pitch dispersant pulping additive synthetic oils synthetic wood pulp | algin fats fatty alcohols silica sodium molybdate talc | anthraquinone fatty esters oils sodium hydroxide surfactants waxes |
| 206 | purified dimethyl sulfoxide (DMSO) | dimethyl sulfoxide | |

^a Based on a records review and interviews with F.J. Dyches and B. Hoover on October 19, 1999.

Table 2. Soil Sampling/Analysis Strategy 2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| | | | *************************************** | |
|-----|--|--|---|------------------------------------|
| Pod | Potential On-Site Source Area/Building | Chemicals of Concern | Soil Sample Location | Analytical Suites |
| | Diked Storage Area | VOCs, Phenols, PAH, Metals, Oil | 1, 2, 3, 4 | VOCs, SVOCs, Metals, TPH |
| 7 | Building 205 | TPH, Metals | 5, 6, 7 | TPH, Metals |
| 3 | Building 204 | Cresol | 8 | SVOCs (Phenois) |
| 4 | Building 203 Tank Farm/WW Sump | VOCs, Phenols, PAH, Metals, Oil | 9, 10 | VOCs, SVOCs, Metals, TPH |
| 5 | Building 203 | Cresol, Methylene Chloride, PCE, Phenols, TDP | 11, 12, 13 | VOCs, SVOCs (Phenols), TDP |
| 9 | Building 202 (East Storage Area) | VOCs, Chlorophenol, Phenols, Cresol, Methylene Chloride, Oil, Metals | 14 | VOCs, SVOCs (Phenols), TPH, Metals |
| 7 | Building 202 | Chlorophenol, Cresol, Phenols, Methylene Chloride | 15, 16 | VOCs, SVOCs (Phenols) |
| ∞ | Building 202 (Transformers) | PCB, VOCs, Phenols, MDB | 17 | PCB, VOCs, SVOCs, MDB |
| 6 | Building 206 | VOCs, Phenols, PAH, Metals | 18, 19 | VOCs, SVOCs, Metals |
| 10 | Building 201 | ТРН | 20 | ТРН |

Table 3. Groundwater Sampling/Analysis Strategy 2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| | | | The state of the s |
|--------------------------------|---|--|--|
| Groundwater Sample Location | Potential On-Site Source Areas/Buildings | Chemicals of Concern | Analytical Suites |
| W-1 | Tank Farm/WW Sump | Oils, Phenols, Chlorophenols, Cresol, Methylene Chloride, PCE, Metals, TPD, PAH, Acid/Caustic | VOCs, SVOCs, Metals, TPH, TDP, Acid/Caustic, PCB, MDB |
| W-2 | Building 206/Building 202 | Oils, Phenols, Chlorophenols, Cresol, Methylene Chloride, PCE, Metals, TPD, PAH, Acid/Caustic | VOCs, SVOCs, Metals, TPH, TDP, Acid/Caustic, PCB, MDB |
| W-3 | Process Water Drain Line | Oils, Phenols, Chlorophenols, Cresol, Methylene Chloride, PCE, Metals, TPD, PAH, Acid/Caustic | VOCs, SVOCs, Metals, TPH, TDP, Acid/Caustic, PCB, MDB |
| W-4 | Hydraulically Downgradient Location | Phenols, Chlorophenols, Cresol, Methylene Chloride, PCE, and TCE | VOCs and SVOCs |
| W-5 | Hydraulically Downgradient Location | Phenols, Chlorophenols, Cresol, Methylene Chloride, PCE, and TCE | VOCs and SVOCs |

Ftj-sgwi.xls January 17, 2001

Table 4. Organic Soil Analytical Results 2000 Site Investigation Former Specialty Chemicals, Inc. Fort James Corporation Camas, Washington

| A | Sample No./ Depth | | (F) | TPH-HCID ^b (mg/Kg) | q (| |) | VOCs ° (mg/Kg) | | | A+Bn/E 4SVOCs A/E SVOCs | A/E SVOCs ¢ | PCBs ^f | TDP 8 | MDB h |
|--|-------------------------|-----|-------|----------------------------------|------|------|---------|-------------------|-------------|------|-------------------------|-------------|-------------------|-----------------|---------|
| 1.5 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 <20 < | (feet bgs) ^a | | | Diesel | Oil | PCE | Acetone | 1,2- DCB | 1,4- DCB | MC | (mg/Kg) | (mg/Kg) | (mg/Kg) | (mg/Kg) (mg/Kg) | (mg/Kg) |
| 1 5 <td>GP 1</td> <td>2.5</td> <td><20 i</td> <td>0\$</td> <td>×100</td> <td><0.1</td> <td><1.0</td> <td><0.1</td> <td><0.1</td> <td><0.5</td> <td><0.33 - 2.0</td> <td>-</td> <td>1</td> <td>1</td> <td> </td> | GP 1 | 2.5 | <20 i | 0\$ | ×100 | <0.1 | <1.0 | <0.1 | <0.1 | <0.5 | <0.33 - 2.0 | - | 1 | 1 | |
| 14 20 650 6100 60.1 60.1 60.2 60.33-2.0 — — — 19 20 650 6100 60.1 61.0 60.1 60.1 60.2 61.65-10.0 — | GP 2 B | 7.5 | <20 | <50 | <100 | <0.1 | <1.0 | <0.1 | <0.1 | <0.5 | <0.33 - 2.0 | | | 1 | 1 |
| 4.5 6.0 6.10 6.11 6.01 6 | GP 3 | 14 | <20 | <50 | <100 | <0.1 | <1.0 | <0.1 | <0.1 | <0.5 | <0.33 - 2.0 | - | | - | : |
| 4.5 <a> <a><td>GP 4</td><td>19</td><td><20</td><td><50</td><td><100</td><td><0.1</td><td><1.0</td><td><0.1</td><td><0.1</td><td><0.5</td><td><1.65 - 10.0</td><td>***</td><td>-</td><td></td><td>-</td> | GP 4 | 19 | <20 | <50 | <100 | <0.1 | <1.0 | <0.1 | <0.1 | <0.5 | <1.65 - 10.0 | *** | - | | - |
| 1.5 | | | | | | | | | | | | | | | |

Table 4. Organic Soil Analytical Results 2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| - | | | 7 | | | |
|---------------------------------------|-------------------------|--------------|----------|---------------------|----------------|---|
| ц вам | (mg/Kg) (mg/Kg) | - | 1 | NE | NE | NE |
| TDP \$ | (mg/Kg) | 1 | 1 | NE | NE | NE |
| PCBs ^f | (mg/Kg) | . 1 | 1 | 10 | 0.013 | 0.22/1.0 |
| A/E SVOCs ° | (mg/Kg) | - | - | NA ^m | NA | NA |
| A+Bn/E ^d SVOCs A/E SVOCs ° | (mg/Kg) | <1.65 - 10.0 | 1 | NE | 7200 (1,2 DCB) | 3,700/3,700 (1,2 - DCB) |
| | MC | <0.1 <0.5 | | 0.5 | NE | 8.9/21 |
| | 1,4- DCB | <0.1 | ŀ | NE | 41.7 | 3.4/8.1 |
| VOCs ^c (mg/Kg) | 1,2- DCB | <0.1 | : | NE | 7,200 | 5.7/19 1,600/6,200 3,700/3,700 3.4/8.1 8.9/21 |
| , | Acetone | <1.0 | | NE | 8,000 | 1,600/6,200 |
| | PCE | <0.1 | *** | 0.5 | 800 | 5.7/19 |
| -a_ | lio Oil | <100 | <100 | NE | NE | NE |
| TPH-HCID ^b (mg/Kg) | Gas Diesel | <50 <100 | 001> 05> | NE | NE | NE |
| E | Gas | 07> | 07> | NE 1 | NE | NE |
| | | 1.5 | 5.5 | | | irial |
| Sample No./ Depth | (feet bgs) ^a | GP 19 | GP 20 | MTCA A ^k | MTCA B" | Region IX PRGs ° Residential/Industrial |

Depth in feet below ground surface (bgs).

^b Total Petroleum Hydrocarbon - Hydrocarbon Identification (TPH-HCID) as gasoline, diesel, and oil by NWTPH-HCID. Results in milligrams per kilogram (mg/Kg).

^c Volatile Organic Compounds (VOCs) by EPA Method 8260B. Results in mg/Kg.

PCE = Tetrachloroethene; 1,2-DCB = 1,2-Dichlorobenzene; 1,4-DCB = 1,4-Dichlorobenzene; MC = Methylene Chloride

^d Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C. Results in mg/Kg.

Acid Extractable Semivolatile Organic Compounds (A/E SVOCs) by EPA Method 8270C. Results in mg/Kg.

Polychlorinated Biphenyls (PCBs) by EPA Method 8082. Results in mg/Kg.

⁸ Thiodiphenol (TDP) by EPA Method 8270SIM + Tentatively Identified Compounds (TICs). Results in mg/Kg.

^h Methylene Dioxybenzene (MDB) by EPA Method 8270B + TICs. Results in mg/Kg.

Not detected at or above the laboratory method reporting limit.

-- = Not analyzed.

* Washington Department of Ecology Model Toxics Control Act (MTCA) Method A Industrial Soil Cleanup Levels.

Not Established.

"Not Applicable.

ⁿ Washington Department of Ecology MTCA Method B Soil Cleanup Levels.

O.S. EPA Region IX Preliminary Remediation Goals (PRGs) - Residential/Industrial, in mg/Kg.

Table 5. Inorganic Soil Analytical Results 2000 Site Investigation Former Specialty Chemicals, Inc. Fort James Corporation Camas, Washington

| Sample ID | (feet bgs) a | | | | Total RCR (mg/ | | | | |
|------------------------------------|--------------|----------|--------------|---------|-------------------|-----------|-----------|------------|------------|
| | . , | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury | Silver | Selenium |
| GP1 | 2.5 | 5.20 | 145 | 0.542 | 20.7 | <10.0 ° | <0.1 | <1 | 0.988 |
| GP3 | 14 | 6.46 | 114 | <0.5 | 24.8 | 14.5 | < 0.1 | <1 | 0.588 |
| GP4 | 19 | 5.76 | 155 | <0.5 | 48.3 | 17.7 | < 0.1 | <1 | 0.939 |
| GP5 | 4.5 | 1.32 | 91.9 | <0.5 | 4.54 | <10 | <0.1 | <1 | 1.37 |
| GP6 | 17.5 | 5.46 | 126 | <0.5 | 29.4 | 12.5 | <0.1 | <1 | 0.921 |
| GP7C | 6 | 0.629 | 5.3 | <0.5 | 3.01 | <10.0 | 0.442 | <1 | 0.824 |
| GP8 | 31.5 | d | | | | | | | |
| GP9 @ 12' | 12 | 1.30 | 104 | <0.5 | 88.3 | 10.4 | < 0.1 | <1 | 0.769 |
| GP9 @ 27.5' | 27.5 | 0.687 | 74.1 | <0.5 | 59.0 | 11.9 | < 0.1 | <1 | 0.874 |
| GP10 | 21.5 | < 0.5 | 120 | <0.5 | 116 | <10.0 | <0.1 | <1 | 1.06 |
| GP11 | 10.5 | | | | 1 | | | | |
| GP12 | 14.5 | | | | | | | | |
| GP13 | 6.5 | | | | | | | | |
| GP14 @ 8' | 8 | <0.5 | 41.8 | <0.5 | 1.40 | <10.0 | <0.1 | <1 | <0.5 |
| GP15 | 7.5 | | | | | | | | |
| GP16 | 2.7 | | | | | | | | |
| GP17 @ 6' | 6 | | | | | | | | |
| GP17C @ 11.5' | 11.5 | | | | | | | | |
| GP18 | 1.5 | 4.04 | 499 | 1.73 | 19.3 | 25.6 | 0.676 | . <1 | 0.560 |
| GP19 | 1 | 4.41 | 99.5 | 1.54 | 23.6 | 29.6 | 0.194 | <1 | 0.737 |
| GP20 | 5.5 | | | | | | | | |
| GP2B | 7.5 | 1.29 | 143 | <0.5 | 23.0 | <10.0 | < 0.1 | <1 | 0.637 |
| MTCA A ° | | 20 | | 2 | 100 | 250 | 1 | NE | NE |
| MTCA B f | | 1.67 | 5,600 | 30 | NE | NE | 24 | 400 | 400 |
| REGION IX PRO Residential/Indus | | 0.39/2.7 | 5400/100,000 | 37/810 | 210/450 | 400/1,000 | 23/610 | 390/10,000 | 390/10,000 |
| USGS 1270 h | | 4.1 | 700 | NE | 100-700 | 20 | 0.2 - 1.3 | NE | 0.2 |

^a Feet below ground surface

^b Total RCRA Metals by EPA Methods 6000/7000. Results in milligrams per kilogram (mg/Kg)

 $^{^{\}rm c}$ <= Not detected at or above the laboratory method reporting limit.

^d -- = Not analyzed.

^e Washington Department of Ecology Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels. Results in mg/Kg.

f Washington Department of Ecology MTCA Method B Soil Cleanup Levels. Results in mg/Kg.

⁸ U.S. EPA Region IX Preliminary Remediation Goals (PRGs) - Residential/Industrial, in mg/Kg.

^h U.S. Geological Survey Professional Paper 1270, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, 1984.

Table 6. Water Level Elevations 2000 Site Investigation Former Specialty Chemicals, Inc. Fort James Corporation Camas, Washington

| Well Number | Sample Date | Surface Elevation (feet NVGD ^a) | Static Water Level (feet BTOC ^b) | Groundwater Elevation (feet NVGD) |
|-------------|-------------|--|---|--------------------------------------|
| | 08/25/00 | 161.22 | 32.35 | 128.90 |
| W-1 | 11/10/2000 | 161.33 | 30.86 | 130.47 |
| | 08/25/00 | 156.00 | 21.49 | 134.51 |
| W-2 | 11/10/2000 | 156.00 | 19.9 | 136.1 |
| 117. 7 | 8/25/2000 | 125.82 | 14.8 | 111.02 |
| W-3 | 11/10/2000 | 123.82 | 14.96 | 110.86 |
| W-4 | 11/10/2000 | 135.14 | 11.5 | 123.64 |
| W-5 | 11/10/2000 | 122.12 | 12.75 | 109.37 |

^a feet above 1929 National Vertical Geodetic Datum (NVGD).

^b feet below top of well casing (BTOC).

| | | | | | - | | | | | |
|--------|-------------------|--------|--------------------------------|---------|--|-------------------------|----------|----------------------------|----------------------------|----------------------------|
| Well | Sample | | PH-HCID ^a (mg/L) | | TPI | SVOCs ^d (µg/ | L) | PCB ^e (μg/L) | TDP ^f (μg/L) | MDB ^g (μg/L) |
| Number | Date | T | Diesel | Oil | (μ <u>P</u> | 1,2-DCB | B(2-EH)P | (ra-/ | | |
| | | Gas | Diesei | | | | 40.0 | -0.5 | | ND |
| W-1 | 08/25/00 | <0.250 | <0.630 | < 0.630 | 0 | <5.0 | <10.0 | <0.5 | | |
| | | | | | | 74.4 | 10.1 | <0.5 | ND | ND |
| W-2 | 08/25/00 | DET | <0.630 | < 0.630 | 7 | /4.1 | | | | |
| | <u> </u> | | | | | <5.0 | 22 | <0.5 | ND | ND |
| W-3 | 08/25/00 | <0.250 | <0.630 | <0.630 | 0 | 5.0 | | | | |
| | | | | | | <5.0 | <10.0 | | | |
| W-4 | 11/10/00 | | | | 0 | <5.0 | 10.0 | | | <u> </u> |
| | | | | | 1 | -60 | <10.0 | | | |
| W-5 | 11/10/00 | | | | 0 | <5.0 | 10.0 | | | |
| | | | <u> </u> | | | | NE | 0.1 | NE | NE |
| N/T | CA A ^h | NE | NE | NE | 1, | NE | NE | V.1 | .,,,,,, | |
| IVI | UA A | | | | —— | + | 1 | 0.0114 | NE | NE |
| | CA B k | NE | NE | NE | 1 | 720 | 6.25 | 0.0114 | IVE | 1,12 |
| MT | CA B | 1 112 | | | | | | <u></u> | | |

^a Total Petroleum Hydrocarbon - Hydrocarbon Identification as gasol

^b Total Petroleum Hydrocarbons as Gasoline by Northwest Series Me

[°] Volatile Organic Compounds by EPA Method 8260B. Results in µ§

^d Semivolatile Organic Compounds by EPA Method 8270C. Results;

Polychlorinated Biphenyls by EPA Method 8082. Results in µg/L.

^fThiodiphenol by EPA Method 8270SIM + Tentatively Identified Co ^g Methylene Dioxybenzene by EPA Method 8260B + TICs. Results i

^h Washington Department of Ecology Model Toxics Control Act Met

i Proposed level

J Current/Proposed Levels

k Washington Department of Ecology Model Toxics Control Act Met

<= Not detected at or above the laboratory method reporting limit.

^{-- =} Not analyzed; ND = Not Detected; DET = Detected; NE = Not E **Bold** = Exceedance of respective regulatory level .

CB = Chlorobenzene

CF = Chloroform

^{1,2-}DCB = 1,2-Dichlorobenzene

^{1,4-}DCB = 1,4-Dichlorobenzene

c-1,2-DCE = cis-1,2-dichloroethene

PCE = Tetrachloroethene

^{1,1,1-}TCA = 1,1,1-Trichloroethane

TCE = Trichloroethene

^{1,2,4-}TMB = 1,2,4-Trimethylbenzene

²⁻CP = 2-Chlorophenol

B(2-EH)P = bis(2-ethylhexyl)phthalate

Table 8. Inorganic Groundwater Analytical Results 2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

| Sample ID | | | | Total RCRA Metals ^a (mg/L) | Vetals ^a ا | | | | Acidity b | Alkalinity ° |
|-------------------------|---------------------|-----------------|---------|--|--------------------------|----------|--------|----------|-----------|--------------|
| | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury | Silver | Selenium | (mg/L) | |
| W-1 <0. | <0.001 ^d | 0.00362 | <0.001 | <0.001 | <0.001 | <0.00125 | <0.001 | <0.001 | 17.1 | 52.8 |
| W-2 0.0 | 0.00268 | 0.0625 | <0.001 | 0.00344 | 0.00367 | <0.00125 | <0.001 | 0.00133 | 15.4 | 63.1 |
| W-3 <0 | <0.001 | 0.00777 | <0.001 | <0.001 | 100:0> | <0.001 | <0.001 | <0.001 | 16.1 | 89.9 |
| MTCA A ° 0. | 0.005 | NE ^f | 0.005 | 0.050 | 0.005 | 0.002 | NE | NE | NE | NE |
| MTCAB ⁸ 5.83 | 5.83E-05 | _ | 0.008 | NE | NE | 0.0048 | 0.08 | 80.0 | NE | NE |

^a Total RCRA Metals by EPA Method 6000/7000. Results in milligrams per liter (mg/L).

^b Acidity by EPA Method 305.2. Results in mg/L.

^o Alkalinity by EPA Method 310.1. Results in mg/L.

^d <= Not detected at or above the laboratory method reporting limit.

^{*} Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Level in mg/L.

^fNE = Not Established.

⁸ Ecology MTCA Method B Groundwater Cleanup Level in mg/L.

APPENDIX A GEOPROBE LOGS

2000 Site Investigation Report Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington SECOR PN: 015.08860.002 January 17, 2001



| FACILITY LOCATION | | | | | I <mark>alty Chemical</mark> Job # <u>015</u> Igton Suri | .08718.00 FACE ELE | S VATION | BORING/WELL_ GP-1 N NA |
|---|--------------------------------|-------------------------------|-------|------------------------------|---|--------------------------------|------------------------------|---|
| START _ | <u>0808</u> | 08/0 | | | FINISH | NG TOP | ELEVA | TION_NA |
| LOGGED | | | MA | FOL | MONITORING DEVICE Mini RAE 2000 w IPMENT Geotech Geoprobe rig utilizing a 4' m | / 100 ppn | <u>i Isobu</u> Ar Iloo | rtylene A |
| COMMEN | | | | | | evi Voeilipi | <u> </u> | <u>.</u> |
| | | | | | | | | |
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lithologic Description | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic |
| 0/0/0 | 8 | | | _ 5 | | | 5 | |
| | | 0.0 | | 5 10 15 - 20 - 25 | Gravelly SAND, orange, gravel is fine to very coarse, sand is fine grained, loose, dry Boring terminated at 2.5 feet (refusal). (GP1B — refusal © 3.5' bgs.) (GP1C — refusal © 3.2' bgs.) | SP | 5 0 5 10 25 | |
| | | | | | | | | |
| Desci | iption | n/Lithold Sample Sample | ogic | ▼ ▼ | Groundwater Level at Time of Drilling Static Groundwater Level Gradational Contact | Concrete | N. Y. | 10/20 Colorado Silica Sand 2" PVC Blank Casing |
| Samp | aborati | mitted | , | SD NS NT 25Y A | Sheen Detected Contact Located Approximately Not Tested (2) Munsell (1990) Soil Color Charts Contact | Bentonite | • | 2° PVC Screen Casing (0.010 slots) |
| ~ roly | | | | 2.51 7 | /2) Munsell (1990) Soil Color Charts ——— Contact | | | DWG: 15-8718-3L |



PAGE 1 OF 1 International Incorporated FACILITY FT JAMES SPECIALTY CHEMICAL BORING/WELL GP-2 015.08718.003 JOB # SURFACE ELEVATION _ LOCATION CAMAS, WASHINGTON CASING TOP ELEVATION_ NA START <u>0831 08/01/00</u> FINISH <u>0835 08/01/00</u> MONITORING DEVICE Mini RAE 2000 w/ 100 ppm isobutylene LOGGED BY DEC SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined COMMENTS w/ acrylic sleeve Unified Soil Classification Below Depth feet PENETRATION Below Well Construction RESULTS Depth B. Surface, Lithologic Description Depth B. Surface, Schematic BLOWS 6"/6"/6" Grass 0 SAND w/ gravel, orange/tan, gravel is fine to coarse, sand is fine to medium grained, trace silt, loose, dry 2.9 SP Boring terminated at 3.5 feet (refusal). 5 10 - 15 - 20 20 - 25 25 2" PVC 10/20 Field Screen/Lithologic Description Sample Groundwater Level at Time of Drilling Gradational Contact ∇ Blank Cólorado Ŧ Static Groundwater Level Preserved Sample 2" PVC SD Sheen Detected No Recovery Casing (0.010 slots) No Sheen Detected NS Approximatel) Sample Submitted for Laboratory Not Tested End Cap (2.5Y 4/2) Munsell (1990) Soil Color Charts Contact Analysis



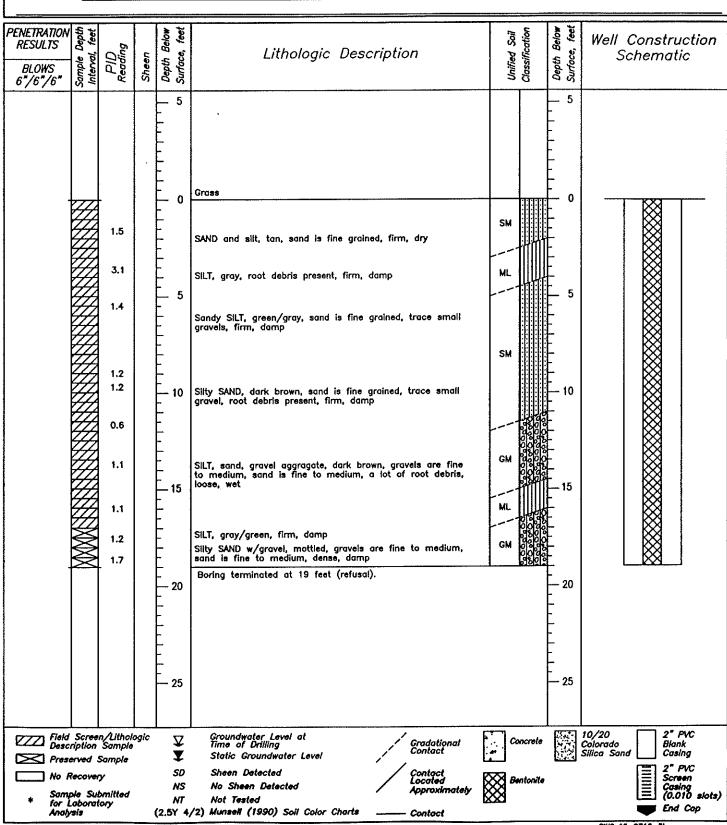
| FACILITY FT JAMES SPECIALTY CHEMICAL JOB # 015.08716.003 BORING/WELL CLOCATION CAMAS, WASHINGTON SURFACE ELEVATION NA | 1 <u>P-2B</u> |
|--|------------------------|
| START <u>1700 08/02/00</u> FINISH <u>1717 08/02/00</u> CASING TOP ELEVATION NA | |
| LOGGED BY DEC MONITORING DEVICE Mini RAE 2000 w/ 100 ppm isobutylene | |
| SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined | |
| COMMENTS w/ acrylic sleeve | |
| | |
| PENETRATION RESULTS BLOWS 6"/6"/6" Soil Lithologic Description Lithologic Description Lithologic Description Schematics Soil Schematics | |
| BLOWS 6"/6" 6" 6" 6" 6" 6" 6" 6" 6" 6" 6" 6" 6" 6 | ic |
| 6"/6"/6" E E C E E E E E E E E E E E E E E E E | |
| 5 | |
| O.0 Gross No recovery in sampler Silk, SAND, gravel aggregate, gravels are fine to cocrae, and is fine-to medium-grained, mottled color, dense, dry Boring terminated at 7.5 feet (refusal). (GP2C - refusal • 4.3' bgs) - 10 - 15 | |
| | |
| | |
| | |
| VZZ Field Screen/Lithologic Groundwater Level at Gradational Concrete Time of Drilling Colorado Blant Contract Silica Sand Cost | ık (|
| Preserved Sample State Groundwater Level | - |
| No Recovery NS No Sheen Detected Sample Submitted * for Laboratory NT Not Tested * Seminately * For Laboratory NT Not Tested * Seminately * For Laboratory * For Lab | en ing 10 slots) |
| Analysis (2.5Y 4/2) Munsell (1990) Soil Color Charts ——— Contact DWG: 15-8716-3L | Сор |



| Internation | | | | ed. | | | | PAGE 1 OF 1 |
|---------------------|----------------------|--------------------|--------------------------|------------------------------|---|--|---------------------|--------------------------------------|
| | | | | | ALTY CHEMICAL JOB # | 015.08718.003 | E | BORING/WELL GP-3 |
| LOCATION | 1 0 | MAC | W | ISHIN | GTON | SURFACE ELEV | 4 <i>TION</i> | NA NA |
| START _ | 0845 | 08/0 | 1/0 | 0 | FINISH <u>0900 08/01/00</u> | CASING TOP E | LEVAT | TION_NA |
| LOCGED | RY | DEC | | | MONITORING DEVICE Mini RAE 200 | 00 w/ 100 ppm | 180DU | yiene |
| SUBCON | TRAC | TOR A | AND | EQU | IPMENT Geotech Geoprobe rig utilizing a | 7 macrosumple | 111140 | |
| COMMEN | 13 <u>H</u> | / ECF | yiiC | 81887 | | | | |
| | 14- | | _ | _ _ | | | के हैं | |
| PENETRATION RESULTS | 18 = | Ď | | Depth Below Surface, feet | lith-lasia Danamintian | Unified Soil Classification | Below e, feet | Well Construction |
| BLOWS | Sample I | PID Reading | Sheen | foce, | Lithologic Description | nified Issifi | Depth B Surface, | Schematic |
| 6"/6"/6" | Sample Interval, | A. S. | ts. | 8 8 | | 5 8 | 23 | |
| | 1 | | | _ 5 | | | 5 | |
| | | | | L | | | _ | |
| | | | | L | | | - | |
| | | | | L | | | - | |
| | | | | <u> </u> | | | <u> </u> | |
| | | | | ١ . | Grass | 3025 | _ 0 | |
| | | 1 | 1 | <u>L</u> | SAND, orange/tan, fine-to medium-grained, few gravel | s, SP | _ | 💹 |
| | | } | | L | root debris present, loose, dry | 1 | _ | |
| | | 0.9 | | L | | | _ | |
| | | 1.4 | | Ē | | | _ | |
| | | '- ^ | | - - 5 | SAND and silt, green/gray, fine grained, firm, dry | SM | _ _ 5 | |
| 1 | | 0.3 | | F " | South diffe sitt, dientil dienti dientied with en | | _ | |
| - | 177 | 3 | | F | | L### | <u>_</u> | |
| | | 2.1 | | F | Becomes damp SILT, dark brown, root debris, firm, damp | | <u>L</u> | |
| | 11 | 1 | ļ | F | | | Ŀ | |
| | 17 | 9.7 | | F | | | F_ 10 | |
| | 111 | 4 "" | | 10 | Becomes wet | ML | F | |
| | 111 | 21.0 | | F | | | E | |
| | 1/ | 7 | | F | Color changes to brown/tan | | Ē | 🔯 |
| | | 8.0 | | - | Gravel present at base of sampler | THE PROPERTY OF THE PROPERTY O | E | |
| | | † "." | | F | Boring terminated at 14 feet (refusal). | | L 15 | |
| | | | 1 | <u> 15</u> | | | E" | |
| | | | | - | | | F. | |
| | | | | - | | | F | |
| İ | | | | F | | | F | |
| | 1 | | | F | | | F | |
| ļ | | | | 20 | | | ⊢ 20 | |
| | | | | F | | | F | |
| | | | | F | | | F | |
| | | | | F | | | F | |
| 1 | } | | | F | | | F | |
| | | | | _ 25 | | | 25 | |
| | | | | | | | | |
| | | <u>.L</u> | | | | | | 10/20 2° PVC |
| EZZI Fic | ild Scre scriptio | en/Lithe n Samp | ologic I a | - | | onal Concrete | | Colorado Blank Silica Sand Casing |
| | | Sample | | ¥ | Static Groundwater Level | لسفا | EVE | |
| | Recov | • | | SD NS | / Located | mately Bentonit | • | Zeren Casing (0.010 slots) |
| * fo | r Labor | ubmitte atory | đ | N | Not Tested | 1 XXX | | (0.010 slots) End Cap |
| | alysis | - | | (2.5Y) | 4/2) Munsell (1990) Soil Color Charls Contact | | | |



| FACILITY FT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08718.003</u> BORING/WELL <u>GP-4</u> |
|--|--|
| LOCATION CAMAS. WASHINGTON | SURFACE ELEVATIONNA |
| START <u>0915 08/01/00</u> FINISH <u>0945 08/01/00</u> | CASING TOP ELEVATION NA |
| LOGGED BY DEC MONITORING DEVICE | Mini RAE 2000 w/ 100 ppm isobutylene |
| SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe | rig utilizing a 4' macrosampler lined |
| COMMENTS w/ acrylic sleeve | |
| | |

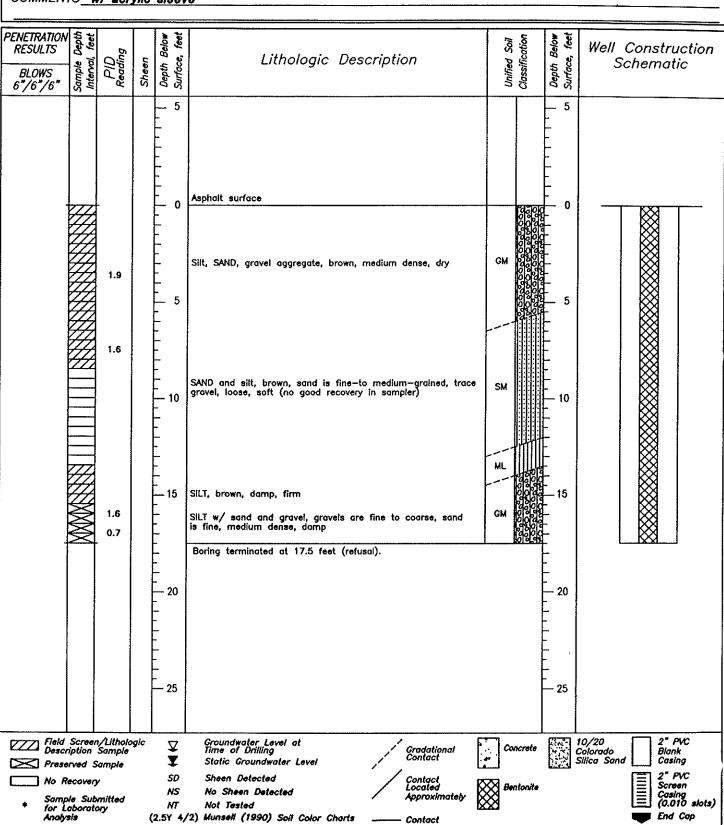




| International Incorporate | ed. | | PAGE 1 OF 1 |
|--|---|--|--|
| FACILITY FT JAMES LOCATION CAMAS, W. START 0956 08/01/0 LOGGED BY DEC | SPECIALTY CHEMICAL ASHINGTON O FINISH 1022 08/01/00 MONITORING DEVICE Mini R. EQUIPMENT Geotech Geoprobe rig utili | SURFACE ELEV CASING TOP E SE 2000 W/ 100 ppm | LEVATION <u>NA</u> Isobutylene |
| Sheen Sheer Sample Dept. 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, 9, | | Unified Soil Classification | Well Construction Schematic |
| 1.3 | Asphalt surface Sitty SAND, gravel, cobble aggregate, brown, brownessent, dense, dry Boring terminated at 4.5 feet (refusal). (GP5B - refusal • 2.0' bgs) GP5C - refusal • 5.6' bgs) - 10 - 20 - 20 - 25 | ck debris GM GR GR GR GR GR GR GR GR GR | 5 - 0 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - |
| Field Screen/Lithologic Description Sample Preserved Sample No Recovery Sample Submitted for Loboratory Analysis | Groundwater Level at Time of Drilling Static Groundwater Level SD Sheen Detected NS No Sheen Detected NT Nat Tested (2.5Y 4/2) Munsell (1990) Soil Color Charts | Gradational Contact Located Approximately Contact | 10/20 Colorado Silica Sand 2" PVC Blank Casing 2" PVC Screen Casing (0.010 slots) End Cap |



| FACILITY _FT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08716.003</u> BORING/WELL GP-6 |
|--|---|
| LOCATION <u>CAMAS, WASHINGTON</u> | SURFACE ELEVATION |
| START <u>1257 08/01/00</u> FINISH <u>1318 08/01/00</u> | CASING TOP ELEVATION NA |
| | Mini RAE 2000 w/ 100 ppm isobutylene |
| SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe | rig utilizing a 4' macrosampier lined |
| COMMENTS w/ acrylic sleeve | |
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| FACILITY | FT | JAME | 3 | SPECIA | ALTY CHEMICAL JOB # _014 | 5.08716. | 003 | BORING/WELL GP-7 |
| LOCATIO | | | | | gtonSur | RFACE EL | | |
| START _ | 1035 | 08/0 | 1/00 | 2 | | | | TION_NA |
| LOGGED | BY . | DEC | | | MONITORING DEVICE MINI RAE 2000 I | w/ 100 p | om Isobe | <u>utylene</u> |
| SUBCON | ITRAC | TOR A | 1ND | EQUI | PMENT Geotech Geoprobe rig utilizing a 4' i | macrosan | ipier iine | 04 |
| COMMEN | VTS_ <u>h</u> | v/ acr | <u>ylic</u> | sleeve | 9 | | | |
| | | | | | | | 1. 4 | |
| PENETRATION RESULTS | NEEN | | | Below e, feet | | Unified Soil | Below 3, feet | Well Construction |
| | 2 c | 0.5 | 5 | 2 8 | Lithologic Description | | \$ 8 | Schematic |
| BLOWS 6"/6"/6" | Sample Interval, | PID Reading | Sheen | Depth Be Surface, | | ting 8 | Depth B Surface, | |
| 6/6/6 | 8 = | | ļ., | ļ | | - | 5 | |
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| | 1/// | - | | F 0 | Asphalt surface | | 0 | |
| | | 2.6 | | _ | Silt, SAND, gravet, cobble aggregate, brown, loose, dry | 100 | | |
| | 22 | 1 | | <u> </u> | | GM IC | 9 -3- | |
| | | 1 | | - | | | 1384 | |
| | | | | L | Boring terminated at 3 feet (refusal). | | F | |
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| | eld Scre | en/Litho | ologic | | Groundwater Level at | هر ا | crete 🔯 | 10/20 2° PVC |
| EZZI D | escriptio | n Sampi | le | ₹ V | Groundwater Level at Time of Drilling Static Groundwater Level Gradational Contact | i con | | Colorado Blank Silica Sand Casing |
| | | Sample | , | SD | Sheen Detected Contact Located | | | 2" PVC Screen |
| • | o Recov | • | , | NS | No Sheen Detected / Approximately | | tonite | Casing (0.010 sign |
| * 1 0 | xr Labor | iubmitted atory | • | NT (2.5Y 4 | Not Tested (/2) Munsell (1990) Soll Color Charts ——— Contact | DXXI | | End Cap |
| | nalysis | | | (2.01 | ye, mental trace, and construct | | | DWG: 15-8716-3L |



| FACILITY FT JAMES SPECIALTY CHEMICAL JOB # 015.08716.003 BORING/WELL GP-7B LOCATION CAMAS. WASHINGTON SURFACE ELEVATION NA | | | | | | | | | | | | |
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| START _ | <u>1241</u> | 08/0 | | | FINISH <u>1347 08/01/00</u> | CAS | ING TOP E | LEVA: | TION NA | | | |
| LOGGED | | | 1/// | FOLI | MONITORING DEVICE IPMENT Geotech Geoprobe | Mini RAE 2000 w | <u>// 100 ppm</u> | laobu r line | tylene d | | | |
| COMMEN | 75 <u> </u> | V/ ACT | vilc | sleev | e | ing dimenig # + in | ia Ci Voailipio | 1 11110 | | | | |
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| PENETRATION RESULTS | Depth feet | | | Below c, feet | | | Soil | Below , feet | Well Construction | | | |
| | ole D | PID Reading | en en | | Lithologic Des | cription | Unified Soil Classification | Depth Bu Surface, | Schematic | | | |
| BLOWS 6"/6"/6" | Sample I Interval, | Rec | Sheen | Depth B Surface, | | | Unii | Dep Surf | | | | |
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| | | | | - | Asphalt surface | | | | | | | |
| | 777 | 0.5 | | - 0 | Silt, SAND, gravel, cobble aggregate, | brown, loose, dry | 900 | _ 0 | | | | |
| | | 0.5 | | - | | | GM NO 00 | - - | | | | |
| | \bowtie | - | | - | Boring terminated at 2.5 feet (refus | a1) | | - | | | | |
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| [777] Field | Scree | n/Lithold | gic | | Groundwater Level at Time of Drilling | / | F \ | (i,e-1 | 10/20 2" PVC | | | |
| Desc. | ription | Sample Sample | - | ¥ | Time of Drilling Static Groundwater Level | Gradational Contact | Concrete | N 1 | Colorado Blank Silica Sand Casing | | | |
| | ecover | | | SD | Sheen Detected | Contact Located | Bentonite | | 2° PVC Screen | | | |
| | ole Sub aborat | milled on | | NS NT | No Sheen Detected Not Tested | Approximately | X | | Casing (0.010 slots) | | | |
| Analy | | | (| 2.5Y 4/ | (2) Munsell (1990) Soil Color Charts | Contact | | | End Cap | | | |



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| FACILITY FT JAMES SPECIALTY CHEMICAL JOB # 015.08718.003 BORING/WELL GP-7C SURFACE ELEVATION NA | | | | | | | | | | | | | |
| LOCATION | CA | MAS. | WA | SHIN | GTON SURF | | | | TION NA | | | | |
| START | | | 1/00 | <u> </u> | FINISH <u>1403 08/01/00</u> CASIN MONITORING DEVICE <u>Mini RAE 2000</u> w/ | | | | l l | | | | |
| LOGGED | מאט. גמ | DEC | N/O | FOU | PMENT Geotech Geoprobe rig utilizing a 4' ma | ICFO88 | mplei | line | 1 | | | | |
| COMMENT | raci | / acr | viic . | sleeve | 9 | | | | | | | | |
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| PENETRATION | \$ ដ | | | slow feet | | 78 | δ | Below , feet | Well Construction | | | | |
| PENETRATION RESULTS | g g | og . | ٦ | Below e, feet | Lithologic Description | Unified Soil | ficat | , Be | Schematic | | | | |
| BLOWS | Sample I Interval, | PID Reading | Sheen | Depth B Surface, | Elthologic Bodon part | Inifie | iassi | Depth Be Surface, | 00,,0,,, | | | | |
| 6"/6"/6" | San | ,α | S | 8 8 | | ~ | 3 | | | | | | |
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| , | | | | _ 0 | Asphalt surface | - | वहागा | O | - | | | | |
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| | # | 1.2 | | - | Silt, SAND, gravel, cobble aggragate, brown, medium dense, dry | GM | 1000 | <u>-</u> | | | | | |
| | <i>777</i> | ,. <u></u> | | _ | ~~ | "" | | - | | | | | |
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| | | Ť | | F | Boring terminated at 6 feet (refusal). | | | - | | | | | |
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| | d Sem | en/Litho | l doalc | | Groundwater Level at Gradational Contact | F. 1/ | Concrete | 23.45 | 10/20 2" PVC Colorado Biank | | | | |
| Des | criptio | n Sampi | 8 | ¥ Z | Time of Drilling Gradational Static Groundwater Level | | | | Silica Sand Casing | | | | |
| | | Sample | • | SD. | Sheen Detected Contact | 1000 v | Danton'i | | 2" PVC Screen | | | | |
| | Recov | ery ubmitled | , | NS | | ₩' | 9entonite | • | Screen Casing (0.010 slots) | | | | |
| * for | Labor | atory | • | NT (2.5Y - | Not Tested 4/2) Munsell (1990) Soll Color Charts Contact | (XX) | | | End Cap | | | | |
| | dysis | | | (2.5) | 7-1/ | | | | DWG: 15-8718-3L | | | | |



| LOCATION | CA | MAS. | W | SHI | IN | ALTY CHEMICAL JOB # 01: GTON SUR FINISH 1150 08/01/00 CAS | RFA | CE ELE | VATIOI | V <u> </u> |
|---|--------------------------------|-------------------------------|-------|----------------|----------|--|-----|--------------------------------|------------------------------|--|
| LOGGED SUBÇONT | BY RAC | DEC TOR A | ND | EQ | U | MONITORING DEVICE <u>Mini RAE 2000 </u> IPMENT <u>Geotech Geoprobe rig utilizing a 4° i</u> | | | | |
| COMMENT | | // acr | VIIC | 8106 | <i>y</i> | | | | | |
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below | | Lithologic Description | | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic |
| | | 2.5 | | 10 10 20 | 5.5 | Asphalt surface SILT w/ sand and gravels, dark brown, gravels are fine to coarse, sand is fine grained, root debris present, firm, dam, slity SAND, orange/tan, sand is fine to medium, loose, dry SILT w/ trace small gravels SAND and silt, brown, sand is fine—to medium—grained, loos dry Cobbles at base of sampler Very dense and hard — no cobbles SAND w/ silt and gravels, mottled orange, sand is fine—to medium—grained, very dense, hard | | G | 5 0 5 20 25 | 10/20 2" PM" |
| Descr | iption | n/Litholo Sample Sample | gic | \ ₹ | | Groundwater Level at Time of Drilling Gradational Contact Static Groundwater Level | | Concrete | | 10/20 2" PVC Colorado Silica Sand Casing |
| No R | ecover, le Sub | y omitted | , | SC NS NT | s T | Sheen Detected Contact No Sheen Detected Located Not Tested Approximately Not Tested Color Charts Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact Contact | | Bentonile | - ' | 2" PVC Screen Casing (0.010 slots) |



| Internation | nal I | ncorpo | rate | ed | | | | | PAGE 2 OF 2 |
|------------------------|---------------------------|-----------------|--------------|---------------------------------------|---|--------------------------|--------------------------------|---------------------|---|
| FACILITY LOCATION | FT CA | JAME MAS. | S S | SPECI. | IGTON | SURI | .08716.003 FACE ELEVA | ITION | |
| | | | | | FINISH <u>1150 08/01/00</u> MONITORING DEVICE | | | | |
| LOGGED SURCONI | BT RACI | DEC TOR A | MA | FOU | IPMENT <u>Geotech Geoprobe</u> | rig utilizing # 4' m | acrosampier | line | d |
| COMMENT | | | | | | | | | |
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| PENETRATION RESULTS | S to | | | feet | | | tion tion | Below, | Well Construction |
| RESULTS | 2 4 | Oig g | 5 | ie Be | Lithologic Des | scription | 30 | Ç Ø | Schematic |
| BLOWS | Sample Interval, | PID Reading | Sheen | Depth Below Surface, feet | | · | Unified Soil Classification | Depth B Surface, | |
| 6"/6"/6" | S E | 9 | \ <u>'</u> ' | | | | 16%9 | 25 | |
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| | | 0.4 | | F | | | GC 1988 | - | 🔯 |
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| | \bowtie | 0.5 | | _ 30 | Clayey, gravelly, SILT, orange/brown, | , firm, moist | | — 30 | 🔯 |
| | \bowtie | | | - | | | <u> </u> | - | |
| | | | Ì | E | Boring terminated at 31.5 feet (ref | fusal). | - | - | |
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| | d Som | en/Litho | doale | | Groundwater Level at | | [7] (t- | Res. | 10/20 2" PVC |
| Des | cription | 'Sampl | a T | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | | Gradational Contact | Concrete | | Colorado Silica Sand Blank Casing |
| | | Sample | | s 0 | | / Contact | <u></u> - | | 2" PVC Soreen |
| | Recove | ery ubmitted | | NS | No Sheen Detected | Located Approximately | Bentonite | | Screen Casing (0.010 slots) |
| * for | Laboro Laboro Nysis | | • | (2.5Y | ^r Not Tested 4/2) Munsell (1990) Soil Color Chart | Contact | LXXI | | End Cap |



| FACILITY FT JAMES SPECIALTY CHEMICAL LOCATION CAMAS, WASHINGTON START 1420 08/01/00 FINISH 1500 08/01/00 CASING TOP ELEVATION NA LOGGED BY DEC MONITORING DEVICE Mini RAE 2000 w/ 100 ppm isobutylene SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined COMMENTS w/ acrylic sleeve | | | | | | | | | | | | |
|---|---------------------|----------------------------------|---|---|------------------------------|--|--|--|--|--|--|--|
| | | | | | | | | | | | | |
| PENETRATION RESULTS BLOWS BLOWS 6"/6"/6"/6" | Reading Sheen | Depth Below Surface, feet | Lithologic Description | Uniffed Soil Classification | Depth Below Surface, feet | Well Construction Schematic | | | | | | |
| | 0.0 24.2 30.1 | 5 10 10 15 15 1 20 1 25 | Gravelly SiLT w/ sand, brown, gravels are fine to coarse, sand is fine—to medium—grained, medium dense, wet Silty SAND w/ gravels, tan/brown, gravel is fine to medium, sand is fine to medium, medium dense, damp | Service Control Contr | 5 - 10 - 20 - 25 | | | | | | | |
| Field Screen/I Description So Preserved Sam No Recovery Somple Submit for Laboratory Analysis | npie ilted | ₩ \$D NS NT (2.5Y 4/ | Groundwater Level at Time of Drilling Gradational Contact Sheen Detected Contact No Sheen Detected Located Approximately Not Tested (2) Munsell (1990) Soil Color Charts Contact | Concrete | 1833 | 2" PVC Colorado Silica Sand 2" PVC Blank Casing 2" PVC Screen Casing (0.010 slots) End Cap | | | | | | |



| International Inco | rporated | | | | PAGE 2 OF 2 |
|--|---|---|--------------------------------|--|--------------------------------------|
| FACILITY FT JA | MES SPEC | JOB # 015. | <u>08718.003</u> | 1 | BORING/WELL_ GP-9 |
| LOCATION _CAMA | S. WASHII | NGTONSURF | ACE ELEV IG TOP E | | |
| START 1420 08 | | FINISH <u>1500 08/01/00</u> CASIN MONITORING DEVICE MINI RAE 2000 W/ | | | 4 |
| LOGGED BY <u>DE</u> SUBCONTRACTOR | AND FOL | JIPMENT Geotech Geoprobe rig utilizing a 4' ma | crosample | r line | 1 |
| COMMENTS W/ | crylic siee | Ve | | | |
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| PENETRATION & to | foet | | tion tion | Below ,, feet | Well Construction |
| BLOWS SHOWS OF THE | Reading Sheen Depth Below Surface, feet | Lithologic Description | Unified Soil Classification | Depth Bu Surface, | Schematic |
| BLOWS Sample DID | Readin Sheen Depth 1 | | Class | Dep Surf | |
| 6"/6"/6" & E | _ 25 | | 6000 | 25 | [KXI] |
| | | coarse, trace silt, medium dense, moist | GM DO | _ | |
| | .e F | | 6666 | _ | |
| | I F | Boring terminated at 27.5 feet (refusal). | 1 8,019,9 | <u> </u> | |
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| | | | <u> </u> | <u> </u> | 10/20 2" PVC |
| ZZZ Field Screen/ Description Sc | mpla 🌂 | | Concrete | | Colorado Blank Silica Sand Casing |
| Preserved Sai | • | Static Groundwater Level | السا | <u> </u> | G 0.00 |
| No Recovery | ٨ | D Sheen Detected Contact Located Located Approximately | Bentonit | • | Screen Casing (0.010 slots) |
| Sample Subm * for Laborator | , ^ | T Not Tested | DXXI | | (0.010 slots) ■ End Cap |



| LOCATION START <u>18</u> LOGGED E | <u>CA</u> 520 Y | MAS, 08/0 DEC | W/ 1/00 | I <i>SHIN</i> | | ACE NG / 10 | ELEV TOP E 0 ppm | ATION LEVA <u>Isobu</u> | N NA TION NA : |
|---|---|---------------------|------------|------------------------------|--|--------------------|--|-------------------------------|--|
| COMMENTS | | | | | | | | | |
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Deptin Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lithologic Description | | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic |
| | | 0.5 | | 5 10 15 - 20 - 25 | Asphalt surface Sity SAND and gravel, mottled brown, gravels are fine to coarse, sand is fine to medium, dense, dry Sand grades coarser Same w/ cobbles present Sandy, silty GRAVELS w/cobbles, brown, gravels are fine to coarse, sand is fine to coarse, loose, dry Clayey, gravelly SiLT, brown, gravels are fine to coarse, trace fine sand, firm, wet Boring terminated at 21.5 feet (refusal). | GI | And States Copying Cop | 5 10 15 - 20 - 25 | |
| Descrip Preser No Re Sample | otion ved S covery s Sub borate | nitted | - | SD NS NT | Groundwater Level at Time of Drilling Gradational Contact Static Groundwater Level Sheen Detected Contact Located Approximately Not Tested | | Concrete Bentonite | | 10/20 Colorado Silica Sand 2" PVC Casing 2" PVC Screen Casing (0.010 slots) End Cap |
| Analysi | 5 | | | 2.5Y 4 | /2) Munsell (1990) Soll Color Charts Contact | www. | | | DWG: 15-8716-3L |



| | Internation | nal I | ncorpo | rate | ed. | | | | | PAGE 1 OF 1 |
|--|---|--------------------------------------|--------------------------------------|-------------|------------------------------|--|--|--|---|-------------------------------------|
| | FACILITY LOCATION START LOGGED SUBCONT | FT CA 1600 BY RAC | JAME MAS. 08/0 DEC TOR A | #/ 1/00 | SPECIA SHIN | GTON FINISH <u>08/01/00</u> MONITORING DEVICE <u>Mir</u> IPMENT <u>Geotech Geoprobe rig</u> | SUR CAS NI RAE 2000 V | FACE ELEVA NNG TOP EL V / 100 ppm | NTION LEVAT I <mark>sobu</mark> l | TON NA tylene |
| ۱ | COMMENT | S <u> </u> | // BCF | <u>YIIC</u> | 8186V | 3 | | | | |
| | PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lithologic Descrip | otion | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic |
| A Company of the Comp | [777] Flok | Screen | en/Lithen Sampl | Nogic . | 5 | Asphalt surface Silty SAND, brown, sand is medium grained to medium, loose, dry No recovery (4-8' bgs) Silty, sandy, GRAVEL, brown, gravel is mesand is fine, loose, dry Boring terminated at 10.5 feet (refusal). | dium to coarse, | SM SO CONCrete | 5 10 20 | 10/20 Z* PMC Blank |
| | Pres | served | Sample | | * | Static Groundwater Level ,' Sheen Detected | / Contact | | | Silica Sand Casing |
| | * San | Recove spie St Laboro lysis | ubmilled | , | SD NS NT (2.5Y 4 | No Sheen Detected Not Tested N/2) Munsell (1990) Soil Color Charts — | Contact Localed Approximately Contact | Bentonite | | Screen Casing (0.010 slots) End Cop |



| FACILITY FT JAMES SPECIALTY CHEMICAL LOCATION CAMAS, WASHINGTON START 0745 08/02/00 FINISH 0815 08/02/00 CASING TOP ELEVATION NA LOGGED BY DEC MONITORING DEVICE Mini RAE 2000 W/ 100 ppm isobutylene SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined COMMENTS W/ acrylic sleeve | | | | | | | | | |
|---|-----------------|-----------------------------|--|--------------------------------|------------------------------|---|--|--|--|
| PENETRATION RESULTS BLOWS 6"/6"/6" 85 | PID Reading | Surface, feet | Lithologic Description | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic | | | |
| Field Screen, Description 3 | 0.9 1.0 0.9 | 5 10 5 - 20 - 25 | Asphalt surface Gravelly SAND, gray, sand is fine to medium, loose, dry SILT, dark brown, trace fine sand, wood debris present, firm, dry SILT w/sand and gravel in varying quantities, multicolored, damp SILT, brown, trace small to medium gravels, firm, damp SILT w/ gravels, brown, gravel is fine to coarse, firm/dense, damp Boring terminated at 14.5 feet (refusal). | GM CONCrete | - 5 - 0 - 10 - 20 | 0/20 2° PVC | | | |
| Preserved So No Recovery Sample Subrifor Laborator Anolysis | omple mitted | SD NS NT (2.5Y 4/2 | Static Groundwater Level Sheen Detected No Sheen Detected Not Tested Contact Located Approximately | Bentonite | | colorado illica Sand Blank Casing 2" PVC Screen Casing (0.010 slots) End Cap | | | |



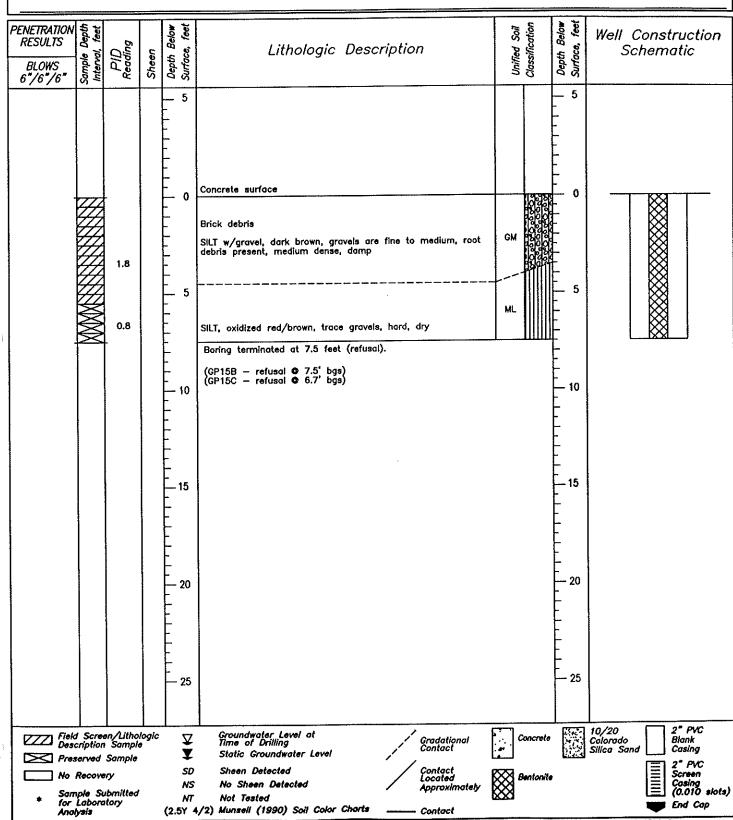
| • | nternat | lion | ノヽ al li | PL DE | v orate | d | | | | | | PAGI | E 1 | OF | 1 |
|------|--|--|-----------------------|------------------|-------------------|------------------------------|--|-------------------|-------------------------|---|---------------------|-------------------------|-------------|--------------------|--------|
| | | | | | | | ALTY CHEMICAL JOB | # _ | 015.0871 | 8.003 | E | BORING/V | VELL. | GP-13 | 3 |
| J. | OCATI | ON | CA | MAS | WA | SHIN | GTON | S | <i>URFACE</i> | ELEVA | <i>NON</i> | <u>NA</u> | | | — |
| : | START | RRT <u>0830 08/02/00</u> FINISH <u>0848 08/02/00</u> | | | | | | | CASING TUP ELEVATION NA | | | | | | |
| Ľ | LOGGED BY <u>DEC</u> MONITORING DEVICE <u>Mini RAE 2000 w/ 100 ppm isobutylene</u> SUBCONTRACTOR AND EQUIPMENT <u>Geotech Geoprobe rig utilizing a 4' macrosampler lined</u> | | | | | | | | | | | | | | |
| | COMMENTS W/ acrylic sleeve | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| Pi | ENETRATI RESULTS | ON | S to | | | feet feet | | | 3 | tion t | Below , feet | Well Co | onstr | ructio | n |
| L | RESULTS | | 9 6 | PID Reading | 5 | Depth Below Surface, feet | Lithologic Description | | | Classification | Se B | | ema | | • |
| | BLOWS | .,, | Sample L Interval, | People | Sheen | Depti | - | | 200 | Coss | Depth B Surface, | | | | |
| - | 6"/6"/6 | <u>'</u> | <i>S</i> ≈ | | - | | | | | · T · · · · · · · · · · · · · · · · · · | | | | | |
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| | | | | | | - | | | | | - | | | | |
| | | j | | | | - | | | 1 | <u> </u> | - | | | | |
| | | | | | | - , | Asphalt surface | | | | - 0 | <u></u> | D-V-4- | | _ |
| | | 1 | 44 | - | | - 0 | | | | | - | | \bowtie | | |
| | | ĺ | | | | - ' | SILT, brown, some gravels and cobbles, gravels or coarse, trace fine sand, soft, damp | re fine | to ML | | - | | \bowtie | | |
| | | | | | | - | | | | | - | | \boxtimes | | |
| | | ŀ | \mathcal{H} | | | - | | | | | - | | \bowtie | | |
| | | | \mathbb{Z} | 0.0 | | 5 | GRAVEL w/sand, gray, gravels are fine to coarse, | sand i | is SW | | - _ 5 | | \bowtie | | |
| | | | \bowtie | | | E | fine to medium, loose, dry | | 3" | | - - | | \bowtie | | |
| | | f | \simeq | _ | | L | Boring terminated at 6.5 feet (refusal). | | .1 | -!: | - | L | 100 | | |
| 1.00 | | | | | | _ | | | | | - | | | | |
| | | | · | | | _ | (GP13B - refusal 0 6.5' bgs) (GP13C - refusal 0 6.3' bgs) | | | | - | | | | |
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| | | | | | | | | | | | | | | | |
| - | | ~ | <u> </u> | | -1 | | Conventional at 1 | | المنا | | <u>।</u> | 10/20 | | ?" PVC | |
| | | Desc | ription | en/Litha Samp | le | ∇ ¥ | Groundwater Level at Time of Drilling Gn Static Groundwater Level | adation intact | al . | Concrete | | Colorado Silica Sand | | Blank Casing | |
| | | | | Sample | , | ₹ SD | · / | ntoct cated | L | | ******* | | | ?" PVC Screen | |
| | | | Recove Na Si | rry ibmilled | 4 | NS | No Sheen Detected / Ap | cated proxim | ately 🞇 | Bentonite | | | l≣l∢ | Casing 10.010 s | siots) |
| | ₹ . | | Laboro | | - | <i>NT</i> (2.5Y 4 | | ontact | (XX) | | | | ' | nd Cop | |



| FACILITY FT JAMES SPECIALTY CHEMICAL LOCATION CAMAS, WASHINGTON START 0923 08/02/00 FINISH 0955 08/02/00 LOGGED BY DEC MONITORING DEVICE Mini RAE 2000 w/ 100 ppm isobutyiene SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined COMMENTS w/ acrylic sleeve | | | | | | | | | | |
|---|--------------------------------|------------------------------------|-------|-----------------------------------|--|--------|---|------------------------------|--|--|
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lithologic Description | | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic | |
| | | 22.8 | | - 5 - 0 - 5 - 10 - 15 | Asphalt surface Clayey SILT, brown, trace medium gravels, firm, dar SILT and gravels, gray, gravels are medium to coar firm, dry SILT, dark gray, very stiff, dry Boring terminated at 8 feet (refusal). (GP14B - refusal • 7.0' bgs) (GP14C - refusal • 7.0' bgs) | | ML | 5 - 10 - 20 - 25 | | |
| Descr Prese | iption | n/Litholo Sample Sample Y | gic | ∇ ▼ so | Static Groundwater Level / Conta | rct. | Concrete | 18.73 | 10/20 Colorado Silica Sand 2° PVC Blank Casing 2" PVC Screen | |
| * Sample Submitted for Laboratory Analysis | | | (2 | NS NT .5Y 4, | No Sheen Detected Appro Not Tested (2) Munsell (1990) Soil Color Charts — Conta | ximate | • | | Casing (0.010 slots) End Cap | |



015.08716.003 BORING/WELL GP-15 FACILITY FT JAMES SPECIALTY CHEMICAL JOB # SURFACE ELEVATION __ ŃΑ LOCATION CAMAS. WASHINGTON CASING TOP ELEVATION_ FINISH 1420 08/02/00 START <u>1400 08/02/00</u> MONITORING DEVICE Mini RAE 2000 w/ 100 ppm isobutylene LOGGED BY DEC SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe rig utilizing a 4' macrosampler lined COMMENTS w/ acrylic sleeve



Contact

DWG: 15-8716-3L

(2.5Y 4/2) Munsell (1990) Soil Color Charts



| FACILITY <u>FT JAME</u> LOCATION <u>CAMAS</u> , START <u>0800 08/0</u> LOGGED BY DEC | WASHIN 3/00 | <u>GTON</u> SUI FINISH <u>0810 08/03/00</u> CAS | RFACE ELEV. SING TOP E | /ATION N ELEVATION N | |
|--|---------------------------------------|--|---|---------------------------------------|--|
| | ND EQU | MONITORING DEVICE Mini RAE 2000 IPMENT Geotech Geoprobe rig utilizing a 4' | w/ 100 ppm macrosample | er lined | |
| PENETRATION Sample Septing Sep | Sheen Depth Below Surface, feet | Lithologic Description | Unified Soil Classification | | Construction chematic |
| 0.7 | 5 | Gravelly SiLT, brown, gravels are fine to medium, loose, dry Boring terminated at 2.7 feet (refusal). (GP16B — refusal © 2.5' bgs) (GP16C — refusal © 2.5' bgs) | (A) (A) (A) (A) (A) (A) (A) (A) (A) (A) | | |
| Field Screen/Litholog Description Sample Preserved Sample No Recovery Sample Submitted for Laboratory Analysis | SD NS NT | Groundwater Level at Time of Drilling Gradational Static Groundwater Level Sheen Detected Contact Located Approximately Not Tested 2) Munsell (1990) Soil Color Charts Contact | Concrete Bentonite | 10/20 Colorado Silica Sand | 2" PVC Blank Casing 2" PVC Screen Casing (0.010 slots) End Cop |



| Internatio | nal l | ncorpo | \ orate | ed | | | | | PAGE 1 OF 1 |
|---|---|--------------------------------------|--------------------|------------------------------|---|----------------------------------|--------------------------------------|--------------------------------|---|
| FACILITY LOCATION START _ LOGGED | FT G / 1015 BY RAC | JAMI MAS. 08/0 DEC TOR A | ES S W/ 2/00 | SPECIA SHIN D | FINISH <u>1035 08/02/00</u> MONITORING DEVICE Mini RAE 20 0 PMENT Geotech Geoprobe rig utilizing a | SURFAI CASINO 00 w/ | CE ELEV G TOP E 100 ppm | ATION LEVAT Isobu | TION NA tylene |
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lithologic Description | | Unified Soil Classification | Depth Below | Well Construction Schematic |
| | | 82.8 792 7.0 | | 5 - 0 - 5 - 10 - 15 20 | Concrete surface w/ fiberglass SILT and gravel, brown, gravels are fine to coarse, odd present, medium dense/firm, damp SILT, sand, and gravel, brown/gray, gravel is fine to coard is fine to medium, strong odor present, medium damp Boning terminated at 9 feet (refusal). (GP178 — refusal • 7.5' bgs) | i - jakiye ya da ku | G | 0 - 5 - 10 - 25 - 25 | |
| Pres | served Recove | ıbmitted | | SD NS NT (2.5Y 4 | Groundwater Level at Time of Drilling Static Groundwater Level Sheen Detected No Sheen Detected Not Tested /2) Munsell (1990) Soll Color Charts — Contact | <u>.</u> | Concrete Bentonite | | 10/20 Colorado Silica Sand 2" PVC Blank Casing 2" PVC Screen Casing (0.010 slots) End Cap |

DWG: 15-8716-3L



| Internati | onal I | ncorpo | rate | ed | | | | | PAGE 1 OF 1 |
|------------------|------------------------------|-----------------------|---------------------|------------------------------|--|--------------|----------------|---------------------|--------------------------------|
| | | | | | | .08716 | .00 | 3 | BORING/WELL GP-17C |
| LOCATIO START | N <u>C/</u> 1115 | <u>AMAS.</u> OR/O2 | <u>-WA</u> 2/00 | I <i>SHIN</i> | | | | | V <u>NA</u> TION NA |
| LOGGED | | | ,, , , , | | MONITORING DEVICE MINI RAE 2000 W. | | | | |
| SUBCON | ITRAC | TOR A | | | IPMENT <u>Geotech Geoprobe rig utilizing a 4' m</u> | acrosa | mple | r line | od |
| COMMEN | V/S <u>v</u> | v/ acr | ylic | <i>81001</i> | 6 | | | | |
| PENETRATIO | N S = | | | * * | | | <u> </u> | a ** | |
| RESULTS | 18,5 | ng (| | Depth Below Surface, feet | Lithologic Description | Unified Soil | Classification | Below feet | Well Construction |
| BLOWS | Sample , Interval, | PID Reading | Sheen | epth | Enthologic Description | nifiec | assif | Depth B Surface, | Schematic |
| 6"/6"/6" | S E | ~ | S | | | 10 | | ļ | |
| | | | | _ 5 - | | | | _ 5 | |
| | | | | _ | | | | F | |
| | | | | | | | | - - | |
| | | | | - | | | | - | |
| | | | | 0 | Asphalt/fiberglass surface | | | _ 0 | |
| | | | | _ | | | 3600 3600 | <u> </u> | |
| | | | | - | | GM | | <u>-</u> | |
| | | | | - | SHT sand and group brown army group is fine to course | " | | - - | 💹 |
| | | | | - | SILT, sand and gravel, brown/gray, gravel is fine to coarse, sand is fine to medium, no odor, medium dense, damp | | | | |
| | | | | 5 | | 1 | | _ 5 | 🔯 |
| | \bowtie | 1.2 | | | | | | - | |
| | | | | - | Zeolite present | | | - | 🔯 |
| | | | | - - | | ML | | - | 🔯 |
| | | 17.1 | | - - - 10 | SILT, black, some smali gravels, hard, dry | | | 10 | |
| | \otimes | | | - '` | oici, bidox, some sindir gravers, hard, dry | | | - ' | |
| | | - | | - | Boring terminated at 11.5 feet (refusal). | | 111111 | - - | |
| | | | | | (GP17B refusal ⊙ 7.5' bgs) | | | - | |
| | | | | - 15 | | | | 15 | |
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| | | | , F | - | | | | _ | |
| | | | . E | - 25 | | | | 25 | |
| | | | | 2.0 | | | | 10 | |
| | | | | | | | | | |
| ZZZ Field | d Scree cription | n/Litholo Sample | gic | ₹ | Groundwater Level at Gradational | Cor | crete | | 10/20 2" PVC Colorado Blank |
| Pre: | served : | Sample | | ▼ SD | Static Groundwater Level Contact | | | | Silica Sand Casing |
| | Recover nple Sul | • | | NS. | Sheen Detected Contact No Sheen Detected Approximately Approximately | ⊗ Ber | donite | | |
| * for | ipie sui Laborat lysis | | ¢ | <i>NT</i> 2.5Y 4, | Not Tested /2) Munsell (1990) Soll Color Charts ——— Contact | EXX3 | | | (0.010 slots) End Cap |

DWG: 15-8716-3L



| Internatio | nal I | ncorpo | orate | ed. | | | PAGE 1 OF 1 |
|---|-----------------|-----------------------------|----------|------------------------------|---|---|---|
| FACILITY | FT | JAME | :s s | PECI | ALTY CHEMICAL JOB # | 015.08718.003 | BORING/WELL GP-18 |
| LOCATION | | | | | 91.77 | SURFACE ELEVAT CASING TOP ELE | |
| START _ | | | | | FINISH <u>08/03/00</u> MONITORING DEVICE MINI RAE 200 | | |
| LOGGED | DI RAC | TOR A | 1ND | FOU | PMENT Geotech Geoprobe rig utilizing a | 4' macrosampier l | ined |
| COMMEN | rs <u>u</u> | // BCF | ylic | sleev | • | | <u> </u> |
| | | | | | | | |
| PENETRATION RESULTS BLOWS 6"/6"/6" | ptt cet | | | olow feet | | Unified Soil Classification Depth Below | Well Construction |
| KESULIS | d to | 6 ding | eu | h B | Lithologic Description | fied siffice at the E | Schematic |
| BLOWS 6"/6"/6" | amp | PID Reading | Sheen | Depth Below Surface, feet | | Clas Dep | Sur |
| 0/0/0 | 5, - | | <u> </u> | 5 | | | 5 |
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| | | | | _ | | | |
| | | | | _ 0 | Basalt | | 0 |
| | \bowtie | 1.0 | | _ | Sand, SILT w/gravel, loose, damp | GM POOR | |
| <u> </u> | | | | _ | Boring terminated at 1.5 feet (refusal). | - | <u> </u> |
| | | | | - | (GP18B — refusal ♥ 1.5' bgs) (GP18C — refusal ♥ 1.5' bgs) | F | |
| | | | | <u> </u> | (GP18C — refusal © 1.5' bgs) | F | |
| | | | | 5 | | <u> </u> | 5 |
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| | | | | | | | |
| TTT Flak | d Sam | en/Lithe | oloalc | L | Groundwater Level at | concrete | 10/20 2° PVC |
| | | en/Litho Sampl Sample | | ₹ | Time of Drilling Gradatic Static Groundwater Level Groundwater Level | inai Concrete | Colorado Blank Silica Sand Casing |
| I | Recov | | | SD | Sheen Detected Contact | Bentonite | 2" PVC Screen Casing (0.010 stats) |
| San | nple Si | ubmitted | , | NS NT | No Sheen Detected Approxin | nately | Casing (0.010 slots) |
| * for | Labori Iysis | | | <i>NT</i> (2.5Y 4 | Not lested (1/2) Munsell (1990) Soil Color Charls ———— Contact | هدعدي | End Cap |

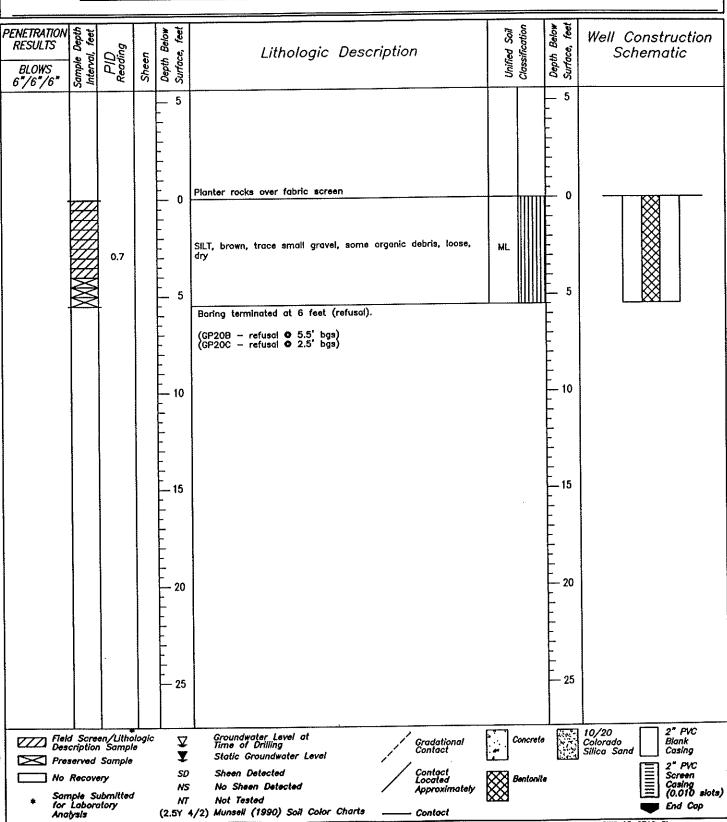


| LOCATION START LOGGED | <u>CA</u> 08/0 BY RAC | MAS. 3/00 DEC TOR A | W/ | EQU | FINISH <u>08/0</u> MONITORI IPMENT <u>Geote</u> | 03/00 NG DEVICE_ | Mini RAE 200 | SURFAC CASING 00 w/ 1 0 | E ELEV TOP E 00 ppm | ATION LEVA Isobu | TION <u>NA</u> |
|--|--|------------------------------|-------|------------------------------------|---|--|--|--------------------------------------|----------------------------------|------------------------------|---|
| PENETRATION RESULTS BLOWS 6"/6"/6" | Sample Depth Interval, feet | PID Reading | Sheen | Depth Below Surface, feet | Lith | ologic Des | cription | | Unified Soil Classification | Depth Below Surface, feet | Well Construction Schematic |
| | | 0.6 | | - 5 - 0 - 10 - 15 - 20 | Basalt Sandy SILT w/gravel Boring terminated of (GP19B - refusal (GP19C | t 1 feet (refusal) 1.0' bgs) 1.0' bgs) |). | | GM POO | 5 - 10 - 15 20 25 | 10 (20 77 01/0 |
| Description Descri | iption rved S scover le Sul sborat | mitted | | SD NS NT (2.5Y 4) | Groundwater Leve Time of Drilling Static Groundwate Sheen Detected No Sheen Detect Not Tested (2) Munsell (1990) S | er Level | Gradation Contact Contact Located Approxim | <u></u> | Concrete Bentonite | Sec. 25. | 10/20 Colorado Silica Sand 2" PVC Blank Casing Casing (0.010 slots) End Cop DWG: 15-8718-3L |

DWG: 15-8716-3L



| | <u> </u> |
|--|---|
| FACILITY FT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08716.003</u> BORING/WELL <u>GP-20</u> |
| LOCATION CAMAS. WASHINGTON | "SURFACE ELEVATIONNA |
| START 0945 08/03/00 FINISH 1000 08/03/00 | CASING TOP ELEVATION NA |
| 377111 <u>00+0 00/00/00</u> | |
| LOGGED BY DEC MONITORING DEVICE | Mini RAE 2000 w/ 100 ppm isobutylene |
| SUBCONTRACTOR AND EQUIPMENT Geotech Geoprobe | rig utilizing a 4' macrosampier linea |
| COMMENTS w/ acrylic sleeve | |
| | |



APPENDIX B LABORATORY ANALYTICAL REPORTS SOIL SAMPLES

2000 Site Investigation Report Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington SECOR PN: 015.08860.002 January 17, 2001



11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223 425.420.9200 fax 425.420.9210 East 11115 Montgomery, Suite B, Spokane, WA 99206-4776 509.924.9200 fax 509.924.9290 Seattle

Spokane

9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210 Portland

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---------------|---------------|--------|----------------|----------------|
| GP1 | P008088-01 | Soil | 08/01/00 08:09 | 08/03/00 16:00 |
| GP3 | P008088-03 | Soil | 08/01/00 09:00 | 08/03/00 16:00 |
| GP4 | P008088-04 | Soil | 08/01/00 09:45 | 08/03/00 16:00 |
| GP5 | P008088-05 | Soil | 08/01/00 10:22 | 08/03/00 16:00 |
| GP6 | P008088-06 | Soil | 08/01/00 13:18 | 08/03/00 16:00 |
| GP7C | P008088-09 | Soil | 08/01/00 14:03 | 08/03/00 16:00 |
| GP8 | P008088-10 | Soil | 08/01/00 11:50 | 08/03/00 16:00 |
| GP9 @ 12' | P008088-12 | Soil | 08/01/00 14:35 | 08/03/00 16:00 |
| GP9 @ 27.5' | P008088-13 | Soil | 08/01/00 15:00 | 08/03/00 16:00 |
| GP10 | P008088-14 | Soil | 08/01/00 15:43 | 08/03/00 16:00 |
| GP11 | P008088-15 | Soil | 08/01/00 16:12 | 08/03/00 16:00 |
| GP12 | P008088-16 | Soil | 08/02/00 08:15 | 08/03/00 16:00 |
| GP13 | P008088-17 | Soil | 08/02/00 08:48 | 08/03/00 16:00 |
| GP14 @ 8' | P008088-19 | Soil | 08/02/00 09:50 | 08/03/00 16:00 |
| GP15 | P008088-20 | Soil | 08/02/00 14:20 | 08/03/00 16:00 |
| GP16 | P008088-21 | Soil | 08/03/00 08:10 | 08/03/00 16:00 |
| GP17 @ 6' | P008088-23 | Soil | 08/02/00 10:35 | 08/03/00 16:00 |
| GP17C @ 11.5' | P008088-25 | Soil | 08/02/00 11:48 | 08/03/00 16:00 |
| GP18 | P008088-26 | Soil | 08/03/00 09:15 | 08/03/00 16:00 |
| GP19 | P008088-27 | Soil | 08/03/00 08:55 | 08/03/00 16:00 |
| GP20 | . P008088-28 | Soil | 08/03/00 09:50 | 08/03/00 16:00 |
| GP2B | P008088-29 | Soil | 08/02/00 17:17 | 08/03/00 16:00 |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 1 of 98



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Portland 503.906.9200 fax 503.906.9210

541,383.9310 fax 541.382,7588

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711

Jecor

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Hydrocarbon Identification per NW-TPH Methodology North Creek Analytical - Portland

| | | Reporting | | | | | | | |
|------------------------------|--------|-----------|-----------|----------|----------------|-----------|--------------|----------|-------------|
| Analyte | Result | Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
| GP1 (P008088-01) Soil | | | | | Sampled: 08/01 | /00 Recei | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | n | #1 | Ħ | н | Ħ | н | |
| Heavy Oil Range Hydrocarbons | ND | 100 | ** | # | н | N | Ħ | Ħ | |
| Surr: 1-Chlorooctadecane | 109 % | 50-150 | | | | | | | |
| GP3 (P008088-03) Soil | | | | | Sampled: 08/01 | /00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | ti | н | H | н | tt | Ħ | |
| Heavy Oil Range Hydrocarbons | ND | 100 | n . | Ħ | ŧſ | er | " | 11 | |
| Surr: 1-Chlorooctadecane | 114 % | 50-150 | | | | | | | |
| GP4 (P008088-04) Soil | | | | | Sampled: 08/01 | i/00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| sel Range Hydrocarbons | ND | 50.0 | tt. | ** | ŧŧ | 49 | ** | 11 | |
| vy Oil Range Hydrocarbons | ND | 100 | ** | 11 | 11 | 11 | # | H | |
| Surr: 1-Chlorooctadecane | 105 % | 50-150 | | | | | | | |
| GP5 (P008088-05) Soil | | | | | Sampled: 08/01 | 1/00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | 11 | # | Ħ | Ħ | Ħ | Ħ | |
| Heavy Oil Range Hydrocarbons | ND | 100 | н | tt | tl | н | Ħ | H | |
| Surr: 1-Chlorooctadecane | 106 % | 50-150 | | | | | | | |
| GP6 (P008088-06) Soil | | | | | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | ′00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | et | ** | ** | | " | н | |
| Heavy Oil Range Hydrocarbons | ND | 100 | 11 | н | н | н | 11 | # | |
| Surr: 1-Chlorooctadecane | 93.5 % | 50-150 | | | | | | | |

North Creek Analytical - Portland

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 2 of 98



Tualatin, OR 97062

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Hydrocarbon Identification per NW-TPH Methodology

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|---------|-------|
| GP7C (P008088-09) Soil | | | | | Sampled: 08/01 | /00 Recei | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/09/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | ** | 44 | н | 11 | e | н | |
| Heavy Oil Range Hydrocarbons | ND | 100 | ** | 11 | 1I | ** | Ħ | н | |
| Surr: 1-Chlorooctadecane | 99.1 % | 50-150 | | | | | | | |
| GP9 @ 12' (P008088-12) Soil | | | | | Sampled: 08/01 | /00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | u | # | н | 27 | 18 | п | |
| Heavy Oil Range Hydrocarbons | ND | 100 | ŧŧ | 11 | и | tt. | " | H | |
| Surr: 1-Chlorooctadecane | 100 % | 50-150 | · | | | | | | |
| GP9 @ 27.5' (P008088-13) Soil | | | | | Sampled: 08/01 | /00 Recei | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | l | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | ** | # | н | tt | u | н | |
| Heavy Oil Range Hydrocarbons | ND | 100 | ee | 68 | 11 | Ħ | ** | н | / |
| Surr: 1-Chlorooctadecane | 102 % | 50-150 | | | | | | | , |
| GP10 (P008088-14) Soil | | | | | Sampled: 08/01 | /00 Recei | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | # | ŧŧ | ** | Ħ | " | Ħ | |
| Heavy Oil Range Hydrocarbons | ND | 100 | 11 | eF | 11 | Ħ | Ħ | Ħ | |
| Surr: 1-Chlorooctadecane | 108 % | 50-150 | | | | | | | |
| GP14 @ 8' (P008088-19) Soil | | | | | Sampled: 08/02 | /00 Recei | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | Ħ | # | ** | tt | " | e e | |
| Heavy Oil Range Hydrocarbons | ND | 100 | 11 | ** | 11 | TP | н | tt | |
| Surr: 1-Chlorooctadecane | 98.0 % | 50-150 | , | | | | | | |
| | | | | | | | | | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 3 of 98



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corت

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Hydrocarbon Identification per NW-TPH Methodology

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|---------|-------|
| GP20 (P008088-28) Soil | | | | | Sampled: 08/03 | /00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | " | n | н | н | e | Ħ | |
| Heavy Oil Range Hydrocarbons | ND | 100 | н | n | rt | 15 | # | H | |
| Surr: 1-Chlorooctadecane | 111 % | 50-150 | | | | | | | |
| GP2B (P008088-29) Soil | | | | | Sampled: 08/02 | 2/00 Rece | ived: 08/03/ | 00 | |
| Gasoline Range Hydrocarbons | ND | 20.0 | mg/kg dry | 1 | NWTPH HCID | 08/07/00 | 08/08/00 | 0080170 | |
| Diesel Range Hydrocarbons | ND | 50.0 | Ħ | 11 | ** | н | n | tt | |
| Heavy Oil Range Hydrocarbons | ND | 100 | н | н | 11 | # | tt | 19 | |
| Surr: 1-Chlorooctadecane | 98.0 % | 50-150 | | | | | | | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 4 of 98



Tualatin, OR 97062

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods

Project Manager: Joe Hunt

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|-------------------------------|--------|--------------------|------------|----------|---------------|------------|--------------|---------|--------|
| GP1 (P008088-01) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Arsenic | 5.20 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | ······ |
| Barium | 145 | 0.500 | н | le . | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | 0.542 | 0.500 | u | și | Ħ | Ħ | Ħ | ** | |
| Chromium | 20.7 | 0.500 | æ | ti. | Ħ | 11 | " | u | |
| Lead | ND | 10.0 | ŧr | н | ŧŧ | n | 08/14/00 | | |
| Mercury | ND | 0.100 | Ħ | н | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.988 | 0.500 | Ħ | н | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | н | tt | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP3 (P008088-03) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Arsenic | 6.46 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 114 | 0.500 | 11 | ** | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | 11 | ** | и | n | tt | н | |
| Chromium | 24.8 | 0.500 | 11 | tt | II | н | ti | n | |
| Lead | 14.5 | 10.0 | ti . | e | Ü | íi. | 08/14/00 | Ħ | |
| Mercury | ND | 0.100 | ** | tt | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.588 | 0.500 | # | Ħ | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | # 3 | tt | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP4 (P0 08088-04) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Arsenic | 5.76 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 155 | 0.500 | н | Ħ | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | н | н | н | H | " | t: | |
| Chromium | 48.3 | 0.500 | н | 11 | Ħ | Ħ | II. | er | |
| Lead | 17.7 | 10.0 | н | # | Ħ | Ħ | 08/14/00 | er . | |
| Mercury | ND | 0.100 | н | ** | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.939 | 0.500 | 11 | 11 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | 11 | ** | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |

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North Creek Analytical, Inc. **Environmental Laboratory Network**

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occor

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Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Not |
|------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-----|
| GP5 (P008088-05) Soil | | | | S | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Arsenic | 1.32 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/11/00 | 08/17/00 | 0080303 | |
| Barium | 91.9 | 0.500 | 11 | н | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |
| Cadmium | ND | 0.500 | n | Et | 11 | Ħ | Ħ | ħ | |
| Chromium | 4.54 | 0.500 | н | ** | Ħ | н | Ħ | 11 | |
| Lead | ND | 10.0 | Ħ | н | Ħ | Ħ | Ħ | н | |
| Mercury | ND | 0.100 | Ħ | Ħ | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 1.37 | 0.500 | * | *1 | EPA 6020 | 08/11/00 | 08/17/00 | 0080303 | |
| Silver | ND | 1.00 | 11 | #1 | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |
| GP6 (P008088-06) Soil | | | | 5 | Sampled: 08/0 | 1/00 Rece | ived: 08/03/0 |)0 | |
| Arsenic | 5.46 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/11/00 | 08/22/00 | 0080303 | |
| Barium | 126 | 0.500 | n | rı- | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |
| Cadmium | ND | 0.500 | Ħ | tr | Ħ | tt | n | ti | |
| Chromium | 29.4 | 0.500 | # | " | ** | et | Ħ | ıı . | |
| - d | 12.5 | 10.0 | n | 11 | ** | Ħ | H | n | |
| cury | ND | 0.100 | # | 11 | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.921 | 0.500 | н | Ħ | EPA 6020 | 08/11/00 | 08/17/00 | 0080303 | |
| Silver | ND | 1.00 | 11 | 11 | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |
| GP7C (P008088-09) Soil | | | | : | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| Arsenic | 0.629 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/11/00 | 08/22/00 | 0080303 | |
| Barium | 53.0 | 0.500 | " | Ħ | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |
| Cadmium | ND | 0.500 | ** | # | ** | tt | н | t) | |
| Chromium | 3.01 | 0.500 | Ħ | 11 | u | ** | Ħ | ŧŧ | |
| Lead | ND | 10.0 | Ħ | Ħ | Ħ | ч | Ħ | u . | |
| Mercury | 0.442 | 0.100 | H | | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.824 | 0.500 | н | | EPA 6020 | 08/11/00 | 08/17/00 | 0080303 | |
| Silver | ND | 1.00 | н | н | EPA 6010A | 08/11/00 | 08/14/00 | 0080304 | |

North Creek Analytical - Portland

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| GP9 @ 12' (P008088-12) Soil | | | | ; | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| Arsenic | 1.30 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 104 | 0.500 | н | Ħ | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | ** | H | Ħ | H | n | н | |
| Chromium | 88.3 | 0.500 | # | н | н | Ħ | Ħ | ti | |
| Lead | 10.4 | 10.0 | ** | u | н | Ħ | 08/14/00 | Ħ | |
| Mercury | ND | 0.100 | н | N | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.769 | 0.500 | #t | Ħ | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | tt | н | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP9 @ 27.5' (P008088-13) Soil | | | | : | Sampled: 08/0 | 1/00 Recei | ived: 08/03/0 | 00 | |
| Arsenic | 0.687 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 74.1 | 0.500 | Ħ | | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | ti | tt | ts | Н | ti | et . | |
| Chromium | 59.0 | 0.500 | Ħ | 11 | tf | н | | u | |
| Lead | 11.9 | 10.0 | н | н | tř | 11 | 08/14/00 | tr | |
| Mercury | ND | 0.100 | U | ıı. | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.874 | 0.500 | н | н | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | N | н | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP10 (P008088-14) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ived: 08/03/0 | 00 | |
| Arsenic | ND | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 120 | 0.500 | 11 | Ħ | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | u | ŧŧ | 11 | н | Ħ | 11 | |
| Chromium | 116 | 0.500 | ti | ** | # | н | Ħ | 11 | |
| Lead | ND | 10.0 | tt | e | " | Ħ | 08/14/00 | ti | |
| Mercury | ND | 0.100 | Pt . | Ħ | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 1.06 | 0.500 | Ħ | | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | ** | 45 | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |

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cor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods North Creek Analytical - Portland

| | | | · · | | | | | | |
|-----------------------------|--------|--------------------|-----------|----------|----------------|------------|--------------|---------|---------------------------------------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
| GP14 @ 8' (P008088-19) Soil | | | | S | Sampled: 08/02 | 2/00 Recei | ved: 08/03/0 | 00 | |
| Arsenic | ND | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 41.8 | 0.500 | н | н | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | 11 | 11 | Ħ | Ħ | H | ** | |
| Chromium | 1.40 | 0.500 | н | н | n | Ħ | * | 11 | |
| Lead | ND | 10.0 | \$f | " | ** | * | 08/14/00 | tt | |
| Mercury | ND | 0.100 | n | Ħ | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | ND | 0.500 | H | tt | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | 11 | ** | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP18 (P008088-26) Soil | | | | : | Sampled: 08/0 | 3/00 Rece | ived: 08/03/ | 00 | |
| Arsenic | 4.04 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Arsenic Barium | 499 | 0.500 | 11 | н | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | 1.73 | 0.500 | н | ** | tf | et | п | п | |
| Chromium | 19.3 | 0.500 | ar | 11 | 11 | 11 | н | ** | |
| z ad | 25.6 | 10.0 | A | Ħ | U | н | 08/14/00 | 11 | |
| | 0.676 | 0.100 | 91 | ** | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.560 | 0.500 | 18 | 11 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | н | tf | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| GP19 (P008088-27) Soil | | | | | Sampled: 08/0 | 3/00 Rece | ived: 08/03/ | 00 | · · · · · · · · · · · · · · · · · · · |
| Arsenic | 4.41 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 99.5 | 0.500 | | 11 | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | 1.54 | 0.500 | | Ħ | u | н | • | 11 | |
| Chromium | 23.6 | 0.500 | H | 11 | ** | tt | Ħ | " | |
| Lead | 29.6 | 10.0 | | ti | 11 | н | 08/14/00 | ** | |
| Mercury | 0.194 | 0.100 | n | Ħ | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.737 | 0.500 | | н | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | | Ħ | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| UNIVOI | - 1.2 | | | | | | | | |

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP2B (P008088-29) Soil | | | | 5 | Sampled: 08/0 | 2/00 Recei | ived: 08/03/ | 00 | |
| Arsenic | 1,29 | 0.500 | mg/kg dry | 1 | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Barium | 143 | 0.500 | et | Ħ | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |
| Cadmium | ND | 0.500 | | ** | tt | N | н | 11 | |
| Chromium | 23.0 | 0.500 | ** | ** | ** | 11 | # | ** | |
| Lead | ND | 10.0 | # | * | | ** | 08/14/00 | * | |
| Mercury | ND | 0.100 | Ħ | Ħ | EPA 7471A | 08/11/00 | 08/11/00 | 0080296 | |
| Selenium | 0.637 | 0.500 | Ħ | Ħ | EPA 6020 | 08/08/00 | 08/17/00 | 0080209 | |
| Silver | ND | 1.00 | Ħ | n | EPA 6010A | 08/07/00 | 08/14/00 | 0080175 | |

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541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals corئ

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

08/24/00 08:39

Polychlorinated Biphenyls per EPA Method 8082 North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP17 @ 6' (P008088-23) Soil | | | | S | Sampled: 08/0 | 2/00 Recei | ived: 08/03/ | 00 | |
| Aroclor 1016 | ND | 67.0 | ug/kg dry | 1 | EPA 8082 | 08/07/00 | 08/14/00 | 0080178 | |
| Aroclor 1221 | ND | 134 | н | ti | ŧŧ | Ħ | Ħ | er | |
| Arocior 1232 | ND | 67.0 | et | н | Ħ | н | н | ** | |
| Aroclor 1242 | ND | 67.0 | Ħ | * | Ħ | H | | 11 | |
| Arocior 1248 | 289 | 67.0 | ** | * | и | Ħ | * | н | |
| Aroclor 1254 | ND | 67.0 | Ħ | Ħ | et | # . | # | ** | |
| Aroclor 1260 | ND | 67.0 | н | н | Ħ | Ħ | Ħ | 16 | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 55.1 % | 63-119 | | | | | | | S-07 |
| Surr: Decachlorobiphenyl | 75.5 % | 52-131 | | | | | | | |
| GP17C @ 11.5' (P008088-25) Soil | | | | 5 | Sampled: 08/0 | 2/00 Rece | ived: 08/03/ | 00 | |
| Aroclor 1016 | ND | 67.0 | ug/kg dry | 1 | EPA 8082 | 08/07/00 | 08/10/00 | 0080178 | |
| Aroclor 1221 | ND | 134 | 11 | 1t | u | N | " | н | |
| Arocior 1232 | ND | 67.0 | n | 19 | tr | ** | 11 | tr | |
| clor 1242 | ND | 67.0 | n | п | 11 | H | Ħ | 49 | |
| | ND | 67.0 | Ħ | er . | ** | н | P. | #1 | |
| Aroclor 1254 | ND | 67.0 | Ħ | ** | n | n | #1 | Ħ | |
| Aroclor 1260 | ND | 67.0 | н | 11 | P | | 11 | Ħ | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 100 % | 63-119 | | | | | | | |
| Surr: Decachlorobiphenyl | 92.6 % | 52-131 | | | | | | | |

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Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Secor

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|--|----------|--------------------|-------------|----------|---------------|------------|-------------|-----------|------|
| GP1 (P008088-01) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/ | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 0,8/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | н | 11 | n | ŧI | # | ** | |
| Bromobenzene | ND | 100 | Ħ | н | Ħ | Ħ | H | 4 | |
| 3romochioromethane | ND | 100 | tt | н | b | et . | Ħ | II. | |
| Bromodichloromethane | ND | 100 | Ħ | * | Ħ | Ħ | Ħ | H | |
| Bromoform | ND | 100 | Ħ | 11 | # | н , | # | Ħ | |
| 3romomethane | ND | 500 | Ħ | ** | Ħ | Ħ | ** | н | |
| 2-Butanone | ND | 1000 | 11 | 11 | 11 | 11 | at . | н | |
| n-Butylbenzene | ND | 500 | п | 11 | # | н | ** | u | |
| ec-Butylbenzene | ND | 100 | н | 47 | # | u | ** | н | |
| ert-Butylbenzene | ND | 100 | 11 | 11 | ** | 11 | tt | н | |
| Carbon disulfide | ND | 1000 | ** | æ | ŧ | H | tr | ŧI | |
| Carbon tetrachloride | ND | 100 | 11 | n | ŧ | 10 | tt | 11 | |
| Chlorobenzene | ND | 100 | 11 | Ħ | tr | 11 | tt | 10 | |
| Chloroethane | ND | 100 | 10 | ti | tf | ts | u | # | |
| Chloroform | ND | 100 | ** | н | ıı | B | н | 45 | , |
| Chloromethane | ND | 500 | ŧi | н | н | H | 11 | ** | |
| 2-Chlorotoluene | ND | 100 | 44 | н | H | " | 11 | 41 | |
| i-Chlorotoluene | ND | 100 | 46 | ti | н | ** | 11 | ** | |
| ,2-Dibromo-3-chloropropane | ND | 500 | ** | H | Ħ | B | 11 | et . | |
| Dibromochloromethane | ND | 100 | # \$ | н | н | H. | ** | ** | |
| ,2-Dibromoethane | ND | 100 | 69 | н | n | ir . | ŧı | ti | |
| Dibromomethane | ND | 100 | 61 | н | п | Ħ | 19 | tt | |
| ,2-Dichlorobenzene | ND | 100 | er . | н | fl | ıı | 11 | 65 | |
| ,3-Dichlorobenzene | ND | 100 | H | 11 | н | н | 11 | U | |
| ,4-Dichlorobenzene | ND | 100 | er | Ħ | 11 | Ħ | 11 | p) | |
| Dichlorodifluoromethane | ND | 500 | ŧr | н | Ħ | н | ** | 11 | |
| ,1-Dichloroethane | ND | 100 | Ħ | н | 11 | н | e | BE . | |
| ,2-Dichloroethane | ND | 100 | Ħ | 11 | н | n | 11 | tt | |
| ,1-Dichloroethene | ND | 100 | ŧı | а | 44 | н | ** | et | |
| eis-1,2-Dichloroethene | ND | 100 | er | Ħ | 44 | н | e | ** | |
| rans-1,2-Dichloroethene | ND | 100 | tt | # | # | n | ** | tt | |
| 1,2-Dichloropropane | ND | 100 | н | 19 | 11 | н | 11 | er . | |
| ,3-Dichloropropane | ND | 100 | Ħ | Iŧ | ** | n | 11 | tt | |
| 2,2-Dichloropropane | ND ND | 100 | н | 48 | 11 | Ħ | | ti | |
| ,1-Dichloropropene | ND ND | 100 | Ħ | 11 | 41 | н | " | rt . | |
| is-1,3-Dichloropropene | ND ND | 100 | н | 4 | 11 | 11 | | tt | |
| | ND ND | 100 | н | 15 | • | 11 | | Ħ | |
| rans-1,3-Dichloropropene Ethylbenzene | ND ND | 100 | н | | ** | " | | | |

North Creek Analytical - Portland

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cor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|-----------|--------------|----------|-------|
| GP1 (P008088-01) Soil | | | | (| Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | I | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | Ħ | N | Ħ | H | * | |
| Isopropylbenzene | ND | 200 | ŧi | и | el | ** | н | н | |
| p-Isopropyltoluene | ND | 200 | Ħ | Ħ | Ħ | Ħ | 15 | Ħ | |
| 4-Methyl-2-pentanone | ND | 500 | ** | н | " | н | " | ** | |
| Methyl tert-butyl ether | ND | 100 | ** | н | # | н. | * | " | |
| Methylene chloride | ND | 500 | Ħ | Ħ | # | н | Ħ | 11 | |
| Naphthalene | ND | 200 | п | n | п | Ħ | н | 11 | |
| n-Propylbenzene | ND | 100 | tı | 11 | ** | 11 | Ħ | II | |
| Styrene | ND | 100 | 11 | 11 | " | 11 | 11 | H | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | 11 | н | 11 | Ħ | 11 | # | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | 11 | n | Ħ | н | Ħ | 11 | |
| Tetrachloroethene | ND | 100 | н | ** | H | н | Н | H | |
| Toluene | ND | 100 | ŧr | | ti . | ** | tr | H | |
| 1,2,3-Trichlorobenzene | ND | 100 | ** | 11 | 1t | 49 | 2\$ | ti ti | |
| 4-Trichlorobenzene | ND | 100 | 11 | н | * | #1 | ** | Ħ | |
| 1,1,1-Trichloroethane | ND | 100 | н | n | H | 11 | # | " | |
| 1,1,2-Trichloroethane | ND | 100 | H | H | н | Ħ | ft | 11 | |
| Trichloroethene | ND | 100 | ţi | 11 | tr | | н | 11 | |
| Trichlorofluoromethane | ND | 100 | 4 | 11 | W | 11 | Ħ | 11 | |
| 1,2,3-Trichloropropane | ND | 100 | # | 11 | ** | " | " | H | |
| 1,2,4-Trimethylbenzene | ND | 100 | Ħ | H | 41 | 11 | " | | |
| 1,3,5-Trimethylbenzene | ND | 100 | Ħ | ŧſ | Ħ | н | 11 | | |
| Vinyl chloride | ND | 100 | tr | н | н | Ħ | ** | H | |
| o-Xylene | ND | 100 | tt | # | * | " | " | | |
| m,p-Xylene | ND | 200 | 11 | 11 | Ħ | 11 | 11 | er | |
| Surr: 4-BFB | 90.9 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 92.1 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 87.1 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 83.0 % | 70-130 | | | | | | | |
| | | | | | | | | | |

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|-----------|-------|
| GP3 (P008088-03) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ved: 08/03/ | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | н | BE . | R | Ħ | Ħ | |
| Bromobenzene | ND | 100 | 11 | U | " | ** | ** | 11 | |
| Bromochloromethane | ND | 100 | # | H | * | W | Ħ | 11 | |
| Bromodichloromethane | ND | 100 | # | Ħ | Ħ | II | er . | # | |
| Bromoform | ND | 100 | * | # | er | н . | ŧI | tt . | |
| Bromomethane | ND | 500 | tr | 11 | 11 | H | Ħ | # | |
| 2-Butanone | ND | 1000 | āt | " | ti . | (I | 11 | tt | |
| n-Butylbenzene | ND | 500 | ŧŧ | 11 | 11 | н | 11 | tf | |
| sec-Butylbenzene | ND | 100 | *1 | e e | 11 | H | u | et | |
| tert-Butylbenzene | ND | 100 | tt | tt | 14 | n | 19 | et | |
| Carbon disulfide | ND | 1000 | Ħ | | 41 | 19 | 19 | # | |
| Carbon tetrachloride | ND | 100 | ti | tt | e | π | 19 | Ħ | |
| Chlorobenzene | ND | 100 | н | " | es | 11 | " | II | |
| Chloroethane | ND | 100 | II. | u | ** | 57 | # | п | |
| Chloroform | ND | 100 | θ | II . | в | ŧſ | 21 | U | - |
| Chloromethane | ND | 500 | и | 11 | B | ŧr | H | н | - I |
| 2-Chlorotoluene | ND | 100 | ** | II . | * | ti | a | н | - |
| 4-Chlorotoluene | ND | 100 | 4 | 11 | tf . | ŧı | EI | н | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | # | #1 | tt | n | н | 11 | |
| Dibromochloromethane | ND | 100 | ** | # | IP. | н | n | 11 | |
| 1,2-Dibromoethane | ND | 100 | ** | * | tt | 11 | U | " | |
| Dibromomethane | ND | 100 | es | 44 | II | n | II | 40 | |
| 1,2-Dichlorobenzene | ND | 100 | # | e | u | H | 11 | 11 | |
| 1,3-Dichlorobenzene | ND | 100 | " | e | Ħ | н | 11 | ft | |
| 1,4-Dichlorobenzene | ND | 100 | ** | ** | 11 | 11 | 11 | Ħ | |
| Dichlorodifluoromethane | ND | 500 | n | tt | ŧŧ | 11 | u | st | |
| 1,1-Dichloroethane | ND | 100 | Ħ | # | Ħ | 19 | Ħ | et | |
| 1,2-Dichloroethane | ND | 100 | " | " | 11 | 10 | e | er | |
| 1,1-Dichloroethene | ND | 100 | tr | ** | 11 | H | 11 | tr | |
| cis-1,2-Dichloroethene | ND | 100 | tt | R | ti | 11 | 48 | tt | |
| trans-1,2-Dichloroethene | ND | 100 | н | H | ** | 11 | tt | tt | |
| 1,2-Dichloropropane | ND | 100 | tf | H | ** | zŧ | ** | н | |
| 1,3-Dichloropropane | ND | 100 | ıı . | tt | ** | ** | tt. | H | |
| 2,2-Dichloropropane | ND | 100 | U | ti | a | ŧŧ | şŧ | 31 | |
| 1,1-Dichloropropene | ND | 100 | н | ıı | " | H | u | н | |
| cis-1,3-Dichloropropene | ND | 100 | 11 | п | н | 11 | н | U | |
| trans-1,3-Dichloropropene | ND | 100 | Ħ | 11 | n | н | n | н | |
| Ethylbenzene | ND | 100 | n | n | 11 | Ħ | н | H | |

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Spokane

Portland

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39

Project Manager: Joe Hunt Tualatin, OR 97062

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|---------|-------|
| GP3 (P008088-03) Soil | | | | Ş | Sampled: 08/0 | 1/00 Recei | ved: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | 11 | н | Ħ | #1 | Ħ | |
| Isopropylbenzene | ND | 200 | Ħ | 11 | n | H | rr | ** | |
| -Isopropyitoluene | ND | 200 | Ħ | н | н | н | . н | Ħ | |
| -Methyl-2-pentanone | ND | 500 | 11 | ŧŧ | tr | | 11 | # | |
| Methyl tert-butyl ether | ND | 100 | # | H | н | # . | ti | ** | |
| Methylene chloride | ND | 500 | H | 11 | Ħ | N | π | ** | |
| Vaphthalene | ND | 200 | +17 | н | ti | н | ti | 11 | |
| -Propylbenzene | ND | 100 | 11 | Ħ | " | 11 | " | н | |
| styrene | ND | 100 | H | 11 | st. | #1 | 11 | n | |
| ,1,1,2-Tetrachloroethane | ND | 100 | N | Ħ | 15 | Ħ | Н | Ħ | |
| ,1,2,2-Tetrachloroethane | ND | 100 | tt | u | н | Ħ | Ħ | n | |
| 'etrachloroethene | ND | 100 | ** | tt | II | tf | ** | н | |
| Toluene | ND | 100 | н | ** | Ħ | 18 | 11 | Ħ | |
| 2,3-Trichlorobenzene | ND | 100 | ‡í | n | ŧi | н | u | tr. | |
| 4-Trichlorobenzene | ND | 100 | tt | Ħ | Ħ | н | н | ** | |
| ,1,1-Trichloroethane | ND | 100 | ** | H* | 11 | ¥t | 11 | 11 | |
| .1,2-Trichloroethane | ND | 100 | H | et. | ŧŧ | #5 | 11 | ti | |
| Trichloroethene | ND | 100 | (1 | # | " | . 11 | 11 | Ħ | |
| richlorofluoromethane | ND | 100 | W | н | 11 | н | H | ** | |
| 1,2,3-Trichloropropane | ND | 100 | 11 | Ħ | Ħ | н | ** | н | |
| 1,2,4-Trimethylbenzene | ND | 100 | н | ** | tt | Ħ | # | Ħ | |
| 1,3,5-Trimethylbenzene | ND | 100 | Ħ | 11 | ** | Ħ | н | ** | |
| Vinyl chloride | ND | 100 | 46 | H | 11 | n | н | ** | |
| o-Xylene | ND | 100 | Ħ | ** | н | н | ** | Ħ | |
| m,p-Xylene | ND | 200 | Ħ | 11 | tt | # | 11 | tı | |
| Surr: 4-BFB | 93.0 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 90.7 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 86.4 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 87.6 % | 70-130 | | | | | | | |

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network**

Page 14 of 98



Tualatin, OR 97062

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Project Number: 015.08716.001

Reported: Project Manager: Joe Hunt 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP4 (P008088-04) Soil | | | | S | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | ** | ** | 11 | H | * | |
| Bromobenzene | ND | 100 | II | Ħ | 10 | H | ŧŧ | n | |
| Bromochloromethane | ND | 100 | Ħ | tt | H | Ħ | Ħ | Ħ | |
| Bromodichloromethane | ND | 100 | II. | II | ** | н | Ħ | н | |
| Bromoform | ND | 100 | н | H | n | н. | H | н | |
| Bromomethane | ND | 500 | # | 11 | н | Ħ | н | ** | |
| 2-Butanone | ND | 1000 | 11 | # | tr . | II | 11 | Ħ | |
| n-Butylbenzene | ND | 500 | H | ** | ŧŧ | н | н | Ħ | |
| sec-Butylbenzene | ND | 100 | 18 | 11 | II . | II | н | ** | |
| tert-Butylbenzene | ND | 100 | ** | 11 | ŧr | 11 | Ħ | tt | |
| Carbon disulfide | ND | 1000 | Ħ | 9 | н | 11 | Ħ | * | |
| Carbon tetrachloride | ND | 100 | er . | Ħ | н | 11 | Ħ | es | |
| Chlorobenzene | ND | 100 | # | ęŧ. | н | 11 | ** | 8 | |
| Chloroethane | ND | 100 | п | Ħ | н | ** | 11 | tt | |
| Chloroform | ND | 100 | u | t# | и | rt | 41 | Ħ | |
| Chloromethane | ND | 500 | H | Ħ | 11 | tt | 11 | tř | i |
| 2-Chlorotoluene | ND | 100 | н | Ħ | 11 | ** | ** | ti | |
| 4-Chlorotoluene | ND | 100 | н | n | 11 | n | ¥ | tr | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | ü | 11 | Ħ | n | e | Ħ | |
| Dibromochloromethane | ND | 100 | Ħ | 0 | | ŧı | er | Ħ | |
| 1,2-Dibromoethane | ND | 100 | 11 | II | t# | ti | n | н | |
| Dibromomethane | ND | 100 | Ħ | н | R | н | u | N | |
| 1,2-Dichlorobenzene | ND | 100 | 11 | H | ** | ** | н | н | |
| 1,3-Dichlorobenzene | ND | 100 | ** | ** | ŧŧ | " | n | Ħ | |
| 1,4-Dichlorobenzene | ND | 100 | tt. | ** | * | #1 | н | н | |
| Dichlorodifluoromethane | ND | 500 | ŧ | 11 | н | 11 | н | Ħ | |
| 1,1-Dichloroethane | ND | 100 | tt | 11 | " | ** | * | н | |
| 1,2-Dichloroethane | ND | 100 | ti | • | " | ** | н | н | |
| 1,1-Dichloroethene | ND | 100 | \$F | ** | tí | 44 | н | Ħ | |
| cis-1,2-Dichloroethene | ND | 100 | tt. | | н | 44 | н | Ħ | |
| trans-1,2-Dichloroethene | ND | 100 | II | ** | н | 10 | 11 | ti | |
| 1,2-Dichloropropane | ND | 100 | R | ** | ** | ** | H | ** | |
| 1,3-Dichloropropane | ND | 100 | Ħ | n | Ħ | ee . | 4 | # | |
| 2,2-Dichloropropane | ND | 100 | tı | tt | н | ** | и | 11 | |
| 1,1-Dichloropropene | ND | 100 | н | tt | 11 | " | ** | " | |
| cis-1,3-Dichloropropene | ND | 100 | II | 41 | 11 | bF . | 11 | ** | |
| trans-1,3-Dichloropropene | ND | 100 | 11 | u | 49 | Ħ | ** | * | |
| Ethylbenzene | ND | 100 | Ħ | ŧ | 44 | ** | * | ** | |

North Creek Analytical - Portland

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 15 of 98



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Spokane

Portland

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..¿cor

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

Tualatin, OR 97062

P.O. Box 1508

Project Manager: Joe Hunt

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|---------|
| GP4 (P008088-04) Soil | | | | (| Sampled: 08/0 | 1/00 Recei | ived: 08/03/ | 00 | 1100100 |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | ** | 11 | Ħ | ** | н | |
| Isopropylbenzene | ND | 200 | er | Ħ | n | N | Ħ | ** | |
| p-Isopropyltoluene | ND | 200 | H | Ħ | Ħ | Ħ | 11 | н | |
| 4-Methyl-2-pentanone | ND | 500 | ** | н | Ħ | Ħ | rr | Ħ | |
| Methyl tert-butyl ether | ND | 100 | Ħ | Ħ | ** | # . | Ħ | п | |
| Methylene chloride | ND | 500 | н | Ħ | ** | н | ** | Ħ | |
| Naphthalene | ND | 200 | ** | 11 | a | ** | ** | n | |
| n-Propylbenzene | ND | 100 | 55 | II | н | ** | 11 | II. | |
| Styrene | ND | 100 | # | II | н | 11 | Ħ | Ħ | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | 11 | Ħ | 4 | н | H | н | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | н | " | * . | н | ** | ** | |
| Tetrachloroethene | ND | 100 | #1 | 11 | ** | tt | 11 | tt | |
| Toluene | ND | 100 | ** | 11 | н | 11 | н | 11 | |
| 1.2,3-Trichlorobenzene | ND | 100 | 11 | н | Ħ | 11 | (I | n | |
| 4-Trichlorobenzene | ND | 100 | н | tř | er | И | N | н | |
| 1,1,1-Trichloroethane | ND | 100 | H | н | ** | . # | " | H | |
| 1,1,2-Trichloroethane | ND | 100 | # | # | 11 | Ħ | ** | Ħ | |
| Trichloroethene | ND | 100 | ** | н | Ħ | ** | # | # | |
| Trichlorofluoromethane | ND | 100 | 11 | tt | н | ** | н | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | 11 | H. | H | 11 | н | н | |
| 1,2,4-Trimethylbenzene | ND | 100 | tl | ** | ** | 11 | tt | Ħ | |
| 1,3,5-Trimethylbenzene | ND | 100 | tt | ** | н | Ħ | 11 | * | |
| Vinyl chloride | ND | 100 | 11 | ti | н | 10 | н | Ħ | |
| o-Xylene | ND | 100 | n | er | Ħ | 11 | n | Ħ | |
| m,p-Xylene | ND | 200 | ti | ** | 18 | 11 | Ħ | н | |
| Surr: 4-BFB | 95.5 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 87.1 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 86.0 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 86.7 % | 70-130 | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP9 @ 12' (P008088-12) Soil | | | | S | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | н | н | Ħ | # | н | # | |
| Bromobenzene | ND | 100 | н | н | Ħ | ŧ | Ħ | н | |
| Bromochloromethane | ND | 100 | н | н | Ħ | ** | Ħ | н | |
| Bromodichloromethane | ND | 100 | Ħ | Ħ | н | u | * | ti | |
| Bromoform | ND | 100 | H | H | ** | . | 11 | * | |
| Bromomethane | ND | 500 | 18 | Ħ | 85 | tř | tt | ts | |
| 2-Butanone | ND | 1000 | H | н | ts | ŧſ | t | tt | |
| n-Butylbenzene | ND | 500 | 19 | ti | ** | ŧŧ | 11 | Ħ | |
| sec-Butylbenzene | ND | 100 | II | н | tr | tt | tt | # | |
| tert-Butylbenzene | ND | 100 | 11 | Ħ | H | н | tt | tf | |
| Carbon disulfide | ND | 1000 | 11 | n | Ħ | u | tr | tr | |
| Carbon tetrachloride | ND | 100 | ** | 11 | н | II | tt | Ħ | |
| Chlorobenzene | ND | 100 | u. | 11 | II | H | n | н | |
| Chloroethane | ND | 100 | н | 11 | н | Ħ | н | ø | |
| Chloroform | ND | 100 | n | u | и. | 11 | П | н | |
| Chloromethane | ND | 500 | n | " | 11 | " | Ħ | # | + |
| 2-Chlorotoluene | ND | 100 | tt | ** | 11 | • | # | 11 | |
| 4-Chlorotoluene | ND | 100 | ti | tf | 41 | n | н | # | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | Ħ | Ħ | 11 | W | Ħ | ** | |
| Dibromochloromethane | ND | 100 | 11 | Ħ | tt | ** | ** | * | |
| 1,2-Dibromoethane | ND | 100 | Ħ | н | ** | н | • | | |
| Dibromomethane | ND | 100 | 11 | H | Ħ | н | | Ħ | |
| 1,2-Dichlorobenzene | ND | 100 | # | 11 | Ħ | # | | er | |
| 1,3-Dichlorobenzene | ND | 100 | 41 | ** | н | # | ** | er | |
| 1,4-Dichlorobenzene | ND | 100 | et . | 14 | н | 10 | rr . | ŧi | |
| Dichlorodifluoromethane | ND | 500 | et | u | Ħ | # | tr . | Ħ | |
| 1,1-Dichloroethane | ND | 100 | tr . | n | H | 11 | *1 | er | |
| 1,2-Dichloroethane | ND | 100 | tr | 11 | Ħ | ** | n | н | |
| I,I-Dichloroethene | ND | 100 | Ħ | ** | 11 | u | u | H | |
| cis-1,2-Dichloroethene | ND | 100 | tt | ** | n | ** | n | н | |
| trans-1,2-Dichloroethene | ND | 100 | Ħ | ** | # | 15 | п | u | |
| 1,2-Dichloropropane | ND | 100 | Ħ | ** | 8 | ** | U | u | |
| 1,3-Dichloropropane | ND | 100 | u | et | # | \$F | Ħ | п | |
| 2,2-Dichloropropane | ND | 100 | Ħ | н | II. | Ħ | 11 | Ħ | |
| 1,1-Dichloropropene | ND | 100 | H | п | • | н | ** | 11 | |
| cis-1,3-Dichloropropene | ND | 100 | tt. | н | 17 | н | ** | 11 | |
| trans-1,3-Dichloropropene | ND | 100 | 11 | н | н | н | ** | 4 | |
| Ethylbenzene | ND | 100 | ** | 11 | н | Ħ | | | |

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 17 of 98



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Portland

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| | | 1101 | IR CICUR | ^J V- | | | | | | |
|--|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|----------|-------|
| A PARTITION OF THE PARTY OF THE | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| î | GP9 @ 12' (P008088-12) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ived: 08/03/ | 00 | |
| 1 | Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| | 2-Hexanone | ND | 1000 | ŧŧ | # | н | Ħ | н | # | |
| ł | Isopropylbenzene | ND | 200 | n | н | Ħ | н | 31 | н | |
| ; | p-Isopropyltoluene | ND | 200 | 11 | * | tı | er | Ħ | ** | |
| | 4-Methyl-2-pentanone | ND | 500 | tt | n | at . | n | н | 19 | |
| - | Methyl tert-butyl ether | ND | 100 | н | Ħ | ** | н . | Ħ | Ħ | |
| | Methylene chloride | ND | 500 | 11 | H | н | tř | Ħ | Ħ | |
| | Naphthalene | ND | 200 | H | 11 | N | ** | 11 | n | |
| | n-Propylbenzene | ND | 100 | н | n | " | ** | н | 11 | |
| | Styrene | ND | 100 | a | н | n | 11 | Ħ | . " | |
| | 1,1,1,2-Tetrachloroethane | ND | 100 | ŧ | tt | н | ŧI | ** | Ħ | |
| | 1,1,2,2-Tetrachloroethane | ND | 100 | 11 | 11 | tr. | Ħ | н | TI | |
| | Tetrachloroethene | 2950 | 100 | 11 | n | * | 11 | # | ** | |
| | Toluene | ND | 100 | я | н | 11 | 11 | n | H | |
| | 3-Trichlorobenzene | ND | 100 | 11 | n | п | ti | tt | et et | |
| - | +-Trichlorobenzene | ND | 100 | U | ŧı | H | tr | " | | |
| | 1,1,1-Trichloroethane | ND | 100 | ŧŧ | 11 | ** | " | # # | # · | |
| į | 1,1,2-Trichloroethane | ND | 100 | ** | n | Ħ | # | n H | H . | |
| A | Trichloroethene | ND | 100 | 17 | u | н | | " | | |
| | Trichlorofluoromethane | ND | 100 | 11 | 11 | u | H | ** | | |
| | 1,2,3-Trichloropropane | ND | 100 | Ħ | н | ** | n 11 | " | " # | |
| *************************************** | 1,2,4-Trimethylbenzene | ND | 100 | 16 | eŧ | 11 | | , | " | |
| - | 1,3,5-Trimethylbenzene | ND | 100 | н | " | Ħ | ** | " | " | |
| | Vinyl chloride | ND | 100 | Ħ | Ħ | tt | " | | | |
| | o-Xylene | ND | 100 | 92 | н | " | " " | ,, | " # | |
| - | m,p-Xylene | ND | 200 | 11 | H | | | | | |
| **** | Surr: 4-BFB | 93.6 % | 70-130 | | | | | | | |
| | Surr: 1,2-DCA-d4 | 91.4 % | 70-130 | | | | | | | |
| Ì | Surr: Dibromofluoromethane | 86.9 % | 70-130 | | | | | | | |
| | Surr: Toluene-d8 | 88.8 % | 70-130 | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|---------|-------|
| GP9 @ 27.5' (P008088-13) Soil | | | | S | Sampled: 08/0 | 1/00 Recei | ved: 08/03/ | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | Ħ | Ħ | н | H | н | |
| Bromobenzene | ND | 100 | Ħ | н | н | н | # | | |
| Bromochloromethane | ND | 100 | n | | # | н | Ħ | 4 | |
| Bromodichloromethane | ND | 100 | et . | Ħ | н | " | H | • | |
| Bromoform | ND | 100 | н | H | Ħ | и . | H | | |
| Bromomethane | ND | 500 | Ħ | tt | н | | H | Ħ | |
| 2-Butanone | ND | 1000 | tr | н | Ħ | ti | tr | n | |
| n-Butylbenzene | ND | 500 | Ħ | н | Ħ | н | н | н | |
| sec-Butylbenzene | ND | 100 | U | 19 | 11 | 11 | н | Ħ | |
| tert-Butylbenzene | ND | 100 | н | ** | " | Ħ | Ħ | * | |
| Carbon disulfide | ND | 1000 | 19 | # | Ħ | u | " | 46 | |
| Carbon tetrachloride | ND | 100 | Ħ | tt | Ħ | tt | H | Ħ | |
| Chlorobenzene | ND | 100 | 11 | Ħ | н | u | n | tř | |
| Chloroethane | ND | 100 | *1 | ti | u | н | H | н | |
| Chloroform | ND | 100 | n | 19 | н | ** | Ħ | H | |
| Chloromethane | ND | 500 | М | ** | 11 | 11 | | 11 | (|
| 2-Chlorotoluene | ND | 100 | Ħ | ** | ** | 4# | ** | Ħ | |
| 4-Chlorotoluene | ND | 100 | # | H | H . | tr . | " | Ħ | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | # | B | н | tr | H | et | |
| Dibromochloromethane | ND | 100 | | Ħ | н | н | Ħ | н | |
| 1,2-Dibromoethane | ND | 100 | | н | 11 | н | ti | Ħ | |
| Dibromomethane | ND | 100 | ŧr | н | 11 | н | н | H | |
| 1,2-Dichlorobenzene | ND | 100 | н | #1 | # | ** | н | н | |
| 1,3-Dichlorobenzene | ND | 100 | н | * | tt | | н | Ħ | |
| 1,4-Dichlorobenzene | ND | 100 | 11 | • | * | te | ** | ** | |
| Dichlorodifluoromethane | ND | 500 | # | | 61 | tr | Ħ | et . | |
| 1,1-Dichloroethane | ND | 100 | 11 | m | н | Ħ | Ħ | tt | |
| 1,2-Dichloroethane | ND | 100 | " | H | н | H | tt | " | |
| 1,1-Dichloroethene | ND | 100 | ## | ti | u | н | н | ** | |
| cis-1,2-Dichloroethene | ND | 100 | rt | 11 | н | ш | ti | H | |
| trans-1,2-Dichloroethene | ND | 100 | n | 11 | н | # | # | tt . | |
| 1,2-Dichloropropane | ND | 100 | н | 4 | ** | ** | " | H | |
| 1,3-Dichloropropane | ND | 100 | н | et | ** | tt | " | н | |
| 2,2-Dichloropropane | ND | 100 | н | H | tt | ŧr | Ħ | H | |
| 1,1-Dichloropropene | ND | 100 | ** | ** | н | tr | * | H | |
| cis-1,3-Dichloropropene | ND | 100 | ** | н | н | н | tr | ** | |
| trans-1,3-Dichloropropene | ND | 100 | ŧf | н | Ħ | н | н | | |
| Ethylbenzene | ND | 100 | H | н | # | 11 | Ħ | n | |

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP9 @ 27.5' (P008088-13) Soil | | | | | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | ı | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | н | ** | # | 11 | Ħ | Ħ | |
| Isopropylbenzene | ND | 200 | tt | Ħ | # | н | ** | Ħ | |
| p-Isopropyltoluene | ND | 200 | # | Ħ | | | н | n | |
| 4-Methyl-2-pentanone | ND | 500 | n | Ħ | Ħ | ** | | n | |
| Methyl tert-butyl ether | ND | 100 | n | H | Ħ | n . | " | " | |
| Methylene chloride | ND | 500 | N | н | # | Ħ | Ħ | Ħ | |
| Naphthalene | ND | 200 | 11 | Ħ | Ħ | H | Ħ | и | |
| n-Propylbenzene | ND | 100 | • | н | 11 | tt | ** | н | |
| Styrene | ND | 100 | n | Ħ | 11 | 41 | 11 | Ħ | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | n | ** | Ħ | n | Ħ | ** | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | n | Ħ | n | H | Ħ | 11 | |
| Tetrachloroethene | ND | 100 | n | Ħ | tt | n | " | н | |
| Toluene | ND | 100 | 11 | н | Ħ | 16 | 11 | rt . | |
| 1 2,3-Trichlorobenzene | ND | 100 | н | Ħ | Ħ | 11 | 11 | #5 | |
| 1-Trichlorobenzene | ND | 100 | tt | n | # | н | Ħ | н | |
| 1,1,1-Trichloroethane | ND | 100 | ** | 11 | et | н | Ħ | н | |
| 1,1,2-Trichloroethane | ND | 100 | # | н | ** | e | Ħ | н | |
| Trichloroethene | ND | 100 | Ħ | n | н | Ħ | 11 | Ħ | |
| Trichlorofluoromethane | ND | 100 | H | n | Ħ | 11 | 11 | ** | |
| 1,2,3-Trichloropropane | ND | 100 | ii. | Ħ | н | n | tt | ń | |
| 1,2,4-Trimethylbenzene | ND | 100 | ** | ŧı | " | H | н | и | |
| 1,3,5-Trimethylbenzene | ND | 100 | 11 | H | #1 | 11 | # | ** | |
| Vinyl chloride | ND | 100 | ŧr | ** | ĸ | Ħ | ti | Ħ | |
| o-Xylene | ND | 100 | н | Ħ | н | н | Ħ | ti | |
| m,p-Xylene | ND | 200 | н | H | Ħ | Ħ | n | H | |
| Surr: 4-BFB | 94.6 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 93.8 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 90.0 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 93.8 % | 70-130 | | | | | | | |

North Creek Analytical - Portland

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 20 of 98



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503,906,9200 fax 503,906,9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals Secor

Project Number: 015.08716.001 P.O. Box 1508 Project Manager: Joe Hunt Tualatin, OR 97062

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|-------------|--------------|---------|-------|
| GP10 (P008088-14) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | I-02 |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | " | ** | н | * | " | |
| Bromobenzene | ND | 100 | tl | | ** | н | u | ** | |
| Bromochloromethane | ND | 100 | ti | e | Ħ | H | Ħ | ** | |
| Bromodichloromethane | ND | 100 | Ħ | | tr | H | nt | | |
| Bromoform | ND | 100 | H | Ħ | tf | 11 · | n | н | |
| Bromomethane | ND | 500 | Ħ | | Ħ | n | Ħ | N. | |
| 2-Butanone | ND | 1000 | Ħ | # | н | 11 | ti | et . | |
| n-Butylbenzene | ND | 500 | н | tt | tt | 11 | Ħ | | |
| sec-Butylbenzene | ND | 100 | # | tt | ti | 11 | ti | tr | |
| tert-Butylbenzene | ND | 100 | Ħ | Ħ | н | 11 | tt | er | |
| Carbon disulfide | ND | 1000 | # | н | Ħ | 10 | н | tr | |
| Carbon tetrachloride | ND | 100 | # | tf | II . | " | н | Ħ | |
| Chlorobenzene | ND | 100 | # | tt | II | u u | Ħ | н | |
| Chloroethane | ND | 100 | 11 | Ħ | II | Et . | н | Ħ | |
| Chloroform | ND | 100 | " | н | н | rt . | н | Ħ | |
| Chloromethane | ND | 500 | 41 | H | 11 | u | Ħ | н | |
| 2-Chlorotoluene | ND | 100 | 11 | н | н | tr | tı | н | |
| 4-Chlorotoluene | ND | 100 | Ħ | н | н | \$T | н | Ħ | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | 41 | н | 11 | ŧI | u | н | |
| Dibromochloromethane | ND | 100 | * | Ħ | н | n | 11 | н | |
| 1,2-Dibromoethane | ND | 100 | | 11 | 11 | н | Ħ | Ħ | |
| Dibromomethane | ND | 100 | н | 41 | 11 | n | 11 | н | |
| 1,2-Dichlorobenzene | ND | 100 | ** | ** | * | н | н | n | |
| 1,3-Dichlorobenzene | ND | 100 | et | * | | н | N | н | |
| 1,4-Dichlorobenzene | ND | 100 | Ħ | ** | ** | н | Ħ | н | |
| Dichlorodifluoromethane | ND | 500 | tt | Ħ | | Ħ | N | н | |
| 1,1-Dichloroethane | ND | 100 | ** | 11 | * | n | н | Ħ | |
| 1,2-Dichloroethane | ND | 100 | 41 | # | u | *1 | Ħ | tt | |
| 1,1-Dichloroethene | ND | 100 | er | * | • | ti | н | er | |
| cis-1,2-Dichloroethene | ND | 100 | ** | # | șt șt | H | н | er | |
| trans-1,2-Dichloroethene | ND | 100 | ** | ** | te | a | н | er | |
| 1,2-Dichloropropane | ND | 100 | ** | ** | 4 | 11 | н | tr | |
| 1,3-Dichloropropane | ND | 100 | ** | ** | er | н | н | . 4 | |
| 2,2-Dichloropropane | ND | 100 | | " | er | n | 11 | tr | |
| 1,1-Dichloropropene | ND | 100 | eş | # | tr | н | 11 | er | |
| cis-1,3-Dichloropropene | ND | 100 | ŧ | et | н | N | ti ti | н | |
| trans-1,3-Dichloropropene | ND | 100 | ** | п | # | н | n | н | |
| Ethylbenzene | ND | 100 | ** | | н | н | н | н | |

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Page 21 of 98 North Creek Analytical, Inc. **Environmental Laboratory Network**



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Project: Fort James Specialty Chemicals -écor

Project Number: 015.08716.001 P.O. Box 1508 Project Manager: Joe Hunt Tualatin, OR 97062

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP10 (P008088-14) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ived: 08/03/ | 00 | I-02 |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | н | 11 | " | н | н | #1 | |
| Isopropylbenzene | ND | 200 | н | н | Ħ | Ħ | н | н | |
| p-Isopropyltoluene | ND | 200 | 11 | н | Ħ | lf. | н | tt | |
| 4-Methyl-2-pentanone | ND | 500 | Ħ | Ħ | * | ** | H | Ħ | |
| Methyl tert-butyl ether | ND | 100 | Ħ | н | * | н . | " | n | |
| Methylene chloride | ND | 500 | Ħ | н | 11 | ŧI | н | н | |
| Naphthalene | ND | 200 | 11 | н | Ħ | H | H | Ħ | |
| n-Propylbenzene | ND | 100 | 11 | e | 11 | n | ŧŧ | șt. | |
| Styrene | ND | 100 | Ħ | 11 | # | н | ** | н | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | н | Ħ | 11 | н | 11 | ŧŧ | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | ** | н | ŧı | H. | н | Ħ | |
| Tetrachloroethene | 250 | 100 | н | er | n | ** | Ħ | # | |
| Toluene | ND | 100 | fl | 11 | * | 11 | * | #1 | |
| 1 2,3-Trichlorobenzene | ND | 100 | Ħ | н | н | 11 | H | u | |
| 4-Trichlorobenzene | ND | 100 | ** | ıı | 41 | n | 11 | Ħ | |
| 1,1,1-Trichloroethane | ND | 100 | 11 | n | # | ** | H | tf | |
| 1,1,2-Trichloroethane | ND | 100 | н | 11 | | ** | Ħ | Ħ | |
| Trichloroethene | ND | 100 | н | н | Ħ | 11 | Ħ | Ħ | |
| Trichlorofluoromethane | ND | 100 | " | tt | Ħ | u | fl | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | Ħ | ** | ** | Ħ | Ħ | n | |
| 1,2,4-Trimethylbenzene | ND | 100 | ti | ** | ** | u | | ** | |
| 1,3,5-Trimethylbenzene | ND | 100 | | Ħ | Ħ | 11 | н | Ħ | |
| Vinyl chloride | ND | 100 | 11 | ** | Ħ | rl | If | н | |
| o-Xylene | ND | 100 | н | Ħ | | at . | 11 | ** | |
| m,p-Xylene | ND | 200 | ŧŧ | Ħ | " | 11 | н | Ħ | |
| Surr: 4-BFB | 82.0 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 87.2 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 79.7 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 83.9 % | 70-130 | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-----------|--------------------------------------|-----------|------------|-----------|-----------|-------|
| GP11 (P008088-15) Soil | | | | Sampled: 08/01/00 Received: 08/03/00 | | | | | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | tt | # | H | н | н | |
| Bromobenzene | ND | 100 | н | н | н | tt | Ħ | n | |
| Bromochloromethane | ND | 100 | Ħ | Ħ | Ħ | Ð | Ħ | Ħ | |
| Bromodichloromethane | ND | 100 | 11 | Ħ | Ħ | 11 | Ħ | Ħ | |
| Bromoform | ND | 100 | 11 | ** | * | H . | 11 | Ħ | |
| Bromomethane | ND | 500 | и | Ħ | ** | n . | u | Ħ | |
| 2-Butanone | ND | 1000 | ti | Ħ | tt | Ħ | W . | 11 | |
| n-Butylbenzene | ND | 500 | tr | Ħ | tl | tt | # | ** | |
| sec-Butylbenzene | ND | 100 | tt | н | tř | ŧī | tt | 44 | |
| ert-Butylbenzene | ND | 100 | ш | н | н | н | H | Ħ | |
| Carbon disulfide | ND | 1000 | n n | 11 | н | н | п | Ħ | |
| Carbon tetrachloride | ND | 100 | #1 | 11 | 11 | 11 | 11 | н | |
| Chlorobenzene | ND | 100 | # | # | H | 11 | ** | n | |
| Chloroethane | ND | 100 | er | ** | 11 | 15 | ** | 11 | |
| Chloroform | ND | 100 | n | Ħ | tr | u | | " | |
| Chloromethane | ND | 500 | H* | н | н | н | t# | ar . | |
| 2-Chlorotoluene | ND | 100 | ** | н | н | Ħ | н | | |
| 1-Chlorotoluene | ND | 100 | n | н | н | ŧI | tt | tt | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | n | н | 11 | 11 | (f | н | |
| Dibromochloromethane | ND | 100 | Ħ | 11 | 11 | 41 | †1 | n | |
| 1.2-Dibromoethane | ND | 100 | 11 | ** | # | 11 | 11 | н | |
| Dibromomethane | ND | 100 | •• | # | # | tt | н | п | |
| 1,2-Dichlorobenzene | ND | 100 | ** | # | ** | | u | 11 | |
| 1,3-Dichlorobenzene | ND | 100 | ** | Ħ | n | | t? | 47 | |
| ,4-Dichlorobenzene | ND | 100 | н | н | Ħ | et | ti | 11 | |
| Dichlorodifluoromethane | ND | 500 | н | Ħ | н | n | ŧŧ | ** | |
| ,1-Dichloroethane | ND | 100 | n | Ħ | н | n | Ħ | ** | |
| ,2-Dichloroethane | ND | 100 | 11 | Ħ | n | и | ti | ** | |
| ,1-Dichloroethene | ND | 100 | 11 | ŧŧ | tt | н | н | w | |
| cis-1,2-Dichloroethene | ND | 100 | ** | a) | н | 11 | 11 | н | |
| rans-1,2-Dichloroethene | ND | 100 | | 65 | " | ** | ** | n | |
| 1,2-Dichloropropane | ND | 100 | ** | " | at . | " | 11 | н | |
| i,3-Dichloropropane | ND | 100 | H | 11 | ** | н | tt | Ü | |
| 2,2-Dichloropropane | ND | 100 | tt | H | N | н | £ŧ. | Ħ | |
| i,1-Dichloropropene | ND ND | 100 | ıı | | н | н | Ħ | 11 | |
| is-1,3-Dichloropropene | ND ND | 100 | н | н | Ħ | 11 | II | ** | |
| rans-1,3-Dichloropropene | ND ND | 100 | | | 11 | 11 | 6 | H | |
| Ethylbenzene | ND ND | 100 | | | | , | 11 | " H | |

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Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

Project: Fort James Specialty Chemicals

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note | | |
|----------------------------|--------------------------------------|--------------------|-----------|----------|-----------|----------|----------|---------|------|--|--|
| GP11 (P008088-15) Soil | Sampled: 08/01/00 Received: 08/03/00 | | | | | | | | | | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | | | |
| 2-Hexanone | ND | 1000 | # | ** | •• | н | # | ** | | | |
| Isopropylbenzene | ND | 200 | н | н | n | Ħ | ti | 11 | | | |
| p-Isopropyltoluene | ND | 200 | Ħ | H | п | 11 | ŧf | 11 | | | |
| 4-Methyl-2-pentanone | ND | 500 | н | " | Ħ | и | Ħ | H | | | |
| Methyl tert-butyl ether | ND | 100 | ** | * | ** | 11 . | H | ** | | | |
| Methylene chloride | ND | 500 | n | # | ** | н | Ħ | ** | | | |
| Naphthalene | ND | 200 | n | ti | 11 | tt | Ħ | 11 | | | |
| n-Propylbenzene | ND | 100 | ¥ | ti | н | 11 | Ħ | н | | | |
| Styrene | ND | 100 | n | 11 | tr | н | tt | Ħ | | | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | ** | 11 | Ħ | H | *1 | " | | | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | 11 | н | Ħ | ti | 11 | 41 | | | |
| Tetrachloroethene | ND | 100 | н | Ħ | 11 | 35 | It | П | | | |
| Toluene | ND | 100 | ŧŧ | tr | u | 91 | ** | н | | | |
| 1,2,3-Trichlorobenzene | ND | 100 | 11 | ŧŧ | Ħ | 11 | ** | t# | | | |
| \-Trichlorobenzene | ND | 100 | Ħ | Ħ | ** | 11 | 11 | 11 | | | |
| 1,1,1-Trichloroethane | ND | 100 | n | н | #1 | н | Ħ | 11 | | | |
| 1,1,2-Trichloroethane | ND | 100 | н | Ħ | ** | w | H | tt | | | |
| Trichloroethene | ND | 100 | ** | H | Ħ | 1t | Ħ | H | | | |
| Trichlorofluoromethane | ND | 100 | # | 11 | ħ | ti | " | et | | | |
| 1,2,3-Trichloropropane | ND | 100 | Ħ | н | ** | 11 | 11 | 11 | | | |
| 1,2,4-Trimethylbenzene | ND | 100 | Ħ | tf | Ħ | tt | 11 | н | | | |
| 1,3,5-Trimethylbenzene | ND | 100 | | H | н | # | R. | Ħ | | | |
| Vinyl chloride | ND | 100 | н | 11 | tt | 11 | н | et | | | |
| o-Xylene | ND | 100 | н | Ħ | * | U | н | u | | | |
| m,p-Xylene | ND | 200 | # | tr | Ħ | Ħ | н | 11 | | | |
| Surr: 4-BFB | 93.4 % | 70-130 | | | | | | | | | |
| Surr: 1,2-DCA-d4 | 92.6 % | 70-130 | | | | | | | | | |
| Surr: Dibromofluoromethane | 85.6 % | 70-130 | | | | | | | | | |
| Surr: Toluene-d8 | 95.5 % | 70-130 | | | | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|--|----------|--------------------|-----------|----------|---------------|------------|---------------|---------|------|
| GP12 (P008088-16) Soil | | | | | Sampled: 08/0 | 2/00 Recei | ived: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | H | * | * | u | ** | |
| Bromobenzene | ND | 100 | н | н | # | Ħ | 11 | et. | |
| Bromochloromethane | ND | 100 | н | н | Ħ | tr | 11 | et . | |
| Bromodichloromethane | ND | 100 | # | н | Ħ | H | 44 | н | |
| Bromoform | ND | 100 | Ħ | # | # | H . | 11 | Ħ | |
| Bromomethane | ND | 500 | Ħ | n | tt | н | tr . | Ħ | |
| 2-Butanone | ND | 1000 | н | Ħ | 11 | 11 | Ħ | H | |
| n-Butylbenzene | ND | 500 | q | ** | 44 | и | Ħ | н | |
| sec-Butylbenzene | ND | 100 | tf | tt | Ħ | 10 | # | 11 | |
| tert-Butylbenzene | ND | 100 | et | ŧŧ | tt | 11 | u | 11 | |
| Carbon disulfide | ND | 1000 | н | tt | e | 13 | н | 41 | |
| Carbon tetrachloride | ND | 100 | н | н | ti | " | 11 | ** | |
| Chlorobenzene | ND | 100 | н | n | tr . | #f | 11 | ** | |
| Chloroethane | ND | 100 | U | 14 | n | Ħ | 11 | EF | |
| Chloroform | ND | 100 | 11 | 14 | н | Ħ | ti . | # | 7 |
| Chloromethane | ND | 500 | " | 41 | 11 | н | ** | tr | |
| 2-Chlorotoluene | ND | 100 | " | # | H | N | ** | ti | |
| 4-Chlorotoluene | ND | 100 | u | u | н | 11 | H | 0 | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | W | # | " | н | tr . | 11 | |
| Dibromochloromethane | ND | 100 | Ħ | et | u | ** | tt | н | |
| 1,2-Dibromoethane | ND | 100 | n | n | et | u | u | 11 | |
| Dibromomethane | ND | 100 | н | Ħ | н | 11 | U | H | |
| 1,2-Dichlorobenzene | ND | 100 | н | 11 | н | u | # | ** | |
| 1,3-Dichlorobenzene | ND | 100 | ti | н | н | н | ** | 11 | |
| 1,4-Dichlorobenzene | ND | 100 | н | in | Ħ | н | ** | tt. | |
| Dichlorodifluoromethane | ND | 500 | 11 | # | Ħ | ti | ** | a | |
| 1,1-Dichloroethane | ND | 100 | 11 | 11 | # | n | 16 | • | |
| 1,2-Dichloroethane | ND | 100 | ** | | 11 | N | ** | | |
| 1,1-Dichloroethene | ND | 100 | u | | 11 | н | | H | |
| cis-1,2-Dichloroethene | ND | 100 | et | er | 4 | 10 | 11 | Ħ | |
| trans-1,2-Dichloroethene | ND | 100 | ŧr | H | # | ** | tr | н | |
| 1,2-Dichloropropane | ND | 100 | EI | н | ** | 4 | tt | ti | |
| 1,3-Dichloropropane | ND ND | 100 | H | н | pt . | n | u | u | |
| 2,2-Dichloropropane | ND ND | 100 | н | н | | ** | u | Ħ | |
| 1,1-Dichloropropene | ND ND | 100 | | н | н | tr . | н | 11 | |
| cis-1,3-Dichloropropene | ND ND | 100 | H | 11 | н | er | 44 | ** | |
| | | | 10 | | н | н | | " | |
| rans-1,3-Dichloropropene Ethylbenzene | ND ND | 100 100 | ** | " | # | H | " " | " | |

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Environmental Laboratory Network



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Project: Fort James Specialty Chemicals PGCOL

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| l | 1101 | III CICCK | / Amaily to | | | | | | |
|----------------------------|------------------|--------------------|-------------|----------|-----------------|----------|--------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| GP12 (P008088-16) Soil | | | | | Sampled: 08/02/ | 00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | Ħ | #1 | Ħ | Ħ | ** | |
| Isopropylbenzene | ND | 200 | н | Ħ | Ħ | ч | 11 | Ħ | |
| p-Isopropyltoluene | ND | 200 | н | # | ŧr | н | ** | į# | |
| 4-Methyl-2-pentanone | ND | 500 | * | 11 | Ħ | 77 | Ħ | н | |
| Methyl tert-butyl ether | ND | 100 | * | н | Ħ | н · | n | н | |
| Methylene chloride | ND | 500 | 11 | Ħ | et | Ħ | 11 | н | |
| Naphthalene | ND | 200 | н | ** | 95 | н | 11 | ļt | |
| n-Propylbenzene | ND | 100 | ŧŧ | Ħ | 15 | * | н | | |
| Styrene | ND | 100 | 11 | н | u . | ** | Ħ | н | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | u | н | n | Ħ | н | Ħ | |
| 1,1,2.7 Etrachloroethane | ND | 100 | ** | Ħ | ** | π | Ħ | ts | |
| Tetrachloroethene | ND | 100 | 12 | н | и | н | tt | ** | |
| Toluene | ND | 100 | 14 | H | u | | " | n | |
| 1 2,3-Trichlorobenzene | ND | 100 | u | 11 | ŧŧ | ti | 11 | Ħ | |
| 1-Trichlorobenzene | ND | 100 | 97 | 11 | 11 | n | 11 | tt | |
| 1,1,1-Trichloroethane | ND | 100 | Ħ | | 11 | H | tt | n | |
| 1,1,2-Trichloroethane | ND | 100 | n | * | Ħ | н | ** | EF | |
| Trichloroethene | ND | 100 | n | H | ** | Ħ | 11 | ** | |
| Trichlorofluoromethane | ND | 100 | ** | н | 11 | H | Ħ | 11 | |
| 1,2,3-Trichloropropane | ND | 100 | ** | u. | tt. | * | n | Ħ | |
| 1,2,4-Trimethylbenzene | ND | 100 | H | # | ** | Ħ | Ħ | Ħ | |
| 1,3,5-Trimethylbenzene | ND | 100 | ** | н | 11 | н | Ħ | 11 | |
| Vinyl chloride | ND | 100 | n | ** | н | W | ti | н | |
| o-Xylene | ND | 100 | Ħ | ** | н | • | # | * | |
| m,p-Xylene | ND | 200 | ø | н | # | Ħ | Ħ | # | |
| | 91.4% | 70-130 | | | | | | | |
| Surr: 4-BFB | 91.4 % 93.4 % | 70-130 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 93.4 % 89.5 % | 70-130 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 93.0 % | 70-130 70-130 | | | | | | | |
| Surr: Toluene-d8 | 93.U 70 | 70-130 | | | | | | | |

North Creek Analytical - Portland

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 26 of 98



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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383,9310 fax 541.382.7588

Secor Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 P.O. Box 1508 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP13 (P008088-17) Soil | | | | | Sampled: 08/0 | 2/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | n | n | н | r | 11 | N | |
| Bromobenzene | ND | 100 | н | ** | н | Ħ | H | н | |
| Bromochloromethane | ND | 100 | н | 11 | н | н | n | ti | |
| Bromodichloromethane | ND | 100 | tt | н | n | н | Ħ | н | |
| Bromoform | ND | 100 | н | 4 | н | H . | Ħ | Ħ | |
| Bromomethane | ND | 500 | Ħ | | Ħ | Ħ | H | 11 | |
| 2-Butanone | ND | 1000 | tr | u | н | ti | II | Ħ | |
| n-Butylbenzene | ND | 500 | Ħ | u | H | II | n | B | |
| sec-Butylbenzene | ND | 100 | 0 | er | н | H | н | 11 | |
| tert-Butylbenzene | ND | 100 | п | ** | 11 | H | 11 | Ħ | |
| Carbon disulfide | ND | 1000 | Ħ | er | Ħ | 11 | 11 | ** | |
| Carbon tetrachloride | ND | 100 | 1) | u | 11 | ** | 11 | " | |
| Chlorobenzene | ND | 100 | 11 | н | 11 | • | 11 | at . | |
| Chloroethane | ND | 100 | 11 | " | n | IF. | 11 | 11 | |
| Chloroform | ND | 100 | #1 | н | 11 | u | 11 | tt | 1 |
| Chloromethane | ND | 500 | ** | Ħ | # | | ** | er | ' |
| 2-Chlorotoluene | ND | 100 | ** | tt | n | tr . | 11 | н | |
| 4-Chlorotoluene | ND | 100 | ** | н | Ħ | n | 11 | H | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | | tt | Ħ | ıt | II. | Ħ | |
| Dibromochloromethane | ND | 100 | et | 41 | н | н | ** | н | |
| 1,2-Dibromoethane | ND | 100 | Pt | 44 | н | н | п | н | |
| Dibromomethane | ND | 100 | EF | 44 | Ħ | n | rr . | н | |
| 1,2-Dichlorobenzene | ND | 100 | Ħ | ** | н | 1I | н | н | |
| 1,3-Dichlorobenzene | ND | 100 | H | | Ħ | * | н | н | |
| 1,4-Dichlorobenzene | ND | 100 | ti | ££ | Ħ | Ħ | н | Ħ | |
| Dichlorodifluoromethane | ND | 500 | Ħ | e | н | 11 | Ħ | н | |
| 1,1-Dichloroethane | ND | 100 | ŧI | 8 | 11 | 11 | н | н , | |
| 1,2-Dichloroethane | ND | 100 | н | # | Ħ | 11 | Ħ | Ħ | |
| 1,1-Dichloroethene | ND | 100 | н | Ħ | 19 | # | Ħ | 11 | |
| cis-1,2-Dichloroethene | ND | 100 | н | Ħ | 11 | # | н | 41 | |
| trans-1,2-Dichloroethene | ND | 100 | н | tł | ** | n | н | 4 | |
| 1,2-Dichloropropane | ND | 100 | ti | ŧŧ | ** | ** | # | ** | |
| 1,3-Dichloropropane | ND | 100 | Ħ | Ħ | 14 | ** | 11 | 11 | |
| 2,2-Dichloropropane | ND | 100 | Ħ | tt | ** | et | н | 45 | |
| 1,1-Dichloropropene | ND | 100 | ** | н | ** | ** | ** | ** | |
| cis-1,3-Dichloropropene | ND | 100 | ** | н | ** | U | н | Ħ | |
| trans-1,3-Dichloropropene | ND | 100 | ** | h | 11 | н | ** | tf | |
| Ethylbenzene | ND | 100 | н | tt | Ħ | H | " | et | |

North Creek Analytical - Portland

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Bend

Зсог P.O. Box 1508 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39

Project Manager: Joe Hunt Tualatin, OR 97062

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| | | | • | | | | | | |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| GP13 (P008088-17) Soil | | | | 5 | Sampled: 08/0 | 2/00 Recei | ved: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | 11 | ** | н | * | ** | |
| Isopropylbenzene | ND | 200 | н | Ħ | # | Ħ | ** | ** | |
| p-Isopropyltoluene | ND | 200 | n | tt | н | Ħ | 11 | н | |
| 4-Methyl-2-pentanone | ND | 500 | H | 8 | н | R | 17 | Ħ | |
| Methyl tert-butyl ether | ND | 100 | H | 4 | Ħ | н. | ** | # | |
| Methylene chloride | ND | 500 | ** | Ħ | • | Ħ | 11 | H | |
| Naphthalene | ND | 200 | n | ti | и | n | 11 | Ħ | |
| n-Propylbenzene | ND | 100 | n | Ħ | II . | tt | Ħ | Н | |
| Styrene | ND | 100 | n | 19 | " | 11 | tt | н | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | | 11 | ŧŧ | Н | ĸ | ** | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | Ħ | н | # | ų | ** | 11 | |
| Tetrachloroethene | ND | 100 | n | tř | u | tt . | н | 41 | |
| Toluene | ND | 100 | tr | te | tt | tt | n | н | |
| 1 2,3-Trichlorobenzene | ND | 100 | Ħ | 11 | н | 11 | ** | Ħ | |
| 1-Trichlorobenzene | ND | 100 | 11 | Ħ | ft | 11 | 8 | tt | |
| 1,1,1-Trichloroethane | ND | 100 | Ħ | Ħ | 11 | Ħ | ** | • | |
| 1,1,2-Trichloroethane | ND | 100 | ti | H | 11 | tt | Ħ | н | |
| Trichloroethene | ND | 100 | ŧŧ | ** | н | H. | Ħ | н | |
| Trichlorofluoromethane | ND | 100 | " | ** | tt | 11 | н | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | ** | н | 19 | II | # | ** | |
| 1,2,4-Trimethylbenzene | ND | 100 | 11 | H | н | ti | н | # | |
| 1,3,5-Trimethylbenzene | ND | 100 | tt | ** | Ħ | ** | IP | н | |
| Vinyl chloride | ND | 100 | ** | 11 | Ħ | ** | 0 | er | |
| o-Xylene | ND | 100 | 41 | Ħ | ** | 11 | " | " | |
| m,p-Xylene | ND | 200 | н | Ħ | 1) | и | н | | |
| Surr: 4-BFB | 105 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 103 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 98.2 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 107 % | 70-130 | | | | | | | |

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Lisa Domenighini, Project Manager

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|---------------------------------------|--------------------|-----------|----------|---------------|------------|--------------|-------------|-------|
| GP14 @ 8' (P008088-19) Soil | · · · · · · · · · · · · · · · · · · · | | | 5 | Sampled: 08/0 | 2/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | " | H | # | 41 | н | н | |
| Bromobenzene | ND | 100 | U | н | et | Ħ | ŧı | ti | |
| Bromochloromethane | ND | 100 | 8 | ** | ** | п | н | n | |
| Bromodichloromethane | ND | 100 | ** | * | Ħ | ** | | H | |
| Bromoform | ND | 100 | H | Ħ | H | н . | 11 | 11 | |
| Bromomethane | ND | 500 | н | n | н | Ħ | н | Ħ | |
| 2-Butanone | ND | 1000 | Ħ | н | n | n | et e | ** | |
| n-Butylbenzene | ND | 500 | U | н | н | n | ** | 11 | |
| sec-Butylbenzene | ND | 100 | И | н | н | II | tr | Ħ | |
| tert-Butylbenzene | ND | 100 | 11 | н | 11 | n | Ħ | tí | |
| Carbon disulfide | ND | 1000 | | н | 11 | 11 | n | tt | |
| Carbon tetrachloride | ND | 100 | R | 46 | tr . | u | 0 | н | |
| Chlorobenzene | ND | 100 | H | ŧŧ | tr | tr | U | н | |
| Chloroethane | ND | 100 | н | # | tt . | н | n | 11 | |
| Chloroform | ND | 100 | н | # | н | N | 11 | 11 | |
| Chloromethane | ND | 500 | H | Ħ | н | н | u | 11 | |
| 2-Chlorotoluene | ND | 100 | н | н | н | n | u | tt | |
| 4-Chlorotoluene | ND | 100 | Ħ | H | N | н | 0 | u | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | er | н | ** | 11 | ** | ** | |
| Dibromochloromethane | ND | 100 | ti | n | ts | 44 | er | # | |
| 1,2-Dibromoethane | ND | 100 | tt | 11 | er | 4\$ | Ħ | IF . | |
| Dibromomethane | ND | 100 | et | 11 | n | # | Ħ | ti | |
| 1,2-Dichlorobenzene | ND | 100 | R . | tt. | n | ** | 11 | ti | |
| 1,3-Dichlorobenzene | ND | 100 | H | н | H | ŧř | Ħ | Ħ | |
| I.4-Dichlorobenzene | ND | 100 | н | Ħ | n | н | 11 | n | |
| Dichlorodifluoromethane | ND | 500 | Ħ | tt | N | н | 4 | н | |
| 1,1-Dichloroethane | ND | 100 | 11 | 11 | n | n | 46 | 11 | |
| 1,2-Dichloroethane | ND | 100 | ** | | н | n | 11 | н | |
| 1,1-Dichloroethene | ND | 100 | ** | н | 17 | н | 11 | н | |
| cis-1,2-Dichloroethene | ND | 100 | | #1 | 11 | н | ** | H | |
| trans-1,2-Dichloroethene | ND | 100 | er . | ** | tr | 16 | n | 11 | |
| 1,2-Dichloropropane | ND | 100 | er . | ** | n | 11 | tt | ** | |
| 1,3-Dichloropropane | ND | 100 | н | * | " | 11 | ŧr | # | |
| 2,2-Dichloropropane | ND | 100 | н | * | н | ** | ti | ** | |
| 1,1-Dichloropropene | ND | 100 | n | ii . | н | e | n | tt | |
| cis-1,3-Dichloropropene | ND | 100 | н | n | н | H | н | n . | |
| trans-1,3-Dichloropropene | ND | 100 | # | н | ** | н | # | н | |
| Ethylbenzene | ND | 100 | ** | # | 40 | Ħ | ** | н | |

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Joor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|-----------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|---------|------|
| GP14 @ 8' (P008088-19) Soil | | | | (| Sampled: 08/02 | /00 Recei | ved: 08/03/0 | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | ** | Ħ | * | Ħ | Ħ | н | |
| Isopropylbenzene | ND | 200 | Ħ | Ħ | н | н | Ħ | ŧŧ | |
| p-Isopropyltoluene | ND | 200 | Ħ | H | н | H . | Ħ | ** | |
| 4-Methyl-2-pentanone | ND | 500 | н | ** | Ħ | н | H | n | |
| Methyl tert-butyl ether | ND | 100 | ** | # | # | н. | * | н | |
| Methylene chloride | ND | 500 | Ħ | H | tt | н | 11 | n | |
| Naphthalene | ND | 200 | н | ** | 11 | ŧŧ | 11 | u u | |
| n-Propylbenzene | ND | 100 | Ħ | 11 | 11 | 15 | H | " | |
| Styrene | ND | 100 | 11 | 11 | н | 47 | er | 19 | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | Ħ | н | II | 11 | 11 | II | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | ŧi. | н | н | tt | Н | tı | |
| Tetrachloroethene | ND | 100 | et | ti | H. | н | н | ** | |
| Toluene | ND | 100 | ** | ** | 11 | tr | tt | * | |
| 1,2,3-Trichlorobenzene | ND | 100 | ** | н | Ħ | 11 | 11 | 11 | |
| 4-Trichlorobenzene | ND | 100 | н | 11 | н | н | н | п | |
| 1,1,1-Trichloroethane | ND | 100 | Ħ | * | tt | н | " | Ħ | |
| 1,1,2-Trichloroethane | ND | 100 | tt | ** | 11 | Ħ | # | ** | |
| Trichloroethene | ND | 100 | ** | Ħ | 11 | ** | н | н | |
| Trichlorofluoromethane | ND | 100 | 11 | 11 | 11 | * | u | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | Ħ | # | н | Ħ | ** | п | |
| 1,2,4-Trimethylbenzene | ND | 100 | er . | e e | н | Ħ | Ħ | ŧŧ | |
| 1,3,5-Trimethylbenzene | ND | 100 | # | *1 | Ħ | Ħ | H | ** | |
| Vinyl chloride | ND | 100 | +I | н | н | Ħ | ** | н | |
| o-Xylene | ND | 100 | н | # | н | 11 | ** | er . | |
| m,p-Xylene | ND | 200 | * | ** | ŧŧ | Ħ | 11 | " | |
| Surr: 4-BFB | 109 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 97.5 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 95.1 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 100 % | 70-130 | | | | | | | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|------------|----------|---------------|------------|--------------|----------|-------|
| GP15 (P008088-20) Soil | | | | S | Sampled: 08/0 | 2/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | H | Ħ | u | ** | Ħ | Ħ | |
| Bromobenzene | ND | 100 | n | ŧī | ** | ŧŧ | Ħ | 11 | |
| Bromochloromethane | ND | 100 | tt . | * | Ħ | u | H | 19 | |
| Bromodichloromethane | ND | 100 | ** | tt | # | H | Ħ | H | |
| Bromoform | ND | 100 | e ¢ | n | ** | | H | Ħ | |
| Bromomethane | ND | 500 | et . | H | # | e | H | н | |
| 2-Butanone | ND | 1000 | ** | Ħ | 11 | nt . | n | II | |
| n-Butylbenzene | ND | 500 | 41 | tr | ** | 11 | H | н | |
| sec-Butylbenzene | ND | 100 | 4\$ | et | и | 11 | Ħ | н | |
| tert-Butylbenzene | ND | 100 | 11 | ti | n | 11 | Ħ | п | |
| Carbon disulfide | ND | 1000 | £ £ | ti | н | 11 | ti | н | |
| Carbon tetrachloride | ND | 100 | 41 | # | н | 11 | H | н | |
| Chlorobenzene | ND | 100 | 11 | es | n | 11 | u | ti | |
| Chloroethane | ND | 100 | # | ŧ | n | 11 | н | n | |
| Chloroform | ND | 100 | 12 | " | #1 | 11 | н | n | |
| Chloromethane | ND | 500 | 11 | tt | н | # | Ħ | # | |
| 2-Chlorotoluene | ND | 100 | 17 | et | н | 11 | tt | er | |
| 4-Chlorotoluene | ND | 100 | H | # | н | 11 | · · | 65 | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | 11 | et | п | н | * | * | |
| Dibromochloromethane | ND | 100 | 19 | u | н | н | ŧ | tr | |
| 1,2-Dibromoethane | ND | 100 | Ħ | e | н | Ħ | ** | BE . | |
| Dibromomethane | ND | 100 | Ħ | • | Ħ | 11 | 13 | 16 | |
| 1,2-Dichlorobenzene | ND | 100 | 11 | ** | tt | ti | 11 | 16 | |
| 1,3-Dichlorobenzene | ND | 100 | Ħ | " | Ħ | tt | # | ** | |
| 1,4-Dichlorobenzene | ND | 100 | ŧŧ | 11 | # | н | 11 | 44 | |
| Dichlorodifluoromethane | ND | 500 | 11 | 11 | r# | н | 41 | н | |
| 1,1-Dichloroethane | ND | 100 | u | Ħ | 29 | Ħ | ti | 11 | |
| 1,2-Dichloroethane | ND | 100 | н | Ħ | Ħ | tt | н | H | |
| 1,1-Dichloroethene | ND | 100 | н | н | es | * | н | H | |
| cis-1,2-Dichloroethene | ND | 100 | n | н | " | u | Ħ | н | |
| trans-1,2-Dichloroethene | ND | 100 | н | H | 45 | ** | Ħ | н | |
| 1,2-Dichloropropane | ND | 100 | н | н | ** | ** | н | н | |
| 1,3-Dichloropropane | ND | 100 | u | н | ** | 11 | п | н | |
| 2,2-Dichloropropane | ND | 100 | ti | Ħ | 11 | 11 | et e | н | |
| 1,1-Dichloropropene | ND | 100 | Ħ | ** | tt | 11 | н | n | |
| cis-1,3-Dichloropropene | ND | 100 | н | Ħ | 11 | #1 | н | n | |
| trans-1,3-Dichloropropene | ND | 100 | н | ** | # | 11 | Ħ | u | |
| Ethylbenzene | ND | 100 | er | # | 44 | #1 | ** | u | |

North Creek Analytical - Portland

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Lisa Bomenighini, Project Manager

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Jécor

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| | 1401 | th Creek | Alluxy tr | | | | | | |
|----------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| GP15 (P008088-20) Soil | | | | ; | Sampled: 08/02 | 2/00 Rece | ived: 08/03/ | | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | # | Ħ | Ħ | • | Ħ | Ħ | |
| Isopropylbenzene | ND | 200 | Ħ | н | ** | 11 | н | н | |
| p-Isopropyltoluene | ND | 200 | Ħ | * | * | Ħ | # | ** | |
| 4-Methyl-2-pentanone | ND | 500 | Ħ | # | Ħ | н | Ħ | 11 | |
| Methyl tert-butyl ether | ND | 100 | Ħ | ĸ | н | и . | ** | Ħ | |
| Methylene chloride | ND | 500 | ** | ** | н | Ħ | " | н | |
| Naphthalene | ND | 200 | Ħ | Ħ | н | н | n | ** | |
| n-Propylbenzene | ND | 100 | H | P | ** | st | ET | 10 | |
| Styrene | ND | 100 | u | ** | " | н | ** | н | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | 11 | 41 | 11 | 11 | ** | W | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | н | n | н | ar . | ŧI | 41 | |
| Tetrachloroethene | ND | 100 | ** | tt | Ħ | 11 | н | н | |
| Toluene | ND | 100 | ** | 11 | 11 | н | " | Ħ | |
| 1 2,3-Trichlorobenzene | ND | 100 | ŧI | н | н | н | н | ec | |
| 4-Trichlorobenzene | ND | 100 | н | II. | n | # | tt | 15 | |
| 1,1,1-Trichloroethane | ND | 100 | ** | * | 11 | Ħ | | н | |
| 1,1,2-Trichloroethane | ND | 100 | п | Ħ | Ħ | н | " | Ħ | |
| Trichloroethene | ND | 100 | Ħ | Ħ | Ħ | et | Ħ | ** | |
| Trichlorofluoromethane | ND | 100 | н | ** | ** | 99 | н | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | Ħ | 11 | ff | н | н | н | |
| 1,2,4-Trimethylbenzene | ND | 100 | н | Ħ | tt | tt | н | ** | |
| 1,3,5-Trimethylbenzene | ND | 100 | * | # | ** | 10 | 11 | Ħ | |
| Vinyl chloride | ND | 100 | н | Ħ | u | H | " | w | |
| o-Xylene | ND | 100 | H | tt | ti ti | n | н | " | |
| m,p-Xylene | ND | 200 | ** | ** | # | ** | tt | # | |
| Surr: 4-BFB | 95.2 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 94.4 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 88.4 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 91.6% | 70-130 | | | | | | | |

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| GP16 (P008088-21) Soil | | | | 5 | Sampled: 08/0 | 3/00 Recei | ived: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | H | Ħ | н | Ħ | Ħ | ** | |
| Bromobenzene | ND | 100 | es | Ħ | н | n | Ħ | 11 | |
| Bromochloromethane | ND | 100 | er | н | H | Ħ | Ħ | 41 | |
| Bromodichloromethane | ND | 100 | Ħ | Ħ | Ħ | n | n | н | |
| Bromoform | ND | 100 | N | #1 | # | u · | | er | |
| Bromomethane | ND | 500 | Ħ | " | Ħ | n | tı | н | |
| 2-Butanone | ND | 1000 | 11 | | " | ŧr | н | n | |
| n-Butylbenzene | ND | 500 | et | er | et | ŧſ | н | н | |
| sec-Butylbenzene | ND | 100 | e | tt | tt | н | H | н | |
| tert-Butylbenzene | ND | 100 | Ħ | Ħ | н | Ħ | 11 | n | |
| Carbon disulfide | ND | 1000 | ti | н | п | 11 | 11 | et | |
| Carbon tetrachloride | ND | 100 | п | н | 11 | 10 | a | ŧr | |
| Chlorobenzene | ND | 100 | # | 11 | ** | • | ** | e | |
| Chloroethane | ND | 100 | 4 | 19 | ** | tt . | Ħ | n | |
| Chloroform | ND | 100 | ** | ee ee | Ħ | н | н | и | |
| Chloromethane | ND | 500 | ts | н | Ħ | н | н | п | • |
| 2-Chlorotoluene | ND | 100 | tt | er | н | н | Ħ | | |
| 4-Chlorotoluene | ND | 100 | W | н | н | н | Ħ | • | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | n | II | n | 11 | ** | 16 | |
| Dibromochloromethane | ND | 100 | н | Ħ | н | ** | ** | Ħ | |
| 1,2-Dibromoethane | ND | 100 | 11 | 11 | ** | n | ** | er | |
| Dibromomethane | ND | 100 | 11 | 45 | 46 | u | H . | tr | |
| 1,2-Dichlorobenzene | ND | 100 | " | ** | ** | W | н | п | |
| 1,3-Dichlorobenzene | ND | 100 | ** | н | Ħ | H | н | н | |
| 1,4-Dichlorobenzene | ND | 100 | н | ** | н | н | Ħ | н | |
| Dichlorodifluoromethane | ND | 500 | н | Ħ | н | н | Ħ | Ħ | |
| 1,1-Dichloroethane | ND | 100 | н | н | н | 11 | ** | u | |
| 1,2-Dichloroethane | ND | 100 | II. | ri | ** | 11 | 4 | | |
| 1,1-Dichloroethene | ND | 100 | 11 | Ħ | n | # | ** | ** | |
| cis-1,2-Dichloroethene | ND | 100 | 11 | ** | 11 | | er e | tt | |
| trans-1,2-Dichloroethene | ND | 100 | ** | 11 | 25 | " | H | н | |
| 1,2-Dichloropropane | ND | 100 | ** | er | rt . | tt | Ħ | н | |
| 1,3-Dichloropropane | ND | 100 | Ħ | ŧı | н | tt | U | н | |
| 2,2-Dichloropropane | ND | 100 | H | н | н | н | н | Ħ | |
| 1,1-Dichloropropene | ND | 100 | ** | н | 11 | 11 | * | ** | |
| cis-1,3-Dichloropropene | ND ND | 100 | Ħ | н | 11 | # | * | ** | |
| trans-1,3-Dichloropropene | ND | 100 | H | 4 | * | u | ** | ** | |
| Ethylbenzene | ND ND | 100 | 11 | " | t+ | ** | н | ** | |

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|-----------|-------|
| GP16 (P008088-21) Soil | | | | | Sampled: 08/0 | 3/00 Recei | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | tr | н | п | н | H | н | |
| Isopropylbenzene | ND | 200 | Ħ | n | Ħ | • | ĸ | ** | |
| p-Isopropyltoluene | ND | 200 | Ħ | Ħ | н | н. | н | 4 | |
| 4-Methyl-2-pentanone | ND | 500 | н | ** | Ħ | # | n | Ħ | |
| Methyl tert-butyl ether | ND | 100 | ** | Ħ | " | # . | н | H | |
| Methylene chloride | ND | 500 | # | н | Ħ | * | 15 | ** | |
| Naphthalene | ND | 200 | 11 | Ħ | 11 | 15 | # | ŧŧ | |
| n-Propylbenzene | ND | 100 | н | * | н | # | 11 | n | |
| Styrene | ND | 100 | *1 | 11 | ts | 11 | н | n | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | tt. | Ħ | ** | н | H | Ħ | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | 11 | (1 | 11 | n | Ħ | н | |
| Tetrachloroethene | ND - | 100 | 11 | # | 11 | . # | ** | • | |
| Toluene | ND | 100 | n | " | tt | 91 | 11 | 19 | |
| 1,2,3-Trichlorobenzene | ND | 100 | ti | Ħ | н | 11 | Ħ | H | |
| 4-Trichlorobenzene | ND | 100 | # | н | Ħ | Ħ | Ħ | II | |
| 1,1,1-Trichloroethane | ND | 100 | 11 | tt | 11 | H | 11 | H | |
| 1,1,2-Trichloroethane | ND | 100 | Ħ | н | н | H | 11 | e | |
| Trichloroethene | ND | 100 | H | Ħ | Ħ | ** | н | * | |
| Trichlorofluoromethane | ND | 100 | tt | # | t# | # | 11 | n | |
| 1,2,3-Trichloropropane | ND | 100 | ** | н | * | #1 | Ħ | Ħ | |
| 1,2,4-Trimethylbenzene | ND | 100 | 11 | H | Ħ | H | tt | Ħ | |
| 1,3,5-Trimethylbenzene | ND | 100 | n | u | Ħ | Ħ | #1 | \$F | |
| Vinyl chloride | ND | 100 | R | 11 | н | * | H | 11 | |
| o-Xylene | ND | 100 | ** | н | er | Ħ | Ħ | ti | |
| m,p-Xylene | ND | 200 | n | Ħ | ** | n | W . | н | |
| Surr: 4-BFB | 97.4 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 96.5 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 92.6 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 96.1 % | 70-130 | | | | | | | |

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|---------|-------|
| GP17 @ 6' (P008088-23) Soil | | | | 5 | Sampled: 08/0 | 2/00 Recei | ved: 08/03/ | 00 | |
| Acetone | 5130 | 1000 | ug/kg đry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| Benzene | ND | 100 | n | Ħ | et | * | # | ** | |
| Bromobenzene | ND | 100 | н | н | tt . | * | ** | 11 | |
| Bromochloromethane | ND | 100 | н | н | 8 | ŧŧ | 11 | H | |
| Bromodichloromethane | ND | 100 | н | н | a | ŧī | #1 | H | |
| Bromoform | ND | 100 | н | * | * | H. | " | tr | |
| Bromomethane | ND | 500 | н | н | 0) | H | ** | Ħ | |
| 2-Butanone | ND | 1000 | н | H | ** | u | 11 | н | |
| n-Butylbenzene | ND | 500 | II. | Ħ | tr | u | ** | H. | |
| sec-Butylbenzene | ND | 100 | 11 | 11 | b? | Ħ | ** | ** | |
| tert-Butylbenzene | ND | 100 | 11 | 41 | Ħ | н | 11 | н | |
| Carbon disulfide | ND | 1000 | 11 | 11 | Ħ | И | et | н | |
| Carbon tetrachloride | ND | 100 | # | # | n | н | tr | н | |
| Chlorobenzene | ND | 100 | ei | e | u | 11 | ti | н | |
| Chloroethane | ND | 100 | tt | e e | п | 11 | H | н | |
| Chloroform | ND | 100 | н | ţ; | Ħ | 11 | ti | н | |
| Chloromethane | ND | 500 | ti | II. | н | 44 | Ħ | 11 | |
| 2-Chlorotoluene | ND | 100 | tt | ** | # | 11 | ti | н | |
| 4-Chlorotoluene | ND | 100 | н | ŧr | 11 | (1 | н | н | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | н | tt | * | | н | Ħ | |
| Dibromochloromethane | ND | 100 | 11 | n | ** | u | н | Ħ | |
| 1,2-Dibromoethane | ND | 100 | Ħ | н | u | ** | Ħ | # | |
| Dibromomethane | ND | 100 | 11 | Ħ | ** | н | H | н | |
| 1,2-Dichlorobenzene | 50100 | 500 | ** | 5 | ** | | 08/18/00 | 11 | I-02 |
| 1,3-Dichlorobenzene | ND | 100 | # | 1 | 11 | Ħ | 08/15/00 | н | |
| 1,4-Dichlorobenzene | 1100 | 100 | ** | 14 | er | ŧŧ | 11 | 11 | |
| Dichlorodifluoromethane | ND | 500 | 11 | Ħ | Ħ | Ħ | # | н | |
| 1,1-Dichloroethane | ND | 100 | ** | н | # | H | 11 | #1 | |
| 1,2-Dichloroethane | ND | 100 | ** | 11 | H | Ħ | 19 | ** | |
| 1,1-Dichloroethene | ND | 100 | 26 | 11 | ŧ | tt | 11 | 11 | |
| cis-1,2-Dichloroethene | ND | 100 | ŧŧ | 11 | n | н | 19 | и | |
| trans-1,2-Dichloroethene | ND | 100 | t# | 11 | Ħ | II | 10 | 11 | |
| 1,2-Dichloropropane | ND | 100 | 41 | ** | н | н | 11 | 11 | |
| 1,3-Dichloropropane | ND | 100 | tr | ** | н | Н | u | 11 | |
| 2,2-Dichloropropane | ND | 100 | ŧſ | et | н | н | tr | ** | |
| 1,1-Dichloropropene | ND | 100 | H | tt | н | Ħ | ŧſ | u | |
| cis-1,3-Dichloropropene | ND | 100 | ŧ | н | н | 19 | Ħ | 66 | |
| trans-1,3-Dichloropropene | ND | 100 | п | Ħ | 11 | 11 | н | e | |
| Ethylbenzene | ND | 100 | Ħ | н | # | ** | н | | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Environmental Laboratory Network



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541,383,9310 fax 541,382,7588

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP17 @ 6' (P008088-23) Soil | | | | | Sampled: 08/0 | 2/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/15/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | ** | 11 | * | ** | Ħ | н | |
| Isopropylbenzene | ND | 200 | Ħ | Ħ | H | Ħ | н | н | |
| p-Isopropyltoluene | ND | 200 | н | tI | n | Ħ | Ħ | # | |
| 4-Methyl-2-pentanone | ND | 500 | n | Ħ | # | Ħ | Ħ | n | |
| Methyl tert-butyl ether | ND | 100 | ** | Ħ | Ħ | H - | tt | Ħ | |
| Methylene chloride | 750 | 500 | Ħ | н | Ħ | N | tt | н | |
| Naphthalene | ND | 200 | ti | 11 | " | 11 | n | н | |
| n-Propyibenzene | ND | 100 | tt | II | | 11 | 11 | Ħ | |
| Styrene | ND | 100 | ŧŧ | н | Ħ | и | Ħ | # | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | " | tŧ | н | Ħ | Н | 11 | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | 11 | ** | н | H | Ħ | н | |
| Tetrachloroethene | ND | 100 | Ħ | 4 | tt | ** | ** | н | |
| Toluene | ND | 100 | ti | # | ** | Ħ | ŧ | ŧi | |
| 1 2,3-Trichlorobenzene | ND | 100 | er | 11 | 19 | Ħ | 11 | н | |
| 4-Trichlorobenzene | ND | 100 | ** | Ħ | н | H | Ħ | н | |
| 1,1,1-Trichloroethane | ND | 100 | н | н | Ħ | ** | H | н | |
| 1,1,2-Trichloroethane | ND | 100 | н | a | Ħ | н | n | н | |
| Trichloroethene | ND | 100 | Ħ | ** | " | * | н | н | |
| Trichlorofluoromethane | ND | 100 | ** | н | # | н | Ħ | ** | |
| 1,2,3-Trichloropropane | ND | 100 | ** | Ħ | Ħ | # | Ħ | н | |
| 1,2,4-Trimethylbenzene | ND | 100 | Ħ | Ħ | н | н | H | 11 | |
| 1,3,5-Trimethylbenzene | ND | 100 | 11 | ** | н | н | H | н | |
| Vinyl chloride | ND | 100 | tt | Ħ | н | 11 | ** | • | |
| o-Xylene | ND | 100 | æ | п | Ħ | Ħ | H | Ħ | |
| m,p-Xylene | ND | 200 | ** | et . | п | Ħ | н | Ħ | |
| Surr: 4-BFB | 63.9 % | 70-130 | | | | | | | S-0 |
| Surr: 1,2-DCA-d4 | 89.1 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 84.2 % | 70-130 | | | | | | | |
| | 00 101 | 70 120 | | | | | | | |

88.1 %

70-130

North Creek Analytical - Portland

Surr: Toluene-d8

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Secor Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 P.O. Box 1508

Reported:

Tualatin, OR 97062 Project Manager: Joe Hunt

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---------------------------------|--------|--------------------|-----------|------------|---------------|------------|--------------|---------|-------|
| GP17C @ 11.5' (P008088-25) Soil | | | | 5 | Sampled: 08/0 | 2/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| Benzene | ND | 100 | Ħ | # | ** | Ħ | Ħ | Ħ | |
| Bromobenzene | ND | 100 | Ħ | " | tt. | # | " | Ħ | |
| Bromochloromethane | ND | 100 | н | 4 ' | Ħ | 11 | u | н | |
| Bromodichloromethane | ND | 100 | н | ** | ** | 10 | ** | Ħ | |
| Bromoform | ND | 100 | н | tt | Ħ | # . | # | 4 | |
| Bromomethane | ND | 500 | н | Ħ | tr | u | Ħ | ** | |
| 2-Butanone | ND | 1000 | н | # | tt | 11 | 12 | 41 | |
| n-Butylbenzene | ND | 500 | и | ** | H | 11 | ** | 11 | |
| sec-Butyibenzene | ND | 100 | n | 11 | ti | 1t | ŧŧ | 19 | |
| tert-Butylbenzene | ND | 100 | N | ** | н | 11 | tt | Ħ | |
| Carbon disulfide | ND | 1000 | н | ĸ | н | 11 | ** | ** | |
| Carbon tetrachloride | ND | 100 | н | ** | и | 41 | # | ** | |
| Chlorobenzene | ND | 100 | 11 | ** | tt | # | Ħ | 4 | |
| Chloroethane | ND | 100 | н | ** | Ħ | 0 | Ħ | ** | |
| Chloroform | ND | 100 | н | ** | U | ** | # | ti | e e |
| Chloromethane | ND | 500 | 11 | ** | н | tt | tt | tt | |
| 2-Chlorotoluene | ND | 100 | 11 | H | н | n | tr | ų | |
| 4-Chlorotoluene | ND | 100 | и | tt | п | t# | H | ** | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | 11 | ** | tt | ** | | ** | |
| Dibromochloromethane | ND | 100 | 11 | H | н | H | ŧŧ | ** | |
| 1,2-Dibromoethane | ND | 100 | 11 | H. | н | H | H | tt | |
| Dibromomethane | ND | 100 | Ħ | ** | 11 | II. | tr | ** | |
| 1,2-Dichlorobenzene | 382 | 100 | " | ** | н | ır | ** | et | |
| 1,3-Dichlorobenzene | ND | 100 | H | t† | Ħ | ** | и | et | |
| 1,4-Dichlorobenzene | ND | 100 | ** | tr | н | H | н | ıt | |
| Dichlorodifluoromethane | ND | 500 | ** | * | Ħ | | Ħ | BE . | |
| 1,1-Dichloroethane | ND | 100 | ** | * | 11 | 11 | tr | ** | |
| 1,2-Dichloroethane | ND | 100 | 11 | Ħ | н | H | tr | " | |
| 1,1-Dichloroethene | ND | 100 | ** | Ħ | n | N. | H | ** | |
| cis-1,2-Dichloroethene | ND | 100 | 11 | ** | н | • | Ħ | 41 | |
| trans-1,2-Dichloroethene | ND | 100 | ** | ff. | н | | ŧr | 11 | |
| 1,2-Dichloropropane | ND | 100 | # | | н | | н | 41 | |
| 1,3-Dichloropropane | ND | 100 | ** | н | н | u | n | н | |
| 2,2-Dichloropropane | ND | 100 | " | Ħ | н | H. | * | " | |
| 1,1-Dichloropropene | ND | 100 | ** | н | н | • | н | 61 | |
| cis-1,3-Dichloropropene | ND | 100 | ** | н | н | H | н | ** | |
| trans-1,3-Dichloropropene | ND | 100 | * | н | ** | tr . | Ħ | * | |
| Ethylbenzene | ND | 100 | ** | н | 11 | ır | н | н | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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North Creek Analytical, Inc. **Environmental Laboratory Network**



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541.383.9310 fax 541.382.7588

Jecor

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---------------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP17C @ 11.5' (P008088-25) Soil | | | | | Sampled: 08/0 | 2/00 Recei | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | H | # | Ħ | ** | Ħ | |
| Isopropylbenzene | ND | 200 | н | Ħ | н | Ħ | 11 | н | |
| p-Isopropyltoluene | ND | 200 | н | " | Ħ | 11 | 17 | e | |
| 4-Methyl-2-pentanone | ND | 500 | 99 | " | 44 | " | Ħ | ** | |
| Methyl tert-butyl ether | ND | 100 | Ħ | Ħ | Ħ | # . | Ħ | н | |
| Methylene chloride | ND | 500 | н | н | ri | ŧi | Ħ | н | |
| Naphthalene | ND | 200 | н | tt | ŧŧ | ti | 41 | Ħ | |
| n-Propylbenzene | ND | 100 | 10 | # | | tt | Ħ | ** | |
| Styrene | ND | 100 | Ħ | 11 | 11 | U | rt | ## | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | н | H | Ħ | 11 | Ħ | н | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | Ħ | tŧ | Ħ | н | 11 | н | |
| Tetrachloroethene | ND | 100 | Ħ | . 11 | tr | tr | 11 | H | |
| Toluene | ND | 100 | Ħ | 31 | 11 | ŧŧ | Ħ | tt | |
| 1 2,3-Trichlorobenzene | ND | 100 | 11 | 11 | 11 | 11 | ts | 11 | |
| 4-Trichlorobenzene | ND | 100 | н | ti | н | ** | ** | 11 | |
| 1,1,1-Trichloroethane | ND | 100 | н | et | IT | 41 | 11 | н | |
| 1,1,2-Trichloroethane | ND | 100 | 11 | н | | н | 11 | H | |
| Trichloroethene | ND | 100 | 11 | 11 | 11 | ır | Ħ | H | |
| Trichlorofluoromethane | ND | 100 | н | Ħ | Ħ | Ħ | H | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | ŧŧ | n | н | # | н | # | |
| 1,2,4-Trimethylbenzene | ND | 100 | n | | ts | Ħ | 11 | #1 | |
| 1,3,5-Trimethylbenzene | ND | 100 | ** | 41 | ** | tt | tt | | |
| Vinyl chloride | ND | 100 | Ħ | н | n | ** | ** | ** | |
| o-Xylene | ND | 100 | et | н | Ħ | Ħ | es | ** | |
| m,p-Xylene | ND | 200 | ** | # | t | ti | स | it . | |
| Surr: 4-BFB | 81.6% | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 90.0 % | 70-130 | | | | | | | |

84.0 %

91.2 %

70-130

70-130

North Creek Analytical - Portland

Surr: Dibromofluoromethane

Surr: Toluene-d8

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 38 of 98



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503.906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP18 (P008088-26) Soil | | | · | Ş | Sampled: 08/0 | 3/00 Recei | ved: 08/03/0 | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| Benzene | ND | 100 | н | u | n | n | Ħ | tt | |
| Bromobenzene | ND | 100 | Ħ | tt | tt | tt | Ħ | ŧŧ | |
| Bromochloromethane | ND | 100 | ** | н | Ħ | u | н | tf | |
| Bromodichloromethane | ND | 100 | н | 4 | Ħ | t # | ŧr | Ħ | |
| Bromoform | ND | 100 | н | Ħ | Ħ | tt · | н | et | |
| Bromomethane | ND | 500 | " | H | Ħ | Ħ | н | Ħ | |
| 2-Butanone | ND | 1000 | ŧŧ | . # | 11 | Ħ | n | et . | |
| n-Butylbenzene | ND | 500 | ŧŧ | tf | 11 | Ħ | н | er | |
| sec-Butylbenzene | ND | 100 | ** | Ħ | 11 | Ħ | n | Ħ | |
| tert-Butylbenzene | ND | 100 | 11 | Ħ | 11 | н | н | Ħ | |
| Carbon disulfide | ND | 1000 | ** | tt | # | н | н | ti | |
| Carbon tetrachloride | ND | 100 | N . | tr | 11 | H | n | н | |
| Chlorobenzene | ND | 100 | Ħ | Ħ | 11 | U | II | U | |
| Chloroethane | ND | 100 | tř | H | 11 | Ü | 11 | U | |
| Chloroform | ND | 100 | ti | n | ** | U | 11 | U | |
| Chloromethane | ND | 500 | n | tt | tt | H | n | II . | |
| 2-Chlorotoluene | ND | 100 | Ħ | И | 41 | Ħ | Ħ | н | |
| 4-Chlorotoluene | ND | 100 | H | н | ** | Ħ | n | И | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | н | н | tt | 11 | ** | # | |
| Dibromochloromethane | ND | 100 | Ħ | Ħ | tt | ** | u u | 11 | |
| 1,2-Dibromoethane | ND | 100 | 11 | Ħ | 11 | 11 | u | 11 | |
| Dibromomethane | ND | 100 | 11 | \$1 | tř | 11 | u | 11 | |
| 1,2-Dichlorobenzene | ND | 100 | 11 | ** | Ħ | • | н | 11 | |
| 1,3-Dichlorobenzene | ND | 100 | # | н | H | # | n | n | |
| 1,4-Dichlorobenzene | ND | 100 | н | ** | Ħ | " | H | ** | |
| Dichlorodifluoromethane | ND | 500 | ** | * | tt | • | н | ** | |
| 1,1-Dichloroethane | ND | 100 | 11 | ** | Ħ | ıı | н | 1t | |
| 1,2-Dichloroethane | ND | 100 | 34 | | tt | u | н | ** | |
| 1,1-Dichloroethene | ND | 100 | ** | | H | u | н | « | |
| cis-1,2-Dichloroethene | ND | 100 | # | ** | п | tt | н | 11 | |
| trans-1,2-Dichloroethene | ND | 100 | a | ** | H | ıı | н | tı . | |
| 1,2-Dichloropropane | ND | 100 | ** | er | n | " | n | 41 | |
| 1,3-Dichloropropane | ND | 100 | ,,, | tt | н | ** | н | 11 | |
| 2,2-Dichloropropane | ND | 100 | ti | tt | н | п | н | u | |
| 1,1-Dichloropropene | ND | 100 | Ħ | rt | н | н | U | н | |
| cis-1,3-Dichloropropene | ND | 100 | и | н | н | н | 11 | н | |
| trans-1,3-Dichloropropene | ND | 100 | н | н | н | Ħ | ** | н | |
| Ethylbenzene | ND | 100 | H | н | 41 | н | и | н | |

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Environmental Laboratory Network



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Spokane

Portland

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эесог

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

P.O. Box 1508 Tualatin, OR 97062

Project Manager: Joe Hunt

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|-----------|----------|
| GP18 (P008088-26) Soil | | | | | Sampled: 08/0: | 3/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/16/00 | 0080135 | |
| 2-Hexanone | ND | 1000 | Ħ | Ħ | n | Ħ | # | Ħ | |
| Isopropylbenzene | ND | 200 | н | Ħ | Ħ | 11 | Ħ | н | |
| p-Isopropyltoluene | ND | 200 | H | Ħ | # - | Ħ | ıt | и | |
| 4-Methyl-2-pentanone | ND | 500 | ** | Ħ | | Ħ | н | 51 | |
| Methyl tert-butyl ether | ND | 100 | Ħ | ** | n | H . | # | Ħ | |
| Methylene chloride | ND | 500 | Ħ | Ħ | #1 | # | H | Ħ | |
| Naphthalene | ND | 200 | H | Ħ | tt | Ħ | Ħ | Ħ | |
| n-Propylbenzene | ND | 100 | * | н | " | н | 11 | " | |
| Styrene | ND | 100 | Ħ | Ħ | e | tt | 4 | 11 | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | и | н | 11 | " | Ħ | н | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | * | 11 | Ħ | ** | н | H | |
| Tetrachloroethene | ND | 100 | 19 | н | ŧſ | II | н | 44 | |
| Toluene | ND | 100 | Ħ | Ħ | н | Ħ | ** | ** | |
| 1 2.3-Trichlorobenzene | ND | 100 | Ш | ** | 11 | tt | н | u | |
| 4-Trichlorobenzene | ND | 100 | H | ** | п | ** | н | tl | |
| 1,1,1-Trichloroethane | ND | 100 | 11 | Ħ | Ħ | n | # | ** | |
| 1,1,2-Trichloroethane | ND | 100 | Ħ | н | u | Ħ | | " | |
| Trichloroethene | ND | 100 | н | 17 | Ħ | Ħ | Ħ | n | |
| Trichlorofluoromethane | ND | 100 | ** | # | Ħ | | Ħ | Ħ | |
| 1,2,3-Trichloropropane | ND | 100 | | н | tt | п | Ħ | tt | |
| 1,2,4-Trimethylbenzene | ND | 100 | | Ħ | n | Ħ | tt | " | |
| 1,3,5-Trimethylbenzene | ND | 100 | | n | ** | н | 11 | н | |
| Vinyl chloride | ND | 100 | | 11 | # | ** | н | " | |
| o-Xylene | ND | 100 | | н | н | Ħ | Ħ | * | |
| m,p-Xylene | ND | 200 | | п | н | Ħ | Ħ | | <u> </u> |
| Surr: 4-BFB | 88.7 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 92.4 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 87.0 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 93.3 % | 70-130 | | | | | | | |

North Creek Analytical - Portland

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|------------|------------|---------------|------------|-------------|---------|-------|
| GP19 (P008088-27) Soil | | | | 5 | Sampled: 08/0 | 3/00 Recei | ved: 08/03/ | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/06/00 | 0080136 | |
| Benzene | ND | 100 | 11 | tr | Ħ | # | н | M | |
| Bromobenzene | ND | 100 | tt | NF. | Ħ | 11 | н | Ħ | |
| Bromochloromethane | ND | 100 | Ħ | Ħ | н | #1 | н | н | |
| Bromodichloromethane | ND | 100 | tl | н | Ħ | Ħ | Ħ | н | |
| Bromoform | ND | 100 | н | t # | H | n . | H | н | |
| Bromomethane | ND | 500 | н | * | Ħ | Ħ | Ħ | н | |
| 2-Butanone | ND | 1000 | н | tt | Ħ | " | u | н | |
| n-Butylbenzene | ND | 500 | н | tt | Ħ | 8 | II | н | |
| sec-Butylbenzene | ND | 100 | ti | tt | н | ** | tı | н | |
| tert-Butylbenzene | ND | 100 | Ħ | Ħ | H | 41 | Ħ | Ħ | |
| Carbon disulfide | ND | 1000 | Ħ | Ħ | н | ** | Ħ | н | |
| Carbon tetrachloride | ND | 100 | 11 | n | н | ** | H | н | |
| Chlorobenzene | ND | 100 | # | U | н | " | 11 | n | |
| Chloroethane | ND | 100 | # | n | Ħ | Ħ | u | Ħ | |
| Chloroform | ND | 100 | 11 | н | н | Ħ | Ħ | н | |
| Chloromethane | ND | 500 | ** | U | н | tr | 11 | # | Í |
| 2-Chlorotoluene | ND | 100 | ** | н | Ħ | ** | ti | n | , |
| 4-Chlorotoluene | ND | 100 | # | н | 11 | | n | Ħ | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | ** | Ħ | н | n | 11 | ** | |
| Dibromochloromethane | ND | 100 | e | 11 | # | n | 11 | ** | |
| 1,2-Dibromoethane | ND | 100 | ¢¢ | н | 11 | н | et. | ** | |
| Dibromomethane | ND | 100 | 45 | # | 11 | н | et | 11 | |
| 1,2-Dichlorobenzene | ND | 100 | tt | 19 | 11 | н | tt | 11 | |
| 1,3-Dichlorobenzene | ND | 100 | | ** | " | н | 40 | tt. | |
| 1,4-Dichlorobenzene | ND | 100 | t } | 11 | ** | н | \$ | # | |
| Dichlorodifluoromethane | ND | 500 | Ħ | 11 | 44 | H | # | 9t | |
| 1,1-Dichloroethane | ND | 100 | tr | 14 | ** | н | 11 | 11 | |
| 1,2-Dichloroethane | ND | 100 | t# | 41 | • | H | ** | li . | |
| 1,1-Dichloroethene | ND | 100 | Ħ | 19 | # | II | tt | Ħ | |
| cis-1,2-Dichloroethene | ND | 100 | Ħ | # | ,, | н | Ħ | 11 | |
| trans-1,2-Dichloroethene | ND ND | 100 | Ħ | 19 | ** | n | ** | 11 | |
| I,2-Dichloropropane | ND ND | 100 | Ħ | 11 | • | н | ** | 11 | |
| 1,3-Dichloropropane | ND ND | 100 | Ħ | 11 | et . | н | 11 | 10 | |
| 2,2-Dichloropropane | ND ND | 100 | Ħ | 11 | W . | H | 11 | it | |
| 1,1-Dichloropropene | ND ND | 100 | tr | | | Ħ | a | tr . | |
| cis-1,3-Dichloropropene | ND ND | 100 | 11 | u | et | H | # | tt | |
| trans-1,3-Dichloropropene | ND ND | 100 | H | ч | tt | Ħ | 28 | Ħ | |
| Ethylbenzene | ND ND | 100 | H | a | н | | | ** | |

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North Creek Analytical, Inc. **Environmental Laboratory Network**

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Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

P.O. Box 1508 Project Manager: Joe Hunt Tualatin, OR 97062

08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|------------|----------|---------------|------------|--------------|---------|-------|
| GP19 (P008088-27) Soil | | | | (| Sampled: 08/0 | 3/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/06/00 | 0080136 | |
| 2-Hexanone | ND | 1000 | и | н | * | Ħ | н | Ħ | |
| Isopropylbenzene | ND | 200 | et | et | н | Ħ | Ħ | н | |
| p-Isopropyitoluene | ND | 200 | ** | * | н | tt | н | н | |
| 4-Methyl-2-pentanone | ND | 500 | Ħ | " | н | n | ** | Ħ | |
| Methyl tert-butyl ether | ND | 100 | Ħ | Ħ | tt | # . | # | et | |
| Methylene chloride | ND | 500 | Ħ | Ħ | ** | н | н | Ħ | |
| Naphthalene | ND | 200 | . H | н | 11 | Ħ | Ħ | и | |
| n-Propylbenzene | ND | 100 | ** | tt | 11 | " | | п | |
| Styrene | ND | 100 | 11 | n | 11 | " | ** | H | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | 11 | " | н | 11 | Ħ | | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | n n | н | н | # | 11 | ** | |
| Tetrachloroethene | ND | 100 | ti | н | ** | н | H | * | |
| Toluene | ND | 100 | ŧr | Ħ | H | Ħ | tt | 11 | |
| 1.2,3-Trichlorobenzene | ND | 100 | 11 | ** | 11 | Ħ | n | н | |
| 1-Trichlorobenzene | ND | 100 | н | ** | н | | 19 | H | |
| 1,1,1-Trichloroethane | ND | 100 | н | # | tt | 11 | 11 | • | |
| 1,1,2-Trichloroethane | ND | 100 | ti | Ħ | It | Ħ | Ħ | 11 | |
| Trichloroethene | ND | 100 | ** | Ħ | | n | Ħ | Ħ | |
| Trichlorofluoromethane | ND | 100 | 15 | н | 41 | n | ** | Ħ | |
| 1,2,3-Trichtoropropane | ND | 100 | # | | 41 | 0 | * | Ħ | |
| 1,2,4-Trimethylbenzene | ND | 100 | ŧi | Ħ | н | 11 | н | # | |
| 1,3,5-Trimethylbenzene | ND | 100 | н | н | ti | 11 | н | Ħ | |
| Vinyl chloride | ND | 100 | Ħ | tt | ** | n | # | n | |
| o-Xylene | ND | 100 | #1 | Ħ | 11 | H | ** | н | |
| m,p-Xylene | ND | 200 | n | # | ti | n | 11 | Ħ | |
| Surr: 4-BFB | 90.0 % | 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 90.0 % | 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 88.6 % | 70-130 | | | | | | | |
| Surr: Toluene-d8 | 82.1 % | 70-130 | | | | | | | |

North Creek Analytical - Portland

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|------------|----------|----------------|------------|--------------|---------|-------|
| GP2B (P008088-29) Soil | | | | 5 | Sampled: 08/02 | 2/00 Recei | ived: 08/03/ | 00 | |
| Acetone | ND | 1000 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/06/00 | 0080136 | |
| Benzene | ND | 100 | Ħ | ti . | н | ** | Ħ | Ħ | |
| Bromobenzene | ND | 100 | Ħ | H | н | 15 | Ħ | H | |
| Bromochloromethane | ND | 100 | Ħ | Ħ | Ħ | н | н | * | |
| Bromodichloromethane | ND | 100 | н | н | н | e | н | Ħ | |
| Bromoform | ND | 100 | н | Ħ | Ħ | H . | н | н | |
| Bromomethane | ND | 500 | Ħ | н | Ħ | tt | Ħ | н | |
| 2-Butanone | ND | 1000 | u | н | Ħ | ŧŧ | N | и | |
| n-Butylbenzene | ND | 500 | н | н | 11 | ŧr | U | Ħ | |
| sec-Butylbenzene | ND | 100 | u | н | 14 | n | n | н | |
| tert-Butylbenzene | ND | 100 | н | Ħ | H | EI | H | н | |
| Carbon disulfide | ND | 1000 | н | 11 | 11 | н | 11 | н | |
| Carbon tetrachloride | ND | 100 | н | H | 11 | U | n | и | |
| Chlorobenzene | ND | 100 | #1 | 11 | " | " II | 11 | н | |
| Chloroethane | ND | 100 | и | " | ** | II. | 10 | н | _ |
| Chloroform | ND | 100 | 11 | " | 65 | н | 47 | н | - (|
| Chloromethane | ND | 500 | 11 | ** | ** | 11 | II. | н | |
| 2-Chlorotoluene | ND | 100 | 41 | ** | 8 | 11 | # | Ħ | |
| 4-Chlorotoluene | ND | 100 | 11 | | ** | 11 | W. | ** | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | ** | II . | u | n | e | # | |
| Dibromochloromethane | ND | 100 | 41 | Ħ | tt | u u | н | н | |
| 1,2-Dibromoethane | ND | 100 | e : | Ħ | et . | | N | 70 | |
| Dibromomethane | ND | 100 | e | H | ** | n | н | 11 | |
| 1,2-Dichlorobenzene | ND | 100 | er | tt | n | | u | • | |
| 1,3-Dichlorobenzene | ND | 100 | et | Ħ | н | ŧr | н | 97 | |
| 1,4-Dichlorobenzene | ND | 100 | ¢) | Ħ | н | H | н | # | |
| Dichlorodifluoromethane | ND | 500 | ** | Ħ | * | Ħ | н | ** | |
| 1,1-Dichloroethane | ND | 100 | ŧf | Ħ | н | a | н | 92 | |
| 1,2-Dichloroethane | ND | 100 | eş. | tr | н | tt | n | ** | |
| 1,1-Dichloroethene | ND | 100 | er | ** | n | н | н | " | |
| cis-1,2-Dichloroethene | ND | 100 | P | н | н | ti | н | ** | |
| trans-1,2-Dichloroethene | ND | 100 | ŧŧ | n | U | II. | н | ** | |
| 1,2-Dichloropropane | ND | 100 | El | н | н | II. | H | er | |
| 1,3-Dichloropropane | ND | 100 | tt | н | H | n n | н | ** | |
| 2,2-Dichloropropane | ND | 100 | ti | н | H | п | Ħ | ti | |
| 1,1-Dichloropropene | ND | 100 | Ħ | н | н | ŧŧ | 16 | et | |
| cis-1,3-Dichloropropene | ND | 100 | н | # | n | ** | 11 | Ħ | |
| trans-1,3-Dichloropropene | ND | 100 | н | н | ** | 11 | ** | Ħ | |
| Ethylbenzene | ND | 100 | Ħ | н | Ħ | ** | ** | н | |

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Jecor

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39

P.O. Box 1508 Tualatin, OR 97062

Project Manager: Joe Hunt Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|------------------|--------------------|-----------|----------|---------------|-----------|--------------|---------|-------|
| GP2B (P008088-29) Soil | | | | S | Sampled: 08/0 | 2/00 Rece | ived: 08/03/ | 00 | |
| Hexachlorobutadiene | ND | 200 | ug/kg dry | 1 | EPA 8260B | 08/04/00 | 08/06/00 | 0080136 | |
| 2-Hexanone | ND | 1000 | ** | Ħ | | ** | Ħ | ** | |
| sopropylbenzene | ND | 200 | n | n | * | Ħ | tt | ** | |
| -Isopropyltoluene | ND | 200 | tr . | H | 11 | п | ** | Ħ | |
| -Methyl-2-pentanone | ND | 500 | * | Ħ | н | Ħ | Ħ | H | |
| Methyl tert-butyl ether | ND | 100 | Ħ | Ħ | ** | н . | н | ** | |
| Methylene chloride | ND | 500 | н | # | • | н | Ħ | 11 | |
| Vaphthalene | ND | 200 | 11 | Ħ | N | tr | 11 | Ħ | |
| -Propylbenzene | ND | 100 | 11 | н | tt | " | п | Ħ | |
| Styrene | ND | 100 | н | Ħ | ** | 11 | Ħ | 11 | |
| ,1,1,2-Tetrachloroethane | ND | 100 | Ħ | Ħ | н | 11 | Ħ | 11 | |
| ,1,2,2-Tetrachloroethane | ND | 100 | ** | 11 | н | Ħ | Ħ | tt | |
| Cetrachloroethene | ND | 100 | 11 | U | Ħ | ** | н | Ħ | |
| Coluene | ND | 100 | tt | tt | 11 | 11 | tř | 11 | |
| 2,3-Trichlorobenzene | ND | 100 | 11 | 11 | н | и | 11 | н | |
| 4-Trichlorobenzene | ND | 100 | ** | н | Ħ | 24 | 11 | PT | |
| 1,1,1-Trichloroethane | ND | 100 | 0 | tt . | # | ** | Ħ | ** | |
| ,1,2-Trichloroethane | ND | 100 | ut. | e | н | Ħ | # | n | |
| Frichloroethene | ND | 100 | ** | Ħ | Ħ | Ħ | 11 | Ħ | |
| Frichlorofluoromethane | ND | 100 | 11 | н | rt | ti | . 11 | н | |
| 1,2,3-Trichloropropane | ND | 100 | н | tt | H | #1 | tt . | " | |
| 1,2,4-Trimethylbenzene | ND | 100 | æ | n | Ħ | п | ** | Ħ | |
| 1,3,5-Trimethylbenzene | ND | 100 | 11 | н | н | tt | Ħ | Ħ | |
| Vinyl chloride | ND | 100 | н | 11 | | ** | н | н | |
| | ND | 100 | H | Ħ | " | н | н | Ħ | |
| o-Xylene m,p-Xylene | ND ND | 200 | 11 | Ħ | Ħ | ŧŧ | 11 | Ħ | |
| | 100 % | 70-130 | | | | | | | |
| Surr: 4-BFB | 100 % 89.9 % | 70-130 70-130 | | | | | | | |
| Surr: 1,2-DCA-d4 | 87.3 % | 70-130 70-130 | | | | | | | |
| Surr: Dibromofluoromethane | 87.3 % 88.2 % | 70-130 70-130 | | | | | | | |
| Surr: Toluene-d8 | 00.4 70 | 70-130 | | | | | | | |

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541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|--------|
| GP1 (P008088-01) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | ****** |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| Acenaphthylene | ND | 0.330 | 11 | н | ** | Ħ | * | | |
| Anthracene | ND | 0.330 | ** | Ħ | # | н | ** | Ħ | |
| Benzo (a) anthracene | ND | 0.330 | Ħ | Ħ | Ħ | н | tr | Ħ | |
| Benzo (a) pyrene | ND | 0.330 | tt | н | н | # | н | # | |
| Benzo (b) fluoranthene | ND | 0.330 | н | # | н | 16 . | Ħ | # | |
| Benzo (ghi) perylene | ND | 0.330 | н | н | 11 | u | # | ** | |
| Benzo (k) fluoranthene | ND | 0.330 | # | u | ŧŧ | tr | æ | et | |
| Benzoic Acid | ND | 1.00 | 11 | | es | tr | ** | ** | |
| Benzyl alcohol | ND | 0.330 | tt | н | 13 | ti | Ħ | # | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | ti | Ħ | н | Ħ | н | H | |
| Butyl benzyl phthalate | ND | 0.330 | Ħ | н | ŋ | n | н | Ħ | |
| 4-Chloro-3-methylphenol | ND | 0.330 | п | ** | н | 11 | 14 | ** | |
| 4-Chloroaniline | ND | 2.00 | n | ** | 44 | ¢(| 11 | 11 | |
| Bis(2-chloroethoxy)methane | ND | 0.330 | н | Ħ | tr. | ri | | et . | |
| Bis(2-chloroethyl)ether | ND | 0.330 | | H | ri . | н | R | tt | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | tr | Ħ | п | н | н | Ħ | |
| 2-Chloronaphthalene | ND | 0.330 | Ħ | # | п | н | н | н | |
| 2-Chlorophenol | ND | 0.330 | Ħ | н | н | 41 | н | н | |
| 1-Chlorophenyl phenyl ether | ND | 0.330 | Ħ | н | 41 | ** | н | *1 | |
| Chrysene | ND | 0.330 | 11 | | 45 | ŧŧ | ** | ** | |
| Di-n-butyl phthalate | ND | 1.00 | ** | н | Hr. | Ħ | et | н | |
| Di-n-octyl phthalate | ND | 0.330 | u | н | Ħ | n | Ħ | tr | |
| Dibenzo (a,h) anthracene | ND | 0.330 | tt | # | н | u | ti | " | |
| Dibenzofuran | ND | 0.330 | n | " | # | 44 | н | # | |
| 1,2-Dichlorobenzene | ND | 1.00 | Ħ | e | н | st. | Ħ | et | |
| 1,3-Dichlorobenzene | ND | 1.00 | U | H | а | Ħ | a | 11 | |
| 1,4-Dichlorobenzene | ND | 1.00 | 11 | * | * | u | ** | ** | |
| 3,3'-Dichlorobenzidine | ND | 1.00 | 19 | Ħ | н | н | U | e\$ | |
| 2,4-Dichlorophenol | ND | 0.330 | | Ħ | н | Н | le . | er | |
| Diethyl phthalate | ND | 0.330 | ** | H | н | # | Ħ | ** | |
| 2,4-Dimethylphenol | ND | 1.00 | Ħ | ** | 14 | | Ħ | ti | |
| Dimethyl phthalate | ND | 0.330 | н | н | ** | u | н | n | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | н | н | ** | ** | 11 | н | |
| 2,4-Dinitrophenol | ND | 2.00 | ** | Ħ | | II | 41 | # | |
| 2,4-Dinitrotoluene | ND | 0.500 | " | н | ** | u | n | * | |
| 2,6-Dinitrotoluene | ND | 0.500 | tt | H | н | H | н | н | |
| Bis(2-ethylhexyl)phthalate | ND | 2.00 | | * | н | н | н | Ħ | |
| Fluoranthene | ND | 0.330 | Ħ | | , | | # | Ħ | |

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Project: Fort James Specialty Chemicals сοгی۔

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|--------------|----------|---------------|----------|-------------|---------|-------|
| GP1 (P008088-01) Soil | | | | \$ | Sampled: 08/0 | | ved: 08/03/ | | |
| Fluorene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| Hexachlorobenzene | ND | 0.330 | 11 | 11 | Ħ | # | | N | |
| Hexachlorobutadiene | ND | 1.00 | н | Ħ | tt | | # # | 11 | |
| Hexachlorocyclopentadiene | ND | 1.00 | ** | et | ** | | # | n n | |
| Hexachloroethane | ND | 1.00 | Ħ | Ħ | ** | # | | ti | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | Ħ | # | ** | н . | | ** | |
| Isophorone | ND | 0.330 | H | Ħ | ** | 11 | # | | |
| 2-Methylnaphthalene | ND | 0.330 | н | 11 | n | Ħ | H | H | |
| 2-Methylphenol | ND | 0.330 | ti | ti | u | 11 | 11 | et | |
| 3-,4-Methylphenol | ND | 0.330 | ** | tt | ** | ** | н | ** | |
| Naphthalene | ND | 0.330 | 11 | " | Ħ | 11 | Ħ | н | |
| 2-Nitroaniline | ND | 0.330 | Ħ | н | Ħ | H | u. | н | |
| 3-Nitroaniline | ND | 1.00 | 11 | tř | tř | ** | Ħ | si. | |
| 4-Nitroaniline | ND | 0.330 | н | 11 | н | 11 | Ħ | 11 | |
| Nitrobenzene | ND | 0.330 | n | н | ti | ** | H. | u | |
| itrophenol | ND | 0.330 | *** | tt | Ħ | 11 | 11 | H. | |
| 4-Nitrophenel | ND | 1.00 | 11 | ** | Ħ | Ħ | Ħ | n | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | Ħ | Ħ | 11 | н | ** | H | |
| N-Nitrosodiphenylamine | ND | 0.330 | tt | Ħ | er | H | # | # | |
| Pentachlorophenol | ND | 1.00 | 11 | ** | 11 | ** | н | 11 | |
| Phenanthrene | ND | 0.330 | Ħ | ti | н | BT | ** | н | |
| Phenol | ND | 0,330 | ** | er | # | " | " | # | |
| Pyrene | ND | 0.330 | u | ** | " | 11 | Ħ | н | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | Ħ | 11 | н | H | ** | # | |
| 2,4,5-Trichlorophenol | ND | 0.330 | ** | | ea | ** | ** | ** | |
| 2,4,6-Trichlorophenol | ND | 0.330 | н | Ħ | н | Ħ | 11 | 11 | |
| Surr: 2-Fluorobiphenyl | 72.8 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 77.3 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 68.4 % | 42-126 | • | | | | | | |
| Surr: Phenol-d6 | 84.6 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 69.1 % | 49-150 |) | | | | | | |
| Surr: 2,4,6-Tribromophenol | 78.6 % | 48-119 | • | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-----------|
| GP3 (P008088-03) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/0 | 00 | |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Acenaphthylene | ND | 0.330 | # | Ħ | u | tt . | n | н | |
| Anthracene | ND | 0.330 | н | 8 | H | ** | н | н | |
| Benzo (a) anthracene | ND | 0.330 | 11 | H | ŧŧ | ** | н | н | |
| Benzo (a) pyrene | ND | 0.330 | Ħ | 11 | ** | n | H | 11 | |
| Benzo (b) fluoranthene | ND | 0.330 | н | н | н | n ' | # | Ħ | |
| Benzo (ghi) perylene | ND | 0.330 | ti | ** | н | H | ų | e | |
| Benzo (k) fluoranthene | ND | 0.330 | II | " | 11 | 11 | ## | 11 | |
| Benzoic Acid | ND | 1.00 | н | | 11 | И | er . | ** | |
| Benzyl alcohol | ND | 0.330 | 11 | tr | 11 | • | ŧſ | ėt | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | ŧ | n | n | u | н | Ħ | |
| Butyl benzyl phthalate | ND | 0.330 | ** | n | ** | н | Ħ | Ħ | |
| 4-Chloro-3-methylphenol | ND | 0.330 | ti | 11 | н | н | н | U | |
| 4-Chloroaniline | ND | 2.00 | ŧŧ | Ħ | н | Ħ | H | II | |
| Bis(2-chloroethoxy)methane | ND | 0.330 | ti | u | 11 | 10 | 10 | 11 | |
| Bis(2-chloroethyl)ether | ND | 0.330 | п | | ** | " | н | ŧr. | \$ |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | н | 11 | e | " | н | W. | ** |
| 2-Chloronaphthalene | ND | 0.330 | # | ŧ | tf | e | н | H . | |
| 2-Chlorophenol | ND | 0.330 | н | Ħ | 16 | P | н | tt . | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | | II | н | rr | Ħ | Ħ | |
| Chrysene | ND | 0.330 | ŧŧ | Ħ | Ħ | н | tt | 11 | |
| Di-n-butyl phthalate | ND | 1.00 | н | # | Ħ | Ħ | tt | 4 | |
| Di-n-octyl phthalate | ND | 0.330 | н | 11 | 11 | н | ** | 19 | |
| Dibenzo (a,h) anthracene | ND | 0.330 | н | | u | | et | ėt | |
| Dibenzofuran | ND | 0.330 | 11 | Ħ | H | er . | et . | Ħ | |
| 1,2-Dichlorobenzene | ND | 1.00 | u | # | н | tt | tr | # | |
| 1,3-Dichlorobenzene | ND | 1.00 | 49 | ti | ri | н | ŧŧ | ** | |
| 1,4-Dichlorobenzene | 'nD | 1.00 | 4 | п | п | н | n | Ħ | |
| 3,3'-Dichlorobenzidine | ND | 1.00 | 9 | н | н | H | ti | 41 | |
| 2,4-Dichlorophenol | ND | 0.330 | | 11 | θ | 11 | н | п | |
| Diethyl phthalate | ND | 0.330 | ** | ** | н | Ħ | 11 | n | |
| 2,4-Dimethylphenol | ND | 1.00 | tr | ** | et . | 4 | 11 | II | |
| Dimethyl phthalate | ND | 0.330 | н | 11 | ti | 44 | ** | н | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | U | RF. | ŧ | ţī | 41 | 11 | |
| 2,4-Dinitrophenol | ND | 2.00 | н | ** | tł. | ** | н | 40 | |
| 2,4-Dinitrotoluene | ND | 0.500 | ** | Ħ | н | Ħ | н | et | |
| 2,6-Dinitrotoluene | ND | 0.500 | w | н | Ħ | н | Ħ | ti | |
| Bis(2-ethylhexyl)phthalate | ND | 2.00 | н | n | # | н | 11 | н | |
| Fluoranthene | ND | 0.330 | н | 11 | 11 | ** | Ħ | н | |

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Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-----------|
| GP3 (P008088-03) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ived: 08/03/0 | 00 | = 1 11181 |
| Fluorene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Hexachiorobenzene | ND | 0.330 | W | H | н | H | # | ** | |
| Hexachlorobutadiene | ND | 1.00 | Ħ | Ħ | Ħ | u | n | 41 | |
| Hexachlorocyclopentadiene | ND | 1.00 | ** | n | Ħ | N | Ħ | 11 | |
| Hexachloroethane | ND | 1.00 | н | * | Ħ | #1 | н | Ħ | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | | * | | н - | н | H | |
| Isophorone | ND | 0.330 | ** | Ħ | н | н | Ħ | 19 | |
| 2-Methylnaphthalene | ND | 0.330 | 11 | Ħ | Ħ | H* | Ħ | ** | |
| 2-Methylphenol | ND | 0.330 | u | н | н | # | н | *1 | |
| 3-,4-Methylphenol | ND | 0.330 | Ħ | Ħ | 11 | 11 | н | 11 | |
| Naphthalene | ND | 0.330 | ** | tt . | Ħ | Ħ | Ħ | Ħ | |
| 2-Nitroaniline | ND | 0.330 | ** | " | # | 11 | Ħ | н | |
| 3-Nitroaniline | ND | 1.00 | 19 | ** | ** | 11 | н | н | |
| 4-Nitroaniline | ND | 0.330 | # | n | ** | ŧI | 11 | н | |
| Nitrobenzene | ND | 0.330 | n | н | 11 | H | ti | • | |
| itrophenol | ND | 0.330 | n | tt | n | H | tl | н | |
| 4-Nitrophenol | ND | 1.00 | H | n | 11 | st | tf | Ħ | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | Ħ | u | н | Ħ | " | Ħ | |
| N-Nitrosodiphenylamine | ND | 0.330 | ** | 11 | н | Ħ | ** | н | |
| Pentachlorophenol | ND | 1.00 | 11 | # | н | 11 | " | н | |
| Phenanthrene | ND | 0.330 | 11 | Ħ | я | II | e | п | |
| Phenol | ND | 0.330 | Ħ | Ħ | н | ti | Ħ | н | |
| Pyrene | ND | 0.330 | Ħ | H | Ħ | Ħ | н | Ħ | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | ** | * | Ħ | | tt | Ħ | |
| 2,4,5-Trichlorophenol | ND | 0.330 | * | n | H | 11 | Ħ | п | |
| 2,4,6-Trichlorophenol | ND | 0.330 | Ħ | п | Ħ | н | Ħ | Ħ | |
| Surr: 2-Fluorobiphenyl | 68.7 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 65.8 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 61.9 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 70.7 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 72.1 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 62.4 % | 48-119 | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001 Reported: Tualatin, OR 97062 Project Manager: Joe Hunt 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| GP4 (P008088-04) Soil | | | | 8 | Sampled: 08/0 | 1/00 Recei | ived: 08/03/0 | 00 | R-05 |
| Acenaphthene | ND | 1.65 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Acenaphthylene | ND | 1.65 | Ħ | н | Ħ | # | Ħ | 11 | |
| Anthracene | ND | 1.65 | er | н | EE | tt | # | n | |
| Benzo (a) anthracene | ND | 1.65 | ŧŧ | н | EE | Ħ | Ħ | н | |
| Benzo (a) pyrene | ND | 1.65 | er | н | Ħ | n | n | н | |
| Benzo (b) fluoranthene | ND | 1.65 | Ħ | н | Ħ | n . | ti | ti | |
| Benzo (ghi) perylene | ND | 1.65 | u, | н | ŧŧ | ** | Ħ | tt | |
| Benzo (k) fluoranthene | ND | 1.65 | PF . | н | tt | ff ff | Ħ | n | |
| Benzoic Acid | ND | 5.00 | Et | н | eç | tt | ŧŧ | u | |
| Benzyl alcohol | ND | 1.65 | Ħ | н | ŧ | tt | Ħ | n | |
| 4-Bromophenyi phenyi ether | ND | 1.65 | er | н | ŧ | # | # | N | |
| Butyl benzyl phthalate | ND | 1.65 | tr | н | * | tt | W | н | |
| 4-Chloro-3-methylphenol | ND | 1.65 | Ħ | п | ŧŧ | # | Ħ | н | |
| 4-Chloroaniline | ND | 10.0 | EF | н | Ħ | # | Ħ | u | |
| Bis(2-chloroethoxy)methane | ND | 1.65 | et | н | ti | ŧŧ | ıı | n | |
| Bis(2-chloroethyl)ether | ND | 1.65 | tr | н | tt | H | # | н | |
| Bis(2-chloroisopropyl)ether | ND | 1.65 | н | н | ti | n | tf | н | |
| 2-Chloronaphthalene | ND | 1.65 | tr | н | Ħ | # | n | Ħ | |
| 2-Chlorophenol | ND | 1.65 | Ħ | н | tt | n | ti | u | |
| 4-Chlorophenyl phenyl ether | ND | 1.65 | er | н | Ħ | # | ts | rt | |
| Chrysene | ND | 1.65 | ŧI | н | ŧŧ | tr | 11 | tt | |
| Di-n-butyl phthalate | ND | 5.00 | Ħ | н | ti | ŧŧ | ŧŧ | tt . | |
| Di-n-octyl phthalate | ND | 1.65 | tt | н | tt | н | ** | n | |
| Dibenzo (a,h) anthracene | ND | 1.65 | н | # | 65 | # | 11 | H | |
| Dibenzofuran | ND | 1.65 | Ħ | Ħ | ** | н | Ħ | н | |
| 1,2-Dichlorobenzene | ND | 5.00 | Ħ | н | Ħ | # | ts | n | |
| 1,3-Dichlorobenzene | ND | 5.00 | Ħ | н | ** | ** | tt | n | |
| 1,4-Dichlorobenzene | ND | 5.00 | ei | н | ** | ** | 15 | tr | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | ŧſ | Ħ | B | н | ŧŧ | #1 | |
| 2,4-Dichlorophenol | ND | 1.65 | u | u | ** | ęt. | ** | # | |
| Diethyl phthalate | ND | 1.65 | er | tı | | ** | " | п | |
| 2,4-Dimethylphenol | ND | 5.00 | \$1 | п | ** | ės – | ** | " | |
| Dimethyl phthalate | ND | 1.65 | Ħ | Ħ | ee | er | tt | ** | |
| 4,6-Dinitro-2-methylphenol | ND | 5.00 | Ħ | n | n | 11 | ** | " | |
| 2,4-Dinitrophenol | ND | 10.0 | Ħ | н | ** | ** | ** | ** | |
| 2,4-Dinitrotoluene | ND | 2.50 | н | н | es | ** | ** | 11 | |
| 2,6-Dinitrotoluene | ND | 2.50 | н | н | e | Ħ | it | TE . | |
| Bis(2-ethylhexyl)phthalate | ND | 10.0 | н | н | ** | # | " | ** | |
| Fluoranthene | ND | 1.65 | н | н | tt | ** | * | ** | |

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Page 49 of 98 North Creek Analytical, Inc.

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occor

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|-----------------|----------|-------------|---------|-------|
| GP4 (P008088-04) Soil | | | | | Sampled: 08/01/ | 00 Rece | ved: 08/03/ | 00 | R-05 |
| Fluorene | ND | 1.65 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Hexachlorobenzene | ND | 1.65 | н | Ħ | п | ** | | ** | |
| Hexachlorobutadiene | ND | 5.00 | H | n | п | Ħ | 11 | Ħ | |
| Hexachlorocyclopentadiene | ND | 5.00 | ** | н | • | н | 11 | Ħ | |
| Hexachloroethane | ND | 5.00 | Ħ | ** | π. | * | 11 | ** | |
| Indeno (1,2,3-cd) pyrene | ND | 1.65 | н | Ħ | Ħ | н . | ts | н | |
| Isophorone | ND | 1.65 | ** | 11 | n | Ħ | 11 | Ħ | |
| 2-Methylnaphthalene | ND | 1.65 | 11 | Ħ | ** | Ħ | , 11 | n | |
| 2-Methylphenol | ND | 1.65 | n | Ħ | 11 | н | tt | ** | |
| 3-,4-Methylphenol | ND | 1.65 | ** | Ħ | ti | # | " | 11 | |
| Naphthalene | ND | 1.65 | 11 | н | н | и | н | Ħ | |
| 2-Nitroaniline | ND | 1.65 | 11 | " | ti | Ħ | Ħ | н | |
| 3-Nitroaniline | ND | 5.00 | , H | 11 | 11 | ** | H | ŧr | |
| 4-Nitroaniline | ND | 1.65 | tt | Ħ | II | 11 | 11 | 11 | |
| Nitrobenzene | ND | 1.65 | 11 | Ħ | tř | Ħ | " | 11 | |
| itrophenol | ND | 1.65 | н | ** | 11 | H | Ħ | Ħ | |
| 4-Nitrophenol | ND | 5.00 | t# | н | 11 | ** | tt | 11 | |
| N-Nitrosodi-n-propylamine | ND | 1.65 | ** | n | Ħ | 11 | n | н | |
| N-Nitrosodiphenylamine | ND | 1.65 | 11 | " | tt | Ħ | н | н | |
| Pentachlorophenol | ND | 5.00 | Ħ | ** | ** | Ħ | tt* | et . | |
| Phenanthrene | ND | 1.65 | W | . # | в | 14 | н | # | |
| Phenol | ND | 1.65 | 11 | H | EF . | #1 | n | н | |
| Pyrene | ND | 1.65 | 11 | • | ** | н | н | ** | |
| 1,2,4-Trichlorobenzene | ND | 1.65 | Ħ | Ħ | 11 | ** | | 45 | |
| 2,4,5-Trichlorophenol | ND | 1.65 | ** | Ħ | Ħ | Ħ | н | ti | |
| 2,4,6-Trichlorophenol | ND | 1.65 | н | H | * | ŧ1 | Ħ | 11 | |
| Surr: 2-Fluorobiphenyl | 94.6 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 82.8 % | 42-126 | | • | | | | | |
| Surr: Nitrobenzene-d5 | 81.9 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 84.4 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 97.9 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 79.7 % | 48-119 | | | | | | | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP8 (P008088-10) Soil | | | | 5 | Sampled: 08/0 | 1/00 Recei | ved: 08/03/ | 00 | |
| 4-Chloro-3-methylphenol | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| 2-Chlorophenol | ND | 0.330 | # | Ħ | # | Ħ | 11 | н | |
| 2,4-Dichlorophenol | ND | 0.330 | Ħ | н | ** | H | ,, | Ħ | |
| 2,4-Dimethylphenol | ND | 1.00 | H | Ħ | # | н | 11 | 11 | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | Ħ | ** | ** | Ħ | | ** | |
| 2,4-Dinitrophenol | ND | 2.00 | н | | H. | n . | # | ** | |
| 2-Methylphenoi | ND | 0.330 | 11 | ** | tt | Ħ | Ħ | • | |
| 3-,4-Methylphenol | ND | 0.330 | 11 | et . | tt | 11 | Ħ | tr | |
| 2-Nitrophenol | ND | 0.330 | 11 | er | tt | n | п | W. | |
| 4-Nitrophenol | ND | 1.00 | 11 | tt | tt | tt | 11 | ŧţ | |
| Pentachlorophenol | ND | 1.00 | | Ħ | tt | rt | 11 | Ħ | |
| Phenol | ND | 0.330 | Ħ | н | 11 | Ħ | 41 | ш | |
| 2,4,5-Trichlorophenol | ND | 0.330 | ŧſ | Ħ | 11 | н | ** | н | |
| 2,4,6-Trichlorophenol | ND | 0.330 | Ħ | Ħ | 11 | 11 | | 4 | |
| Surr: 2-Fluorophenol | 67.4 % | 42-126 | | | • • | | | | |
| Surr: Phenol-d6 | 72.1 % | 42-131 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 58.9 % | 48-119 | | | | | | | |
| GP9 @ 12' (P008088-12) Soil | 225 | | | | Sampled: 08/0 | | ved: 08/03/0 | | · |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Acenaphthylene | ND | 0.330 | | ti | | rr tr | ** | H | |
| Anthracene | ND | 0.330 | | н | n 11 | и н | " | n N | |
| Benzo (a) anthracene | ND | 0.330 | | | | п | | " H | |
| Benzo (a) pyrene | ND | 0.330 | ** | | | | | | |
| Benzo (b) fluoranthene | ND | 0.330 | Ħ | # | | # | | #1 | |
| Benzo (ghi) perylene | ND | 0.330 | H | " | u tr | | | n | |
| Benzo (k) fluoranthene | ND | 0.330 | | #1 | | " | tr tr | н | |
| Benzoic Acid | ND | 1.00 | н | ** | " | " | | 11 | |
| Benzyl alcohol | ND | 0.330 | н . | | | | п | 11 | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | H | | ** | " | H | # | |
| Butyl benzyl phthalate | ND | 0.330 | н | | н | | н | ** | |
| 4-Chloro-3-methylphenol | ND | 0.330 | 11 | ŧr | н | Ħ | н | н | |
| 4-Chloroaniline | ND | 2.00 | 11 | ŧſ | и | н | н | ** | |
| Bis(2-chloroethoxy)methane | ND | 0.330 | 11 | н | 11 | ri . | Ħ | Ħ | |
| Bis(2-chloroethyl)ether | ND | 0.330 | 11 | н | 11 | н | #1 | er . | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | ** | tı | * | # | 4 | Ħ | |
| 2-Chloronaphthalene | ND | 0.330 | | Ħ | ** | Ħ | н | Ħ | |
| 2-Chlorophenol | ND | 0.330 | н | Ħ | ** | # | * | ŧI | |

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оссог

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| | Analyte | Result | Reporting Limit | Ųnits | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---|-----------------------------|----------|--------------------|----------------|----------|---------------|-----------|--------------|---------|-------|
| | GP9 @ 12' (P008088-12) Soil | | | | S | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| | 4-Chlorophenyl phenyl ether | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| | Chrysene | ND | 0.330 | # | н | H | н | ŧŧ | n | |
| | Di-n-butyl phthalate | ND | 1.00 | 11 | 44 | н | ** | Ħ | #1 | |
| | Di-n-octyl phthalate | ND | 0.330 | ** | et | Ħ | ** | н | н | |
| | Dibenzo (a,h) anthracene | ND | 0.330 | Ħ | н | н | 11 | # | н | |
| | Dibenzofuran | ND | 0.330 | H | 4 | n | н . | н | H | |
| | 1,2-Dichlorobenzene | ND | 1.00 | н | # | Ħ | Ħ | п | # | |
| | 1,3-Dichlorobenzene | ND | 1.00 | t) | ti | # | ** | H | H | |
| | 1,4-Dichlorobenzene | ND | 1.00 | ii | Ħ | # | 11 | " | u | |
| | 3,3'-Dichlorobenzidine | ND | 1.00 | ** | rt | н | Ħ | 11 | H | |
| | 2,4-Dichlorophenol | ND | 0.330 | 11 | 11 | н | Ħ | н | er | |
| | Diethyl phthalate | ND | 0.330 | ti | 11 | ч | ** | ** | 11 | |
| | 2,4-Dimethylphenol | ND | 1.00 | Ħ | 11 | n | u | " | Ħ | |
| | Dimethyl phthalate | ND | 0.330 | tt | H | u | Ħ | 19 | н | |
| | 4 6-Dinitro-2-methylphenol | ND | 1.00 | 11 | ** | н | Ħ | 11 | н | |
| | Dinitrophenol | ND | 2.00 | #1 | ŧŧ | Ħ | # | н | H | |
| - | 2,4-Dinitrotoluene | ND | 0.500 | 11 | 11 | 11 | H | Ħ | н | |
| | 2,6-Dinitrotoluene | ND | 0.500 | Ħ | ŧŧ | Ħ | Ħ | н | н | |
| | Bis(2-ethylhexyl)phthalate | ND | 2.00 | FS | ti | Ħ | 11 | 11 | н | |
| | Fluoranthene | ND | 0,330 | 11 | tt | Ħ | н | Ħ | н | |
| | Fluorene | ND | 0.330 | 11 | н | # | н | # | e | |
| | Hexachlorobenzene | ND | 0.330 | н | 19 | ** | n | н | # | |
| | Hexachlorobutadiene | ND | 1.00 | H | 11 | ** | ** | ** | #I | |
| | Hexachlorocyclopentadiene | ND | 1.00 | ** | | н | 11 | # | * | |
| | Hexachloroethane | ND | 1.00 | # | ** | Ħ | Ħ | Ħ | ** | |
| | Indeno (1,2,3-cd) pyrene | ND | 0.330 | 11 | " | н | н | tt | н | |
| | Isophorone | ND ND | 0.330 | # | Ħ | | ** | 17 | н | |
| | 2-Methylnaphthalene | ND | 0.330 | 11 | rt | Ħ | 11 | n | H | |
| | 2-Methylphenol | ND ND | 0.330 | #1 | 11 | tt | Ħ | | #1 | |
| | 3-,4-Methylphenol | ND ND | 0.330 | | 11 | н | * | | Ħ | |
| | Naphthalene | ND | 0.330 | | Ħ | ** | 11 | Ħ | ti | |
| | 2-Nitroaniline | ND ND | 0.330 | | ** | tr | н | н | u | |
| | 3-Nitroaniline | ND | 1.00 | | н | ** | н | tt | 11 | |
| | | ND ND | 0.330 | | н | 4 | н | Ħ | Ħ | |
| | 4-Nitroaniline Nitrobenzene | ND ND | 0.330 | | tf | Ħ | н | н | n | |
| | | ND ND | 0.330 | | н | н | N | Ħ | 11 | |
| | 2-Nitrophenol | ND ND | 1.00 | | #1 | ** | ** | * | н | |
| | 4-Nitrophenol | ND ND | 0.330 | | H | • | ** | ** | н | |
| | N-Nitrosodi-n-propylamine | ND ND | 0.330 | | н | Ħ | * | Ħ | н | |
| | N-Nitrosodiphenylamine | ND | 0.550 | | | | | | | |

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Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711

541,383,9310 fax 541,382,7588

Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|---------------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP9 @ 12' (P008088-12) Soil | | | | | Sampled: 08/0 | 1/00 Recei | ived: 08/03/ | 00 | |
| Pentachlorophenol | ND | 1.00 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/15/00 | 0080345 | |
| Phenanthrene | ND | 0.330 | H | n | Ħ | tf | # | # | |
| Phenol | ND | 0.330 | Н | н | 11 | Ħ | n | # | |
| Pyrene | ND | 0.330 | 11 | Ħ | Ħ | Ħ | *1 | # | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | Ħ | 11 | ** | ti | ** | " | |
| 2,4,5-Trichlorophenol | ND | 0.330 | ** | 11 | 44 | Ħ. | 41 | u | |
| 2,4,6-Trichlorophenol | ND | 0.330 | " | 11 | н | н | н | 11 | |
| Surr: 2-Fluorobiphenyl | 63.8 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | <i>56.5</i> % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 58.7 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 60.1 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 65.0 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 51.1 % | 48-119 | | | | | | | |
| GP9 @ 27.5' (P008088-13) Soil | | | | : | Sampled: 08/0 | 1/00 Recei | ived: 08/03/ | 00 | |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | Ţ |
| Acenaphthylene | ND | 0.330 | n | * | # | # | tl | H | |
| Anthracene | ND | 0.330 | tl | Ħ | Ħ | " | н | Ħ | |
| Benzo (a) anthracene | ND | 0.330 | ú | Ħ | tl | 10 | Ħ | Ħ | |
| Benzo (a) pyrene | ND | 0.330 | п | Ħ | н | | н | Ħ | |
| Benzo (b) fluoranthene | ND | 0.330 | н | н | н | " | н | н | |
| Benzo (ghi) perylene | ND | 0.330 | 11 | н | 11 | ** | u | н | |
| Benzo (k) fluoranthene | ND | 0.330 | 11 | Ħ | Ħ | et | ti | tt | |
| Benzoic Acid | ND | 1.00 | # | Ħ | # | H | н | н | |
| Benzyl alcohol | ND | 0.330 | " | н | ** | ** | Ħ | н | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | #1 | 11 | ** | ** | u | н | |
| Butyl benzyl phthalate | ND | 0.330 | # | #1 | * | ŧr | u | н | |
| 4-Chloro-3-methylphenol | ND | 0.330 | 11 | н | 44 | H | Ħ | н | |
| 4-Chloroaniline | ND | 2.00 | 11 | h | ** | ** | a | н | |
| Bis(2-chloroethoxy)methane | ND | 0.330 | ŧŧ | ** | 41 | n | II | Ħ | |
| Bis(2-chloroethyl)ether | ND | 0.330 | u | 11 | 41 | н | н | ft. | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | 41 | ** | " | н | 11 | н | |
| 2-Chloronaphthalene | ND | 0.330 | ** | ** | 45 | H | ti | H | |
| 2-Chlorophenol | ND | 0.330 | e | Ħ | 8 | н | u | U | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | | 11 | ĸ | н | ft | Ħ | |
| Chrysene | ND | 0.330 | ** | ** | # | н | н | Ħ | |
| Di-n-butyl phthalate | ND | 1.00 | E# | | Ħ | # | 11 | н | |
| Di-n-octyl phthalate | ND | 0.330 | et . | н | H | н | 11 | Ħ | |
| | | | | | | | | | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

Page 53 of 98 North Creek Analytical, Inc.

Environmental Laboratory Network



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эесог

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| | | 14011 | II CICCK | Zinaryti | car - 1 o | | | | | |
|---|-------------------------------|----------|--------------------|-----------|-----------|---------------|-----------|--------------|---------|-------|
| İ | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| , | GP9 @ 27.5' (P008088-13) Soil | | | | 5 | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| ! | Dibenzo (a,h) anthracene | ND | 0.330 | mg/kg dry | i | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| ĺ | Dibenzofuran | ND | 0.330 | H | # | * | ti | Ħ | * | |
| | 1,2-Dichlorobenzene | ND | 1.00 | н | н | Ħ | Ħ | 11 | Ħ | |
| | 1,3-Dichlorobenzene | ND | 1.00 | H | к | Ħ | ** | н | н | |
| | 1,4-Dichlorobenzene | ND | 1.00 | | 11 | • | Ħ | r | Ħ | |
| | 3,3'-Dichlorobenzidine | ND | 1.00 | a | Ħ | n | π - | 11 | и | |
| | 2,4-Dichlorophenol | ND | 0.330 | Ħ | H | н | * | Ħ | Ħ | |
| | Diethyl phthalate | ND | 0.330 | ** | Ħ | 11 | 11 | н | n | |
| - | 2,4-Dimethylphenol | . ND | 1.00 | 11 | 11 | 11 | н | 17 | H | |
| j | Dimethyl phthalate | ND | 0.330 | н | н | 11 | ** | 11 | ŧŧ | |
| | 4,6-Dinitro-2-methylphenol | ND | 1.00 | tt | " | н | Ħ | И | Ħ | |
| Ì | 2,4-Dinitrophenol | ND | 2.00 | " | ** | ** | н | Ħ | н | |
| | 2,4-Dinitrotoluene | ND | 0.500 | Ħ | # | 11 | Ħ | 11 | н | |
| | 2,6-Dinitrotoluene | ND | 0.500 | Ħ | ŧr | tt | 11 | н | Ħ | |
| | 7:s(2-ethylhexyl)phthalate | ND | 2.00 | et | ** | tt | 11 | Ħ | II . | |
| | oranthene | ND | 0.330 | 11 | н | 11 | Ħ | 11 | Ħ | |
| ŕ | Fluorene | ND | 0.330 | н | н | Ħ | n | 11 | ** | |
| | Hexachlorobenzene | ND | 0.330 | Ħ | н | tt | н | tt | ** | |
| | Hexachlorobutadiene | ND | 1.00 | ** | ** | ** | н | н | Ħ | |
| | Hexachlorocyclopentadiene | ND | 1.00 | н | н | # | 11 | u | Ħ | |
| | Hexachloroethane | ND | 1.00 | н | н | ff. | Ħ | Ħ | 11 | |
| | | ND | 0.330 | | Ħ | Ħ | н | tt | н | |
| | Indeno (1,2,3-cd) pyrene | ND ND | 0.330 | | H | Ħ | ** | 11 | Ħ | |
| ĺ | Isophorone | ND ND | 0.330 | | н | t? | Ħ | 11 | 11 | |
| | 2-Methylnaphthalene | ND | 0.330 | | M | ** | н | н | н | |
| Ļ | 2-Methylphenol | ND ND | 0.330 | | Ħ | Ħ | # | Ħ | H | |
| | 3-,4-Methylphenol | ND | 0.330 | | ** | н | 11 | н | н | |
| | Naphthalene | ND | 0.330 | | н | n | н | H | н | |
| , | 2-Nitroaniline | ND ND | 1.00 | | H | н | u | 11 | * | |
| | 3-Nitroaniline | ND ND | 0,330 | | н | 11 | н | Ħ | Ħ | |
| ļ | 4-Nitroaniline | ND ND | 0.330 | | Ħ | н | tt | ** | н | |
| | Nitrobenzene | ND ND | 0.330 | | | ** | ** | #1 | | |
| | 2-Nitrophenol | ND ND | 1.00 | | Ħ | Ħ | Ħ | et | н | |
| | 4-Nitrophenol | ND ND | 0.330 | | # | н | Ħ | н | ¥ | |
| 3 | N-Nitrosodi-n-propylamine | ND ND | 0.330 | | n | # | и | н | ** | |
| 1 | N-Nitrosodiphenylamine | ND ND | 1.00 | | н | н | н | H | # | |
| - | Pentachlorophenol | ND ND | 0.330 | | n | Ħ | # | 11 | Ħ | |
| 1 | Phenanthrene | ND ND | 0.330 | | # | ** | 11 | н | * | |
| | Phenol | ND ND | 0.330 | | H | Ħ | Ħ | Ħ | H | |
| ı | Pyrene | שא | 0.330 | , | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| GP9 @ 27.5' (P008088-13) Soil | | | | 5 | Sampled: 08/0 | 1/00 Rece | ived: 08/03/ | 00 | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| 2,4,5-Trichlorophenol | ND | 0.330 | tt | tt | ** | # | Ħ | | |
| 2,4,6-Trichlorophenol | ND | 0.330 | * | Ħ | 11 | н | н | * | |
| Surr: 2-Fluorobiphenyl | 74.1 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 70.0 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 70.1 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 75.3 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 62.1 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 65.7 % | 48-119 | | | | | | | |
| GP10 (P008088-14) Soil | | | | 9 | Sampled: 08/0 | 1/00 Recei | ived: 08/03/0 | 00 | |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| Acenaphthylene | ND | 0.330 | 11 | N | ŧı | H | ŧI | tt | |
| Anthracene | ND | 0.330 | es | n | 11 | н | Ħ | Ħ | |
| Benzo (a) anthracene | ND | 0.330 | ** | Ħ | # | #1 | Ħ | # | |
| Benzo (a) pyrene | ND | 0.330 | N | 11 | ti | 11 | Ħ | Ħ | : |
| Benzo (b) fluoranthene | ND | 0.330 | ŧŧ | 42 | Ħ | ** | ** | ** | |
| Benzo (ghi) perylene | ND | 0.330 | tř | ** | ** | 11 | * | ** | |
| Benzo (k) fluoranthene | ND | 0.330 | Ħ | n | n | tt | 11 | Ħ | |
| Benzoic Acid | ND | 1.00 | Ħ | Ħ | Ħ | tt | u | # | |
| Benzyl alcohol | ND | 0.330 | Ħ | Ħ | # | Ħ | ** | * | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | н | Ħ | tt | tt | tt | Ħ | |
| Butyl benzyl phthalate | ND | 0.330 | n | н | Ħ | n | n | н | |
| 4-Chloro-3-methylphenol | ND | 0.330 | Ħ | н | 11 | н | Ħ | Ħ | |
| 4-Chloroaniline | ND | 2.00 | Ħ | н | 11 | 11 | Ħ | Ħ | |
| Bis(2-chloroethoxy)methane | ND | 0.330 | ** | н | " | 11 | H | Ħ | |
| Bis(2-chloroethyl)ether | ND | 0.330 | ** | Ħ | Ħ | H | n . | н | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | ** | Ħ | | 11 | н | н | |
| 2-Chloronaphthalene | ND | 0.330 | W. | 11 | ** | 11 | н | н | |
| 2-Chlorophenol | ND | 0.330 | er | 14 | | 11 | Ħ | # | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | tř | 11 | ti- | 11 | Ħ | 11 | |
| Chrysene | ND | 0.330 | N | 10 | tt | u u | Ħ | u | |
| Di-n-butyl phthalate | ND | 1.00 | н | ** | н | * | # | ** | |
| Di-n-octyl phthalate | ND | 0.330 | Ħ | u | н | ŧr | ** | ti | |
| Dibenzo (a,h) anthracene | ND | 0.330 | н | H. | н | н | ** | tt | |
| Dibenzofuran | ND | 0.330 | Ħ | n | Ħ | н | • | н | |
| 1,2-Dichlorobenzene | ND | 1.00 | # | н | 11 | ti | ** | н | |
| 1,3-Dichlorobenzene | ND | 1.00 | 11 | н | # | н | tt | Ħ | |

North Creek Analytical - Portland

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JέCOΓ

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|--------|----------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| | GP10 (P008088-14) Soil | | | | S | Sampled: 08/0 | 1/00 Rece | ived: 08/03/0 | | |
| | 1,4-Dichlorobenzene | ND | 1.00 | mg/kg dry | 1 | EPA 8270C | 08/14/00 | 08/16/00 | 0080345 | |
| | 3,3'-Dichlorobenzidine | ND | 1.00 | 11 | Ħ | * | 19 | * | ** | |
| | 2,4-Dichlorophenol | ND | 0.330 | н | | | Ħ | Ħ | Ħ | |
| | Diethyl phthalate | ND | 0.330 | Ħ | # | # | Ħ | N | н | |
| | 2,4-Dimethylphenol | ND | 1.00 | Ħ | Ħ | • | | H | # | |
| | Dimethyl phthalate | ND | 0.330 | Ħ | | H | H · | M | " | |
| | 4,6-Dinitro-2-methylphenol | ND | 1.00 | н | Ħ | * | н | π | Ħ | |
| | 2,4-Dinitrophenol | ND | 2.00 | H | 11 | Ħ | Ħ | н | Ħ | |
| | 2,4-Dinitrotoluene | ND | 0,500 | 11 | н | n | " | # | ** | |
| | 2,6-Dinitrotoluene | ND | 0.500 | н | Ħ | tr | 11 | ti | # | |
| | Bis(2-ethylhexyl)phthalate | ND | 2.00 | n | 91 | Ħ | Ħ | Ħ | Ħ | |
| | Fluoranthene | ND | 0.330 | ** | 11 | # | н | ** | Ħ | |
| | Fluorene | ND | 0.330 | H | Ħ | n | 11 | # | ** | |
| | Hexachlorobenzene | ND | 0.330 | н | " | н | Ħ | H | 11 | |
| | Hexachlorobutadiene | ND | 1.00 | н , | # | ** | н | Ħ | н | |
| 1 | achlorocyclopentadiene | ND | 1.00 | " | 11 | . н | ır | ** | Ħ | |
| 1 | Hexachloroethane | ND | 1.00 | # | Ħ | н | ** | n | ** | |
| | Indeno (1,2,3-cd) pyrene | ND | 0.330 | н | n | Ħ | Ħ | Ħ | Ħ | |
| | Isophorone | ND | 0.330 | к | н | u | Ħ | ** | н | |
| | 2-Methylnaphthalene | ND | 0.330 | н | н | n | H | 11 | et | |
| | 2-Methylphenol | ND | 0.330 | Ħ | te | Ħ | ** | 11 | ** | |
| | 3-,4-Methylphenol | ND | 0.330 | Ħ | Ħ | п | н | H | н | |
| | Naphthalene | ND | 0.330 | | " | 11 | Ħ | n | Ħ | |
| | 2-Nitroaniline | ND | 0.330 | ** | Ħ | Ħ | " | Ħ | ** | |
| | 3-Nitroaniline | ND | 1.00 | Ħ | н | Ħ | ** | # | Ħ | |
| | 4-Nitroaniline | ND | 0.330 | | 11 | ** | Ħ | Ħ | н | |
| | Nitrobenzene | ND | 0.330 | | н | * | Ħ | Ħ | 10 | |
| | 2-Nitrophenol | ND | 0.330 | | ** | Ħ | 11 | Ħ | 11 | |
| | 4-Nitrophenol | ND | 1.00 | | n | 16 | и | Ħ | н | |
| | N-Nitrosodi-n-propylamine | ND | 0.330 | | н | н | Ħ | ** | Ħ | |
| | N-Nitrosodiphenylamine | ND | 0.330 | | | Ħ | ** | н | Ħ | |
| | Pentachlorophenol | ND | 1.00 | | 41 | ** | Ħ | ** | tt | |
| | Phenanthrene | ND | 0.330 | | H | n | Ħ | Ħ | н | |
| | Phenol | ND | 0.330 | | n | н | Ħ | н | Ħ | |
| , | Pyrene | ND | 0.330 | | н | ** | н | " | Ħ | |
| | 1,2,4-Trichlorobenzene | ND | 0.330 | | Ħ | Ħ | Ħ | ** | | |
| i I | 2,4,5-Trichlorophenol | ND | 0.330 | | н | н | * | rt | н | |
| į | 2,4,6-Trichlorophenol | ND | 0.330 | | ** | Ħ | # | н | н | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|----------------|-----------|--------------|---------|---|
| GP10 (P008088-14) Soil | | | | | Sampled: 08/01 | 1/00 Rece | ived: 08/03/ | 00 | |
| Surr: 2-Fluorobiphenyl | 59.6 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 56.4 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 48.8 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 64.2 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 69.8 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 46.9 % | 48-119 | | | | • | | | S-03 |
| GP11 (P008088-15) Soil | | | | | Sampled: 08/01 | 1/00 Rece | ived: 08/03/ | 00 | R-05 |
| 4-Chloro-3-methylphenol | ND | 0.660 | mg/kg dry | 2 | EPA 8270C | 08/14/00 | 08/17/00 | 0080345 | *************************************** |
| 2-Chlorophenol | ND | 0.660 | 11 | н | Ħ | Ħ | H | " | |
| 2,4-Dichlorophenol | ND | 0.660 | # | H | н | Ħ | н | ** | |
| 2,4-Dimethylphenol | ND | 2.00 | | н | н | 11 | н | " | |
| 4,6-Dinitro-2-methylphenol | ND | 2.00 | ŧŧ | 11 | tt | 11 | и | 65 | |
| 2,4-Dinitrophenol | ND | 4.00 | H | 11 | . 11 | et | Ħ | tt | |
| 2-Methylphenol | ND | 0.660 | Ħ | er . | 9 | | 11 | ** | |
| 3-,4-Methylphenol | ND | 0.660 | н | tt | ** | ** | 11 | n | |
| 2-Nitrophenol | ND | 0.660 | н | Ħ | er | # | Ħ | н | |
| 4-Nitrophenol | ND | 2.00 | н | н | tt | tt | a | н | |
| Pentachlorophenol | ND | 2.00 | Ħ | Ħ | н | ** | " | н | |
| Phenol | ND | 0.660 | Ħ | Ħ | н | н | 15 | н | |
| 2,4,5-Trichlorophenol | ND | 0.660 | u | Ħ | H | н | Ħ | Ħ | |
| 2,4,6-Trichlorophenol | ND | 0.660 | et | 11 | н | H | Ħ | н | |
| Surr: 2-Fluorophenol | 75.3 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 86.3 % | 42-131 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 95.2 % | 48-119 | | | | | | | |

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541.383.9310 fax 541.382.7588

ecor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---|--|--|--|--|----------------------------------|---|--|--|-------|
| GP12 (P008088-16) Soil | | | | S | Sampled: 08/02 | 2/00 Recei | ved: 08/03/(| | |
| 4-Chioro-3-methylphenol | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | |
| 2-Chlorophenol | ND | 0.330 | # | ** | Ħ | п | H | H | |
| 2,4-Dichlorophenol | ND | 0.330 | tt | н | 11 | tt | Ħ | Ħ | |
| 2,4-Dimethylphenol | ND | 1.00 | 11 | II. | п | n | Ħ | 11 | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | Ħ | Ħ | n | Ħ | n | Ħ | |
| 2,4-Dinitrophenol | ND | 2.00 | Ħ | н | Ħ | | Ħ | Ħ | |
| 2-Methylphenol | ND | 0.330 | Ħ | 11 | Ħ | * | H | H | |
| 3-,4-Methylphenol | ND | 0.330 | н | 11 | U | Ħ | # | ti | |
| 2-Nitrophenol | ND | 0.330 | 45 | н | Ħ | H | ti | 11 | |
| 4-Nitrophenol | ND | 1.00 | 11 | н | н | 11 | ŧŧ | 11 | |
| Pentachlorophenol | ND | 1.00 | н | 11 | " | н | ** | H | |
| Phenol | ND | 0.330 | 11 | н | н | ** | N | 1t | |
| 2,4,5-Trichlorophenol | ND | 0.330 | ti | H | et | ** | Đ. | H | |
| 2,4,6-Trichlorophenol | ND | 0.330 | н | 11 | " | ri | 11 | ti | |
| r: 2-Fluorophenol | 80.0 % | 42-126 | | | | | | | |
| r: Phenol-d6 | 88.7 % | 42-131 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 77.3 % | 48-119 | | | | | | | |
| OD42 (0000000 15) 5-11 | | | | | Sampled: 08/0 | 2/00 Rece | ived: 08/03/ | 00 | R-0 |
| GP13 (P008088-17) Soil | | 0.660 | | | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | |
| 4-Chloro-3-methylphenol | ND | 0.660 | mg/kg dry | 2 | EPA 82/0C | 100/13/00 | # | # | |
| 2-Chlorophenol | ND | 0.660 | " " | 11 | 11 | # | n | H | |
| 2,4-Dichlorophenol | ND | 0.660 | | | | | | | |
| 2,4-Dimethylphenol | | | | ,, | H | | | ** | |
| · • • - | ND | 2.00 | # | 11 | H SI | H . | H H | 11 H | |
| 4,6-Dinitro-2-methylphenol | ND | 2.00 | Ħ | 11 | | # . # | | | |
| 2,4-Dinitrophenol | ND ND | 2.00 4.00 | H 61 | | a | er . 11 11 | 41 | н | |
| 2,4-Dinitrophenol 2-Methylphenol | ND ND ND | 2.00 4.00 0.660 | # # | 11 11 | a | FF . FF . H | 11 | Ħ | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol | ND ND ND ND | 2.00 4.00 0.660 0.660 | 61 61 14 61 | 11 | a | 11 | 19 11 | ri Pr | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol | ND ND ND ND ND | 2.00 4.00 0.660 0.660 0.660 | 17 44 44 44 | 17 14 14 17 | e 11 11 | 11 - 11 - 11 - 11 - 11 - 11 - 11 - 11 | (1 11 11 | H H H | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol | ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 0.660 2.00 | 27 61 61 62 63 63 63 64 64 64 64 64 64 64 64 64 64 64 64 64 | 17 17 14 11 11 | er es 19 19 14 | 17 - 18 18 18 18 18 18 18 18 18 18 18 18 18 | 11 11 11 11 | 11 11 11 | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol | ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 0.660 2.00 2.00 | 67 68 64 67 89 87 | 15 27 44 21 21 21 | e 13 14 19 | | 61 11 11 11 | H 19 18 18 | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol | ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 2.00 2.00 0.660 | 17 49 41 41 41 41 | 15 17 18 18 18 18 | 67 67 67 68 68 | H | 41 21 11 11 14 | H 19 18 18 | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol 2,4,5-Trichlorophenol | ND ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 2.00 2.00 0.660 0.660 | 17 67 68 67 19 18 18 18 | 15 17 18 18 18 18 18 | 67 67 68 68 68 68 | 11 11 | 44 21 44 15 16 16 16 18 | H H H H H H H H H H H H H H H H H H H | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol | ND ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 2.00 2.00 0.660 0.660 | 17 41 42 43 44 44 44 44 44 | 15 17 18 18 18 18 | 67 67 67 68 68 | H H | 41 21 41 11 12 41 11 | 11 14 15 15 15 15 15 15 15 15 15 15 15 15 15 | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol 2,4,5-Trichlorophenol | ND ND ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 2.00 2.00 0.660 0.660 | 17 44 44 44 44 44 44 44 44 44 44 44 44 44 | 15 17 18 18 18 18 18 | 67 67 68 68 68 68 | H H | 44 21 44 15 16 16 16 18 | 11 14 15 15 15 15 15 15 15 15 15 15 15 15 15 | |
| 2,4-Dinitrophenol 2-Methylphenol 3-,4-Methylphenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol | ND ND ND ND ND ND ND ND | 2.00 4.00 0.660 0.660 2.00 2.00 0.660 0.660 | 17 49 41 41 41 41 41 41 | 15 17 18 18 18 18 18 | 67 67 68 68 68 68 | H H | 44 21 44 15 16 16 16 18 | 11 14 15 15 15 15 15 15 15 15 15 15 15 15 15 | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

Reporting Analyte Result Limit Units Dilution Method Prepared Analyzed Batch Notes GP14 @ 8' (P008088-19) Soil Sampled: 08/02/00 Received: 08/03/00 Acenaphthene ND 0.330 mg/kg dry 1 **EPA 8270C** 08/15/00 08/16/00 0080365 4-Chloro-3-methylphenol ND 0.330 2-Chlorophenol ND 0.330 1,4-Dichlorobenzene ND 1.00 2,4-Dichlorophenol ND 0.330 2,4-Dimethylphenol ND 1.00 4,6-Dinitro-2-methylphenol ND 1.00 2,4-Dinitrophenol ND 2.00 2,4-Dinitrotoluene ND 0.500 2-Methylphenol ND 0.330 3-,4-Methylphenol ND 0.330 2-Nitrophenol ND 0.330 4-Nitrophenol ND 1.00 N-Nitrosodi-n-propylamine ND 0.330 Pentachlorophenol ND 1.00 Phenol ND 0.330 Pyrene ND 0.330 1,2,4-Trichlorobenzene ND 0.330 2,4,5-Trichlorophenol ND 0.330 2,4,6-Trichlorophenol ND 0.330 Surr: 2-Fluorophenol 74.6% 42-126

Surr: Phenol-d6 81.3 % 42-131 Surr: 2,4,6-Tribromophenol 73.6% 48-119

GP15 (P008088-20) Soil Sampled: 08/02/00 Received: 08/03/00

| | | | | | | | | ~~ |
|----------------------------|----|-------|-----------|----|-----------|----------|----------|---------|
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 |
| Acenaphthylene | ND | 0.330 | 11 | ** | Ħ | u | Ħ | Ħ |
| Anthracene | ND | 0.330 | ŧr | ** | н | tr | 11 | Ħ |
| Benzo (a) anthracene | ND | 0.330 | н | ** | н | Ц | u | ** |
| Benzo (a) pyrene | ND | 0.330 | н | t? | н | U | ** | e |
| Benzo (b) fluoranthene | ND | 0.330 | 11 | н | et | 44 | ti | rr |
| Benzo (ghi) perylene | ND | 0.330 | et | ** | 46 | ės – | # | Ħ |
| Benzo (k) fluoranthene | ND | 0.330 | el | | н | tt | ** | Ħ |
| Benzoic Acid | ND | 1.00 | 11 | ** | н | tt. | ti | u |
| Benzyl alcohol | ND | 0.330 | 10 | н | ** | н | Ħ | bs |
| 4-Bromophenyl phenyl ether | ND | 0.330 | ** | # | e | ** | н | n |
| Butyl benzyl phthalate | ND | 0.330 | H | # | н | rt . | 11 | н |
| 4-Chloro-3-methylphenol | ND | 0.330 | н | ** | Ħ | rr | н | ** |
| | | | | | | | | |

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. Environmental Laboratory Network Page 59 of 98



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Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

|] | | | Penorting | * | | | | | | |
|---|-----------------------------|--------|--------------------|-----------|----------|---------------|-----------|-------------|---------|-------|
| | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| | GP15 (P008088-20) Soil | | | | | Sampled: 08/0 | 2/00 Rece | ved: 08/03/ | | |
| 1 | 4-Chloroaniline | ND | 2.00 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | • |
| 1 | Bis(2-chloroethoxy)methane | ND | 0.330 | it | # | ** | | н | H | |
| - | Bis(2-chloroethyl)ether | ND | 0.330 | H | # | Ħ | Ħ | et | ** | |
| | Bis(2-chloroisopropyl)ether | ND | 0.330 | ** | Ħ | Ħ | Ħ | 11 | 11 | |
| W. Carrier | 2-Chloronaphthalene | ND | 0.330 | M | н | н | н | н | H | |
| | 2-Chlorophenol | ND | 0.330 | Ħ | н | н | н. | н | H | |
| | 4-Chlorophenyl phenyl ether | ND | 0.330 | н | Ħ | Ħ | Ħ | н | u. | |
| * | Chrysene | ND | 0.330 | ** | Ħ | Ħ | Ħ | ** | 11 | |
| | Di-n-butyl phthalate | ND | 1.00 | Ħ | н | H | И | 11 | н | |
| ì | Di-n-octyl phthalate | ND | 0.330 | н | | | H | u | n | |
| | Dibenzo (a,h) anthracene | ND | 0.330 | Ħ | 11 | 91 | H. | Ħ | Ħ | |
| | Dibenzofuran | ND | 0.330 | " | и | 11 | ** | ч | 11 | |
| - | 1,2-Dichlorobenzene | ND | 1.00 | 11 | н | a | 41 | ** | 11 | |
| | 1,3-Dichlorobenzene | ND | 1.00 | 11 | ** | Ħ | 11 | 11 | Ħ | |
| | 1 4-Dichlorobenzene | ND | 1.00 | n | 11 | 11 | U | U | Ħ | |
| | Dichlorobenzidine | ND | 1.00 | 16 | # | 11 | n | ** | " | |
| ļ | 2,4-Dichlorophenol | ND | 0.330 | ч | ti | H | ** | 12 | 11 | |
| | Diethyl phthalate | ND | 0.330 | н | н | Ħ | IJ | 11 | 11 | |
| | 2,4-Dimethylphenol | ND | 1.00 | H | " | " | 11 | Ħ | Ħ | |
| | Dimethyl phthalate | ND | 0.330 | ŧr | ** | # | # | H | Ħ | |
| | 4,6-Dinitro-2-methylphenol | ND | 1.00 | 11 | ** | н | ıı | ** | ** | |
| 2 | 2,4-Dinitrophenol | ND | 2.00 | ** | ** | н | 11 | 11 | н | |
| | 2,4-Dinitrotoluene | ND | 0.500 | | ** | | H | H | Ħ | |
| . ! | 2,6-Dinitrotoluene | ND | 0.500 | tf | H | 11 | Ħ | W | H. | |
| | Bis(2-ethylhexyl)phthalate | ND | 2.00 | | H | н | н | 18 | | |
| | Fluoranthene | ND | 0.330 | Ħ | ** | H | Ħ | 11 | H | |
| Ì | Fluorene | ND | 0.330 | Ħ | 11 | ** | н | Ħ | | |
| | Hexachlorobenzene | ND | 0.330 | | н | Ħ | tt | | | |
| ļ | Hexachlorobutadiene | ND | 1.00 | Ħ | Ħ | н | Ħ | 11 | | |
| - | Hexachlorocyclopentadiene | ND | 1.00 | н | ** | " | ŧI | u | | |
| 1 | Hexachioroethane | ND | 1.00 | | ŧI | ** | Ħ | 51 | " | |
| | Indeno (1,2,3-cd) pyrene | ND | 0.330 | H | tt. | н | ** | 11 | | |
| A salahai | Isophorone | ND | 0.330 | | н | n | н | Ħ | | |
| | 2-Methylnaphthalene | ND | 0.330 | | 41 | 11 | n | # | " | |
| | 2-Methylphenol | ND | 0.330 | | EF. | Ħ | ** | | 11 | |
| ı | 3-,4-Methylphenol | ND | 0.330 | | H | н | Ħ | n | п | |
| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | Naphthalene | ND | 0.330 | | # | ** | н | tf | | |
| . ! | 2-Nitroaniline | ND | 0.330 | | # | 11 | | | ,, | |
| | 3-Nitroaniline | ND | 1.00 | " | н | Ħ | ** | " | я | |
| } | | | | | | | | | | |

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|
| GP15 (P008088-20) Soil | | | | S | Sampled: 08/0 | 2/00 Recei | ved: 08/03/0 | 00 | |
| 4-Nitroaniline | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| Nitrobenzene | ND | 0.330 | н | ** | Ħ | н | Ħ | " | |
| 2-Nitrophenol | ND | 0.330 | н | u | Ħ | n | н | ** | |
| 4-Nitrophenol | ND | 1.00 | H | ee | et | н | Ħ | 4 | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | n | u | ** | н | н | " | |
| N-Nitrosodiphenylamine | ND | 0.330 | н | e | H | н | н | ** | |
| Pentachiorophenol | ND | 1.00 | н | ** | Ħ | н | ti | #1 | |
| Phenanthrene | ND | 0.330 | n | 11 | tt | н | tt | 11 | |
| Phenol | ND | 0.330 | H | 11 | es | tt | 11 | 41 | |
| Pyrene | ND | 0.330 | H | 4 | eş | 91 | tr | Ħ | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | Ħ | H | a | w . | Ħ | #1 | |
| 2,4,5-Trichlorophenol | ND | 0.330 | Ħ | 11 | es | Ħ | tt | #1 | |
| 2,4,6-Trichlorophenol | ND | 0.330 | ţi | 19 | tŧ | H | \$1 | II | |
| Surr: 2-Fluorobiphenyl | 67.0 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 67.4 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 67.0 % | 42-126 | | | | | | | ! |
| Surr: Phenol-d6 | 74.8 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 64.1 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 61.3 % | 48-119 | | | | | | | |
| GP16 (P008088-21) Soil | | | | 5 | Sampled: 08/0 | 3/00 Recei | ived: 08/03/ | 00 | |
| 4-Chloro-3-methylphenol | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| 2-Chlorophenol | ND | 0.330 | " | н | 9 | H . | 18 | ŧŧ | |
| 2,4-Dichlorophenol | ND | 0.330 | ŧŧ | н | u | | et | | |
| 2,4-Dimethylphenol | ND | 1.00 | Ħ | п | 11 | ** | и | ** | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | U | Ħ | н | # | н | " | |
| 2,4-Dinitrophenol | ND | 2.00 | ** | н | Ħ | a | 11 | ** | |
| 2-Methylphenol | ND | 0.330 | ŧŧ | ** | Ħ | Ħ | Ħ | 11 | |
| 3-,4-Methylphenol | ND | 0.330 | 11 | ** | н | Ħ | Ħ | 11 | |
| 2-Nitrophenol | ND | 0.330 | 11 | Ħ | н | н | n | II | |
| 4-Nitrophenol | ND | 1.00 | 11 | tt | н | Н | Ħ | Ħ | |
| Pentachiorophenol | ND | 1.00 | ** | ** | н | Į1 | tt | n | |
| Phenol | ND | 0.330 | 14 | * | н | н | н | Ħ | |
| 2,4,5-Trichlorophenol | ND | 0.330 | н | ŧŧ | н | н | п | ŧŧ | |
| 2,4,6-Trichlorophenol | ND | 0.330 | н | | н | N | н | * | |
| Surr: 2-Fluorophenol | 71.3 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 77.4 % | 42-131 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 73,3 % | 48-119 | | | | | | | |

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Result Result Units Dilution Method Prepared Analyzed Batch | Notes R-05 |
|--|------------|
| Acenaphthene | R-05 |
| Acenaphthene ND 13.2 mg/kg dry 20 EPA 8270C 08/15/00 08/16/00 0080365 Acenaphthylene ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Acenaphthylene ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Anthracene ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Benzo (a) anthracene ND 13.2 " " " Benzo (a) pyrene ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Benzo (a) pyrene ND 13.2 " " " " | |
| Double (a) b) 147.7 | |
| Benzo (b) fluoranthene ND 13.2 " " | |
| Renzo (ghi) perulene ND 13.2 " " " " " | |
| Benzo (k) fluoranthene ND 13.2 " " " | |
| Benzoic Acid ND 40.0 " " " " | |
| Benzyl alcohol ND 13.2 " " " " | |
| 4-Bromophenyl phenyl ether ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Butyl benzyl phthalate ND 13.2 " " " | |
| 4-Chloro-3-methylphenol ND 13.2 " " " | |
| 4-Chloroaniline ND 80.0 " " " " " | |
| 1 Chrostonamics III II II II II II II II II II II II I | |
| 7 12 01110100111011771111111111111111111 | |
| E-chiorocarty typester | |
| Dis(z-citiososopropyr)ener | |
| 2-Cinoronaphinatene | |
| 2-Chiotophenor | |
| The state of the s | |
| on your and the the | |
| and the state of t | |
| Drift Oody Processing | |
| Diverso (a,n) and nacene | |
| Diodizoidian " 09/17/00 " " 09/17/00 " | |
| 1,2-Dichlorobenzene 946 200 " " 09/16/00 " | |
| 1,3-Dichlorobenzene | |
| 1,4-Dichlorobenzene ND 40.0 " " " " " " " " " " " " " " " " " " | |
| 3,3°-Dichlorobenzidine | |
| 2,4-Dichlorophenol ND 13.2 " " " " " " " " " " " " " " " " " " " | |
| Diethyl phthalate ND 13.2 | |
| 2,4-Dimethylphenol | |
| Dimethyl phthalate ND 13.2 | |
| 4,6-Dinitro-2-methylphenol ND 40.0 | |
| 2,4-Dinitrophenol ND 80.0 | |
| 2,4-Dinitrotoluene ND 20.0 | |
| 2,6-Dinitrotoluene ND 20.0 | |
| Bis(2-ethylhexyl)phthalate ND 80.0 " " " " " | |

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|-------------|---------|------|
| GP17 @ 6' (P008088-23) Soil | | | | | Sampled: 08/0 | 2/00 Recei | ved: 08/03/ | 00 | R-0 |
| Fluoranthene | ND | 13.2 | mg/kg dry | 20 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| Fluorene | ND | 13.2 | Ħ | ŧi | ŧŧ | н | н | н | |
| Hexachlorobenzene | ND | 13.2 | н | n | н | ** | ħ | н | |
| Hexachlorobutadiene | ND | 40.0 | н | Ħ | " | ti | H | tt | |
| Hexachlorocyclopentadiene | ND | 40.0 | st. | * | n | h | H | tt | |
| Hexachloroethane | ND | 40.0 | н | н | Ħ | n . | Ħ | Ħ | |
| Indeno (1,2,3-cd) pyrene | ND | 13.2 | 11 | 11 | * | tr | ** | Ħ | |
| Isophorone | ND | 13.2 | \$ | ės . | H | u | ŧr | er | |
| 2-Methylnaphthalene | ND | 13.2 | Ħ | ii | u | U | п | н | |
| 2-Methylphenol | ND | 13.2 | U | n | U | " | 11 | U | |
| 3-,4-Methylphenol | ND | 13.2 | 11 | 11 | ** | Hr. | tt | ** | |
| Naphthalene | ND | 13,2 | ŧ | н | a | u | н | tř | |
| 2-Nitroaniline | ND | 13.2 | н | н | н | 11 | 11 | н | |
| 3-Nitroaniline | ND | 40.0 | 44 | ** | ** | et | ** | 11 | |
| 4-Nitroaniline | ND | 13.2 | 91 | tr | Ħ | ti | n | et | |
| Nitrobenzene | ND | 13.2 | n | п | n | 11 | u | u | |
| 2-Nitrophenol | ND | 13.2 | 11 | Ħ | ** | Ħ | " | 11 | 1 |
| 4-Nitrophenol | ND | 40.0 | 91 | ** | н | Ħ | н | " | |
| N-Nitrosodi-n-propylamine | ND | 13.2 | tt | et . | 11 | 19 | 11 | et | |
| N-Nitrosodiphenylamine | ND | 13.2 | 11 | 4 | ŧi | 59 | ti | Ħ | |
| Pentachlorophenol | ND | 40.0 | et | ** | ŧł | н | H | 11 | |
| Phenanthrene | ND | 13.2 | Ħ | H | u | 11 | II | tr | |
| Phenol | ND | 13.2 | U | н | 11 | " | 11 | , H | |
| Pyrene | ND | 13.2 | ** | н | et | tr | н | " | |
| 1,2,4-Trichlorobenzene | ND | 13.2 | н | Ħ | н | n | н | " | |
| 2,4,5-Trichlorophenol | ND | 13.2 | н | н | ŧŧ | " | " | H | |
| 2,4,6-Trichlorophenol | ND | 13.2 | tt | u | ŧŧ | n | | н | |
| Surr: 2-Fluorobiphenyl | NR | 44-146 | | | | | | | S-03 |
| Surr: 2-Fluorophenol | 77.9 % | 42-126 | | | | | | | CV-C |
| Surr: Nitrobenzene-d5 | NR | 42-126 | | | | | | | S-01 |
| Surr: Phenol-d6 | 87.1 % | 42-131 | | | | | | | 3-01 |
| Surr: p-Terphenyl-d14 | NR | 49-150 | | | | | | | S-01 |
| Surr: 2,4,6-Tribromophenol | 78.6 % | 48-119 | | | | | | | D-01 |

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 63 of 98



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Portland

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals Jecor

Project Number: 015,08716,001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| - Company | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------|---------------------------------|--------|--------------------|-----------|----------|---------------|-------------|---------------|---------|-------|
| | GP17C @ 11.5' (P008088-25) Soil | | | | S | Sampled: 08/0 | 2/00 Rece | ived: 08/03/0 | 00 | |
| **** | Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| | Acenaphthylene | ND | 0.330 | н | Ħ | 11 | 11 | н | н | |
| i | Anthracene | ND | 0.330 | * | Ħ | н | н | н | tt | |
| | Benzo (a) anthracene | ND | 0.330 | # | Ħ | # . | H | n | н | |
| Ì | Benzo (a) pyrene | ND | 0.330 | н | n | н | H | ** | # | |
| | Benzo (b) fluoranthene | ND | 0.330 | н | н | 11 | н . | н | * | |
| | Benzo (ghi) perylene | ND | 0.330 | н | н | H | Ħ | н | H | |
| 1 | Benzo (k) fluoranthene | ND | 0.330 | n | # | tt | и | n | n | |
| | Benzoic Acid | ND | 1.00 | н | e | ti | tt | tt | 41 | |
| , | Benzyl alcohol | ND | 0.330 | tt | н | Ħ | ŧŧ | ** | " | |
| | 4-Bromophenyl phenyl ether | ND | 0.330 | " | ** | 41 | 10 | n | 11 | |
| , | Butyl benzyl phthalate | ND | 0.330 | ** | Ħ | 11 | u u | 11 | н | |
| | 4-Chloro-3-methylphenol | ND | 0.330 | 11 | ti | н | n | tr | Ħ | |
| | 4-Chloroaniline | ND | 2.00 | #1 | ** | tf | n | Ħ | tt | |
| ı | Pis(2-chloroethoxy)methane | ND | 0.330 | н | ** | ** | 11 | # | 11 | |
| | (2-chloroethyl)ether | ND | 0.330 | Ħ | 11 | н | 11 | 11 | 11 | |
| | Bis(2-chloroisopropyl)ether | ND | 0.330 | # | Ħ | н | IJ | 11 | Ħ | |
| | 2-Chloronaphthalene | ND | 0.330 | Ħ | н | H | н | Ħ | н | |
| | 2-Chlorophenol | ND | 0.330 | Ħ | н | ** | Ħ | tt | 44 | |
| | 4-Chlorophenyl phenyl ether | ND | 0.330 | Ħ | н | 11 | tt . | ** | Ħ | |
| | Chrysene | ND | 0.330 | ** | Ħ | 11 | 11 | Ħ | н | |
| | Di-n-butyl phthalate | ND | 1.00 | ** | ** | Ħ | И | И | н | |
| | Di-n-octyl phthalate | ND | 0.330 | Ħ | | H | rı . | ** | ** | |
| Ì | Dibenzo (a,h) anthracene | ND | 0.330 | н | \$1 | " | Ħ | ij | u | |
| | Dibenzofuran | ND | 0.330 | ** | н | н | п | Ħ | Ħ | |
| 1 | 1,2-Dichlorobenzene | ND | 1.00 | ** | Ħ | # | 11 | ŧI | н | |
| | 1,3-Dichlorobenzene | ND | 1.00 | # | н | ** | Ħ | ** | u | |
| | 1,4-Dichlorobenzene | ND | 1.00 | 66 | Ħ | 11 | ## | # · | Ħ | |
| į. | 3,3'-Dichlorobenzidine | ND | 1.00 | | н | #1 | 11 | н | Ħ | |
| | 2,4-Dichlorophenol | ND | 0.330 | #1 | tr | " | Ħ | P | tř | |
| ĺ | Diethyl phthalate | ND | 0.330 | | ** | ŧŧ | N | ** | # | |
| | 2,4-Dimethylphenol | ND | 1.00 | | н | ** | \$1 | 11 | 11 | |
| | Dimethyl phthalate | ND | 0.330 | Ħ | H | Ħ | И | Ħ | H | |
| | 4,6-Dinitro-2-methylphenol | ND | 1.00 | | ** | # | н | tt | ** | |
| | 2,4-Dinitrophenol | ND | 2.00 | | 11 | #1 | \$ t | ** | #1 | |
| ı | 2,4-Dinitrotoluene | ND | 0.500 | | н | 11 | 55 | 11 | н | |
| | 2,6-Dinitrotoluene | ND | 0.500 | | ** | н | 11 | н | tt | |
| İ | Bis(2-ethylhexyl)phthalate | ND | 2.00 | | ** | If | н | ** | ** | |
| | Fluoranthene | ND | 0.330 | | Ħ | 11 | ŧ | ** | 11 | |
| | Williams | | | | | | | | | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---------------------------------|--------|--------------------|-----------|----------|---------------|------------|---------------|---------|-------|
| GP17C @ 11.5' (P008088-25) Soil | | | | Ś | Sampled: 08/0 | 2/00 Recei | ived: 08/03/0 | 00 | |
| Fluorene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| Hexachlorobenzene | ND | 0.330 | 11 | Ħ | " | н | ** | N | |
| Hexachlorobutadiene | ND | 1.00 | tt | n | ti | n | n | Ħ | |
| Hexachlorocyclopentadiene | ND | 1.00 | Ħ | Ħ | Ħ | 11 | Ħ | н | |
| Hexachloroethane | ND | 1.00 | # | н | # | Ħ | н | | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | н | н | ** | | н | н | |
| Isophorone | ND | 0.330 | н | н | н | II. | н | 4 | |
| 2-Methylnaphthalene | ND | 0.330 | н | tt | Ħ | n | n | 65 | |
| 2-Methylphenol | ND | 0.330 | Ħ | ** | u | ** | 11 | ** | |
| 3-,4-Methylphenol | ND | 0.330 | u | es | 11 | Ħ | Ħ | tt | |
| Naphthalene | ND | 0.330 | ti | Ħ | # | n | 14 | # | |
| 2-Nitroaniline | ND | 0.330 | Ħ | 11 | 11 | ti | 11 | ** | |
| 3-Nitroaniline | ND | 1.00 | 11 | Ħ | ŧı | н | 15 | tt . | |
| 4-Nitroaniline | ND | 0.330 | 11 | tt | ŧi | ** | ŧŝ | er | |
| Nitrobenzene | ND | 0.330 | es | н | ts | H | tr | tr | |
| 2-Nitrophenol | ND | 0.330 | 11 | # | ti | 11 | ** | 11 | , " |
| 4-Nitrophenol | ND | 1.00 | Ħ | tt | ti | u | Ħ | n | , |
| N-Nitrosodi-n-propylamine | ND | 0.330 | tf | 11 | # | 44 | ŧŧ | (t | |
| N-Nitrosodiphenylamine | ND | 0.330 | tt | ** | ti | ** | н | н | |
| Pentachlorophenol | ND | 1.00 | tt | 19 | II | ** | н | tt | |
| Phenanthrene | ND | 0.330 | n | Ħ | Ħ | tr | н | *1 | |
| Phenol | ND | 0.330 | н | ŧŧ | 11 | ti- | и | 19 | |
| Pyrene | ND | 0.330 | н | " | 11 | tt | н | ** | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | Ħ | н | 11 | n | | et | |
| 2,4,5-Trichlorophenol | ND | 0.330 | n | н | ** | . 11 | 19 | ** | |
| 2,4,6-Trichlorophenol | ND | 0.330 | # | Ħ | ** | • п | ** | " | |
| Surr: 2-Fluorobiphenyl | 61.7 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 64.9 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 58.1 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 70.6 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 57.8 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 58.6 % | 48-119 | | | | | | | |

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Pecol

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39 Project Manager: Joe Hunt

Semivolatile Organic Compounds per EPA Method 8270C North Creek Analytical - Portland

| | THOUGH CITCH TIME, NO. | | | | | | | | | | | | |
|---|------------------------|--------------------|-----------|----------|---------------|------------|--------------|---------|-------|--|--|--|--|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes | | | | |
| GP18 (P008088-26) Soil | | | | 5 | Sampled: 08/0 | 3/00 Recei | ved: 08/03/0 | 00 | | | | | |
| Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | | | | | |
| Acenaphthylene | ND | 0.330 | n n | | H | # | # | Ħ | | | | | |
| Anthracene | ND | 0.330 | tt | Ħ | n | Ħ | н | Ħ | | | | | |
| Benzo (a) anthracene | ND | 0.330 | ** | п | Ħ | 11 | H | ** | | | | | |
| Benzo (a) pyrene | ND | 0.330 | H | Ħ | Ħ | Ħ | " | H | | | | | |
| Benzo (b) fluoranthene | ND | 0.330 | Ħ | | н | н . | н | ₹ | | | | | |
| Benzo (ghi) perylene | ND | 0.330 | u | * | н | ** | tf | H | | | | | |
| Benzo (k) fluoranthene | ND | 0.330 | 11 | Ħ | ** | 11 | 15 | Ħ | | | | | |
| Benzoic Acid | ND | 1.00 | U | н | ø | IF | 11 | 11 | | | | | |
| Benzyl alcohol | ND | 0.330 | Ħ | n | ŧŧ | tt | 11 | H | | | | | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | 11 | ** | # | ** | н | e | | | | | |
| Butyl benzyl phthalate | ND | 0.330 | 11 | н | 11 | 11 | ** | ** | | | | | |
| 4-Chloro-3-methylphenol | ND | 0.330 | n | El | Ħ | II. | 99 | Ħ | | | | | |
| 4-Chloroaniline | ND | 2.00 | ŧř | | н | # | н | н | | | | | |
| Pis(2-chloroethoxy)methane | ND | 0.330 | ** | # | Ħ | ŧs. | Ħ | tí | | | | | |
| 2-chloroethyl)ether | ND | 0.330 | 11 | D | ** | 11 | 11 | ** | | | | | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | н | н | 11 | II | 11 | # | | | | | |
| 2-Chloronaphthalene | ND | 0.330 | Ħ | n | Ħ | н | Ħ | Ħ | | | | | |
| 2-Chlorophenol | ND | 0.330 | ** | n | # | " | н | Ħ | | | | | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | 11 | Ħ | ** | 11 | Ħ | " | | | | | |
| Chrysene | ND | 0.330 | | tŧ | 11 | н | # | # | | | | | |
| Di-n-butyl phthalate | ND | 1.00 | | 19 | tı | ir | 11 | н | | | | | |
| Di-n-octyl phthalate | ND | 0.330 | | 11 | BT . | u | Ħ | Ħ | | | | | |
| Dibenzo (a,h) anthracene | ND | 0.330 | | ŧI | 11 | 41 | " | ** | | | | | |
| Dibenzofuran | ND | 0.330 | | Ħ | н | н | и | Ħ | | | | | |
| 1,2-Dichlorobenzene | ND | 1.00 | | n | , H | et | ŧI | Ħ | | | | | |
| 1,3-Dichlorobenzene | ND | 1.00 | | н | ** | #1 | tt | Ħ | | | | | |
| 1,4-Dichlorobenzene | ND | 1.00 | | H | 19 | п | 11 | Ħ | | | | | |
| 3,3'-Dichlorobenzidine | ND | 1.00 | | | н | Ħ | N | н | | | | | |
| 2,4-Dichlorophenol | ND | 0.330 | | ti | | 19 | ** | | | | | | |
| Diethyl phthalate | ND | 0.330 | | н | Ħ | п | 11 | н | | | | | |
| 2,4-Dimethylphenol | ND | 1.00 | | 11 | Ħ | tı | (I | Ħ | | | | | |
| | ND | 0.330 | | н | | 11 | н | u. | | | | | |
| Dimethyl phthalate 4,6-Dinitro-2-methylphenol | ND | 1.00 | | ŧr | n | u | 11 | н | | | | | |
| 2,4-Dinitrophenol | ND | 2.00 | | ** | н | ** | н | н | | | | | |
| 2,4-Dinitrophenol 2,4-Dinitrotoluene | ND | 0.500 | | ŧ | ** | ŧı | ŧŧ | ŧŧ | | | | | |
| 2,4-Dinitrotoluene | ND | 0.500 | | н | 11 | Ħ | 11 | # | | | | | |
| • | ND ND | 2.00 | | ** | н | Ħ | ŧŧ | н | | | | | |
| Bis(2-ethylhexyl)phthalate | ND | 0.330 | | Ħ | ŧs | tr | n | | | | | | |
| Fluoranthene | 1417 | 0,550 | , | | | | | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes | | |
|----------------------------|--------|--------------------|------------|--------------------------------------|-----------|------------|----------|---------|-------|--|--|
| GP18 (P008088-26) Soil | | | | Sampled: 08/03/00 Received: 08/03/00 | | | | | | | |
| Fluorene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | | | |
| Hexachlorobenzene | ND | 0.330 | # | et | " | Ħ | 11 | er | | | |
| Hexachlorobutadiene | ND | 1.00 | Ħ | 15 | et | tt | 11 | ti | | | |
| Hexachlorocyclopentadiene | ND | 1.00 | н | et | ŧŧ | Ħ | H | н | | | |
| Hexachioroethane | ND | 1.00 | ** | Ħ | Ħ | н | 11 | Ħ | | | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | | ** | eş | H . | ** | 11 | | | |
| Isophorone | ND | 0.330 | * | н | tr | N | # | u | | | |
| 2-Methylnaphthalene | ND | 0.330 | 1 (| H | tř | n | | u | | | |
| 2-Methylphenol | ND | 0.330 | EE | ti | н | 11 | ** | н | | | |
| 3-,4-Methylphenol | ND | 0.330 | Ħ | н | tt | 11 | 11 | 11 | | | |
| Naphthalene | ND | 0.330 | Ħ | Ħ | н | 11 | Ħ | 11 | | | |
| 2-Nitroaniline | ND | 0.330 | н | n | н | u | er . | ** | | | |
| 3-Nitroaniline | ND | 1.00 | н | н | п | 12 | 11 | 14 | | | |
| 4-Nitroaniline | ND | 0.330 | н | n | н | ** | н | ** | | | |
| Nitrobenzene | ND | 0.330 | n | В | н | 45 | н | 11 | | | |
| 2-Nitrophenol | ND | 0.330 | Ħ | 11 | 11 | H | H | ** | * . | | |
| 4-Nitrophenol | ND | 1.00 | п | н | 11 | tt | н | ** | | | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | ** | н | n | ti | π | | • | | |
| N-Nitrosodiphenylamine | ND | 0.330 | Ħ | æ | #t | tr | n | es | | | |
| Pentachlorophenol | ND | 1.00 | ** | • | " | ŧŧ | н | * | | | |
| Phenanthrene | ND | 0.330 | tt | tt | * | tt | 11 | tt | | | |
| Phenol | ND | 0.330 | et | ŧŧ | Ħ | n | 11 | Ħ | | | |
| Pyrene | ND | 0.330 | " | tr | tt | U | 19 | Ħ | | | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | ** | #1 | н | U | n | 11 | | | |
| 2,4,5-Trichlorophenol | ND | 0.330 | tr. | н | tt | n | ** | tr | | | |
| 2,4,6-Trichlorophenol | ND | 0.330 | er | n | u | ** | " | tř | | | |
| Surr: 2-Fluorobiphenyl | 78.2 % | 44-146 | | | | | | | | | |
| Surr: 2-Fluorophenol | 79.3 % | 42-126 | | | | | | | | | |
| Surr: Nitrobenzene-d5 | 75.2 % | 42-126 | | | | | | | | | |
| Surr: Phenol-d6 | 87.1 % | 42-131 | | | | | | | | | |
| Surr: p-Terphenyl-d14 | 69.8 % | 49-150 | | | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 76.6 % | 48-119 | | | | | | | | | |

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Project: Fort James Specialty Chemicals .dcor Project Number: 015.08716.001 P.O. Box 1508

Reported: 08/24/00 08:39

Project Manager: Joe Hunt

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| ĺ | | Nor | th Creek | Anaiyu | сиі - Ро | i iianu | | | | |
|---|-----------------------------|----------|--------------------|-----------|----------|---------------|------------|-------------|---------|-------|
| | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| Ì | GP19 (P008088-27) Soil | | | | 5 | Sampled: 08/0 | 3/00 Recei | ved: 08/03/ | 00 | R-05 |
| 1 | Acenaphthene | ND | 1.65 | mg/kg dry | 5 | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | |
| | Acenaphthylene | ND | 1.65 | tt | 11 | rr | н | Ħ | н | |
| 100 | Anthracene | ND | 3.30 | *1 | 10 | u | n | 08/17/00 | ** | S-01 |
| | Benzo (a) anthracene | ND | 1.65 | Ħ | 5 | н | 17 | 08/17/00 | " | |
| Ì | Benzo (a) pyrene | ND | 1.65 | H | Ħ | H | Ħ | # | Ħ | |
| 4000 | Benzo (b) fluoranthene | ND | 1.65 | H | #1 | Ħ | Ħ - | Ħ | Ħ | |
| ٠ | Benzo (ghi) perylene | ND | 1.65 | н | Ħ | n | Ħ | * | ** | |
| ŧ | Benzo (k) fluoranthene | ND | 1.65 | Ħ | 11 | Ħ | ø | 11 | н | |
| | Benzoic Acid | ND | 5.00 | tt | II | Ħ | 11 | Ħ | tt | |
| ļ | Benzyl alcohol | ND | 1.65 | ** | H | tt | H | tt | " | |
| | 4-Bromophenyl phenyl ether | ND | 1.65 | Ħ | | " | | " | # | |
| | Butyl benzyl phthalate | ND | 1.65 | Ħ | Ħ | н | # | 11 | н | |
| ĺ | 4-Chloro-3-methylphenol | ND | 1,65 | et | 11 | n | Ħ | u | н | |
| į | 4-Chloroaniline | ND | 10.0 | #1 | Ħ | н | U | ** | st | |
| | Bis(2-chloroethoxy)methane | ND | 1.65 | ti ti | 11 | 11 | я | 11 | n | |
| | 2-chloroethyl)ether | ND | 1.65 | Ħ | 11 | 11 | 11 | ti | tı | |
| ì | Bis(2-chloroisopropyl)ether | ND | 1.65 | ** | 11 | tt | N | Ħ | Ħ | |
| | 2-Chloronaphthalene | ND | 1.65 | | Ħ | tt | Ħ | ** | ** | |
| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | 2-Chlorophenol | ND | 1.65 | | н | ** | u | n | n | |
| - | 4-Chlorophenyl phenyl ether | ND | 1.65 | | Ħ | 11 | 11 | н | н | |
| i | Chrysene | ND | 1.65 | | н | Ħ | Ħ | H | ** | |
| | Di-n-butyl phthalate | ND | 5.00 | | u | ** | н | 11 | 11 | |
| | Di-n-octyl phthalate | ND | 1.65 | | 11 | 11 | u | Ħ | н | |
| İ | Dibenzo (a,h) anthracene | ND | 1.65 | | ır | 11 | tt | n | # | |
| | Dibenzofuran | ND | 1.65 | | | ** | н | ** | ** | |
| Į. | | ND | 5.00 | | H | 11 | * | ** | 11 | |
| | 1,2-Dichlorobenzene | ND | 5.00 | | ri | IT | # | н | н | |
| ļ | 1,3-Dichlorobenzene | ND ND | 5.00 | | tt | 15 | . # | | ** | |
| | 1,4-Dichlorobenzene | ND | 5.00 | | 11 | и | tr | 11 | н | |
| | 3,3'-Dichlorobenzidine | ND | 1.65 | | tř | н | 11 | , ti | ** | |
| | 2,4-Dichlorophenol | ND ND | 1.65 | | п | u . | u | ** | ** | |
| | Diethyl phthalate | ND ND | 5.00 | | 41 | ** | ** | Ħ | H | |
| | 2,4-Dimethylphenol | ND ND | 1.65 | | н | н | 11 | | n | |
| 4144444 | Dimethyl phthalate | ND | 5.00 | | ** | ** | u | 12 | Ħ | |
| ļ | 4,6-Dinitro-2-methylphenol | | 10.0 | | u | 11 | 41 | #1 | н | |
| | 2,4-Dinitrophenol | ND ND | 2.50 | , | ** | н | 11 | н | ** | |
| į | 2,4-Dinitrotoluene | ND | | • | ** | | н | ** | 19 | |
| - | 2,6-Dinitrotoluene | ND | 2.50 | , | #1 | 11 | er | н | н | |
| . * | Bis(2-ethylhexyl)phthalate | ND | 10.0 1.65 | , | # | н | н | н | Ħ | |
| į | Fluoranthene | ND | 1.03 | , | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|---|--------------------|------------|----------|-----------|----------|----------|------------|-------|
| GP19 (P008088-27) Soil | · 107 EV 101001111111111111111111111111111111 | | | 5 | 00 | R-05 | | | |
| Fluorene | ND | 1.65 | mg/kg dry | 5 | EPA 8270C | 08/15/00 | 08/17/00 | 0080365 | |
| Hexachlorobenzene | ND | 1.65 | н | * | Ħ | * | Ħ | н | |
| Hexachlorobutadiene | ND | 5.00 | н | ** | Ħ | Ħ | tt | н | |
| Hexachlorocyclopentadiene | ND | 5.00 | н | | Ħ | Ħ | Ħ | н | |
| Hexachloroethane | ND | 5.00 | н | | Ħ | u | Ħ | # | |
| Indeno (1,2,3-cd) pyrene | ND | 1.65 | Ħ | * | " | и . | Ħ | ** | |
| Isophorone | ND | 1.65 | ** | er | ** | H | Ħ | ** | |
| 2-Methylnaphthalene | ND | 1.65 | 11 | н | ** | н | # | 45 | |
| 2-Methylphenol | ND | 1.65 | 11 | Ħ | ** | Ħ | 11 | 46 | |
| 3-,4-Methylphenol | ND | 1.65 | et | н | # | 11 | 11 | es | |
| Naphthalene | ND | 1.65 | W. | н | 0 | 15 | u | er | |
| 2-Nitroaniline | ND | 1.65 | Ħ | Ħ | Ħ | " | ų | ŧŗ | |
| 3-Nitroaniline | ND | 5.00 | tt | Ħ | н | | tt | F F | |
| 4-Nitroaniline | ND | 1.65 | Ħ | 44 | н | ** | | er . | |
| Nitrobenzene | ND | 1.65 | tt | ét | н | ŧ | 11 | н | |
| 2-Nitrophenol | | 1.65 | 0 | ** | II | u | H | n . | |
| 4-Nitrophenol | . ND | 5.00 | 41 | ** | 11 | н | 11 | н | |
| N-Nitrosodi-n-propylamine | ND | 1.65 | 11 | tt. | # | Ħ | 11 | н | |
| N-Nitrosodiphenylamine | ND | 1.65 | 16 | tř | 11 | II | Ш | н | |
| Pentachlorophenol | ND | 5.00 | 11 | # | 11 | IJ | Ħ | n | |
| Phenanthrene | ND | 1.65 | ** | Ħ | н | ** | 11 | ** | |
| Phenoi | ND | 1.65 | t f | н | п | ** | 11 | 11 | |
| Pyrene | ND | 1.65 | Ħ | н | н | 10 | н | Ħ | |
| 1,2,4-Trichlorobenzene | ND | 1.65 | tr | н | u | ** | • | tr | |
| 2,4,5-Trichlorophenol | ND | 1.65 | n | # | н | tt. | Ħ | ** | |
| 2,4,6-Trichlorophenol | ND | 1.65 | ti | и | н | н | | er | |
| Surr: 2-Fluorobiphenyl | 87.4 % | 44-146 | | * | | | | | |
| Surr: 2-Fluorophenol | 72.4 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 74.5 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 76.9 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 69.9 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 75.3 % | 48-119 | | | | | | | |

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_ cor

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39

P.O. Box 1508 Tualatin, OR 97062

Project Manager: Joe Hunt Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------|-----------------------------|--------|--------------------|-----------|----------|---------------|------------|--------------|-------------|-------|
| A.C. | GP2B (P008088-29) Soil | | | | 5 | Sampled: 08/0 | 2/00 Recei | ived: 08/03/ | 00 | |
| ! | Acenaphthene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| | Acenaphthylene | ND | 0.330 | H | 11 | n | 11 | H | н | |
| - | Anthracene | ND | 0.330 | N | Ħ | • | Ħ | tt | Ħ | |
| | Benzo (a) anthracene | ND | 0.330 | H | * | Ħ | Ħ | π | | |
| | Benzo (a) pyrene | ND | 0.330 | H | * | Ħ | Ħ | Ħ | Ħ | |
| | Benzo (b) fluoranthene | ND | 0.330 | Ħ | 4 | tt | | н | н | |
| 1 | Benzo (ghi) perylene | ND | 0.330 | Ħ | # | ** | ** | Ħ | Ħ | |
| | Benzo (k) fluoranthene | ND | 0.330 | Ħ | Ħ | Ħ | Ħ | tt | Ħ | |
| | Benzoic Acid | ND | 1.00 | 11 | ĸ | 11 | ti | Ħ | # | |
| | Benzyl alcohol | ND | 0.330 | н | " | Ħ | ** | ** | н | |
| | 4-Bromophenyl phenyl ether | ND | 0.330 | н | н | Ħ | " | Ħ | н | |
| ì | Butyl benzyl phthalate | ND | 0.330 | #f | Ħ | " | # | Ħ | н | |
| | 4-Chloro-3-methylphenol | ND | 0.330 | ** | H | 11 | 11 | " | 4F | |
| ! | 4-Chloroaniline | ND | 2.00 | ti | # | п | н | н | n | |
| | Bis(2-chloroethoxy)methane | ND | 0.330 | II . | н | Ħ | Ħ | 11 | н | |
| į | 2-chloroethyl)ether | ND | 0.330 | tt | н | # | u | 11 | Ħ | |
| ļ | bis(2-chloroisopropyl)ether | ND | 0.330 | # | ** | ** | 11 | Ħ | Ħ | |
| | 2-Chloronaphthalene | ND | 0.330 | 11 | * | 11 | Ħ | H | 11 | |
| ì | 2-Chlorophenol | ND | 0.330 | н | 11 | н | H | н | ŧ | |
| | 4-Chlorophenyl phenyl ether | ND | 0.330 | | Ħ | Ħ | 11 | Ħ | н | |
| i | Chrysene | ND | 0.330 | | н | n | " | ** | н | |
| | Di-n-butyl phthalate | ND | 1.00 | | EI . | 11 | 11 | " | et | |
| | Di-n-octyl phthalate | ND | 0.330 | | н | Ħ | Ħ | Ħ | 19 | |
| İ | Dibenzo (a,h) anthracene | ND | 0.330 | | H | ** | tt | N | н | |
| | Dibenzofuran | ND | 0.330 | H | * | * | # | ** | ŧŧ | |
| ļ | 1,2-Dichlorobenzene | ND | 1.00 | Ħ | Ħ | Ħ | n | •• | " | |
| | 1,3-Dichlorobenzene | ND | 1.00 | Ħ | Ħ | н | ŧŧ | 11 | ŧ | |
| , | 1,4-Dichlorobenzene | ND | 1.00 | | 17 | ** | " | Ħ | н | |
| | 3,3'-Dichlorobenzidine | ND | 1.00 | | 11 | 19 | 11 | H | \$ £ | |
| | 2,4-Dichlorophenol | ND | 0.330 | | 11 | н | н | Ħ | Ħ | |
| ļ | Diethyl phthalate | ND | 0.330 | | н | 16 | Ħ | 11 | н | |
| | 2,4-Dimethylphenol | ND | 1.00 | | ** | 41 | *1 | ** | er | |
| ŀ | Dimethyl phthalate | ND | 0.330 | | 11 | ti | II | 41 | 15 | |
| | 4,6-Dinitro-2-methylphenol | ND | 1.00 | | н | 11 | ŧŧ | ŧi | Ħ | |
| ì | 2,4-Dinitrophenol | ND | 2.00 | | ** | 11 | ** | н | н | |
| | 2,4-Dinitrophenol | ND | 0.500 | | н | н | n | ** | tf . | |
| ļ | 2,6-Dinitrotoluene | ND | 0.500 | | н | Ħ | Ħ | н | H | |
| - | Bis(2-ethylhexyl)phthalate | ND | 2.00 | | Ħ | 9 | n | Ħ | н | |
| | Fluoranthene | ND | 0.330 | | ** | # | H | ** | Ħ | |
| 3 | 1 Indiminion | * 122 | 5.250 | | | | | | | |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015,08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-----------|----------|-----------|----------|----------|---------|-------|
| GP2B (P008088-29) Soil | | | | 5 | 00 | | | | |
| Fluorene | ND | 0.330 | mg/kg dry | 1 | EPA 8270C | 08/15/00 | 08/16/00 | 0080365 | |
| Hexachlorobenzene | ND | 0.330 | н | н | 46 | ŧī | ** | ** | |
| Hexachlorobutadiene | ND | 1.00 | ŧI | Ħ | * | н | 11 | 11 | |
| Hexachlorocyclopentadiene | ND | 1.00 | H | Ħ | et | Ħ | Ħ | Ħ | |
| Hexachloroethane | ND | 1.00 | 11 | н | ** | н | Ħ | ** | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | # | " | Ħ | н . | * | ** | |
| Isophorone | ND | 0.330 | Ħ | H | Ħ | н | * | ee | |
| 2-Methylnaphthalene | ND | 0.330 | Ħ | 11 | B | H | ŧr | ts | |
| 2-Methylphenol | ND | 0.330 | 11 | н | # | 11 | tt | er | |
| 3-,4-Methylphenol | ND | 0.330 | ** | ** | EP . | 19 | 4 | tt . | |
| Naphthalene | ND | 0.330 | 41 | ŧŧ | ŧŧ | 19 | н | er . | |
| 2-Nitroaniline | ND | 0.330 | # | ŧ | н | 19 | Ħ | tř | |
| 3-Nitroaniline | ND | 1.00 | ** | ** | н | ır | н | 61 | |
| 4-Nitroaniline | ND | 0.330 | 26 | tt | н | | Ħ | tr | |
| Nitrobenzene | ND | 0.330 | EF | et . | н | н | 11 | н | |
| 2-Nitrophenol | ND | 0.330 | # | Ħ | U | н | 11 | u | |
| 4-Nitrophenol | ND | 1.00 | tt | н | 18 | Ħ | ** | n | 1 |
| N-Nitrosodi-n-propylamine | ND | 0.330 | tt | н | 11 | H | e | н | |
| N-Nitrosodiphenylamine | ND | 0.330 | tt | н | ** | н | et | ti , | |
| Pentachiorophenol | ND | 1.00 | tt | Ħ | | Ħ | e | н | |
| Phenanthrene | ND | 0.330 | Ħ | ** | ** | 11 | ** | n | |
| Phenol | ND | 0.330 | 0 | ** | ei . | н | ŧŧ | lg . | |
| Ругепе | ND | 0.330 | H | ** | ti | 19 | # | 11 | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | н | ** | et | Ħ | н | H | |
| 2,4,5-Trichlorophenol | ND | 0.330 | 11 | | н | " | H | * | |
| 2,4,6-Trichlorophenol | ND | 0.330 | Ħ | e e | a | " | n | u | |
| Surr: 2-Fluorobiphenyl | 71.8 % | 44-146 | | | | | | | |
| Surr: 2-Fluorophenol | 77.3 % | 42-126 | | | | | | | |
| Surr: Nitrobenzene-d5 | 70.4 % | 42-126 | | | | | | | |
| Surr: Phenol-d6 | 85.2 % | 42-131 | | | | | | | |
| Surr: p-Terphenyl-d14 | 68.3 % | 49-150 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 72.6 % | 48-119 | | | | | | | |

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cor. P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Miscellaneous Physical/Conventional Chemistry Parameters North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method F | repared | Analyzed | Batch | Notes |
|-------------------------------|--------|--------------------|-------------|----------|------------------|----------|---------------|---------|-------------|
| GP1 (P008088-01) Soil | | | | | Sampled: 08/01/0 | 0 Recei | ved: 08/03/0 | 00 | |
| % Solids | 83.0 | 1.00 % | by Weight | 1 | NCA SOP 0 | 8/04/00 | 08/04/00 | 0080120 | |
| GP3 (P008088-03) Soil | | | | | Sampled: 08/01/0 | 0 Recei | ived: 08/03/0 | 00 | |
| % Solids | 77.4 | 1.00 % | by Weight | 1 | NCA SOP 0 | 8/04/00 | 08/04/00 | 0080120 | |
| GP4 (P008088-04) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/0 | 00 | |
| % Solids | 75.6 | 1.00 % | by Weight | 1 | NCA SOP 0 | 8/04/00 | 08/04/00 | 0080120 | |
| GP5 (P008088-05) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/0 | 00 | |
| % Solids | 87.1 | 1.00 % | by Weight | 1 | NCA SOP 0 | 8/04/00 | 08/04/00 | 0080120 | • |
| GP6 (P008088-06) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/6 | 00 | |
| % Solids | 73.9 | 1.00 % | by Weight | 1 | NCA SOP | 8/04/00 | 08/04/00 | 0080120 | |
| /C (P008088-09) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/ | 00 | |
| % Solids | 89.8 | 1.00 % | by Weight | 1 | NCA SOP | 8/04/00 | 08/04/00 | 0080120 | |
| GP8 (P008088-10) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/ | 00 | |
| % Solids | 75.9 | 1.00 % | by Weight | 1 | NCA SOP | 8/04/00 | 08/04/00 | 0080120 | |
| GP9 @ 12' (P008088-12) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/ | 00 | |
| % Solids | 74.8 | 1.00 % | 6 by Weight | . 1 | NCA SOP | 8/04/00 | 08/04/00 | 0080120 | |
| GP9 @ 27.5' (P008088-13) Soil | | | | | Sampled: 08/01/0 | 0 Rece | ived: 08/03/ | 00 | |
| % Solids | 83.0 | 1.00 % | 6 by Weight | 1 | NCA SOP | 08/04/00 | 08/04/00 | 0080120 | |

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001

Reported: 08/24/00 08:39

Miscellaneous Physical/Conventional Chemistry Parameters North Creek Analytical - Portland

Project Manager: Joe Hunt

| Analyte | Result | Reporting Limit Units | Dilution | n Method Pr | epared Analyzed | Batch | Notes |
|---------------------------------|--------|--------------------------|----------|-------------------|------------------|---------|---|
| GP10 (P008088-14) Soil | | | | Sampled: 08/01/00 | Received: 08/03/ | 00 | |
| % Solids | 65.6 | 1.00 % by Weigh | t 1 | NCA SOP 08 | /04/00 08/04/00 | 0080120 | |
| GP11 (P008088-15) Soil | | | | Sampled: 08/01/00 | Received: 08/03/ | 00 | |
| % Solids | 82.2 | 1.00 % by Weigh | t I | NCA SOP 08 | /04/00 08/04/00 | 0080120 | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| GP12 (P008088-16) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | |
| % Solids | 77.7 | 1.00 % by Weigh | t 1 | NCA SOP 08 | /04/00 08/04/00 | 0080120 | |
| GP13 (P008088-17) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | |
| % Solids | 88.5 | 1.00 % by Weigh | t 1 | NCA SOP 08 | /04/00 08/04/00 | 0080120 | |
| GP14 @ 8' (P008088-19) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | |
| % Solids | 81.9 | 1.00 % by Weigh | t 1 | NCA SOP 08 | /04/00 08/04/00 | 0080120 | |
| GP15 (P008088-20) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | ı |
| % Solids | 80.2 | 1.00 % by Weigh | t 1 | NCA SOP 08/ | /04/00 08/04/00 | 0080120 | |
| GP16 (P008088-21) Soil | | | | Sampled: 08/03/00 | Received: 08/03/ | 00 | |
| % Solids | 87.2 | 1.00 % by Weigh | t 1 | NCA SOP 08/ | /04/00 08/04/00 | 0080120 | |
| GP17 @ 6' (P008088-23) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | |
| % Solids | 70.3 | 1.00 % by Weigh | t 1 | NCA SOP 08/ | /04/00 08/04/00 | 0080120 | |
| GP17C @ 11.5' (P008088-25) Soil | | | | Sampled: 08/02/00 | Received: 08/03/ | 00 | |
| % Solids | 79.9 | 1.00 % by Weigh | t 1 | NCA SOP 08/ | /04/00 08/04/00 | 0080120 | |

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COL P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Miscellaneous Physical/Conventional Chemistry Parameters North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------|--------|--------------------|-------------|----------|---------------|-------------|--------------|---------|-------|
| GP18 (P008088-26) Soil | | | | | Sampled: 08/0 | 03/00 Recei | ved: 08/03/ | 00 | |
| % Solids | 84.0 | 1.00 | % by Weight | 1 | NCA SOP | 08/04/00 | 08/04/00 | 0080120 | |
| GP19 (P008088-27) Soil | | | | | Sampled: 08/0 | 03/00 Rece | ived: 08/03/ | 00 | |
| % Solids | 87.5 | 1.00 | % by Weight | 1 | NCA SOP | 08/04/00 | 08/04/00 | 0080120 | |
| GP20 (P008088-28) Soil | | | | | Sampled: 08/0 | 03/00 Rece | ived: 08/03/ | 00 | |
| % Solids | 77.5 | 1.00 | % by Weight | 1 | NCA SOP | 08/09/00 | 08/10/00 | 0080232 | |
| GP2B (P008088-29) Soil | | | | | Sampled: 08/ | 02/00 Rece | ived: 08/03/ | 00 | |
| % Solids | 87.9 | 1.00 | % by Weight | 1 | NCA SOP | 08/04/00 | 08/04/00 | 0080120 | |

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Lisa Domenighini, Project Manager

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Secor Project: Fort James Specialty Chemicals

DET

P.O. Box 1508 Tualatin, OR 97062

Surr: 1-Chlorooctadecane

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

08/24/00 08:39

JEkydroefieldaftiffentlan per NW JEPEUVethodology -QualityControl

North Creek Analytical - Portland %REC RPD Reporting Spike Source %REC Analyte Result Limit Units Level Result Limits RPD Limit Notes Batch 0080170 - TPH-HCID Extraction Blank (0080170-BLK1) Prepared: 08/07/00 Analyzed: 08/08/00 Gasoline Range Hydrocarbons ND 20.0 mg/kg wet Diesel Range Hydrocarbons ND 50.0 Heavy Oil Range Hydrocarbons ND 100 Surr: 1-Chlorooctadecane DET 50-150 **Duplicate (0080170-DUP1)** Source: P008088-01 Prepared: 08/07/00 Analyzed: 08/08/00 Gasoline Range Hydrocarbons ND 20.0 mg/kg dry ND 50 Diesel Range Hydrocarbons ND ND 50.0 50 Heavy Oil Range Hydrocarbons ND 100 ND 50 Surr: 1-Chlorooctadecane 114 DET 4.82 50-150 **Duplicate (0080170-DUP2)** Source: P008099-01 Prepared: 08/07/00 Analyzed: 08/09/00 Gasoline Range Hydrocarbons ND 145 mg/kg dry ND 50 Diesel Range Hydrocarbons DET DET 129 362 50 Heavy Oil Range Hydrocarbons DET 723 DET 119 50

28.9

55.0

50-150

North Creek Analytical - Portland

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North Creek Analytical, Inc. Page 75 of 98 Environmental Laboratory Network



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cor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

roall MeakquerideA ถบบบาดเมารุษต่อง Mathods - Quality Control

| | | | | | | | *************************************** | | | |
|---------|--------|-----------|-------|-------|--------|------|---|-----|-------|---------|
| | | Reporting | | Spike | Source | | %REC | | RPD | |
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| | | | | | | | | | | <i></i> |

| | Analyte | Result | Limit | Units | Level | Kesuit | 70KEC | Lilling | IG D | Dilline | |
|---|----------------------------|--------|---------------|-----------|-----------|------------|----------|---------------------|------|---------|--|
| | Batch 0080175 - EPA 3050 | | | | | | | | | | |
| | Blank (0080175-BLK1) | | | | Prepared: | 08/07/00 | Analyzed | : 08/14/00 | | | |
| | Barium | ND | 0.500 | mg/kg wet | | | | | | | |
| | Cadmium | ND | 0.500 | н | | | | | | | |
| ı | Chromium | ND | 0.500 | u | | | | | | | |
| | Lead | ND | 10.0 | . 11 | | | | | | | |
| | Silver | ND | 1.00 | н | | | | | | | |
| | LCS (0080175-BS1) | | | | Prepared: | 08/07/00 | | i: 08/14/ 00 | | | |
| | Barium | 49.1 | 0.500 | mg/kg wet | 50.0 | | 98.2 | 80-120 | | | |
| ĺ | Cadmium | 18.7 | 0.500 | н | 20.0 | | 93.5 | 80-120 | | | |
| | Chromium | 47.9 | 0.500 | н | 50.0 | | 95.8 | 80-120 | | | |
| | Lead | 92.5 | 10.0 | ** | 100 | | 92.5 | 80-120 | | | |
| - | Silver | 43.2 | 1.00 | 11 | 50.0 | | 86.4 | 80-120 | | | |
| 1 | Duplicate (0080175-DUP1) | | | | Prepared: | 08/07/00 | Analyzed | 1: 08/14/00 | | | |
| *************************************** | um | 153 | 0.500 | mg/kg dry | | 145 | | | 5.37 | 40 | |
| , | Cadmium | 0.542 | 0.500 | Ħ | | 0.542 | | | 0 | 40 | |
| | Chromium | 21.5 | 0.500 | 11 | | 20.7 | | | 3.79 | 40 | |
| | Lead | ND | 10.0 | tt | | ND | | | 10.1 | 40 | |
| | Silver | ND | 1.00 | tt | | ND | | | | 40 | |
| | Matrix Spike (0080175-MS1) | : | Source: P0080 | 88-01 | Prepared | : 08/07/00 | | 1: 08/14/00 | | | |
| | Barium | 213 | 0.500 | mg/kg dry | 60.3 | 145 | 113 | 75-125 | | | |
| | Cadmium | 22.5 | 0.500 | ** | 24.1 | 0.542 | 91.1 | 75-125 | | | |
| | Chromium | 70.5 | 0.500 | 11 | 60.3 | 20.7 | 82.6 | 75-125 | | | |
| | Lead | 118 | 10.0 | н | 121 | ND | 91.0 | 75-125 | | | |
| İ | Silver | 47.4 | 1,00 | tt | 60.3 | ND | 78.6 | 75-125 | | | |
| | Matrix Spike (0080175-MS2) | : | Source: P0080 | 88-27 | Prepared | : 08/07/00 | | d: 08/14/00 | | | |
| | Barium | 160 | 0.500 | mg/kg dry | 57.2 | 99.5 | 106 | 75-125 | | | |
| | Cadmium | 21.4 | 0.500 | 11 | 22.9 | 1.54 | 86.7 | 75-125 | | | |
| | Chromium | 73.7 | 0.500 | n | 57.2 | 23.6 | 87.6 | 75-125 | | | |
| ı | Lead | 130 | 10.0 | | 114 | 29.6 | 88.1 | 75-125 | | | |
| | Silver | 43.5 | 1.00 | " | 57.2 | ND | 75.5 | 75-125 | | | |
| 5 | | | | | | | | | | | |

North Creek Analytical - Portland

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Trotal Meatis, per 1012A(6000/7/000) Series Methods - Quality Control

North Creek Analytical - Portland

| | 1401 | in Creek | L AMALY | iicai - i | UI HABU | | | | | |
|----------------------------|--------|--------------------|-----------|----------------|------------------|------------|---------------------|------|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0080209 - EPA 3050 | | | | | | | | | | |
| Blank (0080209-BLK1) | | | | Prepared | 08/08/00 | Analyzed | l: 08/17/ 00 | | | |
| Arsenic | ND | 0.500 | mg/kg wet | | | | | | | |
| Selenium | ND | 0.500 | ŧſ | | | | | | | |
| LCS (0080209-BS1) | | | | Prepared: | : 08/08/00 | Analyzed | 1: 08/17/00 | | | |
| Arsenic | 10.2 | 0.500 | mg/kg wet | 10.0 | | 102 | 80-120 | | | |
| Selenium | 9.93 | 0,500 | Ħ | 10.0 | | 99.3 | 80-120 | | | |
| Duplicate (0080209-DUP1) | Sou | rce: P0080 | 88-01 | Prepared: | 08/08/00 | Analyzed | l: 08/17/00 | | | |
| Arsenic | 5.54 | 0.500 | mg/kg dry | | 5.20 | | | 6.33 | 40 | |
| Selenium | 0.825 | 0.500 | tt . | | 0.988 | | | 18.0 | 40 | |
| Matrix Spike (0080209-MS1) | Sou | rce: P0080 | 88-01 | Prepared: | 08/08/00 | Analyzed | 1: 08/17/00 | | | |
| Arsenic | 16.3 | 0.500 | mg/kg dry | 12.1 | 5.20 | 91.7 | 75-125 | | | |
| Selenium | 14.3 | 0.500 | N | 12.1 | 0.988 | 110 | 75-125 | | | |
| Matrix Spike (0080209-MS2) | Sou | rce: P0080 | 88-27 | Prepared: | 08/08/00 | Analyzed | l: 08/17/00 | | | 1 |
| Arsenic | 15.2 | 0.500 | mg/kg dry | 11,4 | 4.41 | 94.6 | 75-125 | | | |
| Selenium | 14.1 | 0.500 | Ħ | 11.4 | 0.737 | 117 | 75-125 | | * | |
| Batch 0080296 - EPA 7471 | | | | | | | | | | |
| Blank (0080296-BLK1) | | | | Prepared | & Analyze | ed: 08/11/ | 00 | | | |
| Mercury | ND | 0.100 | mg/kg wet | | | | | | | |
| LCS (0080296-BS1) | | | | Prepared | & Analyze | ed: 08/11/ | 00 | | | |
| Мегсигу | 0.988 | 0.100 | mg/kg wet | 1.00 | | 98.8 | 80-120 | | | |

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Lisa Domenighini, Project Manager

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COL P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

To all Meats par NPA 5000 7000 Spaces Methods : O tallity Controls : . . .

| | Nort | h Creek | Analyt | ical - Po | rtland | | | | | |
|----------------------------|--------|---------------------|-----------|----------------|------------------|------------|----------------|------|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0080296 - EPA 7471 | | | | | | | | | | |
| Duplicate (0080296-DUP1) | Sour | ce: P00808 | 8-01 | Prepared | & Analyz | ed: 08/11/ | 00 | | | |
| Mercury | ND | 0.100 | mg/kg dry | | ND | | | | 40 | |
| Matrix Spike (0080296-MS1) | Sour | ce: P00808 | 8-01 | Prepared | & Analyz | ed: 08/11/ | | | | |
| Mercury | 1.20 | 0.100 | mg/kg dry | 1.21 | ND | 99.2 | 75-125 | | | |
| Matrix Spike (0080296-MS2) | Sour | ce: P00808 | 8-19 | Prepared | & Analyz | ed: 08/11/ | 00 | | | |
| Mercury | 1.19 | 0.100 | mg/kg dry | 1.22 | ND | 97.5 | 75-125 | | | |
| Batch 0080303 - EPA 3050 | | | | | | | | | | |
| Blank (0080303-BLK1) | | | | Prepared: | 08/11/00 | Analyzed | d: 08/17/00 | | | |
| Arsenic | ND | 0.500 | mg/kg wet | | | | | | | |
| Selenium | ND | 0.500 | 11 | | | | | | | |
| LCS (0080303-BS1) | | | | Prepared: | 08/11/00 | Analyze | d: 08/17/00 |) | | |
| enic | 10.1 | 0.500 | mg/kg wet | 10.0 | | 101 | 80-120 | | | |
| wienium | 10.1 | 0.500 | н | 10.0 | | 101 | 80-120 | | | |
| Duplicate (0080303-DUP1) | Soul | rce: P 00808 | 38-05 | Prepared: | 08/11/00 | Analyze | d: 08/22/00 |) | | |
| Arsenic | 0.855 | 0.500 | mg/kg dry | | 1.32 | | | 42.8 | 40 | Q-0 |
| Selenium | 0.884 | 0.500 | н | | 1.37 | | | 43.1 | 40 | Q-0 |
| Matrix Spike (0080303-MS1) | Sou | rce: P00808 | 88-05 | Prepared | | | d: 08/22/00 |) | | |
| Arsenic | 11,5 | 0.500 | mg/kg dry | 11.5 | 1.32 | 88.5 | 75-125 | | | |
| | | | | | | | | | | |

0.500

13.8

North Creek Analytical - Portland

Selenium

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1.37

11.5

108

75-125

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Project Number: 015.08716.001 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Total Metals per EPA 6000/7/000 Series Wethods Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------------------------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| D () 000000 () D (0000 | | • | | | | | | | | |

| Batch U | 1080304 - | EPA 3050 |
|---------|-----------|----------|
|---------|-----------|----------|

| Blank (0080304-BLK1) | | | | Prepared: | 08/11/00 | Analyze | d: 08/14/00 | | | |
|----------------------------|------|----------------------|-----------|-----------|----------|---------|-------------|------|----|------|
| Barium | ND | 0.500 | mg/kg wet | | | - | | | | |
| Cadmium | ND | 0.500 | н | | | | | | | |
| Chromium | ND | 0.500 | tr . | | | | | | | |
| Lead | ND | 10.0 | H | | | | | | | |
| Silver | ND | 1.00 | н | | | | | | | |
| LCS (0080304-BS1) | | | | Prepared: | 08/11/00 | Analyze | d: 08/14/00 | | | |
| Barium | 49.3 | 0.500 | mg/kg wet | 50.0 | | 98.6 | 80-120 | | | |
| Cadmium | 18.6 | 0.500 | ur . | 20.0 | | 93.0 | 80-120 | | | |
| Chromium | 46.9 | 0.500 | н | 50.0 | | 93.8 | 80-120 | | | |
| Lead | 92,5 | 10.0 | Ħ | 100 | | 92.5 | 80-120 | | | |
| Silver | 44.1 | 1.00 | 14 | 50.0 | | 88.2 | 80-120 | | | |
| Duplicate (0080304-DUP1) | Sour | Source: P008088-05 I | | Prepared: | 08/11/00 | Analyze | d: 08/14/00 | | | |
| Barium | 79.8 | 0.500 | mg/kg dry | | 91.9 | | | 14.1 | 40 | 7 |
| Cadmium | ND | 0.500 | н | | ND | | | 66.7 | 40 | Q-06 |
| Chromium | 4.36 | 0.500 | н | | 4.54 | | | 4.04 | 40 | |
| Lead | ND | 10.0 | и | | ND | | | 11.3 | 40 | |
| Silver | ND | 1.00 | ** | | ND | | | 15.5 | 40 | |
| Matrix Spike (0080304-MS1) | Sour | ce: P0080 | 88-05 | Prepared: | 08/11/00 | Analyze | 1: 08/14/00 | | | |
| Barium | 171 | 0.500 | mg/kg dry | 57.4 | 91.9 | 138 | 75-125 | | | Q-02 |
| Cadmium | 19.5 | 0.500 | u | 23.0 | ND | 83.8 | 75-125 | | | • |
| Chromium | 56.2 | 0.500 | Ħ | 57.4 | 4.54 | 90.0 | 75-125 | | | |
| Lead | 107 | 10.0 | u | 115 | ND | 88.5 | 75-125 | | | |
| Silver | 50.0 | 1.00 | ** | 57.4 | ND | 86.4 | 75-125 | | | |
| | | | | | | | | | | |

0.500 mg/kg dry

0.500

0.500

10.0

1.00

64.5

25.8

64.5

129

64.5

170

2.58

24.0

236

7.09

NR

85.3

103

144

75.2

320

24.6

90.3

422

55.6

North Creek Analytical - Portland

Barium

Lead

Silver

Cadmium

Chromium

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75-125

75-125

75-125

75-125

75-125

Q-02

Q-02

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COL

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Polyginochettett Biphanykapar 1924 Maihod 3032 - Opentry Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| | | | | | | | | | | |

| Batch 0080178 - 1 | EP | A | 3550 |
|-------------------|----|---|------|
|-------------------|----|---|------|

| | Batch 0080178 - EPA 3550 | · | | | | | | | | | |
|-------------|------------------------------------|------|--------------|-----------|-------------|----------|----------|---------------------|------|----|------|
| ******* | Blank (0080178-BLK1) | | | | Prepared: | 08/07/00 | Analyzed | l: 08/10/0 0 | | | |
| | Aroclor 1016 | ND | 67.0 | ug/kg wet | | | | | | | |
| | Aroclor 1221 | ND | 134 | ** | | | | | | | |
| 1 | Aroclor 1232 | ND | 67.0 | Ħ | | | | | | | |
| | Aroclor 1242 | ND | 67.0 | Ħ | | | | | | | |
| İ | Aroclor 1248 | ND | 67.0 | | | | | | | | |
| | Aroclor 1254 | ND | 67.0 | H | | | | | | | |
| | Aroclor 1260 | ND | 67.0 | 19 | | | | | | | |
| a de | Surr: 2,4,5,6-Tetrachloro-m-xylene | 33.3 | | # | 33,3 | | 100 | 63-119 | | | |
| , | Surr: Decachlorobiphenyl | 30.5 | | · n | <i>33.3</i> | | 91.6 | 52-131 | | | |
| | LCS (0080178-BS1) | | | | Prepared: | 08/07/00 | Analyzed | 1: 08/10/00 | | | |
| - | Aroclor 1016 | 337 | 67.0 | ug/kg wet | 333 | | 101 | 57-132 | | | |
| | Aroclor 1260 | 370 | 67.0 | Ħ | 333 | | 111 | 60-136 | | | |
| M | · 2,4,5,6-Tetrachloro-m-xylene | 30.9 | | " | 33.3 | | 92.8 | 63-119 | | | |
| - | Surr: Decachlorobiphenyl | 29.6 | | ů | 33.3 | | 88.9 | 52-131 | | | |
| į | LCS Dup (0080178-BSD1) | | | | Prepared: | 08/07/00 | Analyze | 1: 08/10/00 | | | |
| | Aroclor 1016 | 333 | 67.0 | ug/kg wet | 333 | | 100 | 57-132 | 1,19 | 50 | |
| i | Aroclor 1260 | 360 | 67.0 | Ħ | 333 | | 108 | 60-136 | 2.74 | 50 | |
| 1 | Surr: 2,4,5,6-Tetrachloro-m-xylene | 29.3 | | 11 | 33.3 | | 88.0 | 63-119 | | | |
| | Surr: Decachlorobiphenyl | 28.7 | | ** | 33.3 | | 86.2 | 52-131 | | | |
| • | Matrix Spike (0080178-MS1) | Se | ource: P0080 | 88-23 | Prepared: | 08/07/00 | Analyze | d: 08/14/00 | | | |
| | Aroclor 1016 | 399 | 67.0 | ug/kg dry | 474 | ND | 84.2 | 57-132 | | | |
| *********** | Aroclor 1260 | 390 | 67.0 | u | 474 | ND | 82.3 | 60-136 | | | |
| , | Surr: 2,4,5,6-Tetrachloro-m-xylene | 25.4 | | # | 47.4 | | 53.6 | 63-119 | | | S-07 |
| | Surr: Decachlorobiphenyl | 33.4 | | " | 47.4 | | 70.5 | 52-131 | | | |

North Creek Analytical - Portland

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Domenighini, Project Manager

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

08/24/00 08:39

Rolyculorinated Biphenyls per EPA Method 8082 Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| | | | | | | | | | | |

Batch 0080178 - EPA 3550

| Matrix Spike Dup (0080178-MSD1) | Sour | Source: P008088-23 | | | 08/07/00 | | | | | |
|------------------------------------|------|--------------------|-----------|------|----------|------|--------|------|----|--|
| Aroclor 1016 | 564 | 67.0 | ug/kg dry | 474 | ND | 119 | 57-132 | 34,3 | 50 | |
| Aroclor 1260 | 484 | 67.0 | ** | 474 | ND | 102 | 60-136 | 21.5 | 50 | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 31.1 | | " | 47.4 | | 65.6 | 63-119 | | | |
| Surr: Decachlorobiphenyl | 39.9 | | # | 47.4 | | 84.2 | 52-131 | | | |

North Creek Analytical - Portland

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сог P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Yokitle: Diging Compounds per 1924 Method 3260B - Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Batch 0080135 - EPA 5030 | | | | |
|-----------------------------|----|------|-----------|---------------------------------------|
| Blank (0080135-BLK1) | | | | Prepared: 08/04/00 Analyzed: 08/13/00 |
| Acetone | ND | 1000 | ug/kg wet | |
| Benzene | ND | 100 | Ħ | |
| Bromobenzene | ND | 100 | н | |
| Bromochloromethane | ND | 100 | и | |
| Bromodichloromethane | ND | 100 | # | |
| Вготоботт | ND | 100 | H | |
| Bromomethane | ND | 500 | H | |
| 2-Butanone | ND | 1000 | ** | |
| n-Butylbenzene | ND | 500 | Ħ | |
| sec-Butylbenzene | ND | 100 | tt | |
| tert-Butylbenzene | ND | 100 | 11 | |
| Carbon disulfide | ND | 1000 | н | |
| Carbon tetrachloride | ND | 100 | ţl | |
| robenzene | ND | 100 | 11 | |
| Caloroethane | ND | 100 | 11 | |
| Chloroform | ND | 100 | Ħ | |
| Chloromethane | ND | 500 | н | |
| 2-Chlorotoluene | ND | 100 | w | |
| 4-Chlorotoluene | ND | 100 | 11 | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | п | |
| Dibromochloromethane | ND | 100 | ** | |
| 1,2-Dibromoethane | ND | 100 | ** | |
| Dibromomethane | ND | 100 | н | |
| 1,2-Dichlorobenzene | ND | 100 | . " | |
| 1,3-Dichlorobenzene | ND | 100 | | |
| 1,4-Dichlorobenzene | ND | 100 | | |
| Dichlorodifluoromethane | ND | 500 | ** | |
| 1,1-Dichloroethane | ND | 100 | , # | |
| 1,2-Dichloroethane | ND | 100 | Н Н | |
| 1,1-Dichloroethene | ND | 100 | , " | |
| cis-1,2-Dichloroethene | ND | 100 |) н | |
| trans-1,2-Dichloroethene | ND | 100 |) R | |
| 1,2-Dichloropropane | ND | 100 | , " | |
| 1,3-Dichloropropane | ND | 100 |) " | |
| 2,2-Dichloropropane | ND | 100 |) н | |
| 1,1-Dichloropropene | ND | 100 |) " | |

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North Creek Analytical, Inc. **Environmental Laboratory Network**

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Secor

P.O. Box 1508

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt Tualatin, OR 97062

08/24/00 08:39

Wolatile Organic Compounds no clope A Matrod 3260B 2 Quality Control

North Creek Analytical - Portland

| Result Limit Units Level Result %REC Limits RPD Lin | Reporting Spike Source %RJ | | 1 |
|---|--|-------------------|---|
| Analyte Result Limit Only Level Result 1 | Result Limit Units Level Result %REC Lim | s RPD Limit Notes | |

| Analyte | Tesate | | - | | | | |
|----------------------------|--------|------|-----------|-----------------|---------------|----------|------|
| Batch 0080135 - EPA 5030 | | | | | | | |
| Blank (0080135-BLK1) | | | | Prepared: 08/04 | /00 Analyzed: | 08/13/00 | |
| cis-1,3-Dichloropropene | ND | | ug/kg wet | | | | |
| trans-1,3-Dichloropropene | ND | 100 | Ħ | | | | |
| Ethylbenzene | ND | 100 | н | | | | |
| Hexachlorobutadiene | ND | 200 | н | | | | |
| 2-Hexanone | ND | 1000 | " | | | | |
| Isopropylbenzene | ND | 200 | н | | | | |
| p-Isopropyltoluene | ND | 200 | | | | | |
| 4-Methyl-2-pentanone | ND | 500 | | | | | |
| Methyl tert-butyl ether | ND | 100 | | | | | |
| Methylene chloride | ND | 500 | | | | | |
| Naphthalene | ND | 200 | | | | | |
| n-Propylbenzene | ND | 100 | | | | | |
| Styrene | ND | 100 | 11 | | | | |
| 1,1,1,2-Tetrachloroethane | ND | 100 | | | | | |
| 1,1,2,2-Tetrachloroethane | ND | 100 | | | | | |
| Tetrachloroethene | ND | 100 | ŧI | | | | |
| Toluene | ND | 100 | Ħ | | | | |
| 1,2,3-Trichlorobenzene | ND | 100 | | | | | |
| 1,2,4-Trichlorobenzene | ND | 100 | # | | | | |
| 1,1,1-Trichloroethane | ND | 100 | , tt | | | | |
| 1,1,2-Trichloroethane | ND | 100 | , н | | | | |
| Trichloroethene | ND | 100 | 11 | | | | |
| Trichlorofluoromethane | ND | 100 | * | | | | |
| 1,2,3-Trichloropropane | ND | 100 | , " | | | | |
| 1,2,4-Trimethylbenzene | ND | 100 |) , " | | | | |
| 1,3,5-Trimethylbenzene | ND | 100 | " | | | | |
| Vinyl chloride | ND | 100 |) " | | | | |
| o-Xylene | ND | 100 |) " | | | | |
| m,p-Xylene | ND | 200 | | | | | |
| Surr: 4-BFB | 2130 | | " | 2000 | 107 | 70-130 | |
| Surr: 1,2-DCA-d4 | 2100 | | tt | 2000 | 105 | 70-130 | |
| Surr: Dibromofluoromethane | 1860 | | n | 2000 | 93.0 | 70-130 | |
| Surr: Toluene-d8 | 1920 | | " | 2000 | 96.0 | 70-130 | |
| Surr: Toluene-as | 1740 | | | = | | | |

North Creek Analytical - Portland

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Valetitle (Osganië) Campamula pae MPA Vitaliaal 3260B : Omility Control

North Creek Analytical - Portland

| | 1901 | th Creek | Analyt | | | | %REC | | RPD | |
|---------------------------------|--------|--------------------|-----------|----------------|------------------|----------|----------------|-------|-------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | Limit | Notes |
| Batch 0080135 - EPA 5030 | | | | | | | | | | |
| LCS (0080135-BS1) | | | | - | 08/04/00 | | : 08/13/00 | | | |
| Benzene | 2150 | 100 | ug/kg wet | 2500 | | 86.0 | 80-135 | | | |
| Chlorobenzene | 2350 | 100 | Ħ | 2500 | | 94.0 | 80-135 | | | |
| 1,1-Dichloroethene | 1700 | 100 | Ħ | 2500 | | 68.0 | 60-150 | | | |
| Toluene | 2180 | 100 | Ħ | 2500 | | 87.2 | 80-130 | | | |
| Trichloroethene | 1980 | 100 | tt | 2500 | | 79.2 | 70-135 | | | |
| Surr: 4-BFB | 2050 | | " | 2000 | | 103 | 70-130 | | | |
| Surr: 1,2-DCA-d4 | 2040 | | " | 2000 | | 102 | 70-130 | | | |
| Surr: Dibromofluoromethane | 1850 | | u | 2000 | | 92.5 | 70-130 | | | |
| Surr: Toluene-d8 | 1880 | | " | 2000 | | 94.0 | 70-130 | | | |
| Matrix Spike (0080135-MS1) | So | urce: P0080 | 99-01 | Prepared: | 08/04/00 | Analyzed | 1: 08/13/00 | | | Q-0 |
| Benzene | 7440 | 723 | ug/kg dry | 18100 | ND | 41.1 | 60-135 | | | |
| Chlorobenzene | 7400 | 723 | Ħ | 18100 | ND | 40.9 | 65-125 | | | |
| Dichloroethene | 5120 | 723 | II. | 18100 | ND | 28.3 | 60-135 | | | |
| Jene | 7390 | 723 | ti . | 18100 | ND | 40.3 | 60-125 | | | |
| Trichloroethene | 6350 | 723 | Ħ | 18100 | ND | 35.1 | 60-125 | | | |
| Surr: 4-BFB | 6160 | | 11 | 14500 | | 42.5 | 70-130 | | | |
| Surr: 1,2-DCA-d4 | 8300 | | и | 14500 | | 57.2 | 70-130 | | | |
| Surr: Dibromofluoromethane | 7120 | | " | 14500 | | 49.1 | 70-130 | | | |
| Surr: Toluene-d8 | 6660 | | " | 14500 | | 45.9 | 70-130 | | | |
| Matrix Spike Dup (0080135-MSD1) | So | urce: P0080 | 99-01 | Prepared | : 08/04/00 | Analyze | d: 08/13/00 |) | | Q-0 |
| Benzene | 7450 | 723 | ug/kg dry | 18100 | ND | 41.2 | 60-135 | 0.134 | 25 | |
| Chlorobenzene | 7510 | 723 | | 18100 | ND | 41.5 | 65-125 | 1.48 | 25 | |
| 1,1-Dichloroethene | 5510 | 723 | # | 18100 | ND | 30.4 | 60-135 | 7.34 | 25 | |
| Toluene | 7570 | 723 | н | 18100 | ND | 41.3 | 60-125 | 2.41 | 25 | |
| Trichloroethene | 6680 | 723 | Ħ | 18100 | ND | 36.9 | 60-125 | 5.07 | 25 | |
| Surr: 4-BFB | 6100 | | - " | 14500 | | 42.1 | 70-130 | | | S-0 |
| T | 7570 | | " | 14500 | | 52.2 | 70-130 | | | S-0 |
| Surr: 1,2-DCA-d4 | 6500 | | " | 14500 | | 44.8 | 70-130 | | | S-0 |
| Surr: Dibromofluoromethane | 6130 | | u | 14500 | | 42.3 | 70-130 | | | S-0 |
| Surr: Toluene-d8 | 0130 | | | - 10 4 9 | | | | | | |

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Environmental Laboratory Network



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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Volatile Organic Compounts per IPPA Method \$2603 - Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|----------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| <u> </u> | | | | | | | | | | |

| Blank (0080136-BLK1) | | | | Prepared: 08/04/00 Analyzed: 08/06/00 | |
|-----------------------------|----|------|-----------|---------------------------------------|----|
| Acetone | ND | 1000 | ug/kg wet | | - |
| Benzene | ND | 100 | # | | |
| Bromobenzene | ND | 100 | Ħ | | |
| Bromochioromethane | ND | 100 | н | | |
| Bromodichloromethane | ND | 100 | H | | |
| Bromoform | ND | 100 | # | | |
| Bromomethane | ND | 500 | ** | | |
| 2-Butanone | ND | 1000 | н | | |
| n-Butylbenzene | ND | 500 | 11 | | |
| sec-Butylbenzene | ND | 100 | 4 | | |
| tert-Butylbenzene | ND | 100 | t; | | |
| Carbon disulfide | ND | 1000 | ŧŧ | | |
| Carbon tetrachloride | ND | 100 | u | | |
| Chlorobenzene | ND | 100 | 10 | | |
| Chloroethane | ND | 100 | 11 | | ٠, |
| Chioroform | ND | 100 | | | |
| Chloromethane | ND | 500 | tt | | |
| 2-Chlorotoluene | ND | 100 | II | | |
| 4-Chlorotoluene | ND | 100 | H | | |
| 1,2-Dibromo-3-chloropropane | ND | 500 | 11 | | |
| Dibromochloromethane | ND | 100 | a | | |
| 1,2-Dibromoethane | ND | 100 | tr | | |
| Dibromomethane | ND | 100 | н | | |
| 1,2-Dichlorobenzene | ND | 100 | н | | |
| 1,3-Dichlorobenzene | ND | 100 | • | | |
| 1,4-Dichlorobenzene | ND | 100 | tt. | | |
| Dichlorodifluoromethane | ND | 500 | н | | |
| 1,1-Dichloroethane | ND | 100 | II | | |
| 1,2-Dichloroethane | ND | 100 | ** | | |
| 1,1-Dichloroethene | ND | 100 | ** | | |
| cis-1,2-Dichloroethene | ND | 100 | ef . | | |
| trans-1,2-Dichloroethene | ND | 100 | ** | | |
| 1,2-Dichloropropane | ND | 100 | n | | |
| 1,3-Dichloropropane | ND | 100 | 19 | | |
| 2,2-Dichioropropane | ND | 100 | ** | | |
| 1,1-Dichloropropene | ND | 100 | ŧı | | |

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P.O. Box 1508

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Walstille Organic Compounds per DPA Mathoil 3260B - Quality Control

North Creek Analytical - Portland

| | Reporting | | Spike | Source | | %REC | | RPD | |
|----------------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Batch 0080136 - EPA 5030 | | | | | | | | · | · · · · · |
|----------------------------|-------|------|------|-----------|----------------|---------------|----------|---|-----------|
| Blank (0080136-BLK1) | | | | | repared: 08/04 | /00 Analyzed: | 08/06/00 | | |
| cis-1,3-Dichloropropene | | ND | 100 | ug/kg wet | | | | | |
| trans-1,3-Dichloropropene | | ND | 100 | н | | | | | |
| Ethylbenzene | | ND | 100 | !! | | | | | |
| Hexachlorobutadiene | p*, - | ND | 200 | н | | | | | |
| 2-Hexanone | Ŋ. | ND | 1000 | н | | | | | |
| Isopropylbenzene | 2. | ND | 200 | н | | | | | |
| p-Isopropyltoluene | | ND | 200 | u | | | | | |
| 4-Methyl-2-pentanone | | ND | 500 | н | | | | | |
| Methyl tert-butyl ether | | ND | 100 | Ħ | | | | | |
| Methylene chloride | | ND | 500 | 11 | | | | | |
| Naphthalene | | ND | 200 | 11 | | | | | |
| n-Propylbenzene | | ND | 100 | п | | | | | |
| Styrene | | ND | 100 | и | | | | | |
| ,2-Tetrachloroethane | | ND | 100 | ** | | | | | |
| .,.,2,2-Tetrachloroethane | | ND | 100 | ** | | | | | |
| Tetrachloroethene | | ND | 100 | " | | | | | |
| Toluene | | ND | 100 | ** | | | | | |
| 1,2,3-Trichlorobenzene | | ND | 100 | 11 | | | | | |
| 1,2,4-Trichlorobenzene | | ND | 100 | Ħ | | | | | |
| 1,1,1-Trichloroethane | 1 | ND | 100 | Ħ | | | | | |
| 1,1,2-Trichloroethane | | ND | 100 | tt | | | | | |
| Trichloroethene | Ž. | ND | 100 | 11 | | | 3 | | |
| Trichlorofluoromethane | | ND | 100 | 11 | | | | | |
| 1,2,3-Trichloropropane | | ND | 100 | Н | | | | , | |
| 1,2,4-Trimethylbenzene | | ND | 100 | Ħ | | | | | |
| 1,3,5-Trimethylbenzene | | ND | 100 | 11 | | | | | |
| Vinyl chloride | | ND | 100 | 11 | | | | | |
| o-Xylene | | ND | 100 | Ħ | | | | | |
| m,p-Xylene | | ND | 200 | Ħ | | | | | |
| Surr: 4-BFB | | 2180 | | " | 2000 | 109 | 70-130 | • | |
| Surr: 1,2-DCA-d4 | | 1910 | | " | 2000 | 95.5 | 70-130 | | |
| Surr: Dibromofluoromethane | | 1830 | | " | 2000 | 91.5 | 70-130 | | |
| Surr: Toluene-d8 | | 1750 | | " | 2000 | 87.5 | 70-130 | | |

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Spokane

Prepared: 08/04/00 Analyzed: 08/06/00

Prepared: 08/04/00 Analyzed: 08/06/00

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508

LCS (0080136-BS1)

Matrix Spike (0080136-MS1)

Project Number: 015.08716.001

Reported: 08/24/00 08:39

Tualatin, OR 97062

Project Manager: Joe Hunt

Valatile(Organic Compounds per DPA) Vlethad 8260B - Quali

North Creek Analytical - Portland

| Analyte | | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|-----------------|----------|--------|--------------------|-------|----------------|------------------|------|----------------|-----|--------------|-------|
| Batch 0080136 - | EPA 5030 | | | | | | | | | | |

| Benzene | 2410 | 100 ug/kg wet | 2500 | 96.4 | 80-135 |
|--------------------|------|---------------|------|------|--------|
| Chlorobenzene | 2630 | 100 " | 2500 | 105 | 80-135 |
| 1,1-Dichloroethene | 2040 | 100 " | 2500 | 81.6 | 60-150 |
| Toluene | 2410 | 100 " | 2500 | 96.4 | 80-130 |

| Toluene | 2410 | 100 | н | 2500 | 96.4 | 80-130 |
|----------------------------|------|-----|---|------|------|--------|
| Trichloroethene | 2530 | 100 | Ħ | 2500 | 101 | 70-135 |
| Surr: 4-BFB | 2090 | | H | 2000 | 105 | 70-130 |
| Surr: 1,2-DCA-d4 | 1960 | | # | 2000 | 98.0 | 70-130 |
| Surr: Dibromofluoromethane | 1890 | | " | 2000 | 94.5 | 70-130 |
| Surr: Toluene-d8 | 1720 | | # | 2000 | 86.0 | 70-130 |

| Benzene | 2600 | 100 ug/kg | dry 2860 | ND | 90.9 | 60-135 |
|----------------------------|------|-----------|----------|----|------|--------|
| Chlorobenzene | 2660 | 100 " | 2860 | ND | 93.0 | 65-125 |
| 1,1-Dichloroethene | 2090 | 100 " | 2860 | ND | 73.1 | 60-135 |
| Toluene | 2560 | 100 " | 2860 | ND | 89.5 | 60-125 |
| Trichloroethene | 2660 | 100 " | 2860 | ND | 93.0 | 60-125 |
| Surr: 4-BFB | 2110 | a | 2290 | | 92.1 | 70-130 |
| Surr: 1,2-DCA-d4 | 2050 | " | 2290 | | 89.5 | 70-130 |
| Surr: Dibromofluoromethane | 1980 | " | 2290 | | 86.5 | 70-130 |

1830

Source: P008088-27

| Surr: Toluene-d8 | 1840 | | " | 2290 | | 80.3 | 70-130 | | | |
|---------------------------------|------|-----------|-----------|-----------|----------|---------|---------------------|-------|----|--|
| Matrix Spike Dup (0080136-MSD1) | Sour | ce: P0080 | 88-27 | Prepared: | 08/04/00 | Analyze | d: 08/06/ 00 | • | | |
| Benzene | 2570 | 100 | ug/kg dry | 2860 | ND | 89.9 | 60-135 | 1.16 | 25 | |
| Chiorobenzene | 2640 | 100 | н | 2860 | ND | 92.3 | 65-125 | 0.755 | 25 | |
| 1,1-Dichloroethene | 2060 | 100 | Ħ | 2860 | ND | 72.0 | 60-135 | 1.45 | 25 | |
| Toluene | 2550 | 100 | н | 2860 | ND | 89.2 | 60-125 | 0.391 | 25 | |
| Trichloroethene | 2680 | 100 | н | 2860 | ND | 93.7 | 60-125 | 0.749 | 25 | |
| Surr: 4-BFB | 2110 | | " | 2290 | · | 92.I | 70-130 | | | |
| Surr: 1,2-DCA-d4 | 2030 | | " | 2290 | | 88.6 | 70-130 | | | |
| Surr: Dibromofluoromethane | 1950 | | н | 2290 | | 85.2 | 70-130 | | | |

2290

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Surr: Toluene-d8

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70-130

79.9

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semiyolatile () remits Compounds per 1912 A Metholi 32/00 - Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Batch | 008034 | 5 - EP | A 3550 |
|-------------|--------|--------|--------|
| Water Court | | | |

| Blank (0080345-BLK1) | | | Prepared | d: 08/14/00 Analy | zed: 08/16/00 | |
|-----------------------------|----|---------|-----------|-------------------|---------------|------|
| Acenaphthene | ND | 0.330 m | ıg/kg wet | | | |
| Acenaphthylene | ND | 0.330 | н | | | |
| Anthracene | ND | 0.330 | н | | | |
| Benzo (a) anthracene | ND | 0.330 | н | | | |
| Benzo (a) pyrene | ND | 0.330 | Ħ | | | |
| Benzo (b) fluoranthene | ND | 0.330 | 11 | | | |
| Benzo (ghi) perylene | ND | 0.330 | н | | | |
| Benzo (k) fluoranthene | ND | 0.330 | н | | | |
| Benzoic Acid | ND | 1.00 | п | | | |
| Benzyl alcohol | ND | 0.330 | Ħ | | | |
| 4-Bromophenyl phenyl ether | ND | 0.330 | 11 | | | |
| Butyl benzyl phthalate | ND | 0.330 | н | | | |
| 4-Chloro-3-methylphenol | ND | 0.330 | | | | |
| loroaniline | ND | 2.00 | 11 | | | |
| 2-chloroethoxy)methane | ND | 0.330 | Ħ | | | |
| Bis(2-chloroethyl)ether | ND | 0.330 | н | | | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | Ħ | | | |
| 2-Chloronaphthalene | ND | 0.330 | Ħ | | | |
| 2-Chlorophenol | ND | 0.330 | н | | | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | Ħ | | - | |
| Chrysene | ND | 0.330 | ** | | | |
| Di-n-butyl phthalate | ND | 1.00 | 11 | | | |
| Di-n-octyl phthalate | ND | 0.330 | Ħ | | | |
| Dibenzo (a,h) anthracene | ND | 0.330 | Ħ | | | |
| Dibenzofuran | ND | 0.330 | ** | | | |
| 1,2-Dichlorobenzene | ND | 1.00 | Ħ | | | |
| 1,3-Dichlorobenzene | ND | 1.00 | Ħ | | | |
| 1,4-Dichiorobenzene | ND | 1.00 | Ħ | | | |
| 3,3'-Dichlorobenzidine | ND | 1.00 | Ħ | | | |
| 2,4-Dichlorophenol | ND | 0.330 | et | | | |
| Diethyl phthalate | ND | 0.330 | ** | | | |
| 2,4-Dimethylphenol | ND | 1.00 | H | | | |
| Dimethyl phthalate | ND | 0.330 | Ħ | | | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | ** | | | |
| 2,4-Dinitrophenol | ND | 2.00 | Ħ | | | |
| 2,4-Dinitrotoluene | ND | 0.500 | н | | | |

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 88 of 98



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Portland

503.906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711

541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semigobile Organic Composition IPA Method 32/00 - Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|----------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| <u> </u> | | | | | | | | | | |

| Blank (0080345-BLK1) | | | | Prepared: 08/14/00 |) Analyze | d- 08/16/00 | |
|----------------------------|----------|-------|-----------|--------------------|-----------|-------------|------|
| 2,6-Dinitrotoluene | ND | 0.500 | mg/kg wet | 11cparcu. 06/14/00 | Miaiyzo | u. 00/10/00 | |
| Bis(2-ethylhexyl)phthalate | ND ND | 2.00 | mg/kg wer | | | | |
| Fivoranthene | ND | 0.330 | н | | | | |
| Fluorene | ND ND | 0.330 | # | | | | |
| Hexachlorobenzene | ND ND | 0.330 | ts | | | | |
| Hexachlorobutadiene | ND | 1.00 | # | | | | |
| Hexachlorocyclopentadiene | ND | 1.00 | 11 | | | | |
| Hexachloroethane | ND | 1.00 | 4 | | | | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | 65 | | | | |
| Isophorone | ND | 0.330 | | | | | |
| 2-Methylnaphthalene | ND | 0.330 | ti | | | | |
| 2-Methylphenol | ND | 0.330 | ## | | | | |
| 3-,4-Methylphenol | ND | 0.330 | Ħ | | | | |
| Naphthalene | ND ND | 0.330 | н | | | | |
| 2-Nitroaniline | ND | 0.330 | n | | | | i |
| 3-Nitroaniline | ND | 1.00 | н | | | | * |
| 4-Nitroaniline | ND | 0.330 | H | | | | |
| Nitrobenzene | ND | 0.330 | 11 | | | | |
| 2-Nitrophenol | ND | 0.330 | ** | | | | |
| 4-Nitrophenol | ND | 1.00 | ** | | | | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | ir | | | | |
| N-Nitrosodiphenylamine | ND | 0.330 | n | | | | |
| Pentachiorophenol | ND | 1.00 | *1 | | | | |
| Phenanthrene | ND | 0.330 | H | | | | |
| Phenol | ND | 0.330 | н | | | | |
| Pyrene | ND | 0.330 | н | | | | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | н | | | | |
| 2,4,5-Trichlorophenol | ND | 0.330 | н | | | | |
| 2,4,6-Trichlorophenol | ND | 0.330 | н | | | | |
| Surr: 2-Fluorobiphenyl | 1.86 | | # | 2.50 | 74.4 | 44-146 | |
| Surr: 2-Fluorophenol | 3.80 | | " | 5.00 | 76.0 | 42-126 | |
| Surr: Nitrobenzene-d5 | 1.81 | | # | 2.50 | 72.4 | 42-126 | |
| Surr: Phenol-d6 | 4.17 | | Ħ | 5.00 | 83.4 | 42-131 | |
| Surr: p-Terphenyl-d14 | 1.74 | | H | 2.50 | 69.6 | 49-150 | |
| Surr: 2,4,6-Tribromophenol | 3,73 | | u | 5.00 | 74.6 | 48-119 | |

North Creek Analytical - Portland

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%REC

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COF

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Spike

Source

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

RPD

Sontwokille Organic Communicators DPA Mathod 3270C - Quality Control

North Creek Analytical - Portland

Reporting

| | Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
|---|----------------------------|--------|-----------|-----------|-----------|----------|----------|-------------|-----|-------|-------|
| | Batch 0080345 - EPA 3550 | | | | | | | | · | | |
| 1 | LCS (0080345-BS1) | | | | Prepared: | 08/14/00 | Analyzed | : 08/16/00 | | | |
| ļ | Acenaphthene | 1.79 | 0.330 | mg/kg wet | 2.50 | | 71.6 | 47-145 | | | |
| í | 4-Chloro-3-methylphenol | 3.62 | 0.330 | Ħ | 5.00 | | 72.4 | 22-147 | | | |
| 1 | 2-Chlorophenol | 3.57 | 0.330 | Ħ | 5.00 | | 71.4 | 23-134 | | | |
| | 1,4-Dichlorobenzene | 1.77 | 1.00 | Ħ | 2.50 | | 70.8 | 20-124 | | | |
|) | 2,4-Dinitrotoluene | 1.73 | 0.500 | H | 2.50 | | 69.2 | 39-139 | | | |
| | 4-Nitrophenol | 3.67 | 1.00 | Ħ | 5.00 | | 73.4 | 0-132 | | | |
| | N-Nitrosodi-n-propylamine | 1.71 | 0.330 | 11 | 2.50 | | 68.4 | 0-230 | | | |
| | Pentachiorophenol | 2.79 | 1.00 | Ħ | 5.00 | | 55.8 | 14-176 | | | |
| | Phenol | 3.47 | 0.330 | H | 5.00 | | 69.4 | 5-112 | | | |
| ļ | Pyrene | 1.53 | 0.330 | ** | 2.50 | | 61.2 | 52-130 | | | |
| | 1,2,4-Trichlorobenzene | 1.71 | 0.330 | 11 | 2.50 | | 68.4 | 44-142 | | | |
| | Surr: 2-Fluorobiphenyl | 2.05 | | " | 2.50 | | 82.0 | 44-146 | | | |
| | Surr: 2-Fluorophenol | 3.83 | | n | 5.00 | | 76.6 | 42-126 | | | |
| 9 | :: Nitrobenzene-d5 | 1.97 | | u | 2.50 | | 78.8 | 42-126 | | | |
| , | Surr: Phenol-d6 | 4.13 | | " | 5.00 | | 82.6 | 42-131 | | | |
| | Surr: p-Terphenyl-d14 | 1.97 | | H | 2.50 | | 78.8 | 49-150 | | | |
| | Surr: 2,4,6-Tribromophenol | 3.37 | | # | 5.00 | | 67.4 | 48-119 | | | |
| į | Matrix Spike (0080345-MS1) | Sour | ce: P0080 | 88-01 | Prepared: | | | l: 08/16/00 | | | |
| 1 | Acenaphthene | 2.19 | 0.330 | mg/kg dry | 3.01 | ND | 72.8 | 47-145 | | | |
| ; | 4-Chloro-3-methylphenol | 4.46 | 0.330 | 11 | 6.03 | ND | 74.0 | 22-147 | | | |
| | 2-Chlorophenol | 4.34 | 0.330 | ti | 6.03 | ND | 72.0 | 23-134 | | | |
| | 1,4-Dichlorobenzene | 2.00 | 1.00 | ** | 3.01 | ND | 66.4 | 20-124 | | | |
| 1 | 2,4-Dinitrotoluene | 2.22 | 0.500 | 11 | 3.01 | ND | 73.8 | 39-139 | | | |
| | 4-Nitrophenol | 4.26 | 1.00 | Ħ | 6.03 | ND | 70.6 | 0-132 | | | |
| • | N-Nitrosodi-n-propylamine | 2.14 | 0.330 | Ħ | 3.01 | ND | 71.1 | 0-230 | | | |
| ļ | Pentachiorophenol | 3.25 | 1.00 | 11 | 6.03 | ND | 53.9 | 14-176 | | | |
| | Phenol | 4.32 | 0.330 | Ħ | 6.03 | ND | 71.6 | 5-112 | | | |
| 1 | Pyrene | 1.84 | 0.330 | н | 3.01 | ND | 61.1 | 52-130 | | | |

0.330

2.05

2.45

4.82

2.39

5.26

2.2I

4.90

3.01

3.01

6.03

3.01

6.03

3.01

6,03

ND

68.1

81.4

79.9

79.4

87.2

73.4

81.3

North Creek Analytical - Portland

1,2,4-Trichlorobenzene

Surr: 2-Fluorobiphenyl

Surr: 2-Fluorophenol

Surr: Nitrobenzene-d5

Surr: p-Terphenyl-d14

Surr: 2,4,6-Tribromophenol

Surr: Phenol-d6

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44-142

44-146

42-126

42-126

42-131

49-150

48-119

Lisa Domenighini, Project Manager

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Project Number: 015.08716.001 Reported:

Tualatin, OR 97062 Project Manager: Joe Hunt 08/24/00 08:39

Somitzolatile Organic Compounds portBPAA/tothod S2/00 - Quality Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| | | | | | | | | | | |

Batch 0080345 - EPA 3550

| Matrix Spike Dup (0080345-MSD1) | Soui | rce: P0080 | 88-01 | Prepared: | 08/14/00 | Analyze | d: 08/16/00 | | | |
|---------------------------------|------|------------|-----------|-----------|----------|---------|-------------|------|----|--|
| Acenaphthene | 2.07 | 0.330 | mg/kg dry | 3.01 | ND | 68.8 | 47-145 | 5.63 | 60 | |
| 4-Chloro-3-methylphenol | 4.06 | 0.330 | " | 6.03 | ND | 67.3 | 22-147 | 9.39 | 60 | |
| 2-Chlorophenol | 3.97 | 0.330 | ** | 6.03 | ND | 65.8 | 23-134 | 8.90 | 60 | |
| 1,4-Dichlorobenzene | 1.92 | 1.00 | tt | 3.01 | ND | 63.8 | 20-124 | 4.08 | 60 | |
| 2,4-Dinitrotoluene | 2.06 | 0.500 | В | 3.01 | ND | 68.4 | 39-139 | 7.48 | 60 | |
| 4-Nitrophenol | 3.81 | 1.00 | ** | 6.03 | ND | 63.2 | 0-132 | 11.2 | 60 | |
| N-Nitrosodi-n-propylamine | 2.03 | 0.330 | Ħ | 3.01 | ND | 67.4 | 0-230 | 5.28 | 60 | |
| Pentachlorophenol | 3.46 | 1.00 | ŧŧ | 6.03 | ND | 57.4 | 14-176 | 6.26 | 60 | |
| Phenol | 4.00 | 0.330 | н | 6.03 | ND | 66.3 | 5-112 | 7.69 | 60 | |
| Pyrene | 1.75 | 0.330 | н | 3.01 | ND | 58.1 | 52-130 | 5.01 | 60 | |
| 1,2,4-Trichtorobenzene | 1.94 | 0.330 | n | 3.01 | ND | 64.5 | 44-142 | 5.51 | 60 | |
| Surr: 2-Fluorobiphenyl | 2.33 | | н | 3.01 | | 77.4 | 44-146 | | | |
| Surr: 2-Fluorophenol | 4.74 | | n | 6.03 | | 78.6 | 42-126 | | | |
| Surr: Nitrobenzene-d5 | 2.32 | | " | 3,01 | | 77.I | 42-126 | | | |
| Surr: Phenol-d6 | 5.14 | | " | 6.03 | | 85.2 | 42-131 | | | |
| Surr: p-Terphenyl-d14 | 2.07 | | u | 3.01 | | 68.8 | 49-150 | | | |
| Surr: 2,4,6-Tribromophenol | 4.66 | | " | 6.03 | | 77.3 | 48-119 | | | |

Batch 0080365 - EPA 3550

| Blank (0080365-BLK1) | | Prepared: 08/15/00 Analyzed: 08/16/00 | |
|----------------------------|----|---------------------------------------|--|
| Acenaphthene | ND | 0.330 mg/kg wet | |
| Acenaphthylene | ND | 0.330 " | |
| Anthracene | ND | 0.330 " | |
| Benzo (a) anthracene | ND | 0.330 " | |
| Benzo (a) pyrene | ND | 0.330 " | |
| Benzo (b) fluoranthene | ND | 0.330 " | |
| Benzo (ghi) perylene | ND | 0.330 " | |
| Benzo (k) fluoranthene | ND | 0.330 " | |
| Benzoic Acid | ND | 1.00 " | |
| Benzyl alcohol | ND | 0.330 " | |
| 4-Bromophenyl phenyl ether | ND | 0.330 " | |
| Butyl benzyl phthalate | ND | 0.330 " | |
| 4-Chloro-3-methylphenol | ND | 0.330 " | |
| 4-Chloroaniline | ND | 2.00 " | |
| Bis(2-chloroethoxy)methane | ND | 0.330 " | |
| | | | |

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Page 91 of 98 North Creek Analytical, Inc. **Environmental Laboratory Network**



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cor P.O. Box 1508

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported: 08/24/00 08:39

Project Manager: Joe Hunt

SamivolailleOrganieCompounts, per 1984 Method32/0C =OrgilisyControl.

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Batch 0080365 - EPA 3550 | | | | |
|-----------------------------|----|---------|-----------|--------------------------------------|
| Blank (0080365-BLK1) | | | P | repared: 08/15/00 Analyzed: 08/16/00 |
| Bis(2-chloroethyl)ether | ND | 0.330 m | ng/kg wet | |
| Bis(2-chloroisopropyl)ether | ND | 0.330 | | |
| 2-Chloronaphthalene | ND | 0.330 | ** | |
| 2-Chlorophenol | ND | 0.330 | Ħ | |
| 4-Chlorophenyl phenyl ether | ND | 0.330 | н | |
| Chrysene | ND | 0.330 | " | |
| Di-n-butyl phthalate | ND | 1.00 | 11 | |
| Di-n-octyl phthalate | ND | 0.330 | tt | |
| Dibenzo (a,h) anthracene | ND | 0.330 | н | |
| Dibenzofuran | ND | 0.330 | tt | |
| 1,2-Dichlorobenzene | ND | 1.00 | u . | |
| 1,3-Dichlorobenzene | ND | 1.00 | " | |
| 1,4-Dichlorobenzene | ND | 1.00 | н | |
| Dichtorobenzidine | ND | 1.00 | Н | |
| ع, -Dichlorophenol | ND | 0.330 | 17 | |
| Diethyl phthalate | ND | 0.330 | i) | |
| 2,4-Dimethylphenol | ND | 1.00 | 11 | |
| Dimethyl phthalate | ND | 0.330 | Ħ | |
| 4,6-Dinitro-2-methylphenol | ND | 1.00 | H | |
| 2,4-Dinitrophenol | ND | 2.00 | н | |
| 2,4-Dinitrotoluene | ND | 0.500 | 19 | |
| 2,6-Dinitrotoluene | ND | 0.500 | Ħ | |
| Bis(2-ethylhexyl)phthalate | ND | 2.00 | tt | |
| Fluoranthene | ND | 0.330 | " | |
| Fluorene | ND | 0.330 | Ħ | |
| Hexachiorobenzene | ND | 0.330 | ti | |
| Hexachlorobutadiene | ND | 1.00 | ** | |
| Hexachlorocyclopentadiene | ND | 1.00 | 11 | |
| Hexachloroethane | ND | 1.00 | H | |
| Indeno (1,2,3-cd) pyrene | ND | 0.330 | | |
| Isophorone | ND | 0,330 | 11 | |
| 2-Methylnaphthalene | ND | 0.330 | H | |
| 2-Methylphenol | ND | 0.330 | H | |
| 3-,4-Methylphenol | ND | 0.330 | | |
| Naphthalene | ND | 0.330 | " | |
| 2-Nitroaniline | ND | 0.330 | н | |

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North Creek Analytical, Inc. **Environmental Laboratory Network**

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Semivolatile Organic Compounds per EPA Method \$270C = Quality Control.

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | • | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Batch 0080365 - EPA 3550 | | | | | | | |
|----------------------------|------|-------|-----------|----------------|----------------|-------------|--|
| Blank (0080365-BLK1) | | | | Prepared: 08/1 | 15/00 Analyzed | 1: 08/16/00 | |
| 3-Nitroaniline | ND | | mg/kg wet | | | | |
| 4-Nitroaniline | ND | 0.330 | u | | | | |
| Nitrobenzene | ND | 0.330 | ч | | | | |
| 2-Nitrophenol | ND | 0.330 | н | | | | |
| 4-Nitrophenol | ND | 1.00 | H | | | | |
| N-Nitrosodi-n-propylamine | ND | 0.330 | ** | | | | |
| N-Nitrosodiphenylamine | ND | 0.330 | 4 | | | | |
| Pentachlorophenol | ND | 1.00 | # | | | | |
| Phenanthrene | ND | 0.330 | W. | | | | |
| Phenol | ND | 0.330 | u | | | | |
| Pyrene | ND | 0.330 | н | | | | |
| 1,2,4-Trichlorobenzene | ND | 0.330 | H. | | | | |
| 2,4,5-Trichlorophenol | ND | 0.330 | H | | | | |
| 2,4,6-Trichlorophenol | ND | 0.330 | u | | | | |
| Surr: 2-Fluorobiphenyl | 1.94 | | 11 | 2.50 | 77.6 | 44-146 | |
| Surr: 2-Fluorophenol | 3.93 | | " | 5.00 | 78.6 | 42-126 | |
| Surr: Nitrobenzene-d5 | 1.90 | | H | 2.50 | 76.0 | 42-126 | |
| Surr: Phenol-d6 | 4.30 | | " | 5.00 | 86.0 | 42-131 | |
| Surr: p-Terphenyl-d14 | 1.75 | | H | 2.50 | 70.0 | 49-150 | |
| Surr: 2,4,6-Tribromophenol | 3.60 | | " | 5.00 | 72.0 | 48-119 | |
| LCS (0080365-BS1) | | | | Prepared: 08/I | 5/00 Analyzed | 1: 08/16/00 | |
| Acenaphthene | 1.72 | 0.330 | mg/kg wet | 2,50 | 68.8 | 47-145 | |
| 4-Chloro-3-methylphenol | 3.43 | 0.330 | * | 5.00 | 68.6 | 22-147 | |
| 2-Chlorophenol | 3.47 | 0.330 | u | 5.00 | 69.4 | 23-134 | |
| 1,4-Dichtorobenzene | 1.73 | 1.00 | " | 2,50 | 69.2 | 20-124 | |
| 2,4-Dinitrotoluene | 1.77 | 0.500 | | 2.50 | 70.8 | 39-139 | |
| 4-Nitrophenol | 3.21 | 1.00 | # | 5.00 | 64.2 | 0-132 | |
| N-Nitrosodi-n-propylamine | 1.73 | 0.330 | ** | 2.50 | 69.2 | 0-230 | |
| Pentachlorophenol | 3.19 | 1.00 | ** | 5.00 | 63.8 | 14-176 | |
| Phenoi | 3.50 | 0.330 | ır | 5.00 | 70.0 | 5-112 | |
| Pyrene | 1.40 | 0.330 | | 2.50 | 56.0 | 52-130 | |
| 1,2,4-Trichlorobenzene | 1.67 | 0.330 | et | 2.50 | 66.8 | 44-142 | |
| Surr: 2-Fluorobiphenyl | 1.95 | | и | 2.50 | 78.0 | 44-146 | |
| Surr: 2-Fluorophenol | 4.02 | | u | 5.00 | 80.4 | 42-126 | |
| Surr: Nitrobenzene-d5 | 1.94 | | u | 2.50 | 77.6 | 42-126 | |

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Lisa Domenighini, Project Manager

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Environmental Laboratory Network



Secor

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Tualatin, OR 97062

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503.906.9200 1ax 503.906.9210
20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 1ax 541.382.7588

Project: Fort James Specialty Chemicals

Bend

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Sportvoladle@eganteCompoundsquertePAAVtethod8270C = QualityControl

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| Allalyc | | | | | | | | | | |

| Analyte | Result | Fillitt | Ollia | 120101 | Robuit | | | | | |
|---------------------------------|--------|------------|-----------|-----------|----------|------|-------------|------|----|-------|
| Batch 0080365 - EPA 3550 | | | | | | | | | | ·- ·· |
| LCS (0080365-BS1) | | | | | 08/15/00 | | : 08/16/00 | | | |
| Surr: Phenol-d6 | 4.33 | | mg/kg wet | 5.00 | | 86.6 | 42-131 | | | |
| Surr: p-Terphenyl-d14 | 1.74 | | Ħ | 2.50 | | 69.6 | 49-150 | | | |
| Surr: 2,4,6-Tribromophenol | 3,80 | | " | 5.00 | | 76.0 | 48-119 | | | |
| Matrix Spike (0080365-MS1) | Sour | ce: P00808 | | | | | 1: 08/16/00 | | | |
| Acenaphthene | 2.14 | 0.330 | mg/kg dry | 3.05 | ND | 70.2 | 47-145 | | | |
| 4-Chloro-3-methylphenol | 4.23 | 0.330 | 11 | 6.11 | ND | 69.2 | 22-147 | | | |
| 2-Chlorophenol | 4.20 | 0.330 | Ħ | 6.11 | ND | 68.7 | 23-134 | | | |
| ,4-Dichlorobenzene | 1.89 | 1.00 | ** | 3.05 | ND | 62.0 | 20-124 | | | |
| 2,4-Dinitrotoluene | 2.18 | 0.500 | ** | 3.05 | ND | 71.5 | 39-139 | | | |
| i-Nitrophenol | 3.95 | 1.00 | Ħ | 6.11 | ND | 64.6 | 0-132 | | | |
| N-Nitrosodi-n-propylamine | 2.09 | 0.330 | н | 3.05 | ND | 68.5 | 0-230 | | | |
| Pontachlorophenol | 3.99 | 1.00 | Ħ | 6.11 | ND | 65.3 | 14-176 | | | |
| iol | 4.30 | 0.330 | н | 6.11 | ND | 70.4 | 5-112 | | | |
| Pyrene | 1.75 | 0.330 | er . | 3.05 | ND | 57.4 | 52-130 | | | |
| 1,2,4-Trichlorobenzene | 1.96 | 0.330 | Ħ | 3.05 | ND | 64.3 | 44-142 | | | |
| Surr: 2-Fluorobiphenyl | 2.33 | | " | 3.05 | | 76.4 | 44-146 | | | |
| Surr: 2-Fluorophenol | 4.84 | | # | 6.11 | | 79.2 | 42-126 | | | |
| Surr: Nitrobenzene-d5 | 2.34 | | ** | 3.05 | | 76.7 | 42-126 | | | |
| Surr: Phenol-d6 | 5.29 | | " | 6.11 | | 86.6 | 42-131 | | | |
| Surr: p-Terphenyl-dl4 | 2.12 | | " | 3.05 | | 69.5 | 49-150 | | | |
| Surr: 2,4,6-Tribromophenol | 4.52 | | " | 6.11 | | 74.0 | 48-119 | | | |
| Matrix Spike Dup (0080365-MSD1) | Sour | rce: P0080 | 88-19 | Prepared: | 08/15/00 | | d: 08/16/00 | | | |
| Acenaphthene | 2.06 | 0.330 | mg/kg dry | 3.05 | ND | 67.5 | 47-145 | 3.81 | 60 | |
| 4-Chloro-3-methylphenol | 4.07 | 0.330 | Ħ | 6.11 | ND | 66.6 | 22-147 | 3.86 | 60 | |
| 2-Chlorophenol | 4.11 | 0.330 | н | 6.11 | ND | 67.3 | 23-134 | 2.17 | 60 | |
| 1,4-Dichlorobenzene | 1.81 | 1.00 | et | 3.05 | ND | 59.3 | 20-124 | 4.32 | 60 | |
| 2,4-Dinitrotoluene | 2.06 | 0.500 | Ħ | 3.05 | ND | 67.5 | 39-139 | 5.66 | 60 | |
| 4-Nitrophenol | 3.67 | 1.00 | н | 6.11 | ND | 60.1 | 0-132 | 7.35 | 60 | |
| N-Nitrosodi-n-propylamine | 1.99 | 0.330 | ** | 3.05 | ND | 65.2 | 0-230 | 4.90 | 60 | |
| Pentachlorophenol | 3.42 | 1.00 | M | 6.11 | ND | 56.0 | 14-176 | 15.4 | 60 | |
| Phenol | 4.04 | 0.330 | ** | 6.11 | ND | 66.1 | 5-112 | 6.24 | 60 | |
| Pyrene | 1.68 | 0.330 | н | 3.05 | ND | 55.1 | 52-130 | 4.08 | 60 | |
| 1,2,4-Trichlorobenzene | 1.85 | 0.330 | * | 3.05 | ND | 60.7 | 44-142 | 5.77 | 60 | |
| Surr: 2-Fluorobiphenyl | 2.27 | | 11 | 3.05 | | 74.4 | 44-146 | | | |
| omit = 1 more organizary. | | | | | | | | | | |

North Creek Analytical - Portland

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network**

Page 94 of 98



 Seattle
 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223

 425.420.9200
 fax 425.420.9210

 Spokane
 East 11115 Montgomery, Suite B, Spokane, WA 99206-4776

 509.924.9200
 fax 509.924.9290

Spokane

9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Reported: 08/24/00 08:39

Project Manager: Joe Hunt

Semixonalle Organic Compountinger DPA Atentical SP/IIC - Quality

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

Batch 0080365 - EPA 3550

| Matrix Spike Dup (0080365-MSD1) | Source: | P008088-19 | Prepared: 08/1 | 5/00 Analyzed | : 08/16/00 |
|---------------------------------|---------|------------|----------------|---------------|------------|
| Surr: 2-Fluorophenol | 4.68 | mg/kg dry | 6.11 | 76.6 | 42-126 |
| Surr: Nitrobenzene-d5 | 2,26 | и | 3.05 | 74.I | 42-126 |
| Surr: Phenol-d6 | 5.01 | H | 6.11 | 82.0 | 42-131 |
| Surr: p-Terphenyl-d14 | 2.10 | " | 3.05 | 68.9 | 49-150 |
| Surr: 2,4,6-Tribromophenol | 4.52 | " | 6.11 | 74.0 | 48-119 |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 95 of 98



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9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 Portland

503.906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

P.O. Box 1508

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Mikealangons:Physical/Conventional Chemistry Enameters - Quality/Control

North Creek Analytical - Portland

| 4 - 1 - 4 - | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|----------------------------|--------|--------------------|-----------|----------------|------------------|------------|----------------|-----|--------------|-------|
| Analyte | Kesuit | Dulk | Oma | | 100000 | | | | | |
| Batch 0080120 - Dry Weight | | | | | | | | | | |
| Blank (0080120-BLK1) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| % Solids | ND | 5.00% | by Weigl | hŧ | | | | | | |
| Blank (0080120-BLK2) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| % Solids | ND | 5.00% | by Weig | ht | | | | | | |
| Blank (0080120-BLK3) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| % Solids | ND | 5.00% | 6 by Weig | ht | | | | | | |
| LCS (0080120-BS1) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| % Solids | 100 | 5.00% | 6 by Weig | ht | | | 95-105 | | | |
| LCS (0080120-BS2) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| % Solids | 100 | 5.00% | 6 by Weig | ht | | | 95-105 | | | |
| LCS (0080120-BS3) | | | | Prepared | & Analyz | ed: 08/04/ | 00 | | | |
| Solids | 100 | 5.00% | 6 by Weig | ht | | | 95-105 | | | |
| Batch 0080232 - Dry Weight | | | | | | | | | | |
| Blank (0080232-BLK1) | | | | Prepared | & Analyz | ed: 08/09/ | 00 | | | |
| % Solids | ND | 5.00% | 6 by Weig | ht | | | | | | |
| Blank (0080232-BLK2) | | | | Prepared | & Analyz | ed: 08/09/ | 00 | | | |
| % Solids | ND | 5.00% | 6 by Weig | ht | | | | | | |
| LCS (0080232-BS1) | | | | Prepared | & Analyz | ed: 08/09/ | 00 | | | |
| % Solids | 100 | 5.009 | 6 by Weig | ht | | | 95-105 | | - | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

Page 96 of 98 North Creek Analytical, Inc. **Environmental Laboratory Network**



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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 08/24/00 08:39

Miscellaneous)Physical/Conventional/Chemistry/Parameters:: Quality/Con

North Creek Analytical - Portland

| | RPD |
|--|-----------------|
| Analyte Result Limit Units Level Result %REC | RPD Limit Notes |

Batch 0080232 - Dry Weight

LCS (0080232-BS2)

Prepared & Analyzed: 08/09/00

% Solids 100 5.00% by Weight 95-105

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 97 of 98



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 Spokane
 East 11115 Montgomery, Suite B, Spokane, WA 99206-4776 509,924,9200 fax 509,924,9290

Spokane

503.924.3200 18X 503.324.3250 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588 Portland

cor P.O. Box 1508

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

08/24/00 08:39

Notes and Definitions

| | | 1,0100 data 2 92-1-100 |
|--|------|--|
| | I-02 | This sample was analyzed outside of the EPA recommended holding time. |
| | Q-02 | The spike recovery for this QC sample is outside of established control limits due to sample matrix interference. |
| | Q-06 | Analyses are not controlled on RPD values from sample concentrations less than 5 times the reporting limit. |
| | Q-14 | The Spike Recovery and/or RPD is outside of control limits due to a non-homogeneous sample matrix. |
| | R-05 | Reporting limits raised due to dilution necessary for analysis. Sample contains high levels of reported analyte, non-target analyte, and/or matrix interference. |
| | S-01 | The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interferences. |
| | S-02 | The surrogate recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample. |
| | S-03 | Surrogate recovery is outside of NCA established control limits. |
| | S-07 | Surrogate recovery is out of control limits. QA criteria are met when one surrogate is within control limits. |
| | DET | Analyte DETECTED |
| The state of the s | ð | Analyte NOT DETECTED at or above the reporting limit |
| | NR | Not Reported |
| | dry | Sample results reported on a dry weight basis |
| | wet | Sample results reported on a wet weight basis |

North Creek Analytical - Portland

Relative Percent Difference

RPD

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 98 of 98



18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508 9405 S.W. Nimbus Avenue, Beavenon, OR 97008-7132 East 11115 Montgomery, Sulte B, Spokane, WA 99206-4779

(425).420-9200

FAX 420-9210 FAX 924-9290 FAX 906-9210 (509) 924-9200 (503) 906-9200

P. 008088

| ABO (SINGER) | 193 | | | | | | |
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| | CHAIL | CHAIN OF CUSTODY REPORT | DY REPOR | | Work Order # | | 6.008088 |
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| ATTENTION JOE HUNT | | | | 9,50 | | TURNAROUND REC | TURNAROUND REQUEST in Business Day: • |
| ADDRESS: 77.70 CLIL V | Walnut G | - | ATTENTION: | 0,0 | | Organic & Increanic | normalic Analyses |
| 1 | 10 Mamy 31. | | ADDRESS: | ر رون ز | <u> </u> | | |
| | 1900 9 | 7062 | | 756 | | | |
| MONE 503 - 671-2030 | FAX: 503 | 4502-169. | P.O. NUMBER: | P. 101.00 | | 3– | rocarbon Analys |
| MOIRTHAME FORT James Specialty Chenicals | Specialty (| henicals | \ | L 7 | | | 1 2 |
| PROJECT NUMBER: 0/5. 08716. 001 | ,001 | | September 1 | 12,00L | | | . • |
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| RELINQUISHED BY (Manager) | | | DATE | RECEIVED BY (Assessment) | | 1 | |
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| ADDITIONAL REMARKS: | | | | FRINT NAME: | | FIRM: | TIME |
| | | | | | | | × · |

ANALYTICAL Environmental Laboratory Services NORTH CREEK

4.0

18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508 East 11115 Montgamery, Suite B, Spokane, WA 99206-4779 9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132

PAX 420-9210 PAX 924-9290 (509) 924-921~ (425) 420-97

FAX 906-9210 (503) 906-9200

8308001

Work Order #

CHAIN OF CUSTODY REPORT

, i EPA 67,70 SIM ACID EXTRACT ON FOR SOTO SIM)E/8440 * Tumaround Requests less than standard may locur Rush Charges. TURNAROUND REQUEST in Business Day: * Â -COMMENT Ä. E ARCHINE. ARCHIE Areta & Hydrocarbon Analys = 2 7 = Organic & Inorganic Analys 1 = CONTAINERS 4 4 2 p FIRM 3 4 3 M -3 OTHER (W. S. A. O) MATRIX 5 a ashol 8:600 THEY QUOTE A. 80 RECEIVED BY (Symmer) RECEIVED BY (SIE · arou-Halm PRINT NAME: PRINT NAME X X × DITS KILL بر X 80928 Val X × DATE TIME DATE TWE × INVOICE TO: × X × X X P.O. NUMBER: X ATTENTION: ADDRESS: Analysis Roquest: X ٧ X Х X 乂 Laboratory Use Only) NCA SAMPLE ID 503-691-2030 FXX 503-692-7074 Fart James Specialty Chemicals FIRM: 97062 25/20 8480 9560 (420 6935 1435 8 (E) 29 Philo 1430 Mohawk St SAMPLING DATE/TIME 8/2/20 Tualathi Organ 100 · 312 80 · 510 7730 SW. D. Edward Joe Hunt GP9 @ 27.5' RELINQUISHED BY LANGE CLIENT SAMPLE ರಂ IDENTIFICATION DEC SECOR GP9 @ 12' GP9 @ 8' 9 GP14 e RELINQUISHED BY 15 SPIS GPIH GP12 GP13 GP10 ROJECT NUMBER: GPI ROIECT NAME: REPORT TO: PRINT NAME: FRENT NAME: KAMPLED BY: ATTENTION: ADDRESS HOLE

PAGE 20F

ADDITIONAL REMARKS:



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CHAIN OF CUSTODY REPORT

18939 120th Avenue N.B., Suite 101, Bothell, WA 98011-9508 East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132

PAX 420-9210 (425) 420-9200 (509) 924-9200 (503) 906-9200

FAX 906-9210 PAX 924-9290

908086 Work Order #

| REPORT TO: SECOR | | | INVOICE TO: | | | | | |
|-------------------------------------|--|--------------------|---------------------------------------|-----------------------|-----------|----------------|-------------------------------------|--|
| ATTENTION TO PLANT | | | 200 | | 3 ° | TOKAN TOKAN | TUKNAKUUND REQUEST In Business Day: | In Business Day: • |
| 7730 SW. | Mohawk St. | | ADDRESS: | P (R) | 700 | | Organic & Incorpanic Analyse | C Analyse |
| Twalatin | Oregon 97062 | 62 | | K 36 | 24 | | | |
| MONE 503-691-2030 FLX: 503-691-7074 | FAX: 503-6 | 42-7074 | P.O. NUMBER: | 1 | OTEA |) | | |
| MOBECTHAME FORT JAMES S | Fart James Specialty Chemicals | Nicals | 1 | *0 | 1/5/8 | | _ |] |
| PROJECT HUMBER: 0/5. 08716, 001 | , 00/ | | 80g | کر /یرا | 1/250 | OTHER . | - | |
| SAMPED BY: DEC | | | \sim | | / / /3 | * Tumaround Re | quests less than standar | * Turnaround Requests less than standard may lacar Rush Chape. |
| | SAMPLING | NCA SAMPLE ID | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 18 | HAR | MATRIX | #0# | |
| | 8/2/04 | transaction of the | | | | (V) | CONTAINERS | COMMENTS |
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| 2 GP17@4' | 7201 00/1/Y | | | | | | 2 41 | ARC WIVE |
| 4 GP17@6' | 1035 | | × | × | | | 2 | " |
| , GP17C @ 8' | 1128 | | | | | | | ARCHIE |
| SPITC @ 11.5' | 8मा। 👍 | | 火 火 | メ | | | | " |
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| , GP19 | 5530 | , | メメ | | | | 2 684 8 | TAR SOND SILTO |
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| ADOTTONAL REMARKS: | | | | | | | | |

PAGE 3 OF



August 23, 2000

Joe Hunt

SECOR

Service Request No. J2002672

Certification Numbers:

Florida DOH:

E82502

Louisiana:

AI 30759

Massachusetts:

M-FL937

New Hampshire:

294297-A

North Carolina:

527

South Carolina:

96021001

RE: Project No.:

7730 SW Mohawk St.

Tualatin, OR 97062

015,08716 Task # 003

Project Name: Fort James

Dear Joe Hunt:

Enclosed are the results of the samples(s) submitted to our laboratory on these analyses have been assigned our service request number: J2002672.

August 11, 2000.

For your reference,

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in the entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craix R. Myru

Craig Myers

Project Manager

CM/jg

Analytical Report

Client:

SECOR

Project:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672

Date Collected: 8/2/00

Date Received: 8/11/00 Date Extracted: 8/15/00

Date Analyzed: 8/19/00

Tentatively Identified Compounds (TIC) Volatile Organic Compounds EPA Method 8260B Units: µg/Kg (ppb) Dry Weight Basis

Sample Name:

GP17@6'

Lab Code:

J2002672-004

| | | Retention | | |
|------------|------------------|-------------------|----------------------------|--|
| CAS Number | TIC | Time (minutes) | Estimated Concentration | |
| 274-09-9 | 1,3-Benzodioxole | 28.82 | 31000 | |

Craix R. Hym Date: 8 23 00 Approved By: _

Analytical Report

Client:

SECOR

roject:

Sample Matrix: Soil

Fort James / 015.08716 Task # 003

Date Collected: 8/1/00 Date Received: 8/11/00 Date Extracted: 8/11/00 Date Analyzed: 8/15/00

Service Request: J2002672

Tentatively Identified Compounds (TIC) Base Neutral/Acid Semivolatile Organic Compounds EPA Methods 3550/8270 Units: µg/Kg (ppb) Dry Weight Basis

Sample Name:

GP11

Lab Code:

J2002672-001

CAS Number

TIC

Retention Time

Estimated Concentration

| Approved By: | Craw R. Myra | Date: | 8/23/00 | |
|--------------|--------------|-------------|---------|--|
| Approved by. | | | | |

Analytical Report

Client:

SECOR

Project:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672

Date Collected: 8/1/00

Date Received: 8/11/00

Date Extracted: 8/11/00
Date Analyzed: 8/15/00

Tentatively Identified Compounds (TIC)

Base Neutral/Acid Semivolatile Organic Compounds EPA Methods 3550/8270

Units: µg/Kg (ppb)
Dry Weight Basis

Sample Name:

GP12

Lab Code:

J2002672-002

CAS Number

TIC

Retention

Estimated

Time

Concentration

| Approved By: | Gank. Mins | Date: | 8 | 23/ | <u></u> | |
|--------------|------------|-------|----------|-----|---------|--|
| • • • | 3 | - | <i>I</i> | • | | |

Analytical Report

Client:

SECOR

roject:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672
Date Collected: 8/1/00

Date Received: 8/11/00
Date Extracted: 8/11/00

Date Extracted: 8/11/00 Date Analyzed: 8/15/00

Tentatively Identified Compounds (TIC)

Base Neutral/Acid Semivolatile Organic Compounds

EPA Methods 3550/8270 Units: μg/Kg (ppb) Dry Weight Basis

Sample Name:

GP13

Lab Code:

J2002672-003

CAS Number

TIC

Retention

Estimated

Time

Concentration

| Approved By: | Craw R. My | Date: | 8/23/00 | |
|--------------|------------|-------|---------|--|
| | | | , , | |

Analytical Report

Client:

SECOR

Project:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672

Date Collected: 8/1/00
Date Received: 8/11/00
Date Extracted: 8/11/00

Date Analyzed: 8/15/00

Tentatively Identified Compounds (TIC)
Base Neutral/Acid Semivolatile Organic Compounds

EPA Methods 3550/8270 Units: μg/Kg (ppb) Dry Weight Basis

Sample Name:

Method Blank

Lab Code:

EX200287-MB

CAS Number

TIC

Retention

Time

Estimated

Concentration

| Approved By: | Cran R. Min | Date: | 8/23/00 |
|--------------|-------------|-------|---------|
| | 0 0 | | 7 7 |

Analytical Report

Client:
roject:
sample Matrix:

SECOR

Fort James/015.08716 Task # 003

Soil

Service Request: J2002672

Date Collected: 8/1-2/00

Date Received: 8/11/00 1000

Date Extracted: NA

Inorganic Parameters

Sample Name: Lab Code:

GP11 J2002672-001 GP12 J2002672-002 **GP13** J2002672-003

Analyte

Solids, Total

EPA Units Method

160.3

%

MRL Analyzed

10

8/14/00 1200

Date/Time

82.2

80.9

92.0

Approved By: ______ Date: 8/23/00

Analytical Report

Client:

SECOR

Project:

Fort James/015.08716 Task # 003

Sample Matrix:

Soil

Service Request: J2002672

Date Collected: 8/1-2/00

Date Received: 8/11/00 1000

Date Extracted: NA

Inorganic Parameters

Sample Name:

GP17 @ 6'

Lab Code:

J2002672-004

80.0

| Analyte | Units | EPA Method | MRL | Date/Time Analyzed |
|---------------|-------|---------------|-----|-----------------------|
| Solids, Total | % | 160.3 | 10 | 8/14/00 1200 |

Approved By: Can R. Hym Date: 8/23/00

QA/QC Report

lient:

SECOR

roject:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672

Date Collected: NA Date Received: NA

Date Extracted: NA

Date Analyzed: 8/18-19/00

Surrogate Recovery Summary Volatile Organic Compounds EPA Method 8260B

| Sample Name | Lab Code | P e r c e n Dibromofluoromethane | t Rec Toluene-d ₈ | o v e r y 4-Bromofluorobenzene |
|--|---|-------------------------------------|---------------------------------|-----------------------------------|
| GP17 @ 6' Method Blank Laboratory Control Sample Batch QC Batch QC | J2002672-004 J200818-MB J200818-LCS J2002686-001MS J2002686-001MS | | 97 99 96 96 96 | 101 98 100 97 98 |

CAS Acceptance Limits:

82-119

86-121

74-130

| managed Day | Craix Hymn | Date: 8/23/00 |
|-------------|------------|---------------|
| pproved By: | | |

QA/QC Report

Client:

SECOR

Project: Fort Ja

Fort James / 015.08716 Task # 003

Sample Matrix:

Water

Service Request: J2002672

Date Collected: NA
Date Received: NA
Date Extracted: NA

Date Analyzed: 8/18/00

Matrix Spike/Duplicate Matrix Spike Summary
Volatile Organic Compounds
EPA Method 8260B
Units: µg/L (ppb)

Sample Name:

Batch QC

Lab Code:

Batch QC

| | | | | | | Perc | cent R | Recovery | | |
|--------------------|-------|-------|--------|-------|--------|------|--------|-------------------|---------------------|--------------|
| | Spike | Level | Sample | Spike | Result | | | CAS Acceptance | Relative Percent | CAS cceptanc |
| Analyte | MS | DMS | Result | MS | DMS | MS | DMS | Limits | Difference | Limits |
| 1,1-Dichloroethene | 20 | 20 | U | 19 | 18 | 95 | 90 | 59-127 | 5 | 30 |
| Benzene | 20 | 20 | U | 22 | 20 | 110 | 100 | 62-127 | 10 | 30 |
| Trichloroethene | 20 | 20 | U | 19 | 18 | 95 | 90 | 60-135 | 5 | 30 |
| Toluene | 20 | 20 | U | 20 | 20 | 100 | 100 | 64-138 | <1 | 30 |
| Chlorobenzene | 20 | 20 | U | 19 | 18 | 95 | 90 | 61-135 | 5 | 30 |

| Approved By: | Chang R. Hymn | Date: 8/23/00 |
|--------------|---------------|---------------|
| •• | <i>D</i> 0 | |

QA/QC Report

Client:

SECOR

roject:

Fort James / 015.08716 Task # 003

LCS Matrix:

Water

Service Request: J2002672

Date Collected: NA
Date Received: NA
Date Extracted: NA

Date Analyzed: 8/18/00

Laboratory Control Sample Summary Volatile Organic Compounds EPA Method 8260B Units: µg/L (ppb)

| Analyte | True Value | Result | Percent Recovery | EPA Percent Recovery Acceptance Limits |
|--------------------|---------------|--------|---------------------|--|
| 1,1-Dichloroethene | 20 | 17 | 85 | 61-129 |
| Benzene | 20 | 20 | 100 | 63-130 |
| Trichloroethene | 20 | 19 | 95 | 72-127 |
| Toluene | 20 | 19 | 95 | 70-133 |
| Chlorobenzene | 20 | 18 | 90 | 66-132 |

| pproved By: | Crank lynn | Date: | 8/23/ | တ |
|-------------|---------------|-------|-------|---|
| pproved by. | 200-81-1-32-2 | | | |

QA/QC Report

Client:

SECOR

Project:

Fort James / 015.08716 Task # 003

Sample Matrix: Soil

Service Request: J2002672
Date Collected: 8/1/00
Date Received: 8/11/00
Date Extracted: 8/11/00
Date Analyzed: 8/15/00

Surrogate Recovery Summary
Base Neutral/ Acid Semivolatile Organic Compounds
EPA Methods 3550/8270

| Sample Name | Lab Code | NBZ | P e FBP | rcent TPH | R e c | over 2FP | y TBP |
|---------------------------|-----------------|-----|------------|--------------|-------|-------------|----------|
| GP11 | J2002672-001 | 83 | 83 | 105 | 92 | 81 | 88 |
| GP12 | J2002672-002 | 77 | 64 | 84 | 91 | 78 | 84 |
| GP13 | J2002672-003 | 62 | 69 | 88 | 70 | 58 | 70 |
| Method Blank | EX200287-MB | 92 | 99 | 107 | 102 | 87 | 29 |
| Laboratory Control Sample | EX200287-LCS | 93 | 99 | 107 | 100 | 93 | 86 |
| Batch QC | J2002672-001MS | 84 | 77 | 84 | 93 | 84 | 88 |
| Batch QC | J2002672-001DMS | 77 | 81 | 90 | 83 | 75 | 84 |

CAS Acceptance Limits: 33-115 36-116 37-120 42-113 36-113 10-123

NBZ Nitrobenzene-d5
FBP 2-Fluorobiphenyl
TPH Terphenyl-d14
PHL Phenol-d6
2FP 2-Fluorophenol
TBP 2,4,6-Tribromophenol

Approved By: Crang R. Hyram Date: 8/23/00

QA/QC Report

Client:

SECOR

Project:

Fort James / 015.08716 Task # 003

Sample Matrix:

Soil

Service Request: J2002672

Date Collected: NA
Date Received: NA
Date Extracted: 8/11/00

Date Analyzed: 8/15/00

Matrix Spike/Duplicate Matrix Spike Summary
Base Neutral/ Acid Semivolatile Organic Compounds
EPA Methods 3550/8270
Units: μg/Kg (ppb)

Sample Name:

Batch QC

Lab Code:

Batch QC

| Late Code. Dates QC | | | | | | Percent Recovery | | | | | | |
|----------------------------|-------|-------|--------|-------|--------|------------------|-----|-------------------|---------------------|--|--|--|
| | Spike | Level | Sample | Spike | Result | | | CAS Acceptance | Relative Percent | | | |
| Analyte | MS | DMS | Result | MS | DMS | MS | DMS | Limits | Difference | | | |
| Phenol | 3300 | 3300 | U | 2600 | 2500 | 79 | 76 | 40-116 | 4 | | | |
| 2-Chlorophenol | 3300 | 3300 | U | 2500 | 2400 | 76 | 73 | 47-113 | 4 | | | |
| 1,4-Dichlorobenzene | 1650 | 1650 | U | 920 | 1000 | 56 | 61 | 50-120 | 8 | | | |
| N-Nitroso-di-n-propylamine | 1650 | 1650 | U | 1400 | 1400 | 85 | 85 | 51-121 | <1 | | | |
| 1,2,4-Trichlorobenzene | 1650 | 1650 | U | 890 | 1100 | 54 | 67 | 53-121 | 21 | | | |
| 4-Chloro-3-methylphenol | 3300 | 3300 | U | 2700 | 2700 | 82 | 82 | 47-128 | <1 | | | |
| cenaphthene | 1650 | 1650 | U | 990 | 1300 | 60 | 79 | 50-121 | 27 | | | |
| 4-Nitrophenol | 3300 | 3300 | U | 2900 | 2800 | 88 | 85 | 36-135 | 4 | | | |
| 2,4-Dinitrotoluene | 1650 | 1650 | U | 1200 | 1400 | 73 | 85 | 51-125 | 15 | | | |
| Pentachlorophenol | 3300 | 3300 | U | 1200 | 1300 | 36 | 39 | 17-151 | 8 | | | |
| Pyrene | 1650 | 1650 | U | 960 | 1300 | 58 | 79 | 51-115 | 30 | | | |

U

Not detected at or above the MRL.

| | α . α α | Dota | 8/23/02 |
|--------------|------------------------------|---------|---------|
| Approved By: | Crang R. Myrra | Date: _ | المحرات |

QA/QC Report

Client:

SECOR

Service Request: J2002672

Project:

Fort James / 015.08716 Task # 003

Date Collected: NA
Date Received: NA

LCS Matrix:

Soil

Date Extracted: 8/11/00
Date Analyzed: 8/15/00

Laboratory Control Sample Summary

Base Neutral/ Acid Semivolatile Organic Compounds

EPA Methods 3550/8270

Units: μg/Kg (ppb)

CAS Percent Recovery True Percent Acceptance Result Recovery Limits Analyte Value 3000 91 40-116 Phenol 3300 2-Chlorophenol 3300 2900 88 47-113 1,4-Dichlorobenzene 1500 91 50-120 1650 1700 103 51-121 N-Nitroso-di-n-propylamine 1650 1,2,4-Trichlorobenzene 1500 91 53-121 1650 4-Chloro-3-methylphenol 3200 97 47-128 3300 Acenaphthene 1650 1600 97 50-121 4-Nitrophenol 82 36-135 2700 3300 97 2,4-Dinitrotoluene 51-125 1600 1650 Pentachlorophenol 3300 76 2 (a) 17-151 Pyrene 1650 1600 97 51-115

| (a) | Outside of acceptance limits. Since the reduced percent recovery is for a |
|-----|---|
| • | non-target analyte and since the percent recovery for the associated MS/MSD is acceptable, |
| | it is the opinion of CAS that the quality of the sample data has not been significantly affected. |

| Approved By: | Ciais | R. | Hyma | Date: | 8/23/00 |
|--------------|-------|----|------|-------|---------------------------------------|
| | | • | 0 | | , , , , , , , , , , , , , , , , , , , |

QA/QC Report

Client:

SECOR

roject:

Sample Matrix: Soil

Fort James/015.08716 Task # 003

Date Collected: NA Date Received: NA Date Extracted: NA

Service Request: J2002672

Date Analyzed: 8/14/00 1200

Duplicate Summary Inorganic Parameters

Sample Name:

Batch QC

Lab Code:

Batch QC

| | | | | | Duplicate | | Relative |
|---------------|-------|---------------|-----|------------------|------------------|---------|-----------------------|
| Analyte | Units | EPA Method | MRL | Sample Result | Sample Result | Average | Percent Difference |
| Solids, Total | % | 160.3 | 10 | 89.8 | 91.6 | 90.7 | 1.98 |

Crang R. Hym Approved By: __

Columbia Analytical Services, Inc. Cooler Receipt and Preservation Form

| | SECOR | | | Work order: J20 | 02672 | | |
|-------------------------------------|---|----------------|------------------------|---------------------|-------------|-----------|------------|
| Project: | Fort James | 3 / 015.087 | 716 Task # 003 | | | | |
| Cooler re | eceived on | 8/11/00 | | n 8/11/00 | by THT | | |
| | - | | ' | | <u>Yes</u> | No | <u>N/A</u> |
| 1 | Were custod | y seals on o | utside of cooler? | | X | | |
| | If yes, how n | nany and w | here? | One on lid | | | _ 📮 |
| | Were signatu | ure and date | correct? | | X | | |
| 2 | Were custod | y papers pro | operly filled out (inl | k, signed, etc)? | X | | |
| 3 | Did all bottle | es arrive in ; | good condition (unl | broken, etc)? | X | | |
| 4 | Were all bot | tle labels co | rrect (analysis, pres | servation, etc)? | \boxtimes | | |
| 5 | Did all bottle | e labels and | tags agree with cus | stody papers? | X | | |
| 6 | Were correct | t bottles use | d for test indicated? | ? | X | | |
| 7 | Did all samp | oles arrive w | rithin appropriate h | olding times? | X | | |
| 8 | Were VOA | vials checke | d for absence of air | bubbles, and noted? | | | X |
| 9 | Temperature | of cooler u | pon receipt | | 3.4 | Degrees (| C |
| | | | | | | | |
| | | Yes | No | Sample I.D. | Reagent | Vol. | |
| pН | Reagent | | | | | | II |
| 12 | NaOH | | | | | | <u>[</u> |
| | T | | <u></u> | | | | |
| 2 | HNO ₃ | | | | | | |
| 2 | HNO ₃ H ₂ SO ₄ | | | | | | |
| 2 | | ζ | | | | | |
| $\frac{2}{\text{Yes} = \text{all}}$ | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| $\frac{2}{\text{Yes} = \text{all}}$ | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| $\frac{2}{\text{Yes} = \text{all}}$ | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |
| Yes = all No = Sar | H ₂ SO ₄ samples OF | | at lab as listed | | | | |

Chain-of Custody Number:

| | ord. | | | | | | ers | nistno | C | per of | mnN | _ | - | | _ | | | | | .; | is: | ü | ij | | | | - |
|-------------------------|--|-----------|------------|---|------------------|-----------|---------------------|--------------------|------|--|------------------------|-------|-------|-------|-------|------|--|------|--------------------------------|--------------------------|-------------------------|--|---------------------|--------------------|-----------------|------------------|-------------------------|
| | , and are a part of this Record. | | 18N | (P) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) | | | | | | | Comments/ | | | | | | | | Sample Receipt | Total no. of containers: | Chain of custody seals: | Rec'd in good condition/cold: | Conforms to record: | Client: | Client Contact: | Client Phone: | |
| | Additional documents are attached, and are | JAMES | WASHINGTON | | est | | | 7 <i>0</i> M | ∌h: | diao | | . × | × | * | | | | | | in the second | Rabel | - 1 | te <i>8[μ ∞</i> | | | te | |
| Ģ | ment | 7 | 2 | ` | Redu | | | 1192 | rs. | | 010 | | | | × | | | , | , i | 1 | 1 | - 1 | Date. | | | Date | |
| Chain-of Custody Record | поор | FORT | CAMAS | | Analysis Request | | | | sli | steM < | тсгь | 1 | | | | | | | Received by: | 1 | - | SES | g | py: | | | |
| ' Re | tional | e . | ı | İ | Ana | | | tru | stut | lo9 yti ls (13) | 7421 Priori Meta | | | | | | | | ved | 1 | 4 | Company. | [000] | Received by: | | Company. Time | |
| ody | Addii | Job Name: | Location: | | | | <u> </u> | | | 2080 Lead | 3\808 Total | - | | | | | | | Recel | Sign | Print 1 | Con | Time_ | Rece | Sign. Print | Comp | |
| ust | | dob | رة ال | | | | | (SM/ | /O9 |) 0728 (sebío | 9/979 | 1 | | | | | | | | | | | 90 | | | | |
| of C | | | | | | | | elitalo\ olgani | | | | | | | | | | | | Λ ! | 中中 | 7.4 - | धेला | | | | |
| in-c | | | | | | | | (SW/ | /OĐ | lle Org | 8/4/8 | 1 | | | | | | | Ŋ | 3 | B | - 1 | te 8 | | | <u>و</u> | |
| Уhа | | | | | | | | səli | telo | V oitsi 3020 | monA 8\S08 | | | | | | | | 7 | 7 | pun | 30 | (S 6D Date | <u> </u> | | Date | |
| | | | | | | | f.81 | .b Hd. | | bom) (r.814 | | ╄ | | | | | | | ed by: | Shurt | | ĊĮ. | 95) 2 | quished by: | | | |
| R | | | | | | | 0 | |]-H | TTW | 1PHd | | | | | | | | auished | 2 | 9 | pany. | 100 | quish | | pany. | |
| Ŋ | | | | | | | 9 |)-H9TI | M/X | | пон Прнат | 1 | | | | | | | Relin | Sign | Print | Com | Time | Relin | Sign. Print | Com | |
| SECC | | 57. | 47062 | | 23 | | | | | | Matrix | × × | ~ | 2 | Ş | | | | | | | | | | | | |
| | | HOYAMIK | 976 | | # 003 | | 781 | | - | ST S | | 16/2 | 2130 | 8430 | 1035 | | | | | | | | | ૪ | | | |
| | | 120 | 20 | | 100 | # YSB! | ANAMICAL | | (| | ↓ ⊢ | + | | | | | | | - | | | | 7 | 8 1 9 8 8 1 9 1 | | | |
| | | 1 | ` | \ | | | ANA | | - | | 450 | 3/3 | 2/8 | 4/8 | 2/8 | | | | ents: | | | | (| <u>ን</u> | | | |
| | se. SECOR | 7730 SW | 1 5 | | 71280 310 | anager | Laboratory COLUMBIA | nd Time | | Sampler's Name 1) Columber Sampler's Signature | S Organian Por | | | | 80 | | | | Special Instructions/Comments: | | | | | | | | Rev. 2/39 |
| | Field Office. | Address: | | | 1000 | Project # | Laborato | Turnaround Time | | Sampler's | Callipo | 6-0-1 | 41 05 | GP 13 | GP-17 | | | | Special I | <u>.</u> | | ······································ | - 17 | | | | SECOR CUSTREC Rev. 2/95 |



September 08, 2000

7730 SW Mohawk St.

Tualatin, OR 97062

Joe Hunt

Secor

Service Request No. J2002890

Certification Numbers:

Florida DOH:

E82502

Louisiana:

AI 30759

Massachusetts:

M-FL937

New Hampshire:

294297-A

North Carolina:

527

South Carolina:

96021001

RE: Project No.:

015,08716

Project Name: Fort James

Dear Joe Hunt:

Enclosed are the results of the samples(s) submitted to our laboratory on

August 29, 2000.

For your reference,

these analyses have been assigned our service request number: J2002890.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in the entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig R. Myra

Craig Myers

Project Manager

CM/jg

Analytical Report

Client:

Secor

Project:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890 Date Collected: 8/25/00

Date Received: 8/29/00 Date Extracted: NA

Date Analyzed: 9/5/00

Tentatively Identified Compounds (TIC) Volatile Organic Compounds EPA Method 8260B Units: µg/L (ppb)

Sample Name:

MW2-082500

Lab Code:

J2002890-002

CAS Number

TIC

Retention

Time

Estimated

Concentration

| Approved By: | Orang R. Myrin | Date: | 9/8/00 | |
|--------------|----------------|-------|--------|--|
| Approved By. | | | | |

Analytical Report

Client:

Secor

Project:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890

Date Collected: 8/25/00

Date Received: 8/29/00

Date Extracted: NA
Date Analyzed: 9/5/00

Tentatively Identified Compounds (TIC)
Volatile Organic Compounds
EPA Method 8260B
Units: µg/L (ppb)

Sample Name:

MW3-082500

Lab Code:

J2002890-003

CAS Number

TIC

Retention

Estimated

Time Concentration

| Approved By: | Cran & Minn | Date: 9/8/00 |
|--------------|-------------|--------------|
| | | |

Analytical Report

Client:

Secor

roject:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890 Date Collected: 8/25/00

Date Received: 8/29/00 Date Extracted: 8/31/00

Date Analyzed: 9/6/00

Tentatively Identified Compounds (TIC) Base Neutral/Acid Semivolatile Organic Compounds EPA Methods 3510/8270 Units: µg/L (ppb)

Sample Name:

MW1-082500

Lab Code:

J2002890-001

CAS Number

TIC

Retention Time

Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Craig R. Hym Approved By: _

Analytical Report

Client:

Secor

Project:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890 Date Collected: 8/25/00 Date Received: 8/29/00 Date Extracted: 8/31/00

Date Analyzed: 9/6/00

Tentatively Identified Compounds (TIC) Base Neutral/Acid Semivolatile Organic Compounds EPA Methods 3510/8270

Units: µg/L (ppb)

Sample Name:

MW2-082500

Lab Code:

J2002890-002

CAS Number

TIC

Retention

Estimated

Time

Concentration

| Approved By: | Crank Minn | Date: | 9/8/00 |
|--------------|------------|-------|--------|
| - " | | | |

Analytical Report

Client:

Secor

roject:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890

Date Collected: 8/25/00 Date Received: 8/29/00

Date Extracted: 8/31/00

Date Analyzed: 9/6/00

Tentatively Identified Compounds (TIC) Base Neutral/Acid Semivolatile Organic Compounds EPA Methods 3510/8270 Units: µg/L (ppb)

Sample Name:

MW3-082500

Lab Code:

J2002890-003

CAS Number

TIC

Retention Time

Estimated

Concentration

| | • | | 1 | |
|--------------|----------|-------|--------|--|
| | A . A 1/ | | alda | |
| Approved By: | aux Hym | Date: | 918100 | |
| Approved by. | | | | |

QA/QC Report

Client:

Secor

Project:

Fort James / 015.08716

Sample Matrix: Water

Service Request: J2002890

Date Collected: NA Date Received: NA Date Extracted: NA Date Analyzed: 9/5/00

Surrogate Recovery Summary Volatile Organic Compounds EPA Method 8260B

| Sample Name | Lab Code | Percen Dibromofluoromethane | t Rec Toluene-d ₈ | o v e r y 4-Bromofluorobenzene |
|---------------------------|----------------|--------------------------------|---------------------------------|-----------------------------------|
| MW2-082500 | J2002890-002 | 90 | 100 | 109 |
| MW3-082500 | J2002890-003 | 93 | 103 | 109 |
| Method Blank | J200905-MB | 94 | 102 | 113 |
| Laboratory Control Sample | J200905-LCS | 92 | 99 | 106 |
| Batch QC | J2002926-001MS | 94 | 99 | 107 |
| Batch QC | J2002926-001MS | D 91 | 97 | 105 |

CAS Acceptance Limits: 82-119

86-121

74-130

| Approved By: | Craix R. Minn | Date: 9/8/00 |
|--------------|---------------|--------------|
| | | |

QA/QC Report

Client:

Secor

roject:

Fort James / 015.08716

Sample Matrix:

Water

Service Request: J2002890

Date Collected: NA Date Received: NA

Date Extracted: NA

Date Analyzed: 9/5/00

Matrix Spike/Duplicate Matrix Spike Summary Volatile Organic Compounds EPA Method 8260B Units: µg/L (ppb)

Sample Name:

Batch QC

Lab Code:

Batch QC

| | | | | | | Perc | ent K | ecovery | | |
|--------------------|-------|-------|--------|-------|--------|------|-------|-------------------|---------------------|--------------|
| | Spike | Level | Sample | Spike | Result | | | CAS Acceptance | Relative Percent | CAS cceptanc |
| Analyte | MS | DMS | Result | MS | DMS | MS | DMS | Limits | Difference | Limits |
| 1,1-Dichloroethene | 200 | 200 | U | 188 | 192 | 94 | 96 | 59-127 | 2 | 30 |
| Benzene | 200 | 200 | U | 218 | 221 | 109 | 111 | 62-127 | 1 | 30 |
| Trichloroethene | 200 | 200 | U | 214 | 219 | 107 | 110 | 60-135 | 2 | 30 |
| Toluene | 200 | 200 | U | 218 | 222 | 109 | 111 | 64-138 | 2 | 30 |
| Chlorobenzene | 200 | 200 | Ü | 208 | 210 | 104 | 105 | 61-135 | 1 | 30 |

____ Date: ____**9**|**9**|**0**0 Crank Hym Approved By: ___

QA/QC Report

Client:

Secor

Project:

Fort James / 015.08716

LCS Matrix:

Water

Service Request: J2002890

Date Collected: NA
Date Received: NA
Date Extracted: NA
Date Analyzed: 9/5/00

Laboratory Control Sample Summary Volatile Organic Compounds EPA Method 8260B Units: µg/L (ppb)

| True | | Percent | Percent Recovery Acceptance |
|-------|-----------------------------|--|--|
| Value | Result | Recovery | Limits |
| 20 | 19 | 95 | 61-129 |
| 20 | 22 | 110 | 63-130 |
| 20 | 22 | 110 | 72-127 |
| 20 | 22 | 110 | 70-133 |
| 20 | 22 | 110 | 66-132 |
| | Value 20 20 20 20 20 | Value Result 20 19 20 22 20 22 20 22 20 22 | Value Result Recovery 20 19 95 20 22 110 20 22 110 20 22 110 20 22 110 |

| Approved By: | Gar R. Henn | Date: 9/8/00 | |
|--------------|-------------|--------------|--|
| | | | |

QA/QC Report

Client:

Secor

roject:

Sample Matrix: Water

Fort James / 015.08716

Date Collected: 8/25/00 Date Received: 8/29/00 Date Extracted: 8/31/00 Date Analyzed: 9/6/00

Service Request: J2002890

Surrogate Recovery Summary Base Neutral/ Acid Semivolatile Organic Compounds EPA Methods 3510/8270

| Sample Name | Lab Code | NBZ | P e FBP | rcent TPH | R e c PHL | o v e r 2FP | y TBP |
|---------------------------|---------------|-----|------------|--------------|--------------|----------------|----------|
| MW1-082500 | J2002890-001 | 95 | 94 | 77 | 34 | 52 | 92 |
| MW2-082500 | J2002890-002 | 91 | 89 | 80 | 32 | 49 | 89 |
| MW3-082500 | J2002890-003 | 94 | 95 | 98 | 22 | 18 (a) | 35 |
| Method Blank | EX200338-MB | 94 | 93 | 101 | 33 | 33 | 52 |
| Laboratory Control Sample | EX200338-LCS | 98 | 96 | 105 | 38 | 50 | 78 |
| Laboratory Control Sample | EX200338-DLCS | 94 | 92 | 101 | 33 | 34 | 57 |

CAS Acceptance Limits:

35-114

43-116

33-141

10-94

21-100

10-123

NBZ Nitrobenzene-d5 2-Fluorobiphenyl **FBP** Terphenyl-d14 **TPH** Phenol-d6 **PHL** 2-Fluorophenol 2FP 2,4,6-Tribromophenol **TBP**

Outside of acceptance limits because of matrix effects. The sample produced an emulsion during (a) the preparation steps.

Gang R. Myss Approved By: _

QA/QC Report

Client:

Secor

Project:

Fort James / 015.08716

Sample Matrix:

Water

Service Request: J2002890

Date Collected: NA
Date Received: NA
Date Extracted: 8/31/00
Date Analyzed: 9/6/00

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Base Neutral/ Acid Semivolatile Organic Compounds
EPA Methods 3510/8270
Units: µg/L (ppb)

Percent Recovery

| | | | | | | | CAS | Relative |
|----------------------------|-------|---------|-------|--------|-----|------|------------|------------|
| | Spiko | e Level | Spike | Result | | | Acceptance | Percent |
| Analyte | LCS | DLCS | LCS | DLCS | LCS | DLCS | Limits | Difference |
| Phenol | 100 | 100 | 38 | 32 | 38 | 32 | 16-69 | 17 |
| 2-Chlorophenol | 100 | 100 | 78 | 58 | 78 | 58 | 46-106 | 29 |
| 1,4-Dichlorobenzene | 50 | 50 | 42 | 41 | 84 | 82 | 51-107 | 2 |
| N-Nitroso-di-n-propylamine | 50 | 50 | 47 | 46 | 94 | 92 | 50-130 | 2 |
| 1,2,4-Trichlorobenzene | 50 | 50 | 44 | 41 | 88 | 82 | 54-108 | 7 |
| 4-Chloro-3-methylphenol | 100 | 100 | 88 | 82 | 88 | 82 | 46-119 | 7 |
| Acenaphthene | 50 | 50 | 46 | 43 | 92 | 86 | 53-111 | 7 |
| 4-Nitrophenol | 100 | 100 | 28 | 17 | 28 | 17 | 11-81 | 49 |
| 2,4-Dinitrotoluene | 50 | 50 | 43 | 40 | 86 | 80 | 53-120 | 7 |
| Pentachlorophenol | 100 | 100 | 58 | 35 | 58 | 35 | 22-133 | 49 |
| Pyrene | 50 | 50 | 51 | 49 | 102 | 98 | 56-115 | 4 |

| U | Not detected at or above the MRL. |
|---|-----------------------------------|
| | |

| Approved By: | Craix L. Minns | Date: _ | 9/8/00 | |
|--------------|----------------|---------|--------|--|
| , | | | 1 1 | |

Section 8.0 Revision 5.0 Date: June 15, 2000 Page 4 of 4

| Project/Client Fort Jame | . Cooler R | Figueceipt an | ire 8-1 d Preservati | ion Form , | ን <u>ኤ</u> « ስ <mark>ጃ</mark> ዓስ | | |
|---|---|---|-------------------------|--------------|----------------------------------|--|-----------|
| Project/Client Fort Jame | S/SECOR | - | Service Re | quest Number | XXXX 10 | ' | |
| Cooler received on 8/29/00 | by: <u>RJG</u> | _COURIE | er: cas (| PS FEDEX (| CD&L CLIEN | _ | |
| Were custody seals on Were custody papers p Did all bottles arrive in Did any VOA vials con Were Ice or Ice packs Where did the bottles of Temperature of coolers | roperly filled out (i good condition (u ntain significant air present? originate? | nbroken)? | etc.)? | | YE YE YE | SONO SONO SONO SONO SONO SONO SONO SONO | ýr |
| Temperature of cooler Is the temperature with | | | Yes? | Yes? | Yes? | Yes? | Yes? |
| If No, Explain Below | | | No ? | No? | No ? | No? | No? |
| Data/Time Temperaltu | res Taken: 81 | 29100 | <u>ක 100</u> | <u> </u> | | <u> </u> | |
| Date/Time Temperatures Taken: 8/29/80 & 1005 Thermometer ID: Temp Blank Sample Bottle Cooler Temp. IR. Gun | | | | | | | |
| If out of Temperature, Client | | | | | | | |
| Cooler Breakdown: Date: 1. Were all bottle labels ar 2. Did all bottle labels ar 3. Were correct containe 4. Air samples: Explain any discrepancies: | complete (i.e. analy nd tags agree with our ers used for the test: | ysis, preser custody par s indicated? | Canisters Pres | or like Hun | | into var | A Vical S |
| | | YES | NO | Sample I.D. | Reagent | | ol. Added |
| рН | Reagent | | | | | | |
| 12 | N-OIT | | 1 . | | 1 | I . | |
| II | NaOH | | | | | | |
| 2 | HNO ₃ | | | | | | |
| | | | | | | | |
| 2 | HNO ₃ | | | | | | |
| 2 2 | HNO ₁ H ₂ SO ₄ P/PCBs (608 only) | | | | | | |
| 2 2 5-9* | HNO ₃ H ₂ SO ₄ P/PCBs (608 only) NO = Sar | nples were | preserved at la | b as listed | PC OK to ad | just pH | |
| 2 2 5-9* YES = All samples OK *If pH adjustment is required, to VOC \$ (Test) Following the control of the con | HNO ₃ H ₂ SO ₄ P/PCBs (608 only) NO = Sar | { ₂ SO₄ | preserved at la | b as listed | PC OK to ad | just pH | |
| 2 2 5-9* YES = All samples OK *If pH adjustment is required, to VOC \$ (Test) Following the control of the con | HNO ₃ H ₂ SO ₄ P/PCBs (608 only) NO = Sar use NaOH and/or H Vial pH Verification ted after Analysis) llowing Samples | { ₂ SO₄ | preserved at la | b as listed | PC OK to ad | just pH | |
| 2 2 5-9* YES = All samples OK *If pH adjustment is required, to VOC \$ (Test) Following the control of the con | HNO ₃ H ₂ SO ₄ P/PCBs (608 only) NO = Sar use NaOH and/or H Vial pH Verification ted after Analysis) llowing Samples | { ₂ SO₄ | preserved at la | b as listed | PC OK to ad | just pH | |
| 2 2 5-9* YES = All samples OK *If pH adjustment is required, to VOC \$ (Test | HNO ₃ H ₂ SO ₄ P/PCBs (608 only) NO = Sar use NaOH and/or H Vial pH Verification ted after Analysis) llowing Samples | { ₂ SO₄ | preserved at la | b as listed | PC OK to ad | just pH | |

Chain of Custody M

| | | | | | Chain-of Cus | Chain-of Custody Number: | |
|--------------------------------------|------------|------------------|--|--------------------------------------|--|--|--------------------|
| | S | SECOR | Chain-of Custody Record | ustody Re | cord | | |
| Field Office: SECOR | | | | Additional of | documents are attach | Additional documents are attached, and are a part of this Record | 7 |
| Address: 7730 SUL Mohauk Gt. | <i>G</i> . | | | Job Name: | Fort James | | ; |
| Tuelatio, Organ 97062 | 37062 | | | Location: | Camps Wash | 1 | |
| 503-691-2030 51 | ~ | -7074 | | 1 | , | The state of the s | |
| Project # 015. 08716 Task # | | | | Analysis | Red Ped | | |
| Project Manager Joe Hunt | | | | | 6729 17-17-18 18-18-18-18-18-18-18-18-18-18-18-18-18-1 | | |
| 9 | | PH-G 8020 | S) atiles | (S | 111 + 100 100 | | eneni |
| | | a- | edite S/M Nols | \$80 \$\ | 1019 104 | | etn |
| Sampler's Name 0. Edulory CATA | ech | HGT | olok Congai Coc Coc Coc Coc Coc Coc Coc Coc Coc Coc | o (GC | 0,1 | | oO h |
| Sampler's Signature 19, 19 Calum (G | | | natic /802() elth /824() ene /804() fov-ir | 8270 iolde 8080 i Lea | ow a | | o 1 0 0 |
| Sample ID Date Time | le Matrix | 1 9T | Aroi (\$08) (\$28) (\$28) (\$01) (\$08) | \258 \269 \808 \810 \Z42 | 41 | Comments/ | լաոլ |
| 5151 00/548 005590 - 1MW | | | | | ۷. | Instructions | y - |
| TEL 1082500 137 | 7 | | | | × | | Ψ. |
| MW3-082500 | 1 a | | | | - - | | ٦- |
| | | | | | - | | |
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| | | | | | | | |
| | | | | | | | |
| Special Instructions/Comments: | | Relinquished by: | by: DEC. | Received by: € | Res Agand | Sample Receipt | |
| Std 086 | | | an Call | Sign Raz | Jumes | Total no. of containers: | ~ |
| 0000 | | ٦. | design (a floor | | A GENE RAL | Chain of custody seals: | |
| twat | | Company > | SECON SCHOOL | Company_C | <u>ب</u> ا | Rec'd in good condition/cold: | \setminus |
| | |)) | Dale | - IIIIe 108 | Date 3/49 ps | . Conforms to record: | |
| | | Relinquished by: | .yc: | Received by: | | Olient: | |
| | | Print | | - Sign | | | |
| | | Company | | Company | | Oleni Contact: | |
| 777777 | | | Date | _ Time | Date | Client Phone: | 1 |
| SECOR CURTREC Rev. 2/99 | | | | | | | 7 |

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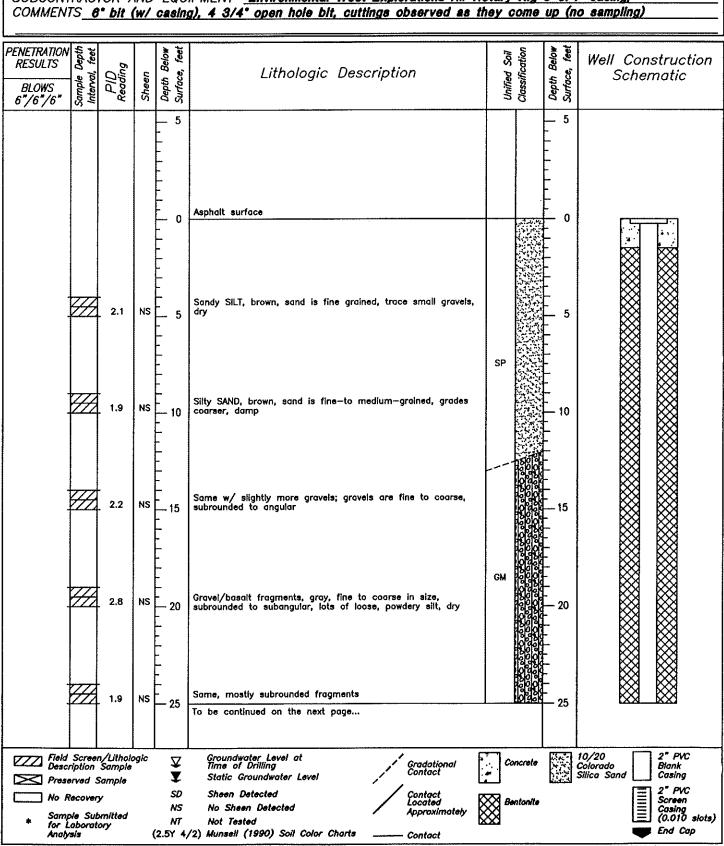
Date:

APPENDIX C MONITORING WELL CONSTRUCTION LOGS

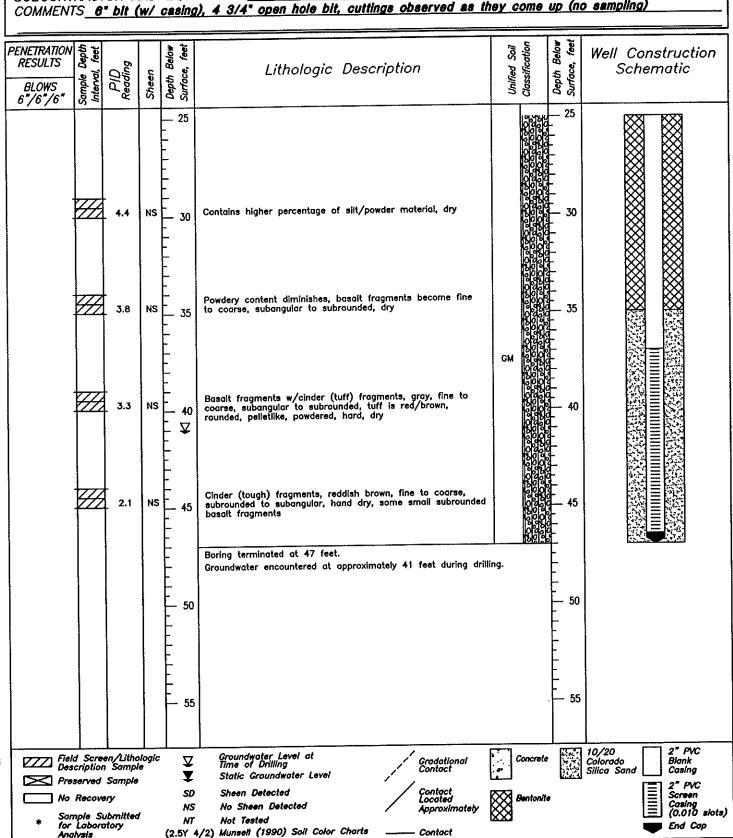
2000 Site Investigation Report Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington SECOR PN: 015.08860.002 January 17, 2001



| FACILITY FORT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08716.008</u> BORING/WELL W-1 |
|---|---|
| LOCATION CAMAS. WASHINGTON | SURFACE ELEVATIONNA |
| START <u>1252 08/22/00</u> FINISH <u>1700 08/22/00</u> | CASING TOP ELEVATION NA |
| LOGGED BY DEC MONITORING DEVICE | Mini RAE 2000 w/ 100 ppm isobutylene |
| SUBCONTRACTOR AND EQUIPMENT Environmental West | Explorations Air Rotary Rig 5 3/4" casing, |
| COMMENTS 6° bit (w/ casing), 4 3/4° open hole bit, cutt | ings observed as they come up (no sampling) |
| | |

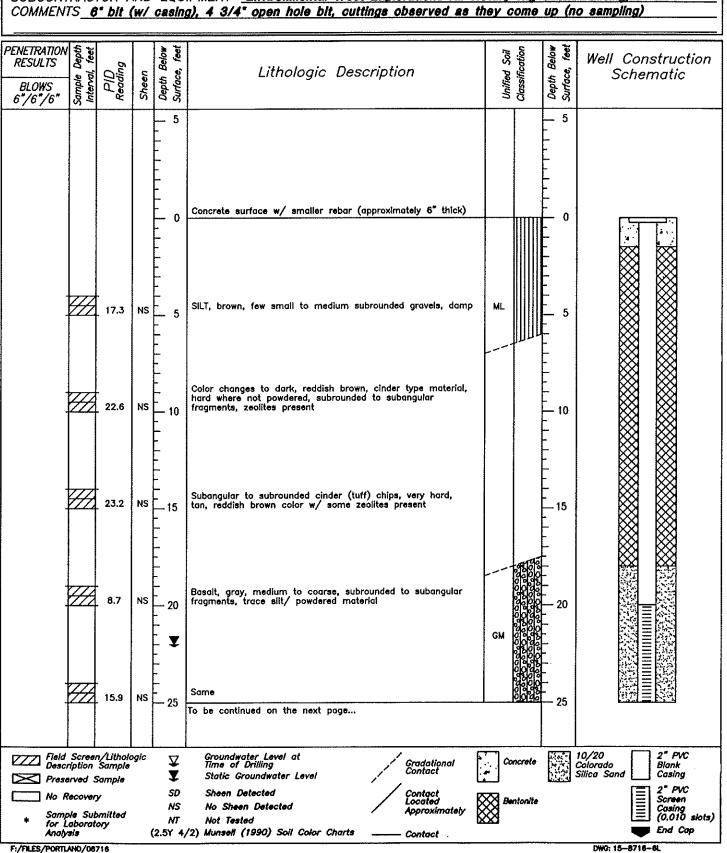


| FACILITY FORT JAMES SPECIALTY CHEMICAL | JOB #BORING/WELL_ W-1 | | | |
|--|--------------------------------------|--|--|--|
| LOCATION CAMAS. WASHINGTON | " SURFACE ELEVATION NA | | | |
| START 1252 08/22/00 FINISH 1700 08/22/00 | | | | |
| LOGGED BY DEC MONITORING DEVICE_ | Mini RAE 2000 w/ 100 ppm isobutylene | | | |
| SUBCONTRACTOR AND EQUIPMENT Environmental West Explorations Air Rotary Rig 5 3/4° casing. | | | | |
| COMMENTS 6" bit (w/ casing), 4 3/4" open hole bit, cuttings observed as they come up (no sampling) | | | | |

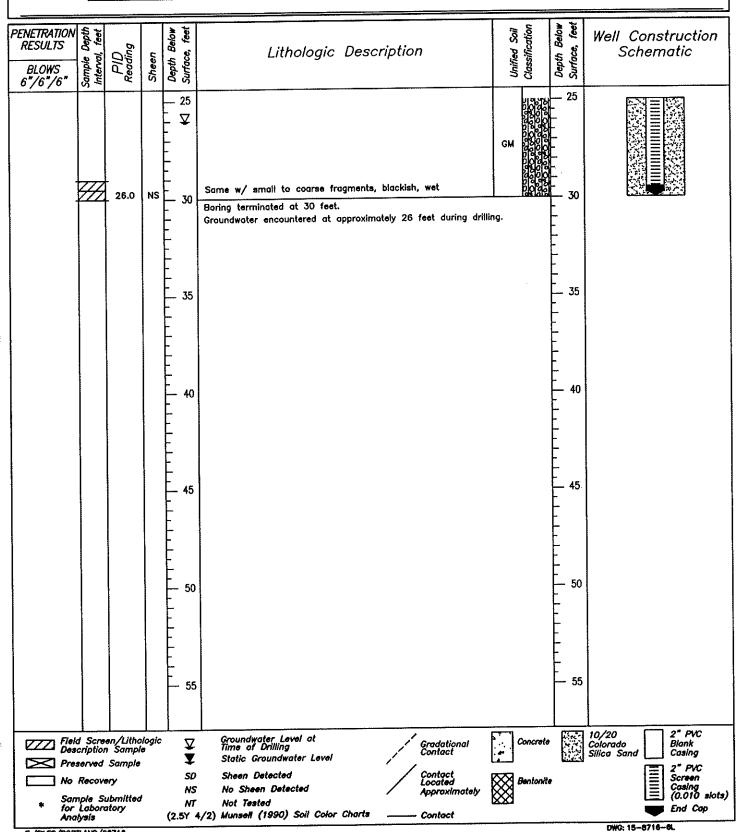




| FACILITY FORT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08718.006</u> BORING/WELL <u>W-2</u> | | | |
|--|---|--|--|--|
| LOCATION CAMAS, WASHINGTON | SURFACE ELEVATION NA | | | |
| START <u>0900 08/22/00</u> FINISH <u>1145 08/22/00</u> | CASING TOP ELEVATION NA | | | |
| LOGGED BY _DEC MONITORING DEVICE_ | Mini RAE 2000 w/ 100 ppm isobutylene | | | |
| SUBCONTRACTOR AND EQUIPMENT Environmental West Explorations Air Rotary Rig 5 3/4° casing, | | | | |
| COMMENTS 6" bit (w/ casing), 4 3/4" open hole bit, cuttings observed as they come up (no sampling) | | | | |



| FACILITY FORT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08716.008</u> BORING/WELL <u>W-2</u> | | | |
|--|--|--|--|--|
| LOCATION CAMAS, WASHINGTON | "SURFACE ELEVATION NA | | | |
| START 0900 08/22/00 FINISH 1145 08/22/00 | CASING TOP ELEVATION NA | | | |
| LOGGED BY DEC MONITORING DEVICE | Mini RAE 2000 w/ 100 ppm isobutylene | | | |
| SUBCONTRACTOR AND EQUIPMENT Environmental West Explorations Air Rotary Rig 5 3/4" casing. | | | | |
| COMMENTS 6" bit (w/ casing), 4 3/4" open hole bit, cuttings observed as they come up (no sampling) | | | | |





| 015 | | | PAGE 1 OF 2 | | |
|--|---|---|--|--|--|
| FACILITY FORT JAMES SPECIALTY CHEMICAL JOB # 015.08718.008 BORING/WELL W-3 | | | | | |
| LOCATION CAMAS, WASHINGTON SURFACE ELEVATION NA START 0845 08/23/00 FINISH 1215 08/25/00 CASING TOP ELEVATION NA | | | | | |
| LOGGED BY DEC | MONITORING DEVICE MINI | | | | |
| | QUIPMENT Environmental West Expl | | | | |
| COMMENTS 6" bit (w/ c | sing), 4 3/4" open hole bit, cuttings o | bserved as they come | up (no sampling) | | |
| | | | | | |
| PENETRATION to to to to to to to to to to to to to | foet | ion | Well Construction | | |
| PENETRATION To be like to be like | | on g | | | |
| BLOWS Brown for Sheen Sh | र्षु Lithologic Descripti | Unified Sail | Schematic Schematic | | |
| 6"/6"/6" 3 5 8 8 8 | | | | | |
| | 5 | | <u> </u> | | |
| | | | - - | | |
| | | | | | |
| | | | F | | |
| | Aspholt surface | | F . | | |
| - | 0 | Y de jo | | | |
| | | 5000 a | | | |
| | | 1000 a | | | |
| | | 0 0 0 0 | F 🔉 🕅 | | |
| 1.1 NS | Clayey SILT w/ gravel, brown, gravels are sr | nall, subrounded, | F.I 🟻 🖼 | | |
| | 5 moist, soft | (000 a | | | |
| | | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | | |
| | | GW 1990 | | | |
| | | 500 a | | | |
| | Same, graels are very small | | | | |
| 1.1 NS | 10 Same, grades are very small |) | F¹º│ | | |
| | | | | | |
| | | Ploab | | | |
| | | | | | |
| 10 15 | Sandy SiLT, brown, sand is very fine grained | , moist, soft, | | | |
| 7/7/ 1.0 NS | trace small subrounded gravels (Lens of black medium grained, well sorted | eand 16-17' has) | — 15 — 20 | | |
| | (Lana of Didok Mediam Granica, was sorted | Sund 10 17 Bgs/ SM | | | |
| | 4 | | | | |
| | | ### | | | |
| 1.4 NS | SILT, brown, some small subrounded gravels, | soft, moist | | | |
| l | 20 | | | | |
| | _ | ML | | | |
| | ¥ | | | | |
| | | | | | |
| 4.3 NS | Basalt fragments, gray, subrounded to subar to coarse pieces, some powdered material (| ngular, small GM brasion silt), dry Solo a | | | |
| 4.3 NS | To be continued on the next page | | 25 | | |
| | | | | | |
| Field Some / Wholesis | | / [*] | [] [] 2" PVC [] 2" PVC | | |
| ZZZ Field Screen/Lithologic Description Sample | Groundwater Level at Time of Drilling Static Groundwater Level | Gradational Concrete | Colorado Blank Silica Sand Casing | | |
| Preserved Sample | SD Sheen Detected | Contact occ | GET 2" DVC | | |
| No Recovery Sample Submitted | NS No Sheen Detected | Contact Located Approximately Bentonite | Zervo Screen Casing (0.010 slots) | | |
| # for Laborators | NT Not Tested | EXX. | (V.V.V 3/013) | | |

Contact

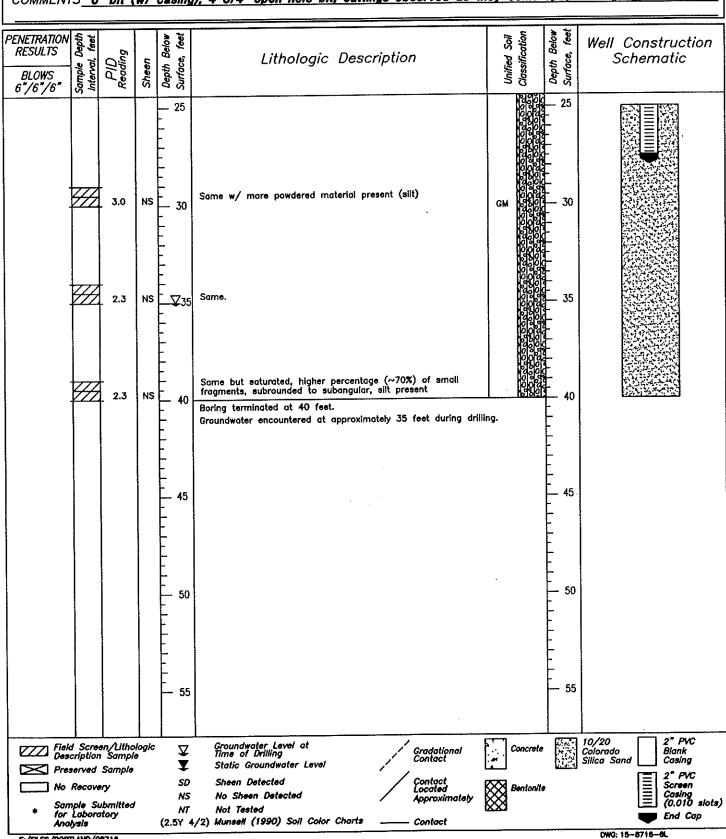
Sample Submitted for Laboratory Analysis

NT Not Tested (2.5Y 4/2) Munsell (1990) Soil Color Charts

End Cop

F:/FILES/PORTLAND/08716

| FACILITY FORT JAMES SPECIALTY CHEMICAL | JOB # <u>015.08716.006</u> BORING/WELL <u>W-3</u> |
|---|---|
| LOCATION CAMAS. WASHINGTON | SURFACE ELEVATION NA |
| START 0845 08/23/00 FINISH 1215 08/25/00 | CASING TOP ELEVATION NA |
| | Mini RAE 2000 w/ 100 ppm isobutylene |
| SUBCONTRACTOR AND EQUIPMENT Environmental West | Explorations Air Rotary Rig 5 3/4" casing, |
| COMMENTS 6" bit (w/ casing), 4 3/4" open hole bit, cutt | ings observed as they come up (no sampling) |





| 015 | .,,,, | | | | | | | PAGE 1 OF 1 |
|------------------------|---------------|------------------|------------|--|---|--------------------------------|----------------------|--------------------------------------|
| LOCATION | CA | MAS. | W | 1 <i>SHIN</i> | | ACE ELEV | <i>ΙΑΤΙΟ</i> Λ | <u> </u> |
| START _ | | | /00 | | | IG TOP E | | |
| LOGGED | | | | | MONITORING DEVICE OVM 580B w/ 100 | | | |
| | | | | | IPMENT Environmental West Air Rotary Rig w/ | | | ie bit |
| COMMEN | 15 | B. DIE | W/ | Casin | g 0-10' bgs) lithology described from cuttings - i | no sampii | ng | |
| | T | | | 1 | | T | | |
| PENETRATION RESULTS | Depth feet | _ | İ | Below e, feet | | Soil | Below , feet | Well Construction |
| | g 6 | Oilg Ging | E | 4 20 | Lithologic Description | Unified Soil Classification | r B | Schematic |
| BLOWS 6"/6"/6" | Sample I | PID Reading | Sheen | Depth B Surface, | | Class | Depth B. Surface, | |
| 0/0/0 | S | | ļ <u>.</u> | ļ | | - | 5 | |
| | | | | 5 | | | E 3 | |
| | | | | E | | | E | |
| | | | | F | | | _ | |
| | | | | E | Asphalt surface | | <u>-</u> | |
| | | | | □ 0 | | | F 0 | |
| | | | | E | | | E | |
| | | | | <u> </u> | | | - | |
| | ZZ | 3.8 | NS | Ē | SILT, brown; trace small gravel; moist | MfL | F | |
| | 722 | - 0.0 | " | 5 | Sizi, Biolin, waso dinan grately motor | | _ 5 - | |
| | | | | Ē | | | | |
| | | | | L | | | <u> </u> | |
| | 22 | 2.6 | NS | - | GRAVEL w/silt, gray; gravels are fine to coarse, mostly | | | |
| | 777 | 2.0 | NS | F- 10 | subrounded; damp | | <u> </u> | <u> </u> |
| | | | | F | | | - | |
| | | | | E | | 1000 | E | |
| | 777 | | | <u> </u> | _ | 1000 | - | |
| | 777 | 2.1 | NS | <u>- V1</u> 5 | GRAVEL/fragments, gray; fine to coarse, mostly subrounded; trace silt; damp | 1860 | 15 | |
| | | | | - | , | GM 1868 | - | |
| | | | | E | | 800 | E | |
| | | _ | | Ε | | 200 | <u> </u> | |
| | 777 | 0.0 | NS | <u> </u> | Same as above, but wet | | <u>-</u> 20 | |
| | | | | F | · | | - | 1878 J == 1888 |
| | | | | E | | 1800 | Εl | |
| | ,,, | | | Ē | | | <u> </u> | |
| | 722 | 0.0 | NS | <u>-</u> 25 | Same as above, wet | l legel | 25 | |
| | | | | F. | Boring terminated at 25 feet. Groundwater encountered at approximately 15 feet during drillir | ng. | | |
| | | | | F | | | E | |
| 1 | | | | E | | | E ! | |
| | | | | 30 | | | 30 | |
| | | | | F | | | F I | |
| | | | | <u> </u> | | | - | |
| | | | | Ė | | | E l | ' |
| | | | | 35 | | | 35 | • |
| | | | | | | | | |
| | | | | | | | | |
| ZZZ Field | Screen | n/Lithol | ogic | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | Groundwater Level at Gradational | Concrete | N.S. | 10/20 2" PVC |
| Desc | • | Sample Sample | | ¥ | | Concrete | | Colorado Blank Silica Sand Casing |

Contact Localed

- Contact

Approximately

Sample Submitted for Laboratory Analysis

No Recovery

SD

NS '

NT

Sheen Detected

Not Tested

No Sheen Detected

(2.5Y 4/2) Munsell (1990) Soil Color Charts

2" PVC Screen Casing (0.010 slots)

End Cap

F:/FILES/PORTLAND/FORT JAMES

DWG: 15-8860-003L

| 015 | | | | PAGE TOFT |
|----------------------------------|---|--|----------------------------|-----------------------------------|
| FACILITY FORT JAME | S SPECIALTY CHEMICAL | JOB # <u>015.08860.</u> | 003 BOR | ING/WELL W-5 |
| LOCATION CAMAS. W. | ASHINGTON | SURFACE EL | EVATION | |
| LOGGED BY DEC | FINISH <u>1120 11/09/00</u> MONITORING DEVICE | OVM 580B w/ 100 ppm I | | |
| SUBCONTRACTOR AND | FOUIPMENT Environmental West | Air Rotary Rig w/ 4 1/2" | open hole b | lt |
| COMMENTS (8" bit w/ | casing 0-10' bgs) lithology describ | ed from cuttings - no sen | pling | • |
| | | | . - | |
| PENETRATION S to RESULTS | feet | cription solution solution | Below feet | ell_Construction |
| Sheen Sheen Sheen | Depth Below Lithologic Descriptions Lithologic Description | cription g | Depth B Surface, | Schematic |
| Symple Somple Symple Sheen Sheen | Dep Surf | \$ 5 | 8.98 | |
| | _ 5 | | _ 5 | |
| | | | E | |
| | E | i i | E I | |
| | - Asphalt surface | and the state of t | F . | |
| | - 0 Asphalt surface | | mt °l | |
| | | | | |
| | | | | |
| 4.1 NS | SILT, reddish brown; trace very fine- | | <u> </u> 5 | $\bowtie \bowtie$ |
| | <u> </u> | ML | | \bowtie |
| | E | | | $\bowtie \bowtie$ |
| | GRAVEL and SILT, reddish brown; fine | to medium gravels. | | $\bowtie \bowtie$ |
| 4.6 NS | = 10 subangular to subrounded; trace coar | se gravel; dry GM | 10 | |
| | (color changes to gray at 12' bgs) | Ĺ ∦ | | |
| | <u>-</u> | | | |
| 4.3 NS | SILT /powder material, gray; dry (some material is comprised of small | | 15 | |
| | (some material is comprised of small can be broken by hand) | I chips — fragments that ML | | |
| | E | | | |
| | E | | | 國圖園 |
| 4.1 NS | Same w/trace medium to large grav | els | 20 | |
| | E | | | 85.09 ± 1500 |
| | E | | | |
| 0.0 NS | Basalt fragments, black; wet | GM | 800 — 300 — 300 — 25 | |
| | E 25 Busult Hughlolits, Statist | \ \frac{\sqrt{\sqrt{\pi}}}{\sqrt{\pi}} | | |
| | E | | | |
| | F | | | |
| 0.0 NS | | | 30 | |
| | Boring terminated at 30 feet. Groundwater encountered at approxim | nately 20 feet during drilling. | Εl | |
| | E | | E | |
| | <u> </u> | | F , | |
| | - 35 | | - 35 | |
| | | | | |
| Fleid Screen/Lithologic | Groundwater Level at | /a F77a. | 10/ | 20 2" PVC |
| Description Sample | Groundwater Level at Time of Drilling Static Groundwater Level | Gradational Contact Contact | Colo | rado Blank a Sand Casing |
| Preserved Sample No Recovery | SD Sheen Detected | Contact Ber | etonite | 2" PVC Screen |
| Sample Submitted | NS No Sheen Detected | Approximately W | I WALE | Screen Casing (0.010 slots) |
| * for Laboratory Analysis | NT Not Tested (2.5Y 4/2) Munsell (1990) Soil Color Charts | Contact | | End Cap |

APPENDIX D LABORATORY ANALYTICAL REPORT AUGUST 2000 GROUNDWATER MONITORING

2000 Site Investigation Report Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington SECOR PN: 015.08860.002 January 17, 2001



Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223 425.420.9200 fax 425.420.9210 ipokane East 11115 Montgomery, Suite B, Spokene, WA 99206-4776 509.924.9200 fax 509.924.9290

Spokane

9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|-----------|---------------|--------|----------------|----------------|
| MWI | P008562-01 | Water | 08/25/00 13:15 | 08/29/00 11:30 |
| MW2 | P008562-02 | Water | 08/25/00 12:37 | 08/29/00 11:30 |
| MW3 | P008562-03 | Water | 08/25/00 14:00 | 08/29/00 11:30 |

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North Creek Analytical, Inc. **Environmental Laboratory Network** Page 1 of 32



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Spokane

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2COL

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Hydrocarbon Identification per NW-TPH Methodology

North Creek Analytical - Portland

| | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-------------|------------------------------|--------|--------------------|-------|----------|----------------|-----------|--------------|---------|-------|
| | MW1 (P008562-01) Water | | | | | Sampled: 08/25 | /00 Rece | ived: 08/29/ | 00 | |
| | Gasoline Range Hydrocarbons | ND | 0.250 | mg/l | 1 | NWTPH HCID | 09/01/00 | 09/05/00 | 0090013 | |
| | Diesel Range Hydrocarbons | ND | 0.630 | u | Ħ | н | tt | * | Ħ | |
| | Heavy Oil Range Hydrocarbons | ND | 0.630 | 11 | н | Ħ | H | Ħ | Ħ | |
| | Surr: 1-Chlorooctadecane | 102 % | 50-150 | | | | | | | |
| *********** | MW2 (P008562-02) Water | | | | | Sampled: 08/25 | 7/00 Rece | ived: 08/29/ | 00 | |
| 1 | Gasoline Range Hydrocarbons | DET | 0.250 | mg/l | i | NWTPH HCID | 09/01/00 | 09/05/00 | 0090013 | D-15 |
| | Diesel Range Hydrocarbons | ND | 0.630 | Ħ | 11 | tt | " | ** | н | |
| į | Heavy Oil Range Hydrocarbons | ND | 0.630 | н | | n . | # | # | H | |
| | Surr: 1-Chlorooctadecane | 100 % | 50-150 | | | | | | | |
| | MW3 (P008562-03) Water | | | | | Sampled: 08/25 | 5/00 Rece | ived: 08/29/ | 00 | |
| | Gasoline Range Hydrocarbons | ND | 0.250 | mg/l | 1 | NWTPH HCID | 09/01/00 | 09/05/00 | 0090013 | |
| Ì | el Range Hydrocarbons | ND | 0.630 | 11 | ** | tt | " | ** | U | |
| | vy Oil Range Hydrocarbons | ND | 0.630 | Ħ | n | ;1 | | | et . | |
| | Surr: 1-Chlorooctadecane | 99.6 % | 50-150 | | | | | | | |

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Gasoline Hydrocarbons per NW TPH-Gx Method

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-------|----------|---------------|-----------|--------------|---------|-------|
| MW2 (P008562-02RE1) Water | | | | 1 | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Gasoline Range Hydrocarbons | 732 | 80.0 | ug/l | 1 | NW TPH-Gx | 09/08/00 | 09/08/00 | 0090138 | , |
| Surr: 4-BFB | 107 % | 50-150 | | | | | | | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network** Page 3 of 32



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541,383,9310 fax 541,382,7588

Jor P.O. Box 1508

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Polychlorinated Biphenyls per EPA Method 8082

North Creek Analytical - Portland

| | | Reporting | | | | Dans J | Analogad | Batch | Notes |
|------------------------------------|--------|----------------|-------|----------|----------------|------------|--------------|----------|-------|
| Analyte | Result | Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| MW1 (P008562-01) Water | | | | 5 | Sampled: 08/2: | 5/00 Recei | ved: 08/29/0 | 00 | |
| Aroclor 1016 | ND | 0.500 | ug/l | 1 | EPA 8082 | 08/31/00 | 09/14/00 | 0080774 | |
| Aroclor 1221 | ND | 1.00 | н | Ħ | H | н | н | н | |
| Aroclor 1232 | ND | 0.500 | * | Ħ | Ħ | Ħ | Ħ | # | |
| Aroclor 1242 | ND | 0.500 | Ħ | ** | H | tr | ** | ** | |
| Aroclor 1248 | ND | 0.500 | Ħ | Ħ | # | н | н | Ħ | |
| Aroclor 1254 | ND | 0.500 | Ħ | н | # | н . | Ħ | H | |
| Aroclor 1260 | ND | 0.500 | 11 | Ħ | # | | | <u> </u> | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 70.0 % | 44-119 | | | | | | | _ |
| Surr: Decachlorobiphenyl | 21.0 % | <i>54-12</i> 8 | | | | | | | S-0 |
| P. 573 (D.0.0.5 (A.0.0.) 13/-4 | | | | • | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| MW2 (P008562-02) Water | 2772 | 0.500 | ug/l | 1 | EPA 8082 | 08/31/00 | 09/14/00 | 0080774 | |
| Aroclor 1016 | ND | 1.00 | nR\1 | 1 H | DIA 0002 | 11 | 11 | " | |
| Aroclor 1221 | ND | | 19 | 11 | Ħ | и | ** | ** | |
| Aroclor 1232 | ND | 0.500 | n | Ħ | " | te. | 13 | 11 | |
| clor 1242 | ND | 0.500 | # | п | u | " | 11 | н | |
| . clor 1248 | ND | 0.500 | ,, | | н | Ħ | н | н | |
| Aroclor 1254 | ND | 0.500 | ** | | Ħ | н | 11 | n | |
| Aroclor 1260 | ND | 0.500 | | | | | | | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 78.2 % | 44-119 | | | | | | | S- |
| Surr: Decachlorobiphenyl | 49.3 % | 54-128 | | | | | | | 2- |
| MW3 (P008562-03) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Aroclor 1016 | ND | 0.500 | ug/l | 1 | EPA 8082 | 08/31/00 | 09/14/00 | 0080774 | |
| Aroclor 1221 | ND | 1.00 | 11 | ** | Ħ | # | n | н | |
| Aroclor 1232 | ND | 0.500 | ŧŧ | Ħ | ** | ŧŧ | ** | n | |
| Aroclor 1242 | ND | 0.500 | ** | Ħ | n | н | н | н | |
| Aroclor 1248 | ND | 0.500 | н | * | Ħ | Ħ | . 11 | N | |
| Aroclor 1254 | ND | 0.500 | H | н | ** | Ħ | ** | 11 | |
| Aroclor 1260 | ND | 0.500 | ** | R | Ħ | 11 | Ħ | II | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 76.0 % | 44-119 | | | | | | • | |
| Surr: Decachlorobiphenyl | 25.6 % | 54-128 | | | | | | | S- |

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-------|----------|---------------|------------|--------------|---------|-------|
| MW1 (P008562-01) Water | | | | 5 | Sampled: 08/2 | 5/00 Recei | ved: 08/29/0 | 00 | |
| Acetone | ND | 10.0 | ug/l | 1 | EPA 8260B | 09/08/00 | 09/08/00 | 0090152 | |
| Benzene | ND | 1.00 | 11 | ŧŧ | ** | u | н | н | |
| Bromobenzene | ND | 1.00 | ** | Ħ | * | н | Ħ | 11 | |
| Bromochloromethane | ND | 1.00 | ** | н | # | H | ** | ŧŧ | |
| Bromodichloromethane | ND | 1.00 | H | n | Ħ | ŧı | 11 | Ħ | |
| Bromoform | ND | 1.00 | н | # | Ħ | н . | Ħ | Ħ | |
| Bromomethane | ND | 5.00 | 11 | u | н | Ħ | ** | н | |
| 2-Butanone | ND | 10.0 | 11 | tt | 16 | n | H | H | |
| n-Butylbenzene | ND | 5.00 | 11 | н | 11 | u | н | н | |
| sec-Butylbenzene | ND | 1.00 | u | н | ** | ** | n | 11 | |
| tert-Butylbenzene | ND | 1.00 | ** | н | tf | tr | U | ** | |
| Carbon disulfide | ND | 10.0 | ** | 14 | ŧŧ | rr . | и | 11 | |
| Carbon tetrachloride | ND | 1.00 | H. | 44 | Ħ | n | # | et . | |
| Chlorobenzene | 11.1 | 1.00 | 11 | ţs | II | н | e | u | |
| Chloroethane | ND | 1.00 | 11 | tt | II | 10 | ** | ti | |
| Chloroform | ND | 1.00 | # | н | 11 | tt | н | n | 2 |
| Chloromethane | ND | 5.00 | 11 | Ш | u | n | н | н | į, |
| 2-Chlorotoluene | ND | 1.00 | tr | н | n | н | # | н | |
| 4-Chlorotoluene | ND | 1.00 | н | 11 | н | н | # | н | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | н | 44 | н | н | 11 | Ħ | |
| Dibromochloromethane | ND | 1.00 | н | er | Ħ | 41 | H. | ** | |
| 1,2-Dibromoethane | ND | 1.00 | ** | Ħ | ** | ** | | er . | |
| Dibromomethane | ND | 1.00 | ** | н. | 11 | 6\$ | tt | tt | |
| 1,2-Dichlorobenzene | 76.6 | 1.00 | e | ti | # | tf | н | ti | |
| 1,3-Dichlorobenzene | ND | 1.00 | # | Ħ | et . | tt | 11 | н | |
| 1,4-Dichlorobenzene | 2.51 | 1.00 | FF | " | | н | # | H | |
| Dichlorodifluoromethane | ND | 5.00 | Ħ | Ħ | н | Ħ | 11 | " | |
| 1,1-Dichloroethane | ND | 1.00 | н | ŧŧ | tt. | H | " | 11 | |
| 1,2-Dichloroethane | ND | 1.00 | п | ** | н | 11 | # | 10 | |
| 1,1-Dichloroethene | ND | 1.00 | н | Ħ | н | ** | Ħ | es | |
| cis-1,2-Dichloroethene | 2.39 | 1.00 | #1 | Ef | 11 | II . | н | u | |
| trans-1,2-Dichloroethene | ND | 1.00 | n . | ti | ** | п | н | tt . | |
| 1,2-Dichloropropane | ND | 1.00 | | 11 | ** | н | н | ır | |
| 1,3-Dichloropropane | ND | 1.00 | н | 11 | ri | н | 11 | п | |
| 2,2-Dichloropropane | ND | 1.00 | н | 41 | Ħ | н | ŧŧ | U | |
| 1,1-Dichloropropene | ND | 1.00 | H | er er | н | 11 | ŧŧ | И | |
| cis-1,3-Dichloropropene | ND | 1.00 | 44 | н | 11 | ** | H | If | |
| trans-1,3-Dichloropropene | ND ND | 1.00 | " | u | 41 | Ħ | ŧŧ | 10 | |
| Ethylbenzene | ND ND | 1.00 | | н | ės | tt | ti | N. | |

North Creek Analytical - Portland

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occor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| MW1 (P008562-01) Water Hexachlorobutadiene 2-Hexanone Isopropylbenzene p-Isopropyltoluene 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride Naphthalene | ND ND ND ND ND ND ND ND ND ND ND ND ND N | 2.00 10.0 2.00 2.00 5.00 1.00 5.00 2.00 1.00 | ug/l " " " " | \$ 1 " " " " " " " " " " " " " " " " " " | Sampled: 08/25 EPA 8260B "" | 09/08/00 | 09/08/00 09/08/00 " | 0090152 | |
|--|--|--|----------------------------|--|-----------------------------------|----------------|---------------------------|----------------|--|
| Hexachlorobutadiene 2-Hexanone Isopropylbenzene p-Isopropyltoluene 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride | ND ND ND ND ND ND ND ND | 10.0 2.00 2.00 5.00 1.00 5.00 2.00 | 19 18 19 64 19 | # # # # | 66 52 51 67 | 11 H | # | 11 11 10 | |
| 2-Hexanone Isopropylbenzene p-Isopropyltoluene 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride | ND ND ND ND ND ND ND | 2.00 2.00 5.00 1.00 5.00 2.00 | 65 91 94 66 11 | ដ ត ត | 53 f1 87 58 | 11 11 11 | ส ส | 11 12 | |
| Isopropylbenzene p-Isopropyltoluene 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride | ND ND ND ND ND ND | 2.00 5.00 1.00 5.00 2.00 | #1 #4 #1 | er er 11 | 11 Pt | H H | ** | H | |
| p-Isopropyltoluene 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride | ND ND ND ND ND | 5.00 1.00 5.00 2.00 | # ee 11 | 11 | 11 11 | H H | ** | H | |
| 4-Methyl-2-pentanone Methyl tert-butyl ether Methylene chloride | ND ND ND ND | 1.00 5.00 2.00 | et H | | 11 | n . | - | | |
| Methyl tert-butyl ether Methylene chloride | ND ND ND ND | 5.00 2.00 | н | | | | " | | |
| Methylene chloride | ND ND ND | 2.00 | | н | ** | | | # | |
| • | ND ND | | н | | " | п | н | n | |
| | ND | 1.00 | | # | Ħ | tt | н | et | |
| n-Propylbenzene | | | # | ** | * | ** | 11 | Ħ | |
| Styrene | | 1.00 | 11 | n . | 11 | 11 | | н | |
| 1,1,1,2-Tetrachloroethane | ND | 1.00 | n | н | tl | н | Ħ | Ħ | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | н | ŧŧ | п | u | н | ** | |
| Tetrachloroethene | 23.6 | 1.00 | • | 11 | ** | ŧŧ | Ħ | ** | |
| Toluene | 1.94 | 1.00 | 11 | н | H | . 41 | " | #1 | |
| 1.2.3-Trichlorobenzene | ND | 1.00 | H | ti | tı | n | Ħ | τι | |
| I-Trichlorobenzene | ND | 1.00 | ** | # | H | u | Ħ | н | |
| 1,1,1-Trichloroethane | ND | 1.00 | . 11 | # | " | # | | " | |
| 1,1,2-Trichloroethane | , ND | 1.00 | Ħ | н | Ħ | Ħ | н | Ħ | |
| Trichloroethene | ND | 1.00 | Ħ | Ħ | н | tt . | Ħ | Ħ | |
| Trichlorofluoromethane | ND | 1.00 | ** | Ħ | li. | " | 11 | Ħ | |
| 1,2,3-Trichloropropane | ND | 1.00 | Ħ | 11 | Ħ | 11 | ** | 11 | |
| 1,2,4-Trimethylbenzene | 1.22 | 1.00 | tt | Ħ | 11 | Ħ | Ħ | ŧI | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | " | " | ŧŧ | н | н | Ħ | |
| Vinyl chloride | ND | 1.00 | Ħ | Ħ | șt. | Ħ | * | ** | |
| o-Xylene | 1.10 | 1.00 | Ħ | Ħ | Ħ | н | * | Ħ | |
| m,p-Xylene | ND | 2.00 | н | | M | n | π | " | |
| Surr: 4-BFB | 94.0 % | 75-125 | | | | | | • | |
| Surr: 1,2-DCA-d4 | 104 % | 75-125 | | | | | | | |
| Surr: 1,2-DCA-a4 Surr: Dibromofluoromethane | 101 % | 75-125 | | | | | | | |
| Surr: Toluene-d8 | 97.5 % | 75-125 | | | | | | | |

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Lisa Domenighini, Project Manager

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Project: Fort James Specialty Chemicals Secor

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015,08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-------|----------|---------------|------------|--------------|---------|-------|
| MW2 (P008562-02) Water | | | • | 5 | Sampled: 08/2 | 5/00 Recei | ved: 08/29/6 | 00 | |
| Acetone | ND | 10.0 | ug/l | 1 | EPA 8260B | 09/08/00 | 09/08/00 | 0090152 | |
| Benzene | ND | 1.00 | et . | н | н | H | Ħ | н | |
| Bromobenzene | ND | 1.00 | ** | н | н | u | Ħ | n. | |
| Bromochloromethane | ND | 1.00 | н | н | п | Ħ | Ħ | н | |
| Bromodichloromethane | ND | 1.00 | M | н | Ħ | n | Ħ | H | |
| Bromoform | ND | 1.00 | н | н | H | н , | 11 | н | |
| Bromomethane | ND | 5.00 | н | Ħ | н | H | 11 | н | |
| 2-Butanone | ND | 10.0 | н | н | Ħ | н | 11 | tt | |
| n-Butylbenzene | ND | 5.00 | Ħ | н | 11 | u | į: | н | |
| sec-Butylbenzene | ND | 1.00 | н | 11 | Ħ | II | 14 | н | |
| tert-Butylbenzene | ND | 1.00 | N. | 11 | # | н | 14 | н | |
| Carbon disulfide | ND | 10.0 | Ħ | # | ti | u | 11 | н | |
| Carbon tetrachloride | ND | 1.00 | 19 | # | # | fl fl | 18 | et | |
| Chlorobenzene | ND | 1.00 | н | 11 | 11 | II | ** | н | |
| Chloroethane | ND | 1.00 | 11 | Ħ | 19 | 11 | ## | H | |
| Chloroform | 1.15 | 1.00 | 14 | tt | 41 | 11 | 48 | н | |
| Chloromethane | ND | 5.00 | ti . | tt | 11 | 19 | # | н | Į. |
| 2-Chlorotoluene | ND | 1.00 | # | e | 41 | 11 | ŧŧ | н | |
| 4-Chlorotoluene | ND | 1.00 | 11 | es | ** | 11 | ŧ1 | н | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | . 11 | ŧ | 11 | ** | ŧŧ | н | |
| Dibromochloromethane | ND | 1.00 | н | e | ** | ** | ** | Ħ | |
| 1,2-Dibromoethane | ND | 1.00 | ** | ŧŧ | ** | ** | \$ † | н | |
| Dibromomethane | ND | 1.00 | ш | SF . | ** | 11 | \$F | 11 | |
| 1,2-Dichlorobenzene | ND | 1.00 | u | ŧŧ | tı. | 1t | ŧŧ | Ħ | |
| 1,3-Dichlorobenzene | ND | 1.00 | ** | н | ** | u | ** | Ħ | |
| 1.4-Dichlorobenzene | ND | 1.00 | H | (1 | | " | Ħ | Ħ | |
| Dichlorodifluoromethane | ND | 5.00 | n | н | Ħ | " | Ħ | Ħ | |
| 1,1-Dichloroethane | ND | 1.00 | 11 | tt | ŧŧ | ** | Ħ | n | |
| 1,2-Dichloroethane | ND | 1.00 | | ti | ** | 26 | tt | 11 | |
| 1,1-Dichloroethene | ND | 1.00 | ** | Ħ | er . | ** | tt | H | |
| cis-1,2-Dichloroethene | ND | 1.00 | ŧŧ | ti | ŧŧ | ŧŧ | tř | н | |
| trans-1,2-Dichloroethene | ND | 1.00 | ** | Ħ | tt | tt | tř | н | |
| 1,2-Dichloropropane | ND | 1.00 | tt | Ħ | Ħ | | tt | Ħ | |
| 1,3-Dichloropropane | ND | 1.00 | ur | н | Ħ | B | tt | н | |
| 2,2-Dichloropropane | ND | 1.00 | H | ш | tı | Ħ | Ħ | H | |
| 1,1-Dichloropropene | ND | 1.00 | н | п | Ħ | ** | H | # | |
| cis-1,3-Dichloropropene | ND | 1.00 | н | н | н | tr . | н . | tt | |
| trans-1,3-Dichloropropene | ND | 1.00 | n | н | н | tt | u | 11 | |
| Ethylbenzene | ND | 1.00 | Ħ | н | 11 | H | н | 11 | |

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P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| | Nort | h Creek | Anaiyı | icai - Fo | Tuanu | | | | |
|--|--------|--------------------|--------|-----------|---------------|------------|-------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| MW2 (P008562-02) Water | | | | | Sampled: 08/2 | 5/00 Recei | ved: 08/29/ | 00 | |
| Hexachlorobutadiene | ND | 2.00 | ug/l | 1 | EPA 8260B | 09/08/00 | 09/08/00 | 0090152 | |
| 2-Hexanone | ND | 10.0 | ** | et | π . | H | н | н | |
| Isopropylbenzene | ND | 2.00 | Ħ | Ħ | H | # | n | Ħ | |
| p-Isopropyltoluene | ND | 2.00 | н | # | n | Ħ | н | Ħ | |
| 4-Methyl-2-pentanone | ND | 5.00 | Ħ | # | • | Ħ | Ħ | н | |
| Methyl tert-butyl ether | ND | 1.00 | n | Ħ | • | т. | Ħ | ** | |
| Methylene chloride | ND | 5.00 | н | Ħ | ** | Ħ | tt. | н | |
| Naphthalene | ND | 2.00 | # | 8 | ** | Ħ | n | tr | |
| n-Propylbenzene | ND | 1.00 | н | Ħ | 11 | н | 11 | н | |
| Styrene | ND | 1.00 | н | Ħ | Ħ | н | 11 | ** | |
| 1,1,1,2-Tetrachloroethane | ND | 1.00 | н | Ħ | н | tf | Ħ | Ħ | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | er | н | ** | # | Ħ | Ħ | |
| Tetrachloroethene | 2.32 | 1.00 | 11 | tt | 10 | ** | ** | н | |
| Toluene | ND | 1.00 | 11 | Ħ | н | # | 11 | н | |
| 1.2,3-Trichlorobenzene | ND | 1.00 | н | Ħ | п | н | 11 | er | |
| 1-Trichlorobenzene | ND | 1.00 | n | Ħ | Ħ | Ħ | . 11 | 11 | |
| 1,1,1-Trichloroethane | 2.71 | 1.00 | e e | Ħ | 67 | - 19 | ** | 11 | |
| 1,1,2-Trichloroethane | ND | 1.00 | 17 | Ħ | 1t | 11 | Ħ | и | |
| Trichloroethene | ND | 1.00 | Ħ | Ħ | ŧı | ** | ii | Ħ | |
| Trichlorofluoromethane | ND | 1.00 | н | 11 | ŧŧ | # ' | Ħ | E# | |
| 1,2,3-Trichloropropane | ND | 1.00 | et | Ħ | . " | n | Ħ | tt | |
| 1,2,4-Trimethylbenzene | ND | 1.00 | ** | u | н | n | Ħ | 11 | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | n | u | я | ** | II | 11 | |
| Vinyl chloride | ND | 1.00 | 0 | # | 11 | 11 | 11 | н | |
| o-Xylene | ND | 1.00 | Ħ | . # | N | Ħ | н | Ħ | |
| m,p-Xylene | ND | 2.00 | ŧŧ. | Ħ | н | н | Ħ | ** | |
| Surr: 4-BFB | 108 % | 75-125 | | | | | - | | |
| Surr: 1,2-DCA-d4 | 99.0 % | 75-125 75-125 | | | | | | | |
| Surr: 1,2-DCA-a4 Surr: Dibromofluoromethane | 96.0 % | 75-125 | | | | | | | |
| Surr: Toluene-d8 | 97.0 % | 75-125 | | | | | | | |

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Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|--------|--------------------|-------|----------|---------------|------------|-------------|---------|-------|
| MW3 (P008562-03) Water | | | | | Sampled: 08/2 | 5/00 Recei | ved: 08/29/ | 00 | |
| Acetone | ND | 10.0 | ug/l | 1 | EPA 8260B | 09/08/00 | 09/08/00 | 0090152 | |
| Benzene | ND | 1.00 | " | | # | н | H | н | |
| Bromobenzene | ND | 1.00 | H | et | 11 | H | н | # | |
| Bromochloromethane | ND | 1.00 | H | н | 11 | Ħ | Ħ | н | |
| Bromodichloromethane | ND | 1.00 | M | н | u | #1 | Ħ | н | |
| Bromoform | ND | 1.00 | Ħ | # | # | # . | * | # | |
| Bromomethane | ND | 5.00 | Ħ | Ħ | u | n | Ħ | Ħ | |
| 2-Butanone | ND | 10.0 | н | Ħ | ti | 11 | 11 | 40 | |
| n-Butylbenzene | ND | 5.00 | Ħ | n | tt | 11 | 11 | ** | |
| sec-Butylbenzene | ND | 1.00 | Ħ | н | tt | 19 | 11 | * | |
| tert-Butylbenzene | ND | 1.00 | Ħ | н | tt | 11 | Ħ | ## | |
| Carbon disulfide | ND | 10.0 | н | Ħ | ti | H | 15 | et . | |
| Carbon tetrachloride | ND | 1.00 | ** | 11 | Ħ | ** | " | tt | |
| Chlorobenzene | ND | 1.00 | н | # | ti | ur . | ø | er . | |
| Chloroethane | ND | 1.00 | 41 | 78 | ti. | tr | ** | Ħ | |
| Chloroform | ND | 1.00 | | ** | 11 | H | H . | H | 1 |
| Chloromethane | ND | 5.00 | n | #1 | н | tt . | H | Ħ | * |
| 2-Chlorotoluene | ND | 1.00 | u | 65 | H | H | W | Ħ | |
| 4-Chlorotoluene | ND | 1.00 | Ħ | ŧ | н | Ħ | ti | н | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | | # | Ħ | H | н | н | |
| Dibromochloromethane | ND | 1.00 | 19 | tt | " | н | N | 0 | |
| 1,2-Dibromoethane | ND | 1.00 | ŧr | # | tt | н | н | н | |
| Dibromomethane | ND | 1.00 | H | ŧŧ | Ħ | И | н | н | |
| 1,2-Dichlorobenzene | ND | 1.00 | n | ** | ** | н | H | н | |
| 1,3-Dichlorobenzene | ND | 1.00 | H | Ħ | tt | 11 | ** | H | |
| 1,4-Dichlorobenzene | ND | 1.00 | н | Ħ | Ħ | 19 | Ħ | 11 | |
| Dichlorodifluoromethane | ND | 5.00 | н | H | er | 19 | 27 | n | |
| 1,1-Dichloroethane | ND | 1.00 | н | н | * | 11 | 11 | # | |
| 1,2-Dichloroethane | ND | 1.00 | Œ | н | н | 11 | # | 11 | |
| 1,1-Dichloroethene | ND | 1.00 | H | II | ti | ** | # | ** | |
| cis-1,2-Dichloroethene | ND | 1.00 | n | н | Ħ | # | n | 11 | |
| trans-1,2-Dichloroethene | ND | 1.00 | 11 | łI | H | • | " | 11 | |
| 1,2-Dichloropropane | ND | 1.00 | Ħ | 11 | Ħ | Ħ | et . | tt | |
| 1,3-Dichloropropane | ND | 1.00 | # | n | н | Ħ | " | er | |
| 2,2-Dichloropropane | ND | 1.00 | " | *1 | 11 | н | tr | н | |
| 1,1-Dichloropropene | ND | 1.00 | ** | * | # | н | H | Ħ | |
| cis-1,3-Dichloropropene | ND | 1.00 | tr | " | # | н | H | н | |
| trans-1,3-Dichloropropene | ND | 1.00 | H. | | 11 | u | Ħ | н | |
| Ethylbenzene | ND | 1.00 | Ħ | | ** | N | н | Ħ | |

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corپ

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|---|---------|--------------------|-------|----------|----------------|-----------|--------------|---------|-------|
| MW3 (P008562-03) Water | | | | | Sampled: 08/25 | i/00 Rece | ived: 08/29/ | 00 | |
| Hexachlorobutadiene | ND | 2.00 | ug/l | 1 | EPA 8260B | 09/08/00 | 09/08/00 | 0090152 | |
| 2-Hexanone | ND | 10.0 | н | H | н | # | Ħ | 11 | |
| Isopropylbenzene | ND | 2.00 | н | н | Ħ | Ħ | Ħ | Ħ | |
| p-Isopropyltoluene | ND | 2.00 | ti | Ħ | n | er | # | Ħ | |
| 4-Methyl-2-pentanone | ND | 5.00 | Ħ | Ħ | ** | H | Ħ | Ħ | |
| Methyl tert-butyl ether | ND | 1.00 | es . | et | n | н . | Ħ | н | |
| Methylene chloride | ND | 5.00 | Ħ | Ħ | er | Ħ | Ħ | Ħ | |
| Naphthalene | ND | 2.00 | н | 11 | н | Ħ | ** | ## | |
| n-Propylbenzene | ND | 1.00 | et | II | н | 11 | н | 41 | |
| Styrene | ND | 1.00 | ** | tt | н | Ħ | H | Ħ | |
| 1,1,1,2-Tetrachloroethane | ND | 1.00 | 11 | Ħ | tt | n | Ħ | n | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | н | tt | Ħ | Ħ | Ħ | Ħ | |
| Tetrachloroethene | ND | 1.00 | II . | tt. | 11 | 11 | н | 11 | |
| Toluene | ND | 1.00 | ŧi | 18 | н | н | н | н | |
| 1.2,3-Trichlorobenzene | ND | 1.00 | Ħ | ti | er | tt | 85 | Ħ | |
| I-Trichlorobenzene | ND | 1.00 | н | Ħ | п | \$8 | 11 | et | |
| 1,1,1-Trichloroethane | ND | 1.00 | w | " | 11 | 11 | Ħ | ** | |
| 1,1,2-Trichloroethane | ND | 1.00 | 11 | | Ħ | 11 | н | Ħ | |
| Trichloroethene | 17.5 | 1.00 | H | 11 | tr | Ħ | 18 | ** | |
| Trichlorofluoromethane | ND | 1.00 | 49 | # | " | er | Ħ | W. | |
| 1,2,3-Trichloropropane | ND | 1.00 | ** | n | 11 | 11 | н | n | |
| 1,2,4-Trimethylbenzene | ND | 1.00 | 11 | # | tt | н | r | н | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | н | # | " | ** | . 11 | ŧī | |
| Vinyl chloride | ND | 1.00 | cr | н | 11 | " | 11 | ** | |
| o-Xylene | ND | 1.00 | 11 | ** | н | ** | н | н | |
| m,p-Xylene | ND | 2.00 | O. | 11 | * | н | . 11 | H | |
| Surr: 4-BFB | 108 % | 75-125 | | | | | | | |
| Surr: 1,2-DCA-d4 | 103 % | 75-125 75-125 | | | | | | | |
| Surr: Dibromofluoromethane | 99.0 % | 75-125 | ÷ | | | | | | |
| Surr: Dioromojiuoromeinune Surr: Toluene-d8 | 96.5 % | 75-125 | | | | | | • | |
| Durr. 10tuene-uo | 20.2 70 | , 5 . 20 | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals

Bend

Project Number: 015.08716 P.O. Box 1508 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-------|----------|---------------|-----------|--------------|-----------|-------|
| MW1 (P008562-01) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Acenaphthene | ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Acenaphthylene | ND | 5.00 | 10 | ** | н | II | ч | 87 | |
| Anthracene | ND | 5.00 | *t | 65 | Ħ | н | а | n | |
| Benzo (a) anthracene | ND | 5.00 | ** | Ħ | н | N | н | Ħ | |
| Benzo (a) pyrene | ND | 5.00 | ** | н | Ħ | 11 | н | Ħ | |
| Benzo (b) fluoranthene | ND | 5.00 | | * . | н | n . | н | tr | |
| Benzo (ghi) perylene | ND | 5.00 | Ħ | tt | Ħ | н | ** | er | |
| Benzo (k) fluoranthene | ND | 5.00 | er | tt. | Ħ | И | н | 81 | |
| Benzoic Acid | ND | 50.0 | er | ŧſ | н | u | # | ŧř | |
| Benzyl alcohol | ND | 10.0 | er | tf | 11 | n | ** | et | |
| 4-Bromophenyl phenyl ether | ND | 5.00 | ei | R | 11 | Н | Ħ | ef | |
| Butyl benzyl phthalate | ND | 5.00 | ŧı | Ħ | н | П | 11 | Ħ | |
| 4-Chloro-3-methylphenol | ND | 5.00 | a | н | 11 | II | u | ŧr | |
| 4-Chloroaniline | ND | 20.0 | u | tt | 11 | 11 | 41 | н | |
| Bis(2-chloroethoxy)methane | ND | 10.0 | ш | tt | 11 | #1 | ti | ti | |
| Bis(2-chloroethyl)ether | ND | 5.00 | u | Ø | # | 11 | ıŧ | Ð | |
| Bis(2-chloroisopropyl)ether | ND | 10.0 | ш | tt | Ħ | " | tt | ŧı | |
| 2-Chloronaphthalene | ND | 5.00 | и | н | 11 | 11 | tf | н | |
| 2-Chlorophenol | ND | 5.00 | ш | tt | Ħ | 31 | н | н | |
| 4-Chlorophenyl phenyl ether | ND | 5.00 | н | н | u | " | 16 | ŧŧ | |
| Chrysene | ND | 5.00 | 11 | и | ti. | ti | ** | п | |
| Di-n-butyl phthalate | ND | 5.00 | 11 | Ħ | 11 | a | tt | n | |
| Di-n-octyl phthalate | ND | 5.00 | # | u | ŧ | tt | H | ti | |
| Dibenzo (a,h) anthracene | ND | 5.00 | # | н | tt | tt | tt | п | |
| Dibenzofuran | ND | 5.00 | ** | 11 | et | tF | tt | н | |
| 1,2-Dichlorobenzene | ND | 5.00 | u | Ħ | tt | tt | Ħ | н | |
| 1,3-Dichlorobenzene | ND | 5.00 | 11 | н | te | ur . | tf | н | |
| 1,4-Dichlorobenzene | ND | 5.00 | 47 | # | n | tŧ | Ħ | п | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | 11 | ** | ** | tr | # | н | |
| 2,4-Dichlorophenol | ND | 5.00 | 1t | н | " | :r | Ħ | н | |
| Diethyl phthalate | ND | 5.00 | #1 | Ħ | # | H | IF | n | |
| 2,4-Dimethylphenol | ND | 10.0 | 46 | * | • | н | # | n | |
| Dimethyl phthalate | ND ND | 5.00 | 41 | 11 | tt | н | # | в | |
| 4,6-Dinitro-2-methylphenol | ND ND | 10.0 | 41 | н | | Ħ | Ħ | н | |
| 2,4-Dinitrophenol | ND ND | 25.0 | ** | 11 | tt. | tt | Ħ | н | |
| 2,4-Dinitrophenoi | ND ND | 5.00 | 11 | 10 | Ħ | n | H | н | |
| • | | | ** | # | ti- | н | н | 11 | |
| 2,6-Dinitrotoluene | ND ND | 5.00 | | | ti | И | н | н | |
| Bis(2-ethylhexyl)phthalate | ND | 10.0 | " | | H | " | | 11 | |
| Fluoranthene | ND | 5.00 | •• | - | | | | ** | |

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Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-------|----------|---------------|------------|--------------|---------|-------|
| MW1 (P008562-01) Water | | | | 5 | Sampled: 08/2 | 5/00 Recei | ved: 08/29/0 | 00 | |
| Fluorene | ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Hexachlorobenzene | ND | 5.00 | #1 | Ħ | н | н | Ħ | н | |
| Hexachlorobutadiene | ND | 10.0 | Ħ | н | # | " | Ħ | ĸ | |
| Hexachlorocyclopentadiene | ND | 10.0 | н | Ħ | Ħ | Ħ | 11 | Ħ | |
| Hexachloroethane | ND | 10.0 | 17 | ** | н | Ħ | Ħ | Ħ | |
| Indeno (1,2,3-cd) pyrene | ND | 5.00 | ** | н . | # | н . | tt | Ħ | |
| Isophorone | ND | 5.00 | Ħ | Ħ | 81 | 11 | ** | # | |
| 2-Methylnaphthalene | ND | 5.00 | н | tf | Ħ | н | 11 | " | |
| 2-Methylphenol | ND | 10.0 | tt | ** | Ħ | ti | Ħ | 11 | |
| 3-,4-Methylphenol | ND | 5.00 | 19 | Ħ | Ħ | н | 15 | н | |
| Naphthalene | ND | 5.00 | н | Ħ | u | 11 | " | н | |
| 2-Nitroaniline | ND | 5.00 | ŧī | H | 11 | ti | ti | et | |
| 3-Nitroaniline | ND | 10.0 | ** | 11 | н | ti | H | н | |
| 4-Nitroaniline | ND | 10.0 | ** | Ħ | Ħ | Ħ | El . | н | |
| Nitrobenzene | ND | 5.00 | u | н | Ħ | 10 | 11 | Ħ | |
| /itrophenol | ND | 5.00 | tt | н | 11 | 19 | II | 51 | |
| 4-Nitrophenol | ND | 25.0 | *t | # | н | н | H | 11 | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | Ħ | # | н | u | " | н | |
| N-Nitrosodiphenylamine | ND | 5.00 | H | Ħ | н | ** | 19 | n | |
| Pentachlorophenol | ND | 10.0 | Ħ | * | Ħ | ** | H | ** | |
| Phenanthrene | ND | 5.00 | et | # | # | 11 | u | 19 | |
| Phenol | ND | 5.00 | Ħ | Ħ | Ħ | Ħ | ** | н | |
| Pyrene | ND | 5.00 | ш | tf | н | 11: | н | ** | |
| 1,2,4-Trichlorobenzene | ND | 5.00 | tt | " | Ħ | II | ti | 11 | |
| 2,4,5-Trichlorophenol | ND | 5.00 | . 11 | н | # | н | 11 | 11 | |
| 2,4,6-Trichlorophenol | ND | 5.00 | Ħ | Ħ | ĸ | H | | H | |
| Surr: 2-Fluorobiphenyl | 98.9 % | 26-135 | | | | | | | |
| Surr: 2-Fluorophenol | 59.6 % | 6-124 | | | | | | | |
| Surr: Nitrobenzene-d5 | 101 % | 23-147 | | | | | | • | |
| Surr: Phenol-d6 | 41.2 % | 11-130 | | | | | | | |
| Surr: p-Terphenyl-d14 | 97.7 % | <i>38-149</i> | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 112 % | 19-126 | | | | | | | |

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Project: Fort James Specialty Chemicals

Bend

P.O. Box 1508 Project Number: 015.08716 Tualatin, OR 97062 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-------|----------|---------------|-----------|--------------|---------|-------|
| MW2 (P008562-02) Water | | | | 5 | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Acenaphthene | · ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Acenaphthylene | ND | 5.00 | " | ŧŧ | н | н | н | Ħ | |
| Anthracene | ND | 5.00 | 81 | н | ** | и | Ħ | Ħ | |
| Benzo (a) anthracene | ND | 5.00 | ** | # | | н | 11 | Ħ | |
| Benzo (a) pyrene | ND | 5.00 | B\$ | н | | Ħ | 11 | н | |
| Benzo (b) fluoranthene | ND | 5.00 | Ħ | Ħ | tt | ** | ** | # | |
| Benzo (ghi) perylene | ND | 5.00 | et | " | Ħ | er | n | ** | |
| Benzo (k) fluoranthene | ND | 5.00 | Ħ | 11 | tř | 11 | ŧŧ | ** | |
| Benzoic Acid | ND | 50.0 | ti | 11 | 11 | ** | ** | ** | |
| Benzyl alcohol | ND | 10.0 | ti | ŧ | Ħ | " | 11 | н | |
| 4-Bromophenyl phenyl ether | ND | 5.00 | II | # | н | * | н | u. | |
| Butyl benzyl phthalate | ND | 5.00 | U | ee | н | ŧŧ | H | tt. | |
| 4-Chloro-3-methylphenol | ND | 5.00 | ** | # | 11 | н | н | re | |
| 4-Chloroaniline | ND | 20.0 | " | ŧŧ | 11 | н | н | tt | |
| Bis(2-chloroethoxy)methane | ND | 10.0 | ** | Ħ | 11 | Ш | 11 | н | |
| Bis(2-chloroethyl)ether | ND | 5.00 | tr | Ħ | 11 | н | 11 | н | |
| Bis(2-chloroisopropyl)ether | ND | 10.0 | н | H | a | II | " | e | j |
| 2-Chloronaphthalene | ND | 5.00 | ŧſ | tt | u | и | tt | * | - |
| 2-Chlorophenol | 11.0 | 5.00 | н | U | u | 19 | " | н | |
| 4-Chlorophenyl phenyl ether | ND | 5.00 | u | Н | n | 19 | 11 | ** | |
| Chrysene | ND | 5.00 | H | 11 | tt | n | 11 | 41 | |
| Di-n-butyl phthalate | ND | 5.00 | 4 | " | н | ŧt | 15 | 44 | |
| Di-n-octyl phthalate | ND | 5.00 | 11 | H | Ħ | u | tt | ** | |
| Dibenzo (a,h) anthracene | ND | 5.00 | • | tt | 11 | n | tr | ee | |
| Dibenzofuran | ND | 5.00 | 11 | ,, | 11 | n | Ħ | tt | |
| 1,2-Dichlorobenzene | 74.4 | 5.00 | ** | и | | н | rr | er . | |
| 1,3-Dichlorobenzene | ND | 5.00 | " | ŧŧ | ч | II | н | et . | |
| I,4-Dichlorobenzene | · ND | 5.00 | ** | н | ** | n | ų | n | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | #f | ti | ** | н | н | ** | |
| 2,4-Dichlorophenol | ND | 5.00 | ŧŧ | tt | | 11 | 11 | tt | |
| Diethyl phthalate | ND | 5.00 | ŧŧ | н | tt. | 11 | IJ | tr | |
| 2,4-Dimethylphenol | ND | 10.0 | £f . | 11 | ** | q | lg . | tr | |
| Dimethyl phthalate | ND | 5.00 | Ħ | # | t# | " | 11 | ti | |
| 4,6-Dinitro-2-methylphenol | ND ND | 10.0 | ti | 11 | tř | \$ | " | II | |
| 2,4-Dinitrophenol | ND ND | 25.0 | ti | 11 | н | st | " | н | |
| 2,4-Dinitrotoluene | ND ND | 5.00 | 11 | " | н | tt | ** | п | |
| 2,6-Dinitrotoluene | ND ND | 5.00 | н | ** | н | ti . | n | 11 | |
| | | 10.0 | н | | # | n | tı | 11 | |
| Bis(2-ethylhexyl)phthalate | 10.1 | | | | | н | н | " | |
| Pluoranthene | ND | 5.00 | " | | | •• | •• | ** | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

P.O. Box 1508 Tualatin, OR 97062

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|---|----------|--------------------|-------|-------------|---------------|------------|--------------|---------|------|
| MW2 (P008562-02) Water | | | | | Sampled: 08/2 | 5/00 Rece | ved: 08/29/0 | 00 | |
| Fluorene | ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Hexachlorobenzene | ND | 5.00 | 11 | tl | ** | Ħ | Ħ | Ħ | |
| Hexachlorobutadiene | ND | 10.0 | н | u | ** | tt | # | н | |
| Hexachlorocyclopentadiene | ND | 10.0 | n | 11 | u | ** | Ħ | ** | |
| Hexachloroethane | ND | 10.0 | Ħ | Ħ | Ħ | Ħ | ** | ** | |
| Indeno (1,2,3-cd) pyrene | ND | 5.00 | Ħ | n | н | # . | # | Ħ | |
| Isophorone | ND | 5.00 | n | ıı | 11 | ** | Ħ | н | |
| 2-Methylnaphthalene | ND | 5.00 | ** | 11 | н | 11 | | # | |
| 2-Methylphenol | ND | 10.0 | Ħ | Ħ | " | н | Ħ | Ħ | |
| 3-,4-Methylphenol | ND | 5.00 | Ħ | " | н . | Ħ | H | н | |
| Naphthalene | ND | 5.00 | н | ** | It | " | ** | ŧτ | |
| 2-Nitroaniline | ND | 5.00 | 11 | Ħ | n | 11 | Ħ | ** | |
| 3-Nitroaniline | ND | 10.0 | н | Ħ | ** | II | II | ŧŧ | |
| 4-Nitroaniline | ND | 10.0 | ** | ., | Ħ | H | н | Ħ | |
| Nitrobenzene | ND | 5.00 | ** | # | н | ** | u | н | |
| itrophenol | ND | 5.00 | tt | ŧI | n | 19 | Ħ | 16 | |
| 4-Nitrophenol | ND | 25.0 | ** | tt | 91 | tt | Ħ | Ħ | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | EP. | ** | tf | " | ** | н | |
| <u> </u> | ND | 5.00 | 11 | н | tt | | n | tt | |
| N-Nitrosodiphenylamine Pentachlorophenol | ND | 10.0 | 11 | Ħ | 11 | 11 | ** | Ħ | |
| Phenanthrene | , ND | 5.00 | 19 | | Ħ | н | Ħ | Ħ | |
| | ND | 5.00 | | (1 | н | ti. | * | ** | |
| Phenol | ND ND | 5.00 | Ħ | н | н | 11 | # | 16 | |
| Pyrene | ND ND | 5.00 | н | n | 11 | Ħ | tt | н | |
| 1,2,4-Trichlorobenzene | ND ND | 5.00 | ** | tt . | н | ** | * | Ħ | |
| 2,4,5-Trichlorophenol | ND | 5.00 | tt | н | и . | ** | 11 | ** | |
| 2,4,6-Trichlorophenol | | | | | | | | | |
| Surr: 2-Fluorobiphenyl | 93.2 % | 26-135 | | | | | | | |
| Surr: 2-Fluorophenol | 53.7 % | 6-124 | | | | | | | |
| Surr: Nitrobenzene-d5 | 91.5 % | 23-147 | | | | | | | |
| Surr: Phenol-d6 | 36.6 % | 11-130 | | | | | | | |
| Surr: p-Terphenyl-d14 | 87.1 % | 38-149 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 113 % | 19-126 | | | | | | | |

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541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

Portland

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015,08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|-----------------------------|----------|--------------------|-------|----------|---------------|------------|--------------|---------|-------|
| MW3 (P008562-03) Water | | | | 5 | Sampled: 08/2 | 5/00 Recei | ived: 08/29/ | 00 | |
| Acenaphthene | ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Acenaphthylene | ND | 5.00 | H | și | H | ŧŧ | Ħ | Ħ | |
| Anthracene | ND | 5.00 | | Ħ | Ħ | n | н | Ħ | |
| Benzo (a) anthracene | ND | 5.00 | H | н | н | n | 4 | et | |
| Benzo (a) pyrene | ND | 5.00 | н | Ħ | Ħ | Ħ | H | tr | |
| Benzo (b) fluoranthene | ND | 5.00 | Ħ | н | Ħ | Ħ. | н | н | |
| Benzo (ghi) perylene | ND | 5.00 | 11 | # | Ħ | tt | ** | н | |
| Benzo (k) fluoranthene | ND | 5.00 | н | 44 | 11 | 11 | ŧŧ | н | |
| Benzoic Acid | ND | 50.0 | n | 1¢ | 11 | II | ıı | н | |
| Benzyl alcohol | ND | 10.0 | Ħ | 11 | н | 11 | Ħ | н | |
| 4-Bromophenyl phenyl ether | ND | 5.00 | 10 | 44 | 11 | 11 | tt | н | |
| Butyl benzyl phthalate | ND | 5.00 | ** | ** | ** | " | Ħ | 11 | |
| 4-Chloro-3-methylphenol | ND | 5.00 | H. | ŧs | 11 | 11 | ŧi | 11 | |
| 4-Chloroaniline | ND | 20.0 | tf | tt | ** | ;1 | tt | 11 | |
| Bis(2-chloroethoxy)methane | ND | 10.0 | H | ** | u | н | п | et . | |
| Bis(2-chloroethyl)ether | ND | 5.00 | н | Ħ | tr | u | u | tf | |
| Bis(2-chloroisopropyl)ether | ND | 10.0 | н | Ħ | tř | u | 11 | н | Ĺ |
| 2-Chloronaphthalene | ND | 5.00 | u | Ħ | 11 | н | н | er | |
| 2-Chlorophenol | ND | 5.00 | н | н | Ħ | tt | 14 | et . | |
| 4-Chlorophenyl phenyl ether | ND | 5.00 | Ħ | н | n | н | 11 | ti | |
| Chrysene | ND | 5.00 | 11 | 8 | n | 11 | # | H | |
| Di-n-butyl phthalate | ND | 5.00 | Ħ | 11 | н | 11 | # | н | |
| Di-n-octyl phthalate | ND | 5.00 | ** | 11 | н | 11 | " | п | |
| Dibenzo (a,h) anthracene | ND | 5.00 | es | ii | н | 11 | ** | н | |
| Dibenzofuran | ND | 5.00 | ŧŧ | | 11 | 11 | II. | 11 | |
| 1,2-Dichlorobenzene | ND | 5.00 | 11 | ** | • | ** | ti | 11 | |
| 1,3-Dichlorobenzene | ND | 5.00 | ** | | 11 | u; | ** | 11 | |
| 1,4-Dichlorobenzene | ND | 5.00 | ti | n | • | Ħ | u u | 44 | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | er . | ** | u | tŧ | Ħ | 10 | |
| 2,4-Dichlorophenol | ND | 5.00 | ** | ŧr | | == | * | 11 | |
| Diethyl phthalate | ND | 5.00 | er | н | ** | # | rt | 11 | |
| 2,4-Dimethylphenol | ND | 10.0 | н | н | tr | II. | tt | 41 | |
| Dimethyl phthalate | ND | 5.00 | Ħ | н | H | tf | tl | ** | |
| 4,6-Dinitro-2-methylphenol | ND | 10.0 | n | н | Ħ | tŧ | 11 | ** | |
| 2,4-Dinitrophenol | ND ND | 25.0 | н | н | н | 19 | n | tt | |
| 2,4-Dinitrotoluene | ND ND | 5.00 | н | н | н | n | н | ŧf. | |
| 2,6-Dinitrotoluene | ND ND | 5.00 | # | * | н | п | н | Ħ | |
| Bis(2-ethylhexyl)phthalate | 22.0 | 10.0 | 46 | ** | 11 | н | 11 | tr | |
| Fluoranthene | ND | 5.00 | ** | | 44 | # | 4 | tt | |

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рог

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

| (¢):k(d) | ing !! (yil anga) | ្រាល់ គ្រង នៃ | YW THE | BIRCE CVA | ilimit (|)nelliky(| Chmirdl | | | |
|-----------------------------|-------------------|--------------------|--------|----------------|------------------|------------|----------------|------|--------------|----------|
| | | th Creek | | | | | | | | |
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0090110 - EPA 5030B | | | | | | | | | | |
| Blank (0090110-BLK1) | | | | Prepared | & Analyze | :d: 09/07/ | 00 | | | |
| Gasoline Range Hydrocarbons | · ND | 80.0 | ug/l | | | | | | | |
| Surr: 4-BFB | 45.3 | | н | 50.0 | | 90.6 | 50-150 | | | |
| LCS (0090110-BS1) | | | | Prepared | & Analyza | ed: 09/07/ | | | | |
| Gasoline Range Hydrocarbons | 1100 | 80.0 | ug/l | 1250 | | 88.0 | 50-150 | | | |
| Surr: 4-BFB | 52,6 | | " | 50.0 | | 105 | 50-150 | | | |
| Duplicate (0090110-DUP1) | Sou | ırce: P00856 | 2-02 | Prepared | & Analyz | ed: 09/07/ | 00 | | | |
| Gasoline Range Hydrocarbons | ND | 4000 | ug/l | | ND | | | | 50 | |
| Surr: 4-BFB | 44.0 | | н | 50.0 | | 88.0 | 50-150 | | | |
| Batch 0090138 - EPA 5030B | | | | | | | | | | |
| Blank (0090138-BLK1) | | | | Prepared | & Analyz | ed: 09/08/ | 000 | | | |
| line Range Hydrocarbons | ND | 80.0 | ug/I | | | | | | | |
| Surr: 4-BFB | 52.4 | | H | 50.0 | | 105 | 50-150 | | | |
| LCS (0090138-BS1) | | | | Prepared | & Analyz | ed: 09/08/ | | | | |
| Gasoline Range Hydrocarbons | 1220 | 80.0 | ug/l | 1250 | | 97.6 | 50-150 | | | <u>,</u> |
| Surr: 4-BFB | 68.8 | | Ħ | 50.0 | | 138 | 50-150 | | | |
| Duplicate (0090138-DUP1) | So | urce: P00903 | 36-02 | Prepared | : 09/08/00 | Analyze | d: 09/09/00 | | | |
| Gasoline Range Hydrocarbons | 160 | 80.0 | ug/l | | 146 | | | 9.15 | 50 | |
| Surr: 4-BFB | 55.3 | | п | 50.0 | | 111 | 50-150 | | | |

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Portland

Prepared: 08/31/00 Analyzed: 09/14/00

102

103

91.2

84.4

45-145

47-155

44-119

54-128

17.5

14.6

50

50

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Secor

5.10

5.15

0.456

0.422

0.500

0.500

ug/l

"

5.00

5.00

0.500

0.500

P.O. Box 1508 Tualatin, OR 97062

Project: Fort James Specialty Chemicals Project Number: 015.08716

Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Rosyelitorinested Biphanyks par 1912 A Weshool 80892 - Questiy Combo

| | 1101 | rth Creek | Analy | | JI HAHU | | | | | |
|-------------------------------------|--------|--------------------|-------|----------------|------------------|----------|----------------|-----|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0080774 - EPA 3510/600 Series | | | | | | | | | | |
| Blank (0080774-BLK1) | | | | Prepared: | 08/31/00 | Analyzed | : 09/14/00 | | | |
| Aroclor 1016 | ND | 0.500 | ug/l | | | | | | | |
| Aroclor 1221 | ND | 1.00 | н | | | | | | | |
| Aroclor 1232 | ND | 0.500 | н | | | | | | | |
| Aroclor 1242 | ND | 0.500 | Ħ | | | | | | | |
| Aroclor 1248 | ND | 0.500 | # | | | | | | | |
| Aroclor 1254 | ND | 0.500 | 11 | | | | | | | |
| Aroclor 1260 | ND | 0.500 | 11 | | | | | | | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 0.415 | | " | 0.500 | | 83.0 | 44-119 | | | |
| Surr: Decachlorobiphenyl | 0.446 | | " | 0.500 | | 89.2 | 54-128 | , | | |
| LCS (0080774-BS1) | ٠. | | | Prepared: | 08/31/00 | Analyzed | : 09/14/00 | | | |
| Aroclor 1016 | 4.28 | 0.500 | ug/l | 5.00 | | 85.6 | 45-145 | | | |
| Aroclor 1260 | 4.45 | 0.500 | " | 5.00 | | 89.0 | 47-155 | | | |
| Surr: 2,4,5,6-Tetrachloro-m-xylene | 0.391 | | " | 0.500 | | 78.2 | 44-119 | | | |
| Surr: Decachlorobiphenyl | 0.368 | | u | 0.500 | | 73.6 | 54-128 | | | 1 |

North Creek Analytical - Portland

LCS Dup (0080774-BSD1)

Surr: 2,4,5,6-Tetrachloro-m-xylene

Surr: Decachlorobiphenyl

Aroclor 1016

Aroclor 1260

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,cor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Volatile (Osgants Comparads per 1812 A Medical 3260B) - Quellis Comrat

| Nor | th Creek. | <u>Analy</u> i | tical - Pe | <u>)rtiana</u> | | | | | |
|------|-----------|----------------|------------|----------------|------|--------|-----|-------|-------|
| | Reporting | | Spike | Source | | %REC | | RPD | |
| D 11 | ¥ !14 | I Imita | ž ovol | Decult | %REC | Limite | RPD | Limit | Notes |

| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | Limits | RPD | Limit | Notes |
|-----------------------------|-----------|--------------------|-------|----------------|------------------|-------------|------------|-----|-------|-------|
| | A LTU WAL | | | | | | | | | |
| Batch 0090152 - EPA 5030 | | | | Drongrad | 09/08/00 | Analyzed | . 09/09/00 | | | |
| Blank (0090152-BLK1) | ND | 10.0 | ug/l | r repared. | . 02/00/00 | 1 Mai y Zwa | . 05105100 | | | |
| Acetone | | 1.00 | ug/i | | | | | | | |
| Benzene | ND | | н | | | | | | | |
| Bromobenzene | ND | 1.00 | Ħ | | | | | | | |
| Bromochloromethane | ND | 1.00 | н | | | | , | | | |
| Bromodichloromethane | ND | 1.00 | | | | | | | | |
| Bromoform | ND | 1.00 | 11 | | | | | | | |
| Bromomethane | ND | 5.00 | | | | | | | | - |
| 2-Butanone | ND | 10.0 | | | | | | | | |
| n-Butylbenzene | ND | 5.00 | | | | | | | | |
| sec-Butylbenzene | ND | 1.00 | 11 | | | | | | | |
| tert-Butylbenzene | ND | 1.00 | " | | | | | | | |
| Carbon disulfide | ND | 10.0 | | | | | | | | |
| Carbon tetrachloride | ND | 1.00 | н | | | | | | | |
| robenzene | ND | 1.00 | er | | | | | | | |
| Unforcethane | ND | 1.00 | " | | | | | | | |
| Chloroform | ND | 1.00 | n | | | | | | | |
| Chloromethane | ND | 5.00 | н | | | | | | | |
| 2-Chlorotoluene | ND | 1.00 | ** | | | | | | | |
| 4-Chlorotoluene | ND | 1.00 | 19 | | | | | | | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | Ħ | | | | | | | |
| Dibromochloromethane | ND | 1.00 | п | | | | | | | |
| 1,2-Dibromoethane | ND | 1.00 | Ħ | | | | | | | |
| Dibromomethane | ND | 1.00 | н | | | | | | | |
| 1,2-Dichlorobenzene | ND | 1.00 | н | | | | | | | |
| 1,3-Dichlorobenzene | ND | 1.00 | ŧ | | | | | | | |
| 1,4-Dichlorobenzene | ND | 1.00 | 19 | | | | | | | |
| Dichlorodifluoromethane | ND | 5.00 | н | | | | | | | |
| 1,1-Dichloroethane | ND | 1.00 | tf | | | | | | | |
| 1,2-Dichloroethane | ND | 1.00 | н | | | | | | | |
| 1,1-Dichloroethene | ND | 1.00 | н | | | | | | | |
| cis-1,2-Dichloroethene | ND | 1.00 | Ħ | | | | | | | |
| trans-1,2-Dichloroethene | ND | 1.00 | # | | | | | | | |
| 1,2-Dichloropropane | ND | 1.00 | 41 | | | | | | | |
| 1,3-Dichloropropane | ND | 1.00 | н | | | | | | | |
| 2,2-Dichloropropane | ND | 1.00 | ir. | | | | | | | |
| 1,1-Dichloropropene | ND | 1.00 | 11 | | | | | | | |

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Lisa Domenighini, Project Manager

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Secor Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

| | vorth Creek | Anaiy | ucai - Po |)ruanu | | | | | | |
|------|-------------|--------|-----------|--------|------|--------|-----|-------|-------|---|
| | Reporting | | Spike | Source | | %REC | | RPD | | |
| Resu | lt Limit | Linits | Level | Result | %REC | Limits | RPD | Limit | Notes | ı |

| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
|----------------------------|--------|-------|-------|-----------|----------|----------|------------|-----|-------|-------|
| Batch 0090152 - EPA 5030 | | u/mi | | | | | | | | |
| Blank (0090152-BLK1) | | | | Prepared: | 09/08/00 | Analyzed | : 09/09/00 | | | |
| cis-1,3-Dichloropropene | ND | 1.00 | ug/l | | | | | | | |
| trans-1,3-Dichloropropene | ND | 1.00 | e | | | | | | | |
| Ethylbenzene | ND | 1.00 | ** | | | | | | | |
| Hexachlorobutadiene | ND | 2.00 | H | | | | | | | |
| 2-Hexanone | ND | 10.0 | H | | | | | | | |
| Isopropylbenzene | ND | 2.00 | 11 | | | | | | | |
| p-Isopropyltoluene | ND | 2.00 | e | | | | | | | |
| 4-Methyl-2-pentanone | ND | 5.00 | ** | | | | | | | |
| Methyl tert-butyl ether | ND | 1.00 | ** | | | | | | | |
| Methylene chloride | ND | 5.00 | ** | | | | | | | |
| Naphthalene | ND | 2.00 | " | | | | | | | |
| n-Propylbenzene | ND | 1.00 | ** | | | | | | | |
| Styrene | ND | 1.00 | 18 | | | | | | | |
| 1,1,1,2-Tetrachioroethane | ND | 1.00 | 11 | | | | | | | i |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | ** | | | | | | | |
| Tetrachloroethene | ND | 1.00 | es . | | | | | | | |
| Toluene | ND | 1.00 | u | | | | | | | |
| 1,2,3-Trichlorobenzene | ND | 1.00 | et | | | | | | | |
| 1,2,4-Trichlorobenzene | ND | 1.00 | # | | | | | | | |
| 1,1,1-Trichloroethane | ND | 1.00 | Ħ | | | | | | | |
| 1,1,2-Trichloroethane | ND | 1.00 | ** | | | | | | | |
| Trichloroethene | ND | 1.00 | et | | - | | | | | |
| Trichlorofluoromethane | ND | 1.00 | u | | | | | | | |
| 1,2,3-Trichloropropane | ND | 1.00 | ŧŧ | | | | | | | |
| 1,2,4-Trimethylbenzene | ND | 1.00 | " | | | | | | | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | ŧŧ | | | | | | | |
| Vinyl chloride | ND | 1.00 | 11 | | | | | | | |
| o-Xylene | ND | 1.00 | 41 | | | | | | | |
| m,p-Xylene | ND | 2.00 | u | | | | | | | |
| Surr: 4-BFB | 21.5 | | " | 20.0 | | 108 | 75-125 | | | |
| Surr: 1,2-DCA-d4 | 20.2 | | н | 20.0 | | 101 | 75-125 | | | |
| Surr: Dibromofluoromethane | 20.2 | | н | 20.0 | | 101 | 75-125 | | | |
| Surr: Toluene-d8 | 20.1 | | " | 20.0 | | 101 | 75-125 | | | |

North Creek Analytical - Portland

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cor P.O. Box 1508 Tualatin, OR 97062

Surr: 1,2-DCA-d4

Surr: Toluene-d8

Surr: Dibromofluoromethane

Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Volatile (Dygnite Congrands) per 1924 Visitad SMOB Queitisy Conced North Creek Analytical - Portland RPD Spike Source %REC Reporting RPD Limit Notes Level Result %REC Limits Units Limit Result Analyte Batch 0090152 - EPA 5030 Prepared: 09/08/00 Analyzed: 09/09/00 LCS (0090152-BS1) 80-125 20.0 85.0 1.00 ug/l 17.0 Benzene 92.0 80-125 20.0 18.4 1.00 Chlorobenzene 70-135 93.0 20.0 1.00 18.6 1,1-Dichloroethene 80-125 88.0 20.0 1.00 17.6 78.0 70-130 20.0 1.00 15.6 Trichloroethene 75-125 106 20.0 Surr: 4-BFB 21.3 75-125 101 20.0 20.3 Surr: 1,2-DCA-d4 75-125 101 20.0 20.1 Surr: Dibromofluoromethane 75-125 20.0 101 20.1 Surr: Toluene-d8 Prepared: 09/08/00 Analyzed: 09/09/00 LCS Dup (0090152-BSD1) 25 2.99 20.0 82.5 80-125 16.5 1.00 ug/l Benzene 25 89.5 80-125 2.75 1.00 20.0 17.9 Chlorobenzene 6.09 25 87.5 70-135 20.0 17.5 1.00 Dichloroethene 25 80-125 4.65 84.0 20.0 1.00 16.8 Juene 25 70-130 8.70 20.0 71.5 14.3 1.00 Trichloroethene 75-125 20.0 101 20.2 Surr: 4-BFB

21.1

20.6

20.1

20.0

20.0

20.0

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106

103

101

75-125

75-125

75-125

Lisa Domenighini, Project Manager

North Creek Analytical, Inc. Environmental Laboratory Network Page 24 of 32



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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Spaniyokulla (d) «gante Compounds par 1912/A A Aleboul 32/000 - 10) rethiy Control

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Blank (0090018-BLK1) | | | | Prepared: 09/01/00 Analyzed: 09/05/00 |
|-----------------------------|----|------|------|---------------------------------------|
| Acenaphthene | ND | 5.00 | ug/l | |
| Acenaphthylene | ND | 5.00 | # | |
| Anthracene | ND | 5.00 | er | |
| Benzo (a) anthracene | ND | 5.00 | tt | |
| Benzo (a) pyrene | ND | 5.00 | er | |
| Benzo (b) fluoranthene | ND | 5.00 | 11 | |
| Benzo (ghi) perylene | ND | 5.00 | et e | |
| Benzo (k) fluoranthene | ND | 5.00 | Ħ | |
| Benzoic Acid | ND | 50.0 | tt | |
| Benzyl alcohol | ND | 10.0 | п | |
| 4-Bromophenyl phenyl ether | ND | 5.00 | п | |
| Butyl benzyl phthalate | ND | 5.00 | н | |
| 4-Chloro-3-methylphenol | ND | 5.00 | u | |
| 4-Chloroaniline | ND | 20.0 | н | |
| Bis(2-chloroethoxy)methane | ND | 10.0 | н | |
| Bis(2-chloroethyl)ether | ND | 5.00 | н | • |
| Bis(2-chloroisopropyl)ether | ND | 10.0 | 11 | |
| 2-Chloronaphthalene | ND | 5.00 | н | |
| 2-Chlorophenol | ND | 5.00 | 11 | |
| 4-Chlorophenyl phenyl ether | ND | 5.00 | 11 | |
| Chrysene | ND | 5.00 | 11 | |
| Di-n-butyl phthalate | ND | 5.00 | ** | |
| Di-n-octyl phthalate | ND | 5.00 | ** | |
| Dibenzo (a,h) anthracene | ND | 5.00 | ** | |
| Dibenzofuran | ND | 5.00 | 12 | |
| 1,2-Dichlorobenzene | ND | 5.00 | ## | |
| 1,3-Dichlorobenzene | ND | 5.00 | 45 | |
| 1,4-Dichlorobenzene | ND | 5.00 | 11 | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | ## | |
| 2,4-Dichlorophenol | ND | 5.00 | tf | |
| Diethyl phthalate | ND | 5.00 | tt | |
| 2,4-Dimethylphenol | ND | 10.0 | 65 | |
| Dimethyl phthalate | ND | 5.00 | 86 | |
| 4,6-Dinitro-2-methylphenol | ND | 10.0 | It | |
| 2,4-Dinitrophenol | ND | 25.0 | ŧI | |
| 2,4-Dinitrotoluene | ND | 5.00 | er | |

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cor\$ر

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716

Reported:

Project Manager: Joe Hunt

09/19/00 12:39

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| North | Creek | Anal | vtical | - Pe | <u>ortland</u> |
|-------|-------|------|--------|------|----------------|
| | | | | | |

| | | | Reporting | | Spike | Source | | %REC | | RPD | 1 |
|---------|---|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | • | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

| Dotoh | 0090018 - | FPA | 3510/600 | Series |
|-------|-------------|-------|----------|--------|
| кинси | 1111401010- | r r A | 2210/000 | SCHES |

| Blank (0090018-BLK1) | | | | Prepared: 09/0 | 1/00 Analyzed | 09/05/00 | |
|----------------------------|------|------|------|----------------|---------------|----------|--|
| 2,6-Dinitrotoluene | ND | 5.00 | ug/l | | | | |
| Bis(2-ethylhexyl)phthalate | ND | 10.0 | н | | | | |
| Fluoranthene | ND | 5.00 | ** | | | | |
| Fluorene | ND | 5.00 | " | | | | |
| Hexachlorobenzene | ND | 5.00 | н | | | | |
| Hexachlorobutadiene | ND | 10.0 | ti | | | | |
| Hexachlorocyclopentadiene | ND | 10.0 | 11 | | | | |
| Hexachloroethane | ND | 10.0 | II | | | | |
| ndeno (1,2,3-cd) pyrene | ND | 5.00 | ti | | | | |
| sophorone | ND | 5.00 | | | | | |
| 2-Methylnaphthalene | ND | 5.00 | н | | | | |
| 2-Methylphenol | ND | 10.0 | н | | | | |
| 3-,4-Methylphenol | ND | 5.00 | Ħ | | | | |
| hthalene | ND | 5.00 | " | | | | |
| z-Nitroaniline | ND | 5.00 | н | | | | |
| 3-Nitroaniline | ND | 10.0 | u | | | | |
| 4-Nitroaniline | ND | 10.0 | ŧŧ | | | | |
| Nitrobenzene | ND | 5.00 | ** | | | | |
| 2-Nitrophenol | ND | 5.00 | n | | | | |
| 4-Nitrophenol | ND | 25.0 | н | | | | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | ** | | | | |
| N-Nitrosodiphenylamine | ND | 5.00 | H | | | | |
| Pentachlorophenol | ND | 10.0 | н | | | | |
| Phenanthrene | ND | 5.00 | 11 | | | | |
| Phenol | ND | 5.00 | 11 | | | | |
| Pyrene | ND | 5.00 | Ħ | | | | |
| 1,2,4-Trichlorobenzene | ND | 5.00 | ** | • | | | |
| 2,4,5-Trichlorophenol | ND | 5.00 | 11 | | | | |
| 2,4,6-Trichlorophenol | ND | 5.00 | ət | | | | |
| Surr: 2-Fluorobiphenyl | 79.1 | | ** | 75.0 | 105 | 26-135 | |
| Surr: 2-Fluorophenol | 88.8 | | " | 150 | 59.2 | 6-124 | |
| Surr: Nitrobenzene-d5 | 78.2 | | H | 75.0 | 104 | 23-147 | |
| Surr: Phenol-d6 | 60.8 | | Ħ | 150 | 40.5 | 11-130 | |
| Surr: p-Terphenyl-d14 | 79.0 | | Ħ | 75.0 | 105 | 38-149 | |
| Surr: 2,4,6-Tribromophenol | 151 | | " | 150 | 101 | 19-126 | |

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

| Semizdkitle@ | | | | | | re-sema | HLYSC ON | TUTTE | S. Charles March | iles literat |
|-------------------------------------|--------|--------------------|-------|----------------|------------------|----------|----------------|-------|------------------|--------------|
| | No | rth Creek | Analy | | ortland | | | | | |
| A 1 4 | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Analyte | Result | Link | Units | LEVCI | Result | 70KEC | Limis | KrD | Tannt | NOIC |
| Batch 0090018 - EPA 3510/600 Series | | | | | | | | | | |
| LCS (0090018-BS1) | | | | Prepared: | 09/01/00 | Analyzed | : 09/05/00 | | | |
| Acenaphthene | 65.1 | 5.00 | ug/l | 75.0 | | 86.8 | 40-110 | | | |
| 4-Chloro-3-methylphenol | 122 | 5.00 | n | 150 | | 81.3 | 40-110 | | | |
| 2-Chlorophenol | 122 | 5.00 | • | 150 | | 81.3 | 40-110 | | | |
| 1,4-Dichlorobenzene | 55.7 | 5.00 | Ħ | 75.0 | | 74.3 | 20-90 | | | |
| 2,4-Dinitrotoluene | 62.7 | 5.00 | e | 75.0 | | 83.6 | 50-110 | | | |
| 4-Nitrophenol | 48.5 | 25.0 | tr | 150 | | 32.3 | 15-100 | | | |
| N-Nitrosodi-n-propylamine | 59.6 | 10.0 | | 75.0 | | 79.5 | 40-110 | | | |
| Pentachlorophenol | 118 | 10.0 | ŧŧ | 150 | | 78.7 | 30-120 | | | |
| Phenoi | 56.2 | 5.00 | ** | 150 | | 37.5 | 15-110 | | | |
| Pyrene | 56.3 | 5.00 | tF. | 75.0 | | 75.1 | 40-110 | | | |
| 1,2,4-Trichlorobenzene | 54.5 | 5,00 | • | 75.0 | | 72.7 | 25-100 | | | |
| Surr: 2-Fluorobiphenyl | 77.4 | | 11 | 75.0 | | 103 | 26-135 | | | |
| Surr: 2-Fluorophenol | 91.2 | | u | 150 | | 60.8 | 6-124 | | | |
| Surr: Nitrobenzene-d5 | 74.6 | | " | 75.0 | | 99.5 | 23-147 | | | ! |
| Surr: Phenol-d6 | 62.4 | | " | 150 | | 41.6 | 11-130 | | | |
| Surr: p-Terphenyl-d14 | 73.9 | | n | 75.0 | | 98.5 | 38-149 | | | |
| Surr: 2,4,6-Tribromophenol | 155 | | " | 150 | | 103 | 19-126 | | | |
| LCS Dup (0090018-BSD1) | | | | Prepared: | 09/01/00 | Analyzed | : 09/06/00 | | | |
| Acenaphthene | 66,9 | 5.00 | ug/i | 75.0 | | 89.2 | 40-110 | 2.73 | 25 | |
| 4-Chloro-3-methylphenol | 128 | 5.00 | 0 | 150 | | 85,3 | 40-110 | 4.80 | 25 | |
| 2-Chlorophenol | 126 | 5.00 | н | 150 | | 84.0 | 40-110 | 3.23 | 25 | |
| 1,4-Dichlorobenzene | 57.0 | 5.00 | Ħ | 75.0 | | 76.0 | 20-90 | 2.31 | 35 | |
| 2,4-Dinitrotoluene | 68.3 | 5.00 | n | 75.0 | | 91.1 | 50-110 | 8.55 | 25 | |
| 4-Nitrophenol | 54.9 | 25.0 | 11 | 150 | | 36.6 | 15-100 | 12.4 | 35 | |
| N-Nitrosodi-n-propylamine | 63.1 | 10.0 | н | 75.0 | | 84.1 | 40-110 | 5.70 | 30 | |
| Pentachlorophenol | 133 | 10.0 | u | 150 | | 88.7 | 30-120 | 12.0 | 30 | |
| Phenol | 58.2 | 5.00 | н | 150 | | 38.8 | 15-110 | 3.50 | 30 | |
| Pyrene | 55.5 | 5.00 | 0 | 75.0 | | 74.0 | 40-110 | 1.43 | 25 | |
| 1,2,4-Trichlorobenzene | 55.2 | 5.00 | н | 75.0 | | 73.6 | 25-100 | 1.28 | 30 | |
| Surr: 2-Fluorobiphenyl | 76.9 | | n | 75.0 | | 103 | 26-135 | | | |
| Surr: 2-Fluorophenol | 93.8 | | H | 150 | | 62.5 | 6-124 | | | |
| Surr: Nitrobenzene-d5 | 74.4 | | H | 75.0 | | 99.2 | 23-147 | | | |
| Surr: Phenol-d6 | 64.3 | | " | 150 | | 42.9 | 11-130 | | | |
| Jennia riprive MV | U7,J | | | 170 | | | | | | |

75.0

150

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69.6

169

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38-149

19-126

92.8

113

Surr: p-Terphenyl-d14

Surr: 2,4,6-Tribromophenol

Lisa Domenighini, Project Manager

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COL

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

Signifyolatile Organic Compountkipavior A Wighton 32-010 - Quality Control 3

North Creek Analytical - Portland

| | | Reporting | | Spike | Source | | %REC | | RPD | l |
|---------|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |
| 1 | | | | | | | | | | |

Batch 0090018 - EPA 3510/600 Series

North Creek Analytical - Portland

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015,08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Conventional Chamsuny Parameter mer APH AVEPA (Visingis Condition

| | Noi | th Creek | Analy | tical - Pe | ortland | | | • | | |
|--------------------------|--------|--------------------|-------|----------------|------------------|-------------|----------------|------|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0090296 - Wet Chem | | | | | | | | | | |
| Blank (0090296-BLK1) | | | | Prepared | & Analyze | d: 09/08/ | 00 | | | |
| Total Alkalinity | ND | 10.0 | mg/l | | | | | | | |
| LCS (0090296-BS1) | | | | Prepared | & Analyze | :d: 09/08/0 | 00 | | | |
| Total Alkalinity | 191 | 10.0 | mg/l | 200 | | 95.5 | 85-115 | | | |
| Duplicate (0090296-DUP1) | So | ırce: P00856 | 2-01 | Prepared | & Analyze | d: 09/08/0 | 00 | | | |
| Total Alkalinity | 52.1 | 10.0 | mg/l | | 52.8 | | | 1.33 | 20 | |
| Batch 0090361 - Wet Chem | | | | | | | | | | |
| Blank (0090361-BLK1) | | | | Prepared | & Analyze | d: 09/14/0 | 00 | | | |
| Acidity | ND | 10.0 | mg/l | | | | | | | |
| Duplicate (0090361-DUP1) | Sot | ırce: P00856 | 2-01 | Prepared | & Analyze | d: 09/14/0 | 00 | | | |
| Acidity | 14.4 | 10.0 | mg/l | | 17.1 | | | 17.1 | 20 | |

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541.383.9310 fax 541.382.7588

Portland

COL

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported: 09/19/00 12:39

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|---|------------------|--------------------|-------|----------------|------------------|---|-------------|-------|--|------------------|
| | <u>INO</u> | rth Creek | Anai | | | | %REC | | RPD | |
| | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | Limits | RPD | Limit | Notes |
| Analyte | Kezut | Lamst | Oma | LOTO | 7,400-14 | | | | | |
| Batch 0I11019 - EPA 3005A | | | | | · | | | | | |
| Blank (0111019-BLK1) | | | | Prepared: | 09/11/00 | Analyzed | l: 09/12/00 | | | |
| Arsenic | ND | 0.00100 | mg/l | | | | | | | |
| Barium | ND | 0.00100 | н | | | | | | | |
| Cadmium | ND | 0.00100 | " | | | | | | | |
| Chromium | ND | 0.00100 | # | | | | | | | |
| Lead | ND | 0.00100 | п | | | | | | | |
| Selenium | ND | 0.00100 | Ħ | | | | | | | |
| Silver | ND | 0.00100 | ** | | | | | | | |
| LCS (0111019-BS1) | | | | Prepared: | 09/11/00 | Analyzed | 1: 09/12/00 | | | |
| Arsenic | 0.189 | 0.00100 | mg/l | 0.200 | | 94.5 | 80-120 | | | |
| Barium | 0.196 | 0.00100 | # | 0.200 | | 98.0 | 80-120 | | | |
| Cadmium | 0.198 | 0.00100 | н | 0.200 | | 99.0 | 80-120 | | | |
| Chromium | 0.196 | 0.00100 | n | 0,200 | | 98.0 | 80-120 | | | |
| ·d | 0.190 | 0.00100 | et | 0.200 | | 95.0 | 80-120 | | | |
| enium | 0.203 | 0.00100 | н | 0.200 | | 101 | 80-120 | | | |
| Silver | 0.203 | 0.00100 | U | 0.200 | | 101 | 60-140 | | | |
| Matrix Spike (0111019-MS1) | So | urce: P00856 | 62-01 | Prepared | : 09/11/00 | Analyze | d: 09/12/00 | | | |
| Arsenic | 0.183 | 0.00100 | mg/l | 0,200 | ND | 91.3 | 75-125 | | | |
| Barium | 0,209 | 0.00100 | н | 0.200 | 0.00362 | 103 | 75-125 | | | |
| Cadmium | 0.191 | 0.00100 | n, | 0.200 | ND | 95.4 | 75-125 | | | |
| Chromium | 0.191 | 0.00100 | 11 | 0.200 | ND | 95.2 | 75-125 | | | |
| Lead | 0.198 | 0.00100 | н | 0.200 | ND | 98.9 | 75-125 | | | |
| Selenium | 0.171 | 0.00100 | | 0.200 | ND | 85.2 | 75-125 | | | |
| Silver | 0.171 | 0.00100 | * | 0.200 | ND | 85.0 | 60-140 | | | |
| | | ource: P00856 | C2 A1 | Prenared | · 09/11/00 | Analyze | d: 09/12/00 |) | | |
| Matrix Spike Dup (0I11019-MSD1) | 0.185 | 0.00100 | mg/l | 0.200 | ND | 92.3 | 75-125 | 1.09 | 20 | |
| Arsenic | 0.185 | 0.00100 | и | 0,200 | 0.00362 | 103 | 75-125 | 0 | 20 | |
| Barium | 0.209 | 0.00100 | u | 0.200 | ND | 97.4 | 75-125 | 2.07 | 20 | |
| Cadmium | 0.193 | 0.00100 | H | 0.200 | ND | 94.7 | 75-125 | 0.525 | 20 | |
| Chromium | 0.190 | 0.00100 | н | 0.200 | ND | 98.4 | 75-125 | 0.506 | 20 | |
| Lead | 0.197 | 0.00100 | ** | 0.200 | ND | 83.7 | 75-125 | 1.77 | 20 | |
| Selenium | | 0.00100 | 11 | 0.200 | ND | 82.0 | 60-140 | 3.57 | 40 | |
| Silver | 0,165 | 0.00100 | | 0.200 | 1110 | J210 | 10 | | | |

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Secor

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716

Project Manager: Joe Hunt

Reported:

09/19/00 12:39

| | No | orth Creel | k Anal | ytical - E | Bothell | | | | | |
|---------------------------------|---------|--------------------|--------|----------------|------------------|----------|----------------|-------|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0115024 - EPA 7470A | | | | | | | | | | |
| Blank (0I15024-BLK1) | | | | Prepared: | 09/15/00 | Analyzed | l: 09/18/00 | | | |
| Mercury | ND | 0.00100 | mg/l | | | | | | | |
| Blank (0I15024-BLK2) | | | | Prepared: | 09/15/00 | Analyzed | : 09/18/00 | | | |
| Mercury | ND | 0.00100 | mg/l | | | | | | | |
| LCS (0I15024-BS1) | | | | Prepared: | 09/15/00 | Analyzed | : 09/18/00 | | | |
| Mercury | 0.00512 | 0.00100 | mg/l | 0.00500 | | 102 | 70-130 | | | |
| Matrix Spike (0I15024-MS1) | So | urce: B0I012 | 8-02 | Prepared: | 09/15/00 | Analyzed | : 09/18/00 | | | |
| Mercury | 0.00301 | 0.00100 | mg/l | 0.00500 | ND | 60.2 | 75-125 | | | Q-13 |
| Matrix Spike Dup (0I15024-MSD1) | So | urce: B0I012 | 8-02 | Prepared: | 09/15/00 | Analyzed | : 09/18/00 | | | |
| Mercury | 0.00303 | 0.00100 | mg/l | 0.00500 | ND | 60.6 | 75-125 | 0.662 | 20 | Q-13 |

North Creek Analytical - Portland

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corپي

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Notes and Definitions

Detected hydrocarbons have non-petroleum peaks or elution pattern that suggests the presence of biogenic interference. D-15

This sample was analyzed outside of the EPA recommended holding time. I-02

Multiple analyses indicate the percent recovery is outside the control limits due to a matrix effect. Q-13

Surrogate recovery is out of control limits. QA criteria are met when one surrogate is within control limits. S-07

DET Analyte DETECTED

Analyte NOT DETECTED at or above the reporting limit ND

Not Reported NR

Sample results reported on a dry weight basis dry

Sample results reported on a wet weight basis wet

Relative Percent Difference **RPD**

North Creek Analytical - Portland

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North Creek Analytical, Inc. **Environmental Laboratory Network**

Page 32 of 32

NORTH CREEK ANALYTICAL Environmental Laboratory Services

9.80

18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508 East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 9405 S.W. Nimbus Avenue, Beaventon, OR 97008-7132

FAX 924-9290 FAX 906-9210 FAX 420-9210 (425) 420-9200 (509) 924-9200 (503) 906-9200

Work Order # 1008562

CHAIN OF CUSTODY REPORT

| | , | | TATO TOTAL TO | | 10 11 | TOTAL OTHER | , (| , |
|---|---|---|--|------------------------|---|-----------------|-------------------------------------|--|
| REPORT TO: SECOR | | | INVOICE TO: CAME | | | P | | |
| ATTENTION: Joe Hunt | · | ٠ | ATTENTION: | | | | מטטאים אביעטבא | Convance request in business Day. |
| | hawk St. | | ADDRESS: | | | - - | S 4 3 2 | Same Analyses |
| Tualati Organ 97062 | 29026 x | | | | | | | |
| MONE 503-691-2030 | FAX: 503-692-7074 | 7-7074 | P.O. MUMBER: | Š | NCA QUOTE #: | | I I | |
| MORETHAME. FOIT James Specialty Chemicals | Secio14 Ch | emieds | | / | | | Stanton | |
| MOJECT MUMBER: 015. 08716 | , | • | `` | Pa | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | OTHER | | |
| SAMPLED BY: DEC | | | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | \sim | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | • Turnaround Re | Spenit. Requests less than stand | Turnaround Requests less than standard may facur Ruth (Sares |
| CLIENT SAMPLE IDENTIFICATION | SAMPLING | NCA SAMPLE ID (Leboraumy Use Only) | 909/UM/023/28 | 100/508/00 | | MATRUX | # OF | |
| 1. MW/- 08250 O | SIE1 04/57/2 | | X | | | | S S | Coe bolow |
| 2 MW2 - 082500 | 754 | | х х х | × λ | | | | |
| 1, MW3- 082500 | 00 <i>h1</i> ^ | - | X X X | × | | | 5 00 | - |
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| RELINQUISHED BY IN. 4 CLICAN | | - | олте <i>β-29.∞</i> | RECEIVED BY (SIJAMINA) | | | | B-20 |
| MINTHAME O. Eduard C | S. Fr. La | FIRM: SECOR | ! | PRINT NAME: | War Man | | FIRM: MP.4 | DOI WE |
| RELINQUISHED BY (Agreenty | | | | | | | | 35 |
| PRINT NAME: DAVING SH MY | de | FIRM: NGO. | TIME | PRINT NAME: | E. Mor | CN. | FIRM: NV | 7.1 |
| ADDITIONAL REMARKS: 8270 STM - acid / base WTPH-HCIV - quantify as 305.1 /310.1 - acid / al | 8270 STM - acid/base noutral extractable WTPH-HCIV- quantify as gas/diesel/oil 305.1/316.1 - acid/alkalist. | setral astructions) diesel loi lists | table 5VOC's | -0001 0109 | field filte | | | 3044 |
| | | | | | | | | - ; |

APPENDIX E LABORATORY ANALYTICAL REPORT NOVEMBER 2000 GROUNDWATER MONITORING

2000 Site Investigation Report Former Fort James Specialty Chemicals 906 NW Drake Street Camas, Washington SECOR PN: 015.08860.002 January 17, 2001



 Seattle
 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223

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503.924.9200 Tax 503.924.9290 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

12/01/00 09:34

ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received | | |
|-----------|---------------|--------|----------------|----------------|--|--|
| W4-111000 | P0K0303-01 | Water | 11/10/00 13:10 | 11/13/00 13:00 | | |
| W5-111000 | P0K0303-02 | Water | 11/10/00 12:45 | 11/13/00 13:00 | | |

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Spokane

Portland

bor P.O. Box 1508 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 12/01/00 09:34

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes | |
|------------------------------|--|--------------------|-------|----------|-----------|----------|----------|---------|-------|--|
| W4-111000 (P0K0303-01) Water | K0303-01) Water Sampled: 11/10/00 Received: 11/13/00 | | | | | | | | | |
| Acetone | 11.4 | 10.0 | ug/l | 1 | EPA 8260B | 11/14/00 | 11/14/00 | 0110489 | | |
| Benzene | ND | 1.00 | H. | и | # | * | н | n | | |
| Bromobenzene | ND | 1.00 | ** | H | Ħ | ** | n | II . | | |
| Bromochloromethane | ND | 1.00 | 11 | n | Ħ | 11 | Ħ | n | | |
| Bromodichloromethane | ND | 1.00 | Ħ | n | ** | Ħ | * | Ħ | | |
| Bromoform | ND | 1.00 | н | U | " | ۰. | ч | Ħ | | |
| Bromomethane | ND | 5.00 | н | 11 | н . | Ħ | н | N | | |
| 2-Butanone | ND | 10.0 | π | ti | n | er er | Ħ | u | | |
| n-Butylbenzene | ND | 5.00 | 11 | tt | tr . | 11 | ** | ** | | |
| sec-Butylbenzene | ND | 1.00 | н | tt | # | H | ** | н | | |
| tert-Butylbenzene | ND | 1.00 | п | # | 11 | н | н | H | | |
| Carbon disulfide | ND | 10.0 | ** | H | 11 | tt | Ħ | n | | |
| Carbon tetrachloride | ND | 1.00 | 55 | 11 | н | r, | ** | H | | |
| Chlorobenzene | 3.36 | 1.00 | 11 | ır | н | 12 | 65 | n | | |
| Chloroethane | ND | 1.00 | 11 | tt | H. | 11 | #1 | # | | |
| roform | ND | 1.00 | n | ** | ** | Ħ | 11 | п | | |
| Curoromethane | ND | 5.00 | п | Ħ | Ħ | Ħ | Ħ | н | | |
| 2-Chlorotoluene | ND | 1.00 | Ħ | ti | н | n | Ħ | ħ. | | |
| 4-Chlorotoluene | ND | 1.00 | 11 | н | н | " | H | | | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | н | tt | ** | н | " | Ħ | | |
| Dibromochloromethane | ND | 1.00 | п | " | ** | н | 11 | н | | |
| 1,2-Dibromoethane | ND | 1.00 | tř | H | *1 | ** | u | Ħ | | |
| Dibromomethane | ND | 1.00 | tt | , н | Ħ | 11 | n | # | | |
| 1,2-Dichlorobenzene | 8,46 | 1.00 | ** | ** | ** | 11 | н . | 11 | | |
| 1,3-Dichlorobenzene | ND | 1.00 | +1 | ** | • | Ħ | + | Ħ | | |
| 1,4-Dichlorobenzene | ND | 1.00 | н | 11 | 11 | н | 11 | н | | |
| Dichlorodifluoromethane | ND | 5.00 | • | #1 | н | | Ħ | Ħ | | |
| 1,1-Dichloroethane | ND | 1.00 | н | ŧŧ | #1 | Ħ | # | n | | |
| 1,2-Dichloroethane | ND | 1.00 | 0 | 11 | #5 | н | н | Ħ | | |
| 1,1-Dichloroethene | ND | 1.00 | ** | II | н | e¢ | Ħ | Ħ | | |
| cis-1,2-Dichloroethene | ND | 1.00 | 11 | tt | н | ** | " | ** | | |
| trans-1,2-Dichloroethene | ND | 1.00 | 11 | 15 | ** | н | н | 11 | | |
| 1,2-Dichloropropane | ND | 1.00 | Ħ | 11 | ** | Ħ | н | н | | |
| 1,3-Dichloropropane | ND | 1.00 | ** | Ħ | н | • | " | Ħ | | |
| 2,2-Dichloropropane | ` ND | 1.00 | н | tt | Ħ | 11 | ** | Ħ | | |
| 1,1-Dichloropropene | ND | 1.00 | 8 | | n | н | н | н | | |
| cis-1,3-Dichloropropene | ND ND | 1.00 | Ħ | н | 11 | u u | ŧř | н | | |
| trans-1,3-Dichloropropene | ND ND | 1.00 | ** | н | Ħ | | ** | * | | |
| uans-1,3-Dichioropropene | MD | 1.00 | | | | | | | | |

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20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716,001 Project Manager: Joe Hunt

Reported:

12/01/00 09:34

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------|--------|--------------------|-------------|----------|---------------|------------|--------------|---------|-------|
| W4-111000 (P0K0303-01) Water | | | | | Sampled: 11/1 | 0/00 Recei | ived: 11/13/ | 00 | |
| Ethylbenzene | ND | 1.00 | ug/l | i | EPA 8260B | 11/14/00 | 11/14/00 | 0110489 | |
| Hexachlorobutadiene | ND | 2.00 | tt | tt | Ħ | H | Ħ | ** | |
| 2-Hexanone | ND | 10.0 | Ħ | n | н | tt | н | " | |
| Isopropylbenzene | ND | 2.00 | n | н | Ħ | H | Ħ | 41 | |
| p-Isopropyltoluene | ND | 2.00 | н | N | Ħ | H | # | " | |
| 4-Methyl-2-pentanone | ND | 5.00 | | * | Ħ | " . | п | | |
| Methyl tert-butyl ether | ND | 1.00 | 48 | н | 11 | H | • | a | |
| Methylene chloride | ND | 5.00 | ** | н | # | Ħ | 11 | ** | |
| Naphthalene | ND | 2.00 | " | 1) | n | н | ** | er | |
| n-Propylbenzene | ND | 1.00 | e \$ | n | ** | n | ** | et | |
| Styrene | ND | 1.00 | 61 | 15 | u | . 41 | 0 | er | |
| 1,1,1,2-Tetrachloroethane | ND | 1.00 | tr | 11 | 4 | 14 | | н | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | tr | • | " | 11 | | H | |
| Tetrachloroethene | ND | 1.00 | ŧI | 10 | tt | 11 | | e | |
| Toluene | ND | 1.00 | Ħ | Et | ** | • | lir . | II . | |
| 1,2,3-Trichlorobenzene | ND | 1.00 | н | " | # | " | tr | 11 | |
| 1,2,4-Trichlorobenzene | ND | 1.00 | н | r | ** | 11 | H | # | |
| 1,1,1-Trichloroethane | ND | 1.00 | н | · н | tt | | H | 41 | |
| 1,1,2-Trichloroethane | ND | 1.00 | ы | Ħ | · tt | 11 | tr | 11 | |
| Trichloroethene | ND | 1.00 | ш | ĸ | ** | | tt | 11 | |
| Trichlorofluoromethane | ND | 1.00 | н | tt | ** | n | H . | " | |
| 1,2,3-Trichloropropane | ND | 1.00 | 11 | н | tt | n | н | ** | |
| 1,2,4-Trimethylbenzene | ND | 1.00 | 11 | н | Ħ | 11 | Н | ** | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | 11 | ti . | n | " | # | ** | |
| Vinyl chloride | ND | 1.00 | # | ti | n | 11 | 11 | ** | |
| o-Xylene | ND | 1.00 | 11 | н | ti | P | Ħ | | |
| m,p-Xylene | ND | 2.00 | u | 11 | II | ŧŧ | Ħ | u | |
| Surr: 4-BFB | 104 % | 75-125 | | | | | | | |
| Surr: 1,2-DCA-d4 | 99.0 % | 75-125 | | | | | | | |
| Surr: Dibromofluoromethane | 94.5 % | 75-125 | | | | | | | |
| Surr: Toluene-d8 | 95.5 % | <i>75-125</i> | | | | | | | |

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cor P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 12/01/00 09:34

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| | Nor | th Creek | Anaiyt | icai - Fu | ruanu | | | | |
|------------------------------|--------|--------------------|--------|-----------|---------------|-----------|--------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| W5-111000 (P0K0303-02) Water | | | | 5 | Sampled: 11/1 | 0/00 Rece | ived: 11/13/ | 00 | |
| Acetone | ND | 10.0 | ug/l | 1 | EPA 8260B | 11/14/00 | 11/14/00 | 0110489 | |
| Benzene | ND | 1.00 | 11 | н | Ħ | " | # | n | |
| Bromobenzene | ND | 1.00 | Ħ | н | н | Ħ | н | | |
| Bromochloromethane | ND | 1.00 | 11 | ** | Ħ | Ħ | н | ** | |
| Bromodichloromethane | ND | 1.00 | 19 | ** | к | Ħ | Ħ | н | |
| Bromoform | ND | 1.00 | N | t; | H | | н | н | |
| Bromomethane | ND | 5.00 | N | н | n | | Ħ | н | |
| 2-Butanone | ND | 10.0 | ŧ | ĸ | ** | " | tt | H | |
| n-Butylbenzene | ND | 5.00 | u | п | ** | ,, | ŧŧ | H | |
| sec-Butylbenzene | ND | 1.00 | 11 | ti | 11 | tı | ** | tr | |
| tert-Butylbenzene | ND | 1.00 | ** | ŧř | н | н | ** | n | |
| Carbon disulfide | ND | 10.0 | ** | ** | n | ŧI | Ħ | 11 | |
| Carbon tetrachloride | ND | 1.00 | 50 | ** | n | н | tt | н | |
| Chlorobenzene | ND | 1.00 | | ŧŧ | ** | н | н | II | |
| Chloroethane | ND | 1.00 | н | 11 | ** | et | n | н | |
| roform | ND | 1.00 | 116 | 11 | 11 | ŧŧ | Ħ | H . | |
| oromethane | ND | 5.00 | п | 11 | ** | ** | | * | |
| 2-Chlorotoluene | ND | 1.00 | ti | tt | n | ** | ** | .41 | |
| 4-Chlorotoluene | ND | 1.00 | Ħ | , # | 41 | 11 | ** | n . | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | | 11 | e | н | 11 | 19 | |
| Dibromochloromethane | ND | 1.00 | 17 - | er | н | 11 | 11 | 11 | |
| 1,2-Dibromoethane | ND | 1.00 | 11 | ** | es es | ¥ | н | tí | |
| Dibromomethane | ND | 1.00 | и. | Ħ | ** | Ħ | Ħ | N | |
| 1,2-Dichlorobenzene | ND | 1.00 | п | н | 91 | ** | ** | tř | |
| 1,3-Dichlorobenzene | ND | 1.00 | н | н | 11 | ** | 11 | ** | |
| 1,4-Dichlorobenzene | ND | 1.00 | Ħ | er . | Ħ | ij | # | 11 | |
| Dichlorodifluoromethane | ND | 5.00 | ** | Ħ | n | 11 | 11 | ŧi | |
| 1,1-Dichloroethane | ND | 1.00 | ** | ŧ | ** | H | Ħ | ŧr | |
| 1,2-Dichloroethane | ND | 1.00 | 11 | Ħ | 11 | н | tt | ŧŧ | |
| 1,1-Dichloroethene | ND | 1.00 | н | н | Ħ | 11 | II | 11 | |
| cis-1,2-Dichloroethene | ND | 1.00 | н | н | н | 11 | 11 | 11 | |
| trans-1,2-Dichloroethene | ND | 1.00 | ч | " | Ħ | u | n | 11 | |
| 1,2-Dichloropropane | ND | 1.00 | 11 | 15 | u | H | H | н | |
| 1,3-Dichloropropane | ND | 1.00 | Ħ | II | " | n | ** | ŧt | |
| 2,2-Dichloropropane | ND | 1.00 | н | tř | n | ** | 11 | 11 | |
| 1,1-Dichloropropene | ND | 1.00 | H | # | н | 11 | 11 | 11 | |
| cis-1,3-Dichloropropene | ND | 1.00 | ŧr | | Ħ | 11 | н | II | |
| trans-1,3-Dichloropropene | ND | 1.00 | e | # | ** | н | н | Ħ | |
| Ethylbenzene | ND | 1.00 | ** | Ħ | ** | н | Ħ | " | |
| ÷ | | | | | | | | | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 12/01/00 09:34

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Note |
|------------------------------|--------|--------------------|-------|----------|---------------|------------|--------------|------------|------|
| W5-111000 (P0K0303-02) Water | | | | | Sampled: 11/1 | 0/00 Recei | ved: 11/13/0 | 00 | |
| Hexachlorobutadiene | ND | 2.00 | ug/l | 1 | EPA 8260B | 11/14/00 | 11/14/00 | 0110489 | |
| 2-Hexanone | ND | 10.0 | " | ** | ** | н | 11 | 41 | |
| Isopropylbenzene | ND | 2.00 | ** | н | ** | 0 | | * | |
| p-Isopropyltoluene | ND | 2.00 | Ħ | # | Ħ | ø | H | e | |
| 4-Methyl-2-pentanone | ND | 5.00 | ĸ | P | H | u | н | ti | |
| Methyl tert-butyl ether | ND | 1.00 | н | * | н | " . | Ħ | ** | |
| Methylene chloride | ND | 5.00 | Ħ | М | п | u | 11 | n | |
| Naphthalene | ND | 2.00 | ш | я | н | u | # | ti | |
| n-Propylbenzene | ND | 1.00 | n | sa | n | ** | ** | u . | |
| Styrene | ND | 1.00 | 11 | 11 | 11 | W | u | 11 | |
| 1,1,1,2-Tetrachloroethane | ND | 1.00 | 11 | Iŧ | 18 | n | 12 | 19 | |
| 1,1,2,2-Tetrachloroethane | ND | 1.00 | ar | æ | tr | U | 11 | 11 | |
| Tetrachloroethene | ND | 1.00 | tr . | u | e: | н | ** | 47 | |
| Toluene | ND | 1.00 | u | Ħ | ** | ** | tt | Ħ | |
| 1,2,3-Trichlorobenzene | ND | 1.00 | ĸ | II | If | u | 0 . | н | |
| 1,2,4-Trichlorobenzene | ND | 1.00 | ĸ | н | Ħ | tt | N | a | |
| 1,1,1-Trichloroethane | ND | 1.00 | 11 | и | ** | tt . | н | " . | , |
| 1,1,2-Trichloroethane | ND | 1.00 | 1t | 44 | 41 | er | n | H | |
| Trichloroethene | ND | 1.00 | tt . | 19 | 8 | н | Ħ | н | |
| Trichlorofluoromethane | ND | 1.00 | e . | a | ŧr | н | 0 | н | |
| 1,2,3-Trichloropropane | ND | 1.00 | •0 | н | ŧŧ | н | ** | ŧŧ | |
| 1,2,4-Trimethylbenzene | ND | 1.00 | n | n | ĸ | 18 | ti | ** | |
| 1,3,5-Trimethylbenzene | ND | 1.00 | E | Ħ | н | 45 | Ħ | tt | |
| Vinyl chloride | ND | 1.00 | н | íl . | Р | н | н | er . | |
| o-Xylene | ND | 1.00 | н | 11 | к | t) | Ħ | u | |
| m,p-Xylene | ND | 2.00 | 11 | 11 | 19 | Ħ | Ħ | Ħ | |
| Surr: 4-BFB | 104 % | 75-125 | | | | | | | |
| Surr: 1,2-DCA-d4 | 99.5 % | 75-125 | | | | | | | |
| Surr: Dibromofluoromethane | 94.5 % | 75-125 | | | | | | | |
| Surr: Toluene-d8 | 93.0 % | 75-125 | | | | | | | |

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COL

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: .

12/01/00 09:34

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------|----------|--------------------|--------|-------------|---------------|------------|-------------|----------|-------|
| W4-111000 (P0K0303-01) Water | | | | | Sampled: 11/1 | 0/00 Recei | ved: 11/13/ | 00 | |
| Acenaphthene | ND | 5.00 | ug/l | 1 | EPA 8270C | 11/16/00 | 11/20/00 | 0110577 | |
| Acenaphthylene | ND | 5.00 | h | Ħ | Ħ | 11 | ** | * | |
| Anthracene | ND | 5.00 | h | | Ħ | Ħ | ** | Ħ | |
| Benzo (a) anthracene | ND | 5.00 | 8 | N | h | Ħ | Ħ | н | |
| Benzo (a) pyrene | ND | 5.00 | w | ч | Ħ | н | H | Ħ | |
| Benzo (b) fluoranthene | ND | 5.00 | | я | ĸ | H . | # | t# | |
| Benzo (ghi) perylene | ND | 5.00 | 2. | *1 | 6. | H | 11 | u | |
| Benzo (k) fluoranthene | ND | 5.00 | t. | н | t: | स | 11 | 11 | |
| Benzoic Acid | ND | 50.0 | 11 | đ | к | ** | н | 11 | |
| Benzyl alcohol | ND | 10.0 | u | લ | 11 | 11 | " | и | |
| 4-Bromophenyl phenyl ether | ND | 5.00 | N | * | b | 11 | # | U | |
| Butyl benzyl phthalate | ND | 5.00 | H | | к | Ħ | ır | п | |
| 4-Chloro-3-methylphenol | ND | 5.00 | Ħ | ** | B! | н | 11 | Ħ | |
| 4-Chloroaniline | ND | 20.0 | , N | н | н | n | И | ** | |
| Bis(2-chloroethoxy)methane | ND | 10.0 | ** | 31 | tr | ŧI | ti | ŧŧ | |
| 2-chloroethyl)ether | ND | 5.00 | 11 | а | 17 | Ħ | Н | H | |
| 2-chloroisopropyl)ether | ND | 10.0 | * | · 11 | ** | ** | н | u | |
| 2-Chloronaphthalene | ND | 5.00 | н | đ | T. | :: | Ħ | 5 | |
| 2-Chlorophenol | ND | 5.00 | u | ¥ | | # | Ħ | a | |
| 4-Chlorophenyl phenyl ether | ND | 5.00 | te . | v\$ | h | 11 | ** | ŧI | |
| Chrysene | ND | 5.00 | Ħ | IJ | ĸ | 11 | ** | ti | |
| Di-n-butyl phthalate | ND ND | 5.00 | R | ч | н , | н | ** | н | |
| Di-n-octyl phthalate | ND ND | 5.00 | 1f | 31 | ĸ | н | Ħ | tt | |
| Dibenzo (a,h) anthracene | ND ND | 5.00 | 11 | А | • | tf | #1 | ** | |
| Dibenzofuran | ND ND | 5.00 | 11 | м | ** | ** | н | ** | |
| | | 5.00 | Ħ | , it | н | " | ** | 11 | |
| 1,2-Dichlorobenzene | ND ND | 5.00 | H | " | н | 11 | e e | 11 | |
| 1,3-Dichlorobenzene | ND ND | | u | 11 . | н | н | 19 | N | |
| 1,4-Dichlorobenzene | | 5.00 | | | ŧŧ | н | 11 | er | |
| 3,3'-Dichlorobenzidine | ND | 5.00 | н | tt | 11 | H | н | 11 | |
| 2,4-Dichlorophenol | ND | 5.00 | | ,, | ** | ** | er . | 11 | |
| Diethyl phthalate | ND | 5.00 | | | 11 | 11 | u | 11 | |
| 2,4-Dimethylphenol | ND | 10.0 | | | 11 | # | 11 | n | |
| Dimethyl phthalate | ND | 5.00 | | 11 | tr | н | #1 | ч | |
| 4,6-Dinitro-2-methylphenol | ND | 10.0 | ** | " | | H | " | ** | |
| 2,4-Dinitrophenol | ND | 25.0 | ** | # # | " | ** | ,, H | ** | |
| 2,4-Dinitrotoluene | ND | 5.00 | 11 | | ,, H | " | ft | | |
| 2,6-Dinitrotoluene | ND | 5.00 | | | n H | 11 | " | н | |
| Bis(2-ethylhexyl)phthalate | ND | 10.0 | н | | 11 | " | " | " | |
| Fluoranthene | ND | 5.00 | ** | н | Ħ | π | יו | • | |

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508

Project Number: 015.08716.001

Reported:

Tualatin, OR 97062

Project Manager: Joe Hunt

12/01/00 09:34

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------|--------|--------------------|------------|----------|---------------|------------|--------------|---------|-------|
| W4-111000 (P0K0303-01) Water | 7 | | | | Sampled: 11/1 | 0/00 Recei | ived: 11/13/ | 00 | |
| Fluorene | ND | 5.00 | ug/l | 1 | EPA 8270C | 11/16/00 | 11/20/00 | 0110577 | |
| Hexachlorobenzene | ND | 5.00 | " | tt | n | 11 | | * | |
| Hexachlorobutadiene | ND | 10.0 | н | | H . | a | ** | rt . | |
| Hexachlorocyclopentadiene | ND | 10.0 | н | HE | н. | u | tr | ii. | |
| Hexachloroethane | ND | 10.0 | Ħ | * | Ħ | | Ħ | н | |
| Indeno (1,2,3-cd) pyrene | ND | 5.00 | ** | tt | # | | Ħ | н | |
| Isophorone | ND | 5.00 | 11 | н | ** | | 11 | H | |
| 2-Methylnaphthalene | ND | 5.00 | 11 | R | tt. | · · | II | 41 | |
| 2-Methylphenol | ND | 10.0 | ** | n n | ** | ** | ш | 44 | |
| 3-,4-Methylphenol | ND | 5.00 | er | tı | | tt | #1 | ** | |
| Naphthalene | ND | 5.00 | п | 19 | ŧŧ | н | # | ** | |
| 2-Nitroaniline | ND | 5.00 | ti | 11 | ŧı | u | ** | e , | |
| 3-Nitroaniline | ND | 10.0 | н | ** | н | n | a , | ** | |
| 4-Nitroaniline | ND | 10.0 | u | e | u | н | u | : | |
| Nitrobenzene | ND | 5.00 | И | i. | n | 11 | ti | ęs – | |
| 2-Nitrophenol | ND | 5.00 | Ħ | ti | n | • | 15 | | |
| 4-Nitrophenol | ND | 25.0 | 11 | ti | 41 | | ** | tt. | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | 11 | ti ti | 11 | ** | tf | # | |
| N-Nitrosodiphenylamine | ND | 5.00 | 16 | н | 41 | ST . | H | Ħ | |
| Pentachlorophenol | ND | 10.0 | 6 . | . " | ŧŧ | tt | n , | н | |
| Phenanthrene | ND | 5.00 | er | ti | t+ | n | н | | |
| Phenol | ND | 5.00 | H | æ | 88 | tt | 11 | н | |
| Pyrene | ND | 5.00 | H : | ŧi | # | ø | н | н | |
| 1,2,4-Trichlorobenzene | ND | 5.00 | 11 | # | tr . | Ħ | 11 | 11 | |
| 2,4,5-Trichlorophenol | ND | 5.00 | n | . # | pt . | Ħ | ** | 11 | |
| 2,4,6-Trichlorophenol | ND | 5.00 | н | • | u | ** | *1 | 11 | |
| Surr: 2-Fluorobiphenyl | 54.9 % | 26-135 | : | | | | | | |
| Surr: 2-Fluorophenol | 35.5 % | 6-124 | | | | | | | |
| Surr: Nitrobenzene-d5 | 54.7 % | 23-147 | | | | | | | |
| Surr: Phenol-d6 | 23.6 % | 11-130 | | | | | | | |
| Surr: p-Terphenyl-d14 | 75.7 % | 38-149 | | • | | | | | |
| Surr: 2,4,6-Tribromophenol | 71.8 % | 19-126 | | | | | | | |
| • | | | | • | | | | | |

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COL P.O. Box 1508

Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

12/01/00 09:34

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| | | Nort | п Сгеек | Analyt | icai - 1 0 | i uanu | ······································ | | | |
|---------------------------------------|------------------------------|--------|--------------------|--------|------------|---------------|--|--------------|-----------|-------|
|) | Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| | W5-111000 (P0K0303-02) Water | | | | | Sampled: 11/1 | 0/00 Recei | ved: 11/13/0 | 00 | |
| | Acenaphthene | ND | 5.00 | ug/l | i | EPA 8270C | 11/16/00 | 11/20/00 | 0110577 | |
| | Acenaphthylene | ND | 5.00 | " | e | * | н | n | н | |
| | Anthracene | ND | 5.00 | 11 | Ħ | 11 | Ħ | н | n | |
| | Benzo (a) anthracene | ND | 5.00 | н | tt | н | | H | st | |
| | Benzo (a) pyrene | ND | 5.00 | ti | ** | 11 | 11 | Ħ | 11 | • |
| ĺ | Benzo (b) fluoranthene | ND | 5.00 | н | 177 | # | n . | * | n | |
| i | Benzo (ghi) perylene | ND | 5.00 | tr | π. | Ħ | ţt | Ħ | # | |
| | Benzo (k) fluoranthene | ND | 5.00 | ** | ĸ | 54 | II | 11 | u | |
| | Benzoic Acid | ND | 50.0 | 11 | . • | 10 | ft | 11 | II . | |
| | Benzyl alcohol | ND | 10.0 | H | n | 16 | 11 | 11 | n | |
| | 4-Bromophenyl phenyl ether | ND | 5.00 | 0 | Ħ. | н | 15 | н | Ħ | |
| 1 | Butyl benzyl phthalate | ND | 5.00 | n | H | H | 11 | ti | 0 | |
| | 4-Chloro-3-methylphenol | ND | 5.00 | tr . | 12 | Ħ | II | . ** | If | |
| | 4-Chloroaniline | ND | 20.0 | 11 | . в | Ħ | Ħ | ** | II | |
| | Bis(2-chloroethoxy)methane | ND | 10.0 | 11 | и | 91 | Ħ | 19 | II | |
| ļ | 2-chloroethyl)ether | ND | 5.00 | 11 | ** | ŧ1 | ti | 11 | н | |
| - | 2-chloroisopropyl)ether | ND | 10.0 | 11 | ø | a | " | н | t) | |
| | 2-Chloronaphthalene | ND | 5.00 | 11 | . 12 | A | ** | H | " | |
| ļ | 2-Chlorophenol | ND | 5.00 | u | 11 | a | 11 | II | 11 | |
| | 4-Chlorophenyl phenyl ether | ND | 5.00 | tr | и . | at ' | II | H | # | |
| i | Chrysene | ND | 5.00 | 11 | tt | 4 | ti | # | 11 | |
| | Di-n-butyl phthalate | ND | 5.00 | 11 | , E | if | Ħ | 11 | u | |
| | Di-n-octyl phthalate | ND | 5.00 | h | e | а | ti | , и | Ħ | |
| | Dibenzo (a,h) anthracene | ND | 5.00 | н | * | н | " | * | ** | |
| | Dibenzofuran | ND | 5.00 | tt | , n | н | Ħ | ** | 14 | |
| ì | 1,2-Dichlorobenzene | ND | 5.00 | 11" | . B | et | н | 17 | H | |
| | 1,3-Dichlorobenzene | ND | 5.00 | ** | | 11 | Ħ | #1 | H | |
| , | 1,4-Dichlorobenzene | ND | 5.00 | n | " | н | " | н | | |
| | 3,3'-Dichlorobenzidine | ND | 5.00 | Ħ | tt | tı | H | ** | # | |
| A A A A A A A A A A A A A A A A A A A | 2,4-Dichlorophenol | ND | 5.00 | ** | . п | # | li . | 11 | ti | |
| | Diethyl phthalate | ND | 5.00 | 11 | tt | 11 . | H | 11 | (I , | |
| | 2,4-Dimethylphenol | ND | 10.0 | н | ** | 19 - | ** | ŧ | | |
| l | Dimethyl phthalate | ND | 5.00 | Ħ | #1 | н | 11 | н | ** | |
| | 4,6-Dinitro-2-methylphenol | ND | 10.0 | ** | II | # | 11 | " | Н | |
| ì | 2,4-Dinitrophenol | ND | 25.0 | ** | tt | 18 | H | 11 | ti | |
| | 2,4-Dinitrotoluene | ND | 5.00 | 11 | # | И | н | 11 | ŧr | |
| | 2,6-Dinitrotoluene | ND | 5.00 | n | 11 | н | W . | н | ** | |
| | Bis(2-ethylhexyl)phthalate | ND | 10.0 | et | 41 | ti | Ħ | Ħ | ** | |
| | Fluoranthene | ND | 5.00 | u | н | ** | 11 | ** | Ħ | |
| | | | | | | | | | | |

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Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Secor

Project Number: 015.08716.001

Reported:

Project Manager: Joe Hunt

12/01/00 09:34

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------------|--------|--------------------|-------|----------|---------------|------------|-------------|----------------|-------|
| W5-111000 (P0K0303-02) Water | | | • | | Sampled: 11/1 | 0/00 Recei | ved: 11/13/ | 00 | |
| Fluorene | ND | 5.00 | ug/l | 1 | EPA 8270C | 11/16/00 | 11/20/00 | 0110577 | Hinda |
| Hexachlorobenzene | ND | 5.00 | et | н | 11 | " | Ħ | н | |
| Hexachlorobutadiene | ND | 10.0 | er | . 14 | " | 16. | # | 41 | |
| Hexachlorocyclopentadiene | ND | 10.0 | Ħ | 10 | u | Ħ | Ħ | ** | |
| Hexachloroethane | ND | 10.0 | ŧı | " . | tt | * | н | ŧŧ | |
| Indeno (1,2,3-cd) pyrene | ND | 5.00 | 11 | " | Ħ | Ħ . | a | tí | |
| Isophorone | ND | 5.00 | ** | | H | Ħ | tř | u · | |
| 2-Methylnaphthalene | ND | 5.00 | ** | н | u, | H | Ħ | tf | |
| 2-Methylphenol | ND | 10.0 | ** | u | н | 11 | n | u | |
| 3-,4-Methylphenol | ND | 5.00 | Ħ | u | 11 | # | n | н | |
| Naphthalene | ND | 5.00 | n | ů | # | 10 | 11 | н | |
| 2-Nitroaniline | ND | 5.00 | Ħ | 14 | 11 | at . | н | n | |
| 3-Nitroaniline | ND | 10.0 | u | ** | | tt | 11 | | |
| 4-Nitroaniline | ND | 10.0 | 11 | ** | tf | u | *1 | 11 | |
| Nitrobenzene | ND | 5.00 | 11 | ŧr | ŧŧ | Ħ | | tr. | |
| 2-Nitrophenol | ND | 5.00 | ** | H | U | H | n | et | |
| 4-Nitrophenol | ND | 25.0 | | đ | 11 | 11 | н | er | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | | n | н . | 11 | н | tt | |
| N-Nitrosodiphenylamine | ND | 5.00 | н | ti | n | 11 | n | u | |
| Pentachlorophenol | ND | 10.0 | er | 11 | ti | 11 | п | u | |
| Phenanthrene | ND | 5.00 | n | | ** | н | Ħ | н | |
| Phenol | ND | 5.00 | п | ** | le. | tt | 11 | 11 | |
| Pyrene | ND | 5.00 | n · | * | tī. | tf | " | . : • u | |
| 1,2,4-Trichlorobenzene | ND | 5.00 | ** | ** | в, | н | ** | # | |
| 2,4,5-Trichlorophenol | ND | 5.00 | 11 | Ħ | N | 11 | ** | es . | |
| 2,4,6-Trichlorophenol | ND | 5.00 | | н | к | ш | B | | |
| Surr: 2-Fluorobiphenyl | 59.9 % | 26-135 | | | | | | | |
| Surr: 2-Fluorophenol | 38.5 % | 6-124 | | | | | | | |
| Surr: Nitrobenzene-d5 | 60.8 % | 23-147 | | | | | | | |
| Surr: Phenol-d6 | 25.0 % | 11-130 | | | | | | | |
| Surr: p-Terphenyl-d14 | 94.6 % | 38-149 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 73.5 % | 19-126 | | | | | | | |
| - | | | | | | | | | |

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orند ـ

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported:

12/01/00 09:34

gante Compounds per EPA-Wethod 8260B-Quality Control

| North | Creek | Ana | lytical | Poi | rtland_ | |
|-------|-------|-----|---------|-----|---------|--|
| | | | | | | |

| | Reporting | | Spike | Source | | %REC | | RPD |
|------------|-------------|-------|-------|--------|------|--------|-----|-------------|
| Analyte Re | esult Limit | Units | Level | Result | %REC | Limits | RPD | Limit Notes |

| Batch 0110489 - EPA 5030 | | | | | |
|-----------------------------|----|------|------|---------------------------------------|----------|
| Blank (0110489-BLK1) | | | | Prepared & Analyzed: 11/14/00 | |
| Acetone | ND | 10.0 | ug/l | | 1. |
| Benzene | ND | 1.00 | u u | | ** |
| Bromobenzene | ND | 1.00 | " | | |
| Bromochloromethane | ND | 1.00 | #1 | | |
| Bromodichloromethane | ND | 1.00 | и | • | |
| Bromoform | ND | 1.00 | ** | • | • |
| Bromomethane | ND | 5.00 | ŧŧ | | 1.91 |
| 2-Butanone | ND | 10.0 | 11 | | : |
| n-Butylbenzene | ND | 5.00 | 11 | | |
| sec-Butylbenzene | ND | 1.00 | H | | * 1 |
| tert-Butylbenzene | ND | 1.00 | " | | |
| Carbon disulfide | ND | 10.0 | 11 | 4.8 | 1 |
| C-bon tetrachloride | ND | 1.00 | и . | | |
| obenzene | ND | 1.00 | н . | | |
| Chloroethane | ND | 1.00 | H | | |
| Chloroform | ND | 1.00 | et | • | |
| Chloromethane | ND | 5.00 | # | | 6.53 |
| 2-Chiorotoluene | ND | 1.00 | н | • | |
| 4-Chlorotoluene | ND | 1.00 | н | A 15 | |
| 1,2-Dibromo-3-chloropropane | ND | 5.00 | ŧŧ | | |
| Dibromochloromethane | ND | 1.00 | ,, | 1 % | * • |
| 1,2-Dibromoethane | ND | 1.00 | 11 | | i = i |
| Dibromomethane | ND | 1.00 | EI | | • |
| 1,2-Dichlorobenzene | ND | 1.00 | tr | | e4.3 |
| 1,3-Dichlorobenzene | ND | 1.00 | 11 | | i. |
| 1,4-Dichlorobenzene | ND | 1.00 | н | • | • |
| Dichlorodifluoromethane | ND | 5.00 | ti | + · · | |
| 1,1-Dichloroethane | ND | 1.00 | # | | ` . • |
| 1,2-Dichloroethane | ND | 1.00 | н | · · · · · · · · · · · · · · · · · · · | |
| 1,1-Dichloroethene | ND | 1.00 | # | | |
| cis-1,2-Dichloroethene | ND | 1.00 | " | | |
| trans-1,2-Dichloroethene | ND | 1.00 | # | | |
| 1,2-Dichloropropane | ND | 1.00 | н | | |
| 1,3-Dichloropropane | ND | 1.00 | | | |
| 2,2-Dichloropropane | ND | 1.00 | ** | | |

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541.383.9310 fax 541.382.7508 https://doi.org/10.1009/

Secor

P.O. Box 1508 Tualatin, OR 97062

Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported: 12/01/00 09:34

| <i>y</i> 😲 | 0.2 | P Reporting | | Spike | Source | | %REC | | RPD | |
|---------------------------|-------------|---------------------------------------|----------|----------|------------|-----------|-------------|------|---|-------|
| Analyte | Result | Limit | Units | Level | Resul! | %REC | Limits | RPD | Limit | Notes |
| Batch 0110577 - EPA 3510 | /600 Series | · · · · · · · · · · · · · · · · · · · | | | | | | • | (, . · · · | |
| LCS (0110577-BS1) | · | | | Prepare | d: 11/16/0 | 0 Analyz | ed: 11/20/0 | 00 | | |
| Acenaphthene | 35.3 | 5.00 | ug/l | 75.0 | | 47.1 | 40-110 | | | |
| 4-Chloro-3-methylphenol | 97.5 | 5.00 | H | 150 | | 65.0 | 40-110 | | | |
| 2-Chlorophenol | 78.1 | 5:.00 | н | 150 | | 52.1 | 40-110 | | | |
| ,4-Dichlorobenzene | 12.8 | 5.00 | Ħ | 75.0 | | 17.1 | 20-90 | | | Q-(|
| 4-Dinitrotoluene | 53.2 | 5.00 | tt | 75.0 | | 70.9 | 50-110 | | | |
| I-Nitrophenol | 46.8 | 25.0 | ŧi | 150 | | 31.2 | 15-100 | | | |
| N-Nitrosodi-n-propylamine | 39.4 | 10.0 | 11 | 75.0 | | 52.5 | 40-110 | | | |
| Pentachlorophenol | 120 | 10.0 | ** | 150 | | 80.0 | 30-120 | | | |
| Phenol | 36.7 | 5.00 | tF . | 150 | | 24.5 | 15-110 | | | |
| Pyrene | 53.7 | 5.00 | II . | 75.0 | | 71.6 | 40-110 | | | |
| ,2,4-Trichlorobenzene | 15.0 | 5.00 | п | 75.0 | | 20.0 | 25-100 | | | Q-0 |
| urr: 2-Fluorobiphenyl | 37.4 | | # | 75.0 | | 49.9 | 26-135 | · | *************************************** | - |
| urr: 2-Fluorophenol | 56.9 | | " | 150 | | 37.9 | 6-124 | | | |
| Surr: Nitrobenzene-d5 | 37.7 | • | " | 75.0 | | 50.3 | 23-147 | | | |
| Turr: Phenol-d6 | 37.7 | • | H | 150 | | 25.1 | 11-130 | | | |
| urr: p-Terphenyl-d14 | 64.8 | | · # | 75.0 | | 86.4 | 38-149 | | | |
| urr: 2,4,6-Tribromophenol | 123 | | " | 150 | | 82.0 | 19-126 | | | |
| CS Dup (0110577-BSD1) | • | , | | Prepared | d: 11/16/0 | 0 Analyze | ed: 11/20/0 | 00 | | |
| Acenaphthene | 34.2 | 5.00 | ug/l | 75.0 | | 45.6 | 40-110 | 3.17 | 25 | |
| -Chloro-3-methylphenol | 92.6 | 5.00 | ** | 150 | | 61.7 | 40-110 | 5.16 | 25 | |
| -Chlorophenol | 69.4 | 5.00 | t# | 150 | | 46.3 | 40-110 | 11.8 | 25 | |
| ,4-Dichlorobenzene | 9.33 | 5.00 | Ħ | 75.0 | | 12.4 | 20-90 | 31.4 | 35 | Q-0 |
| ,4-Dinitrotoluene | 49.4 | 5.00 | ** | 75.0 | | 65.9 | 50-110 | 7.41 | 25 | ` |
| -Nitrophenol | 44.3 | 25.0 | 11 | 150 | | 29.5 | 15-100 | 5.49 | 35 | |
| l-Nitrosodi-n-propylamine | 37.1 | 10.0 | tt | 75.0 | | 49.5 | 40-110 | 6.01 | 30 | |
| entachlorophenol | 115 | 10.0 | c | 150 | | 76.7 | 30-120 | 4.26 | 30 | |
| henol | 34.1 | 5.00 | tt | 150 | | 22.7 | 15-110 | 7.34 | 30 | |
| утепе | 51.1 | 5.00 | 0 | 75.0 | | 68.1 | 40-110 | 4.96 | 25 | |
| 2,4-Trichlorobenzene | 11.3 | 5.00 | н | 75.0 | | 15.1 | 25-100 | 28.1 | 30 | Q-0 |
| urr: 2-Fluorobiphenyl | 37.6 | | | 75.0 | | 50.1 | 26-135 | | | - |
| urr: 2-Fluorophenol | 52.6 | | " | 150 | | 35.1 | 6-124 | | | |
| urr: Nitrobenzene-d5 | 33.2 | | " | 75.0 | | 44.3 | 23-147 | | | |
| urr: Phenol-d6 | 34.7 | | " | 150 | | 23. I | 11-130 | | | |
| | - *** | | | | | | 11 150 | | | |

75.0

150

60.9

115

more instruction of remains that parties the

grand fate of the religion of

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38-149

19-126

81.2

76.7

Surr: p-Terphenyl-d14

Surr: 2,4,6-Tribromophenol

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North Creek Analytical, Inc. Page 15 of 17 **Environmental Laboratory Network**



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SOL

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716.001

Project Manager: Joe Hunt

Reported:

12/01/00 09:34

| | Nort | h Creek | Analys | ical - Po | <u>ortland</u> | | | | | - يعيد |
|----------------------------|--------|--------------------|--------|----------------|------------------|-----------|----------------|------|--------------|----------------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0110489 - EPA 5030 | | | | | | | | | | ; |
| LCS (0110489-BS1) | | : | | Prepare | d & Analy | zed: 11/1 | 4/00 | | | |
| Benzene | 20.0 | 1.00 | ug/l | 20.0 | | 100 | 80-125 | | : | |
| Chlorobenzene | 20.0 | 1.00 | fl | 20.9 | | 100 | 80-125 | | | Marine Comment |
| 1,1-Dichloroethene | 21.5 | 1.00 | H | 20.0 | | 108 | 70-135 | | * . | |
| Toluene | 20.3 | 1.00 | tt | 20.0 | | 101 | 80-125 | | | t , |
| Trichloroethene | 19.5 | 1.00 | ** | 20.0 | | 97.5 | 70-130 | | 1 1 | . 3 |
| Surr: 4-BFB | 20.0 | | " | 20.0 | | 100 | 75-125 | | | |
| Surr: 1,2-DCA-d4 | 19.6 | | H | 20.0 | | 98.0 | 75-125 | | | |
| Surr: Dibromofluoromethane | 18.8 | | H | 20.0 | | 94.0 | 75-125 | | | 1. H F.7. |
| Surr: Toluene-d8 | 19.2 | | H | 20.0 | ٠ | 96.0 | 75-125 | | | |
| LCS Dup (0110489-BSD1) | | | | Prepare | d & Analy | zed: 11/1 | 4/00 | | | |
| Benzene | 19.0 | 1.00 | ug/l | 20.0 | | 95.0 | 80-125 | 5.13 | 25 | |
| Chlorobenzene | 18.8 | 1.00 | ı, | 20.0 | | 94.0 | 80-125 | 6.19 | 25 | A |
| Pichloroethene | 20.1 | 1.00 | н . | 20.0 | | 101 | 70-135 | 6.73 | 25 | |
| xdene | 19.2 | 1.00 | Ħ | 20.0 | | 96.0 | 80-125 | 5.57 | 25 | |
| Trichloroethene | 18.4 | 1.00 | " | 20.0 | | 92.0 | 70-130 | 5.80 | 25 | |
| Surr: 4-BFB | 20.0 | | 11 | 20.0 | * | 100 | 75-125 | | | * * * |
| Surr: 1,2-DCA-d4 | 19.9 | | u | 20.0 | | 99.5 | 75-125 | | | |

18.5

19.0

20.0

20.0

92.5

95.0

75-125

75-125

North Creek Analytical - Portland

Surr: Dibromofluoromethane

Surr: Toluene-d8

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Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508

Project Number: 015.08716.001

Reported:

Tualatin, OR 97062

Project Manager: Joe Hunt

12/01/00 09:34

| Î | √or. | th | Cr | cek / | Anal | lytical | .] | Portland_ |
|---|------|----|----|-------|------|---------|-----|-----------|
| | | | | | | | | |

| | | Reporting | Spi | ke Source | ı | %REC | RPD | |
|--------|------|-----------|-----------|------------|------|--------|-----------|-------|
| nalyte | Resu | t Limit | Units Lev | vel Result | %REC | Limits | RPD Limit | Notes |

| Batch 0110577 - EPA 351 | 0/600 Series | | | | | | | |
|-----------------------------|--------------|----|------|------------|-----------|----------------|-----------------|-------------------------|
| Blank (0110577-BLK1) | | | | | Prepared: | : 11/16/00 Ana | lyzed: 11/20/00 | |
| Acenaphthene | | ND | 5.00 | ug/i | | | | |
| Acenaphthylene | | ND | 5.00 | H / | | | | |
| Anthracene | | ND | 5.00 | Ħ | - | • | | |
| Benzo (a) anthracene | | ND | 5.00 | Ħ P | | 197 | | |
| Benzo (a) pyrene | | ND | 5.00 | H | • | 7 1 x | | |
| Benzo (b) fluoranthene | | ND | 5.00 | 11 | , | 4, 10 | • | Stoke 4 |
| Benzo (ghi) perylene | | ND | 5.00 | 4 | | :1 | | And the second |
| Benzo (k) fluoranthene | | ND | 5.00 | ŧŧ , | | | | |
| Benzoic Acid | | ND | 50.0 | # | ٠, | 14 | | |
| Benzyl alcohol | | ND | 10.0 | ₹ | - | • | | |
| 4-Bromophenyl phenyl ether | | ND | 5.00 | \$ | | t | | • |
| Butyl benzyl phthalate | | ND | 5.00 | ŧı | | • | | • |
| 4-Chloro-3-methylphenol | | ND | 5.00 | ŧI | | | | $\sigma_{i} = \rho_{i}$ |
| 4-Chloroaniline | | ND | 20.0 | n | • | | | · · |
| Bis(2-chloroethoxy)methane | | ND | 10.0 | Ü | | +, | | |
| Bis(2-chloroethyl)ether | | ND | 5.00 | и . | | : | | |
| Bis(2-chloroisopropyl)ether | | ND | 10.0 | n s | 100 | | | . • |
| 2-Chloronaphthalene | | ND | 5.00 | H | . • | | | • |
| 2-Chlorophenol | | ND | 5.00 | U | | | | • |
| 4-Chlorophenyl phenyl ether | | ND | 5.00 | 10 | | | | : |
| Chrysene | | ND | 5.00 | tt · | | + 1 | | er e garage |
| Di-n-butyl phthalate | | ND | 5.00 | H | | | | er vita |
| Di-n-octyl phthalate | | ND | 5.00 | ff : | | | | • |
| Dibenzo (a,h) anthracene | | ND | 5.00 | # " | | | | |
| Dibenzofuran | | ND | 5.00 | fi fi | | | | |
| 1,2-Dichlorobenzene | | ND | 5.00 | a · | | • | | |
| 1,3-Dichlorobenzene | | ND | 5.00 | Ħ | | | | |
| 1,4-Dichlorobenzene | | ND | 5.00 | н • | | | | ; |
| 3,3'-Dichlorobenzidine | | ND | 5.00 | н | | | | |
| 2,4-Dichlorophenol | | ND | 5.00 | н | | * | | |
| Diethyl phthalate | | ND | 5.00 | н | | | | * - 64 |
| 2,4-Dimethylphenol | | ND | 10.0 | н , | | | | |
| Dimethyl phthalate | | ND | 5.00 | н. | | ·U . | | |
| 4,6-Dinitro-2-methylphenol | | ND | 10.0 | 16 | | | | v 3 |
| 2,4-Dinitrophenol | | ND | 25.0 | 6 5 | | | | |
| 2,4-Dinitrotoluene | | ND | 5.00 | ** | | | | |

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Сог

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C

North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|----------------------------|--------|--------------------|-------|----------|----------------|------------|--------------|---------|-------|
| MW3 (P008562-03) Water | | | | | Sampled: 08/2 | 5/00 Recei | ved: 08/29/0 | | |
| Fluorene | ND | 5.00 | ug/l | 1 | EPA 8270C | 09/01/00 | 09/06/00 | 0090018 | |
| Hexachlorobenzene | ND | 5.00 | Ħ | N | Ħ | 11 | Ħ | Ħ | |
| Hexachlorobutadiene | ND | 10.0 | er | II. | Ħ | ** | Ħ | | |
| Hexachlorocyclopentadiene | ND | 10.0 | ** | 11 | e | Ħ | # | ** | |
| Hexachloroethane | ND | 10.0 | Ħ | Ħ | | Ħ | н | Ħ | |
| Indeno (1,2,3-cd) pyrene | ND | 5.00 | Ħ | п | Ħ | | Ħ | Ħ | |
| Isophorone | ND | 5.00 | e | | н | н | tt | ** | |
| 2-Methylnaphthalene | ND | 5.00 | 11 | н | ** | ti . | tt | 19 | |
| 2-Methylphenol | ND | 10.0 | н | 11 | н | 44 | Ħ | н | |
| 3-,4-Methylphenol | ND | 5.00 | Ħ | tr | Ħ | ** | н | Ħ | |
| Naphthalene | ND | 5.00 | 11 | * | Ħ | Ħ | D | H | |
| 2-Nitroaniline | ND | 5.00 | n | 11 | ** | u | #1 | 11 | |
| 3-Nitroaniline | ND | 10.0 | Ш | (t | 11 | II | # | II | |
| 4-Nitroaniline | ND | 10.0 | #F | Ħ | н | 11 | ŧI | tt | |
| Nitrobenzene | ND | 5.00 | ** | ti | tt | 11 | tr | 11 | |
| trophenol | ND | 5.00 | ti | 11 | 11 | (1 | 11 | ** | |
| 4-Nitrophenol | ND | 25.0 | H | II | н | Ħ | 11 | ti | |
| N-Nitrosodi-n-propylamine | ND | 10.0 | tf | a | Ħ | 21 | 11 | it | |
| N-Nitrosodiphenylamine | ND | 5.00 | ** | 11 | t t | 11 | II . | " | |
| Pentachlorophenol | ND | 10.0 | Н | . 11 | 19 | II | 11 | 11 | |
| Phenanthrene | ND | 5.00 | н | tt | H | H | # | 11 | |
| Phenol | ND | 5.00 | n | 1t | rr | 11 | II | n | |
| Pyrene | ND | 5.00 | 11 | H | 11 | II | Ħ | ** | |
| 1,2,4-Trichlorobenzene | ND | 5.00 | н | Ħ | н | tř | 91 | n . | |
| 2,4,5-Trichlorophenol | ND | 5.00 | Ħ | ** | tr | u | U | н | |
| 2,4,6-Trichlorophenol | ND | 5.00 | ** | 11 | 11 | # | | | |
| Surr: 2-Fluorobiphenyl | 94.7 % | 26-135 | | | | | | | |
| Surr: 2-Fluorophenol | 55,2 % | 6-124 | | | | | | | |
| Surr: Nitrobenzene-d5 | 96.8 % | 23-147 | | | | | | | |
| Surr: Phenol-d6 | 38.5 % | 11-130 | | | | | | | |
| Surr: p-Terphenyl-d14 | 94.8 % | 38-149 | | | | | | | |
| Surr: 2,4,6-Tribromophenol | 111% | 19-126 | | | | | | | |

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Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Conventional Chemistry Parameters per APHA/EPA Methods North Creek Analytical - Portland

| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
|------------------------|--------|--------------------|-------|----------|---------------|------------|--------------|---------|-------|
| MW1 (P008562-01) Water | | | | Ś | Sampled: 08/2 | :5/00 Rece | ived: 08/29/ | 00 | |
| Acidity | 17.1 | 10.0 | mg/l | 1 | EPA 305.2 | 09/14/00 | 09/14/00 | 0090361 | I-02 |
| Total Alkalinity | 52.8 | 10.0 | | ** | EPA 310.1 | 09/08/00 | 09/08/00 | 0090296 | |
| MW2 (P008562-02) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Acidity | 15.4 | 10.0 | mg/l | 1 | EPA 305.2 | 09/14/00 | 09/14/00 | 0090361 | I-02 |
| Total Alkalinity | 63.1 | 10.0 | н | | EPA 310.1 | 09/08/00 | 09/08/00 | 0090296 | |
| MW3 (P008562-03) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Acidity | 16.1 | 10.0 | mg/l | 1 | EPA 305.2 | 09/14/00 | 09/14/00 | 0090361 | I-02 |
| Total Alkalinity | 89.9 | 10.0 | at | " | EPA 310.1 | 09/08/00 | 09/08/00 | 0090296 | |

North Creek Analytical - Portland

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 fax 509.924.9290

Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132

503,906.9200 fax 503.906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383,9310 fax 541.382.7588

OL

P.O. Box 1508 Tualatin, OR 97062 Project: Fort James Specialty Chemicals

Project Number: 015.08716 Project Manager: Joe Hunt

Reported:

09/19/00 12:39

Dissolved Metals by EPA 6000/7000 Series Methods

North Creek Analytical - Bothell

| | 110 | THE CLOCK | | | ····· | | | | |
|------------------------|---------|--------------------|-------|----------|---------------|------------|----------------|---------|-------|
| Analyte | Result | Reporting Limit | Units | Dilution | Method | Prepared | Analyzed | Batch | Notes |
| MW1 (P008562-01) Water | | | | 5 | Sampled: 08/2 | 5/00 Recei | ved: 08/29/0 | 00 | |
| Arsenic | ND | 0.00100 | mg/l | 1 | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Barium | 0.00362 | 0.00100 | | Ħ | 11 | + | н | n | |
| Cadmium | ND | 0.00100 | н | 11 | н | Ħ | Ħ | n | |
| Chromium | ND | 0.00100 | n | н | Ħ | 11 | Ħ | 11 | |
| Lead | ND | 0.00100 | * | Ħ | a | ** | Ħ | н | |
| Mercury | ND | 0.00125 | Ħ | ŧr | EPA 7470A | 09/15/00 | 09/18/00 | 0115024 | |
| Selenium | ND | 0.00100 | n | tt. | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Silver | ND | 0.00100 | 11 | Ħ | n | H | ** | et | |
| MW2 (P008562-02) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Arsenic | 0.00268 | 0.00100 | mg/l | 1 | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Barium | 0.0625 | 0.00100 | и | tt. | 11 | Ħ | tl | er | |
| Cadmium | ND | 0.00100 | 11 | Ħ | н | 41 | Ħ | e | |
| Chromium | 0.00344 | 0.00100 | н | н | n | " | 11 | Ħ | |
| J nad | 0.00367 | 0.00100 | н | ti | u. | " | 11 | 11 | |
| bury | ND | 0.00125 | 11 | # | EPA 7470A | 09/15/00 | 09/18/00 | 0115024 | |
| Selenium | ND | 0.00100 | " | " | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Silver | 0.00133 | 0.00100 | ** | *1 | п | tt | t t | * | |
| MW3 (P008562-03) Water | | | | | Sampled: 08/2 | 5/00 Rece | ived: 08/29/ | 00 | |
| Arsenic | ND | 0.00100 | mg/l | 1 | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Barium | 0.00777 | 0.00100 | | # | Ħ | Ħ | ff. | Ħ | |
| Cadmium | ND | 0.00100 | Ħ | н | н | ** | tt | " | |
| Chromium | ND | 0.00100 | Ħ | Ħ | er | 11 | ** | Ħ | |
| Lead | ND | 0.00100 | # | Ħ | " | 11 | н | - O | |
| Mercury | ND | 0.00100 | 11 | н | EPA 7470A | 09/15/00 | 09/18/00 | 0115024 | |
| Selenium | ND | 0.00100 | # | Ħ | EPA 6020 | 09/11/00 | 09/12/00 | 0111019 | |
| Silver | ND | 0.00100 | н | Ħ | H | 11 | 11 | 11 | |

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. **Environmental Laboratory Network**

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 Seattle
 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223 425,420,9200
 425,420,9210

 Spokane
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 fax 509,924,9290

Spokane

9405 SW Nimbus Avenue, Beaverton, DR 97008-7132 503.906.9200 fax 503.906.9210

20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310 fax 541.382.7588

Secor

Project: Fort James Specialty Chemicals

P.O. Box 1508

Project Number: 015.08716

Reported:

Tualatin, OR 97062

Project Manager: Joe Hunt

09/19/00 12:39

| | No | rth Creek | Analy | tical - Po | ortland | | | | | |
|--------------------------------|--------|--------------------|--------------|----------------|------------------|----------|----------------|-----|--------------|-------|
| Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
| Batch 0090013 - EPA 3510 Fuels | | | | | | | | | | |
| Blank (0090013-BLK1) | | | | Prepared: | 09/01/00 | Analyzed | : 09/05/00 | | | |
| Gasoline Range Hydrocarbons | ND | 0.125 | mg/l | | | | | | | |
| Diesel Range Hydrocarbons | ND | 0.315 | н | | | | | | | |
| Heavy Oil Range Hydrocarbons | ND | 0,315 | н | | | | | | | |
| Surr: 1-Chlorooctadecane | DET | | H | 0.100 | | 97.0 | 50-150 | | | |

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Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223

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9405 SW Nimbus Avenue, Beaverton, OR 97008-7132 503.906.9200 fax 503.906.9210. Portland 503.906.9200 fax 503.906.9210 ... 20332 Empire Avenue, Suite F-1, Bend, OR 97701-57119 541.383.9310 fax 541.382.7588

cor

Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062 Project Number: 015.08716.001

Reportedayie

Project Manager: Joe Hunt

i < i

12/01/00 09:34

7 of the fee

ISemivolatile:Organic:Compounds per EPA Method 3270C = Quality Control = 1 + 2 + 2 + 2

North Creek Analytical - Portland

| | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | en v I | Reporting | | Spike | Source | | %REC | | RPD | |
|---------|--|--------|-----------|-------|-------|--------|------|--------|-----|-------|-------|
| Analyte | 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1 | Result | Limit | Units | Level | Result | %REC | Limits | RPD | Limit | Notes |

Batch 0110577 - EPA 3510/600 Series

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager Association of

The state of the s

North Creek Analytical, Inc. 18 Page: 16 of 17 **Environmental Laboratory Network**



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503.906.9200 fax 503,906.9210 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711 541.383.9310- fax 541.382.7589

Secor, Project: Fort James Specialty Chemicals

P.O. Box 1508 Tualatin, OR 97062

Project Number: 015.08716.001 Project Manager: Joe Hunt

Reported: 12/01/00 09:34

Notes and Definitions

| Q-01 | The spike recovery, and/or RPD, for this QC sample is outside of established control limits. Review o | f associated batch QC |
|------|---|-----------------------|
| l | indicates the recovery for this analyte does not represent an out-of-control condition for the batch. | -n |

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

Sample results reported on a wet weight basis wet

RPD Relative Percent Difference

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Lisa Domenighini, Project Manager

North Creek Analytical, Inc. Environmental Laboratory Metwork

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NORTH CREEK ANALYTICAL Environmental Laboratory Services

- The state of the

East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508

FAX 924-9290 FAX 906-9210 (425) 420-9200 FAX 420-9210 (509) 924-9200 FAX 924-9290 (503) 906-9200

Work Order # 1010303

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| REPORT TO: SECOR | INVOICE TO: | TURNAROUND REQUEST in Business Days 4 |
| ATTENDAY JOE Hunt | АТТЕЙПОК | Organic & Inorganic Analyzea |
| 1 | ADDRESS: | (10 7 5 4 3 2 E B |
| Track to Organ | | Fuels & Hydrocarton Analyses |
| 4707-703 FXX: 503-692-7074 | P.O. NUMBER: NCA QUOTE A: | - 7 F |
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