SECOR
International Incorporated

COPY
S. Young

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.

12034 134th Court NE, Suite 102, Redmond, WA 98052 425.372.1600 425.372.1650 Fax www.secor.com

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 ✓

SUMMARY LETTER

SECOR
International Incorporated

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.

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 discussed this site with an Ecology representative in the past? yes
If yes, what is that person's Name? ~~Teddy Le~~
And the approximate date? ~~March 7, 2001~~
Is this a leaking underground storage tank site? (includes piping leaks) No

Please submit the following with this signed form to the appropriate Ecology office (see back of form)

x Site Summary (ECY 020-73)	x Any other existing reports on this site
x A Check or Money Order for $500 made out to "Department of Ecology"	

Applicant completes this section: *(Note: The applicant is responsible for all billings)*

Applicant Name: Georgia-Pacific Corporation / Julie B. Raming		Phone: 404-652-6869
Applicant Address: 133 Peachtree Street		
City: Atlanta	State: Ga	Zip: 30303
Site Name: Former Fort James Specialty Chemical Complex Alternate Name:		
Site Address: 906 NW Drake		
City: Camas	State: WA	Zip: 98607 County: Clark
Site Owner Name: Georgia-Pacific Corporation		
Site Owner Address: 401NE Adams Street		Phone: 360-834-8322
City: Camas	State: WA	Zip: 98607

I, ~~Julie B. Raming request the assis~~tance of the Department of Ecology. With this Application I have enclosed $500. I understand that: this payment is the equivalent of approximately eight (8) hours of staff review and/or assistance on the cleanup of my contaminated site; actual charges will depend on specific staff and charge-out rates of that staff; if total charges are greater than $500, I will be billed for and I agree to pay the remainder; and any excess payments will be refunded to me.

Julie B. Raming 4/12/01
Signature of Applicant Date

Note: The applicant is responsible for all billings.

For Office Use only:

Date:	Hours:	Rate:	Staff Name:
Date:	Hours:	Rate:	Staff Name:
Date:	Hours:	Rate:	Staff Name:
Date:	Hours:	Rate:	Staff Name:

For Office Use only: **Receipts**
Amount Date Pd Rec. #

For FISCAL USE ONLY

173-02-94-005000-5000- -
(LUST/Non-LUST) (Office)

LUST/Non-LUST: LUST - 30 Non-LUST - 20
OFFICE: NWRO - 40 SWRO - 50 ERO - 60
CRO - 70 IND - 80 HDQR - 90

Voluntary Cleanup Program

Washington State - Department of Ecology - Toxics Cleanup Program

Site Summary

This Summary is a required component of your request for assistance under the Voluntary Cleanup Program

Which of the following apply?

- [ ] Requesting assistance on a planned cleanup
- [ ] Requesting assistance on an ongoing cleanup.
- [X] Requesting review of a completed investigation.

Note: If you submitted your Request for Assistance (ECY 020-74) previously without a Site Summary (this form) or this is a revised Site Summary, Please provide this completed form to Ecology at least five (5) working days prior to the meeting/site visit/documentation review (whichever comes first).

A) Site Identification:

Name of Site: Former Ft. James Specialty 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):

City: | State: | Zip:

Township	Range	Section	Quarter-Quarter

If Known:

Latitude: Degree 45.585778 Minute Second

Longitude: Degree -122.409999 Minute Second

Method used to calculate Latitude and Longitude: Referenced EPA,s Detail Report/Envirofacts

How large (in acres) is the site? 8

Please attach two maps to this form. *(see attached reports)*****

1) An area map, showing general location of the site in relation to surrounding bodies of water, cities, highways, and streets. (Please mark site location.)
2) A site diagram showing surrounding cross-streets, labeled building outlines, sampling and well locations, etc.

B) Person/Organization Making Request for Assistance/Review:

Name: Julie B. Raming

Firm: Georgia Pacific

Street Address: 133 Peachtree Street

City: Atlanta | State: Georgia | Zip: 30303

Telephone Number: 404-652-6869 | Extension:

Fax Number: 404-654-6401 | e-mail address: jbraming@gapac.com

Which best describes your involvement with the site? (Check as many as apply.)

Current Owner	[X]	Former Owner	[ ]	Potential Purchaser	[ ]
Current Operator	[ ]	Former Operator	[ ]	Other (specify)	[ ]

Environmental Consultant for
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 [X] no

If yes, has alternate drinking water been provided? [ ] yes [X] 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? [X] yes [ ] no

Within 1/4 mile of the site? [X] yes [ ] no

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

Are they impacted by contamination from the site? [ ] yes [X] no

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

Contaminant	Class *(for office Use*	Affected Soil	Media: Ground-Water	Surface Water	Air	Sediment	Date of Release *(if known)*
Example: Lead		C	C	S	U	S	1967-82
1) 1,4 dichlorobenzene		B	C	N/A	N/A	N/A	U
2) Tetrachloroethene		C	C	N/A	N/A	N/A	U
3) Trichloroethene		O	C	N/A	N/A	N/A	U
4) bis(2-ethylhexyl)phthalate		O	C	N/A	N/A	N/A	U
5) 1,2-dichlorobenzene		B	B	N/A	N/A	N/A	U
6) Polychorinated biphenyls		B	O	N/A	N/A	N/A	U
7) Acetone		B	B	N/A	N/A	N/A	U
8) Methylene Chloride		B	O	N/A	N/A	N/A	U

9) Chlorobenzene		O	B	N/A	N/A	N/A	U
10) Chloroform		O	B	N/A	N/A	N/A	U
11) cis-1,2-dichloroethene		O	B	N/A	N/A	N/A	U
12) Toluene		O	B	N/A	N/A	N/A	U
13) 1,1,1-Trichloroethane		O	B	N/A	N/A	N/A	U
14) 1,2,4-Trimethylbenzene		O	**B	N/A	N/A	N/A	U
15) Xylene		O	B	N/A	N/A	N/A	U
16) 2-Chlorophenol		O	B	N/A	N/A	N/A	U
17) Methylenedioxybenzene		***	O	N/A	N/A	N/A	U
17) Arsenic		C	C	N/A	N/A	N/A	U
18) Barium		B	B	N/A	N/A	N/A	U
19) Cadmium		B	O	N/A	N/A	N/A	U
20) Chromium		C	B	N/A	N/A	N/A	U
21) Lead		B	B	N/A	N/A	N/A	U
22) Mercury		B	O	N/A	N/A	N/A	U
23) Silver		O	O	N/A	N/A	N/A	U
24) Selenium		B	B	N/A	N/A	N/A	U

**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 [x] no [ ] In-progress [ ]
If yes, when? Report rec'd 01/30/01 Were results reported to Ecology? yes [x] no [ ] Date
Describe: (list reports in "E" below)

Remediation:

Has any site cleanup work been done at the site? yes [ ] no: X in-progress [ ]
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

If yes, describe: (list reports in "E" below)

N/A

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:

N/A

Contaminant	Class *(for office Use*	Pounds of Contaminant: Incinerated	Washed	Removed	Treated	*Contained)*
Example: Lead		10	20	40	10	60
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						
9)						
10)						
11)						
12)						

As a result of the cleanup:
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 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 people are now at reduced risk as a result of the cleanup action? N/A

How many pounds of potential pollution was prevented as a result of the cleanup action? Methods/Treatments Used	Soil	Groundwater	Surface Water	Drinking Water	Air	Wastes
Method A						
Method B						
Method C						
Have these levels been met through the site ? Y or N						
Destruction or Detoxification						
Carbon Adsorption[1]						
Biological Treatment						
Chemical Destruction						

Incineration						
[1]*Carbon followed by regeneration: use of granular activated carbon followed by landfilling would be classified in these tables as volume reduction and off-site landfill*						
Media Transfer						
Air stripping/Air Sparging						
Aeration/Vapor Extraction						
Thermal Desorption						
Immobilization						
Vitrification						
Solidification/Stabilization						
Reuse/Recycling[2]						
Specify						
[2]*For example, reuse of free petroleum product recovered in a pump and treat system.*						
Separation/Volume Reduction						
Solvent Extraction						
Soil Washington						
Physical Separation[3]						
[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.)

Title	By:	Date
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

Is additional information concerning the contaminants treated or removed, or cleanup or remediation methods used available in a data base? yes ☐ no: X If yes, what programming software is use? N/A
Is a copy included for our use? yes ☐ no ☐ N/A

F) Property Type: Commercial ☐ Industrial: X Residential ☐ Other ☐ (Please specify)
Property currently being used? yes ☐ no: X
Plans for change in use? yes ☐ no ☐ If yes, please specify: N/A

G) Standard Industrial Classification (SIC) Codes:

List all that apply. If none apply, or if you don't know your SIC code, list activities conducted at the site (i.e. automotive repair and maintenance, construction equipment storage, etc.).

Former production of specialty chemicals to support various client needs.

H) Dangerous Waste Facilities:

Does the facility have a dangerous waste identification number? yes ☐ no ☒
If yes, what is the number? WAD

I) Tank Information:

No underground or active aboveground storage tanks were encountered during the Preliminary Assessment or 2000 Site Investigation. According to Fort James, a 500-gallon partially buried fuel UST was historically located in the landscaped bed of the Building 201 Non-Woven Plant. No information is available on removal of this UST. However, no petroleum residues were detected in two soil samples collected from the reported UST location during the 2000 Site Investigation

Complete this table for ALL tanks, whether underground (UST) or aboveground (AST), including unregulated tanks.
(*Unleaded, leaded diesel, bunker-C, waste oil, heating oil, aviation fuel, other (identify))
(** Tank status: Left in Place, Removed, Closed in Place)

Tank ID	AST/UST	Size	Was Free Product encountered? Product	On GW	In Excavation	Tank Status

J) Owner/Operator History
(Please photocopy and attach copies if additional owners and/or operators are known.)

Type (code) of Owner/Operator (for below):
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 Corporation		Type: 1
Street Address: : 401 NE Adams Street		
City: Camas	State: WA	ZIP: 30303
Contact Persons (if different than owner, above): Julie B. Raming (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-Pacific Corporation		Type: 1
Street Address: 401 NE Adams Street		
City: Camas	State: WA	ZIP: 98607
Contact Persons (if different than owner, 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 James Specialty Chemical Complex		
Street Address: 906 NW Drake		
City: Camas	State: WA	ZIP: 98607
Contact Persons (if different than owner, above):		
Street Address:		
City:	State:	ZIP:
Telephone Number:	Extension:	
Fax Number:	e-mail address:	
Dates of Ownership: to		

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		

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

1) Environmental Consultant: SECOR International 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/Operator. (This must be a person who is on-site during normal working hours and is authorized and qualified to answer questions about the site, or a person who is available during normal business hours and has knowledge about the site and the remediations.		
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:	

3) 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:	

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

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

CHASE MANHATTAN BANK USA
1201 MARKET STREET
WILMINGTON, DELAWARE 19801

62-26
311

4645-09

VENDOR NUMBER	DATE	CHECK NUMBER	PAY EXACTLY
98160	3/22/01	903081529	$********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

Void A. Skik

⑈090308152⑈ ⑆031100267⑆ 630144645050 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 #	GROSS AMOUNT	DISCOUNT	NET AMOUNT	PHONE CONTACT
3/19/01	03192001	500.00	.00	500.00	404-652-6013
TOTALS		500.00	.00	500.00	

GP 10814 (9/97)

FORMS CONTROL NUMBER:
(SEE CHECK NUMBER ABOVE) 6641950

PRELIMINARY SITE ASSESSMENT REPORT

SECOR
International Incorporated

COPY

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

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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 ($DMSO_2$), methylenedioxybenzene (MDB), and purified catechol. TDP is a chemical intermediate used in the manufacturing of guinea worm larvicide, while $DMSO_2$, 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 $DMSO_2$ 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
- $DMSO_2$
- 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. $DMSO_2$ 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.

Building 206. 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.

Underground Storage Tanks. 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. Residuals and 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

REFERENCE: USGS 7.5 MINUTE QUADRANGLE; CAMAS, WASHINGTON

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SITE LOCATION MAP

FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: 1

JOB#: 015.08716.600 APPR: JTN DWN: KPM DATE: 07/18/00

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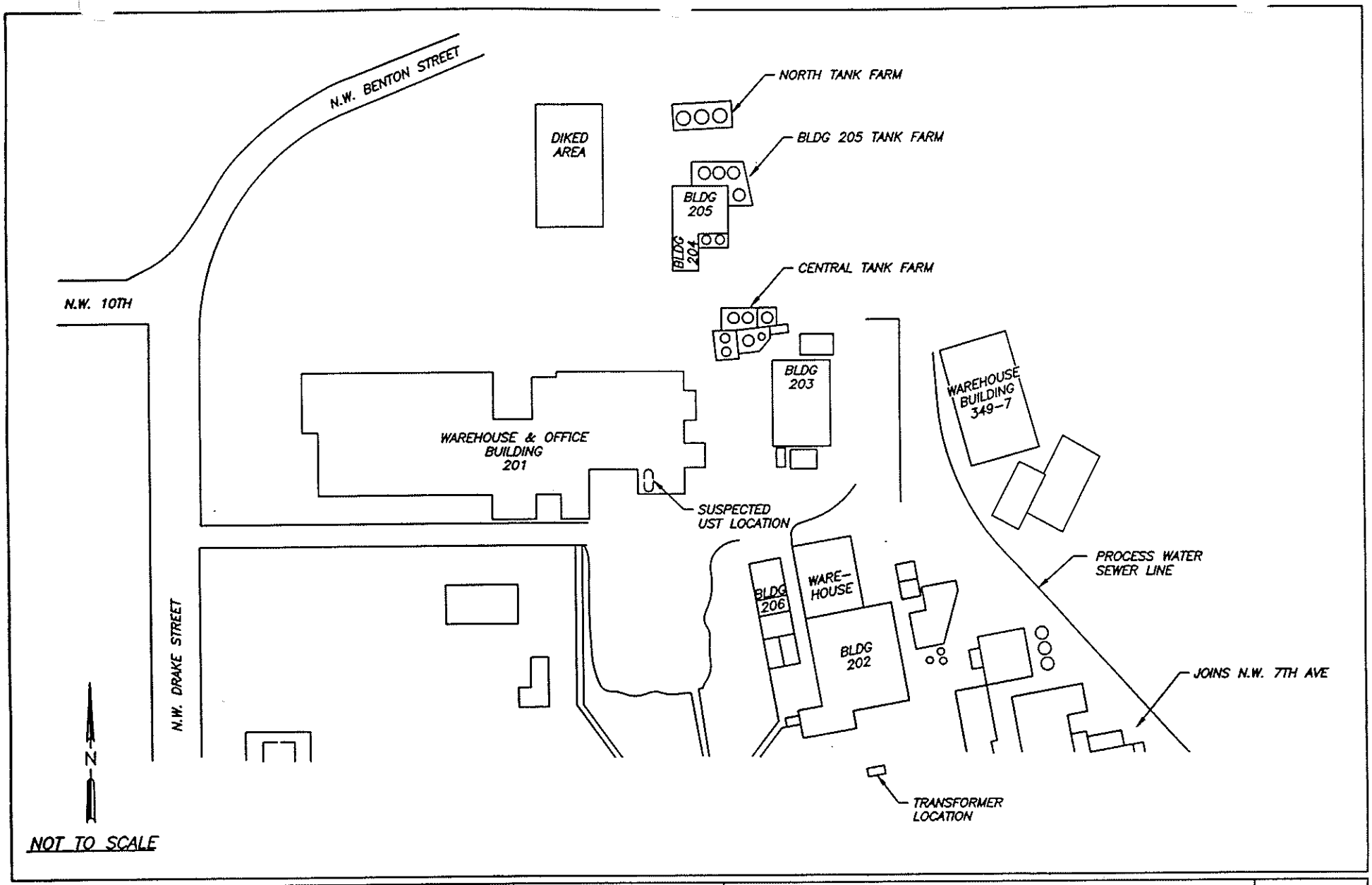
DWG: 15-87616-5(1)



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FACILITIES LAYOUT

FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **2**

JOB#: 015.08716.500 APPR: DWN: KPM DATE: 7/18/00

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DWG: 15-8716-52

TABLES

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

Date	Material Spilled	Estimated Volume	Media Impacted	Cause	Remedial Action
11/88	CZ 777 pitch dispersed	Unknown	Blue Creek	Storm sewer discharge to Blue Creek.	Not stated.
3/89	HCl	< 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.
08/90	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 lbs	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
07/08/96	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.

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

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

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

4,4'-THIODIPHENOL

TECHNICAL BULLETIN

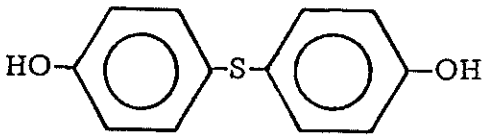
Crown Zellerbach
Chemical Products Division
Camas, Washington 98607

Crown Zellerbach

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.

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PHYSICAL PROPERTIES

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) grams/cubic centimeter at 25°C	1.385		
Refractive index (3) (crystals)	$\parallel$ n_D^{25}	1.688	
	$\perp$ n_D^{25}	1.608	
Heat of fusion (4), calories/gram	approx.	38	
Acid dissociation constants (5)(31) (50% aq. ethanol, 25°C)	pKa_1	10.3	
	pKa_2	11.1	
Polarographic half-wave potential (6)	$E_{1/2}$	0.85 V	
Spectra	Absorbance Peaks (nm)		Extinction Coefficient (logϵ)
Ultraviolet in 6% aq. EtOH (5)	(neutral)	231.2	4.16
	(neutral)	248.6	4.16
	(alkaline)	265.0	4.39
" in methanol (2) (see curve)	(neutral)	233.0	4.16
	(neutral)	251.0	4.18
Visible in 96% H_2SO_4 (7)		840	1400
		520	500
Infrared (9)(36) (see curve)			
Electron spin resonance in 96% H_2SO_4 (7)			

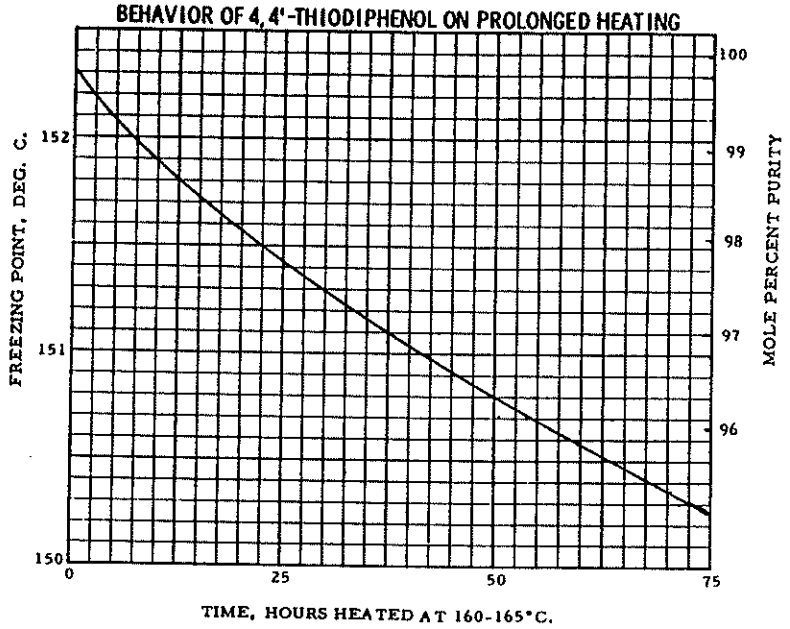
Solubilities of 4,4'-Thiodiphenol (TDP)

	Weight Percent (2)		
	25°C	60°C	80°C
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, hours	Total Recovery %	Isomers found, %		
		2,2'	2,4'	4,4'
5	95	21	63	16
24	95	42	47	10

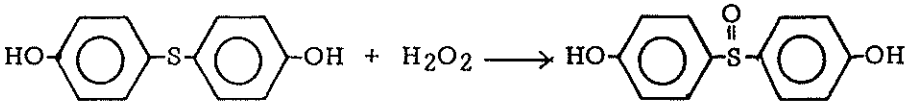
Dilute alkaline solutions of 4,4'-thiodiphenol are relatively stable when refluxed with exposure to air. After 2-3 hours there was little effect. After eight hours a small loss in product and reduction in melting point was obtained. Presence of iron increased the degradation under these conditions.

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.

CHEMICAL PROPERTIES

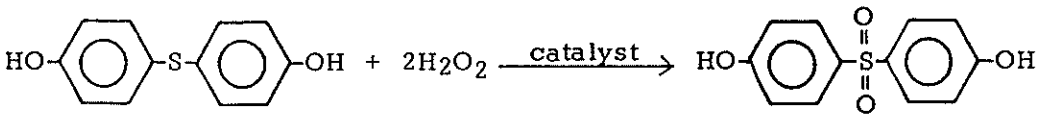
REACTIONS WITH THE SULFUR GROUP

The sulfoxide of 4,4'-thiodiphenol (TDP) is readily prepared (1). A laboratory procedure is available in the Appendix.



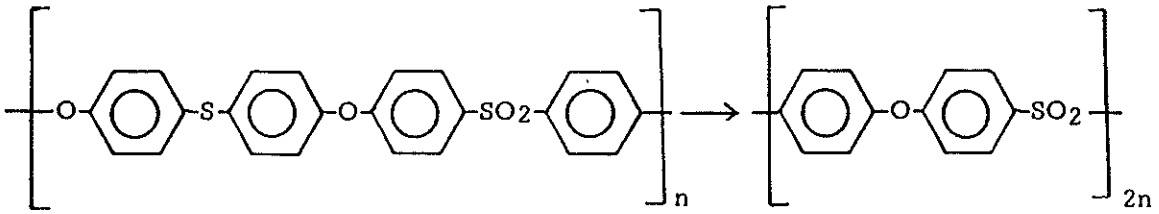
4,4'-Sulfinyldiphenol
m.p. 195°C (dec.)

The sulfone 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.



4,4'-Sulfonyldiphenol
m.p. 247+°C

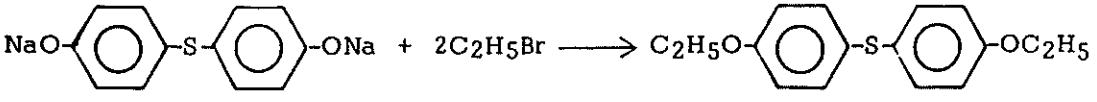
After being incorporated into a polymer backbone, TDP can be oxidized to the sulfone. The polymer was dissolved in chloroform and treated with hydrogen peroxide in acetic acid or aqueous potassium permanganate (51).



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).

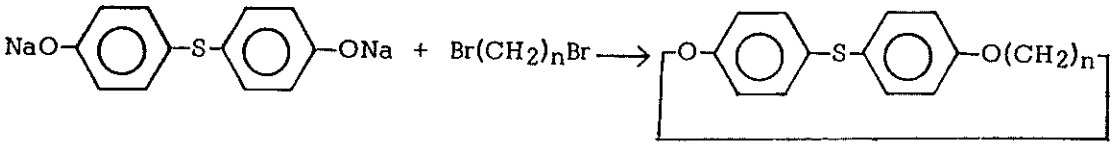


4,4'-Thiodiphenol diethylether
m.p. 55°C

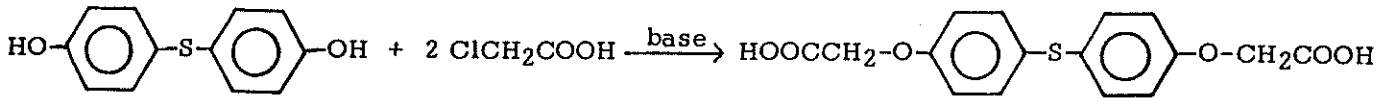
CHEMICAL PROPERTIES

Ethers (cont.)

Cyclic ether systems have been prepared from $Br(CH_2)_nBr$ where n = 6, 8, 10 although aliphatic dihalides usually give polymers (10).

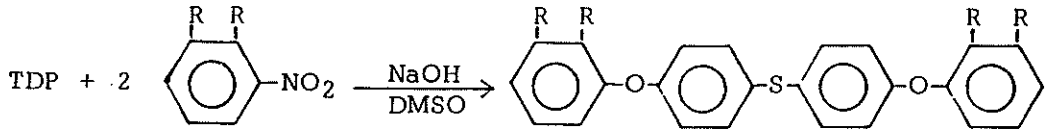


TDP reacts with chloroacetic acid to form the biscarboxymethyl ether (57).



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

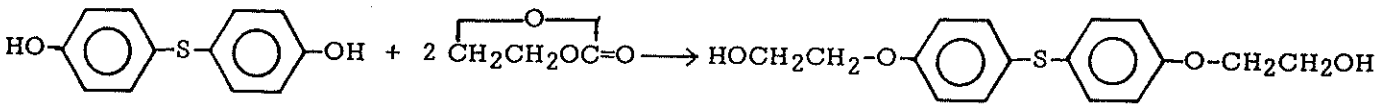
The reaction of TDP and diethyl-3-nitrophthalate results in the formation of a bis aryl ether (89).



R = $-COOCH_2CH_3$

Hydroxyethylation

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).

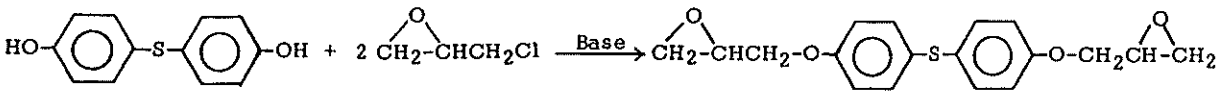


4,4'-Thiodiphenol-bis(2-hydroxyethyl ether)
m.p. 102.8°C

CHEMICAL PROPERTIES

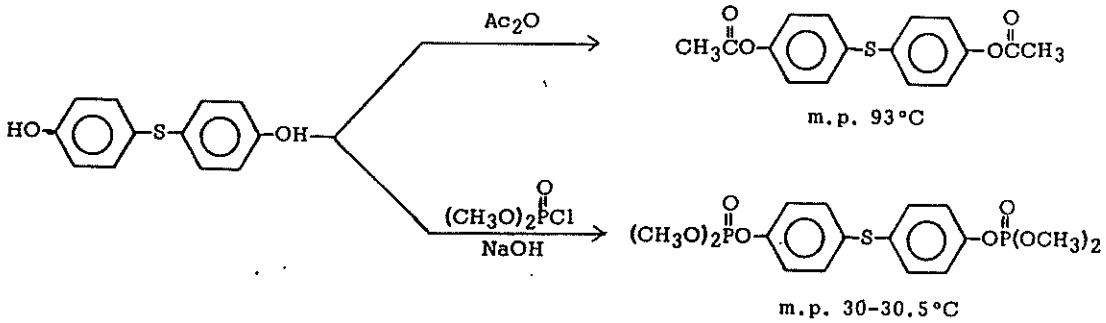
Glycidyl Ethers

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).



Esterification

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



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-methylbenzyl)phenol] (72) and with cyclohexene to give 4,4'-thiobis(2-cyclohexylphenol) (73).

Halogenation

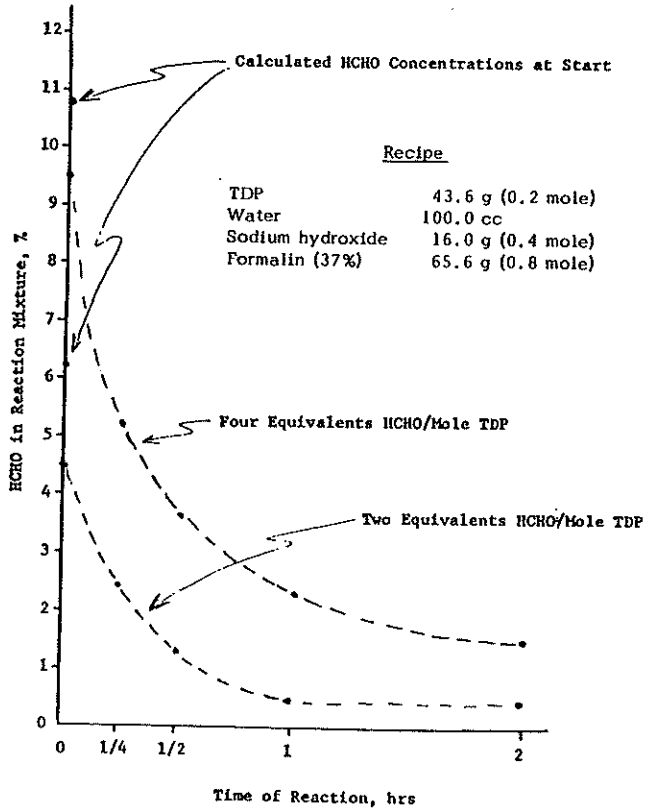
The reaction of 4,4'-thiodiphenol with chlorine results in cleavage to form p-chlorophenol and other chlorinated phenols (52). Bromine reacts with TDP in carbon disulfide to produce, tetrabromo-4,4'-thiodiphenol (67,137).

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):

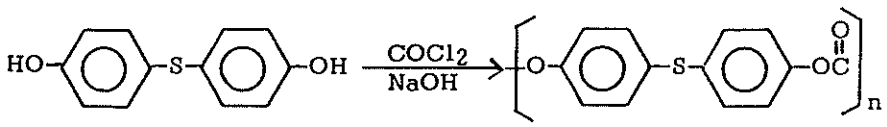


The rate and products from the reaction of TDP with formaldehyde in an alkaline medium were studied by paper chromatography (68). Using sulfuric acid catalysis, TDP, 4-phenolsulfonic acid, and formaldehyde were reacted to form a resin (69). Other references to the reaction of TDP with formaldehyde include: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

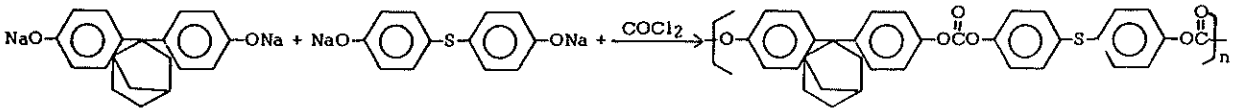
POLYMERS

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.



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).



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).

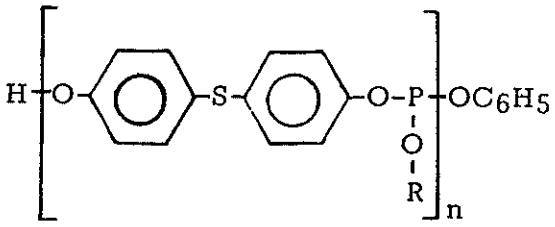
POLYMERS

Polyesters

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(oxyethylene)glycol were heated for several hours to give a polyester (25). In somewhat 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).

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).

Animal Feed Supplement

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).

Pharmaceutical

4,4'-Thiodiphenol or its salts are useful as hypolipidemic agents in mammals (132).

Varnish

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).

ANALYTICAL METHODS

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.

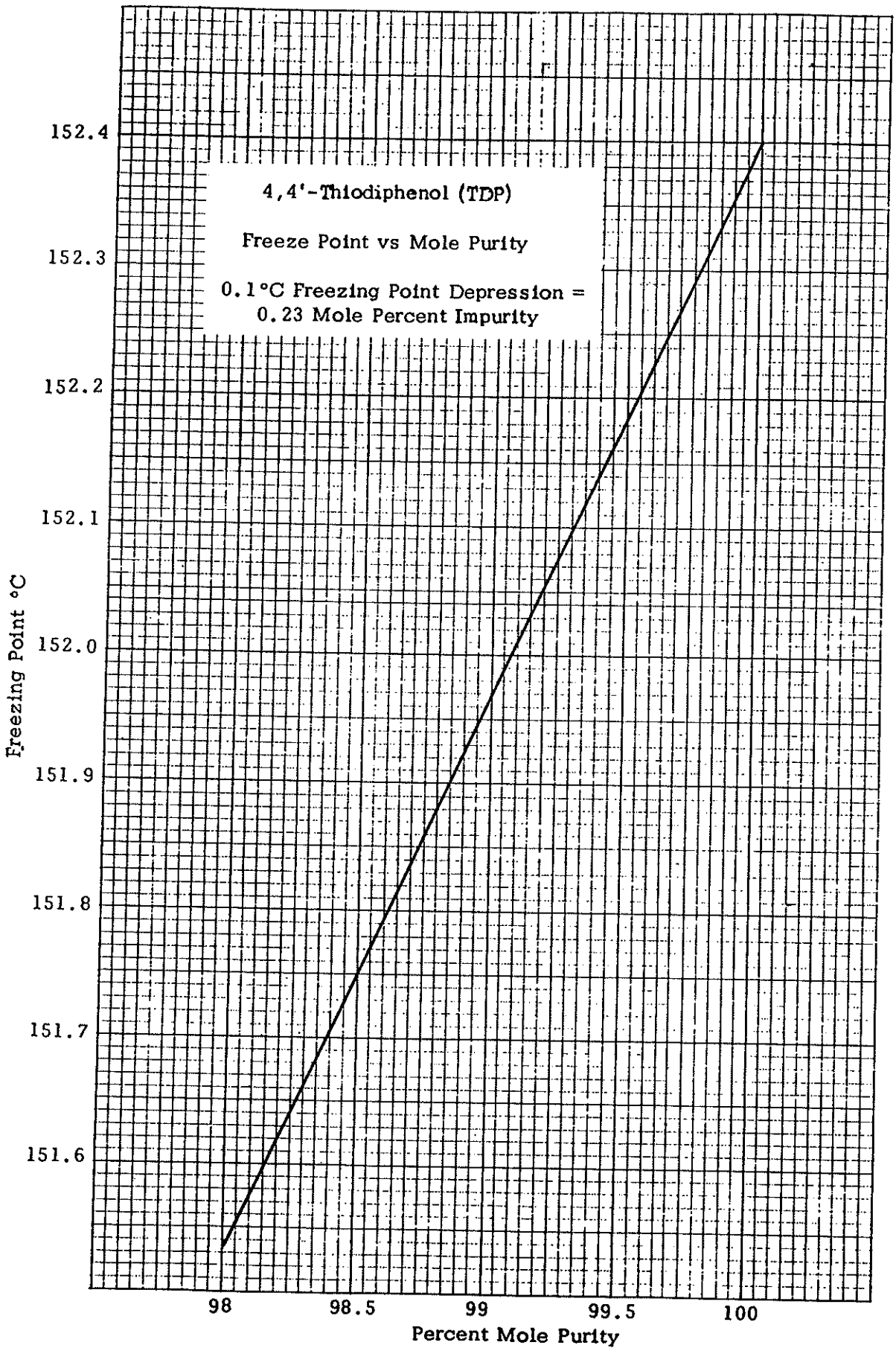
Results

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.

ANALYTICAL METHODS



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-SO_2-methanol

   Mix 300 ml C.P. pyridine and 300 ml anhydrous methanol. Bubble in 60 grams of SO_2. This can be done with the solution on a platform balance to weigh directly the SO_2 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.

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

   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. Standardization of Reagents

The Karl Fischer solution must be standardized at least weekly. Add 20 ml of anhydrous methanol and 5 ml of the pyridine-SO_2-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.

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

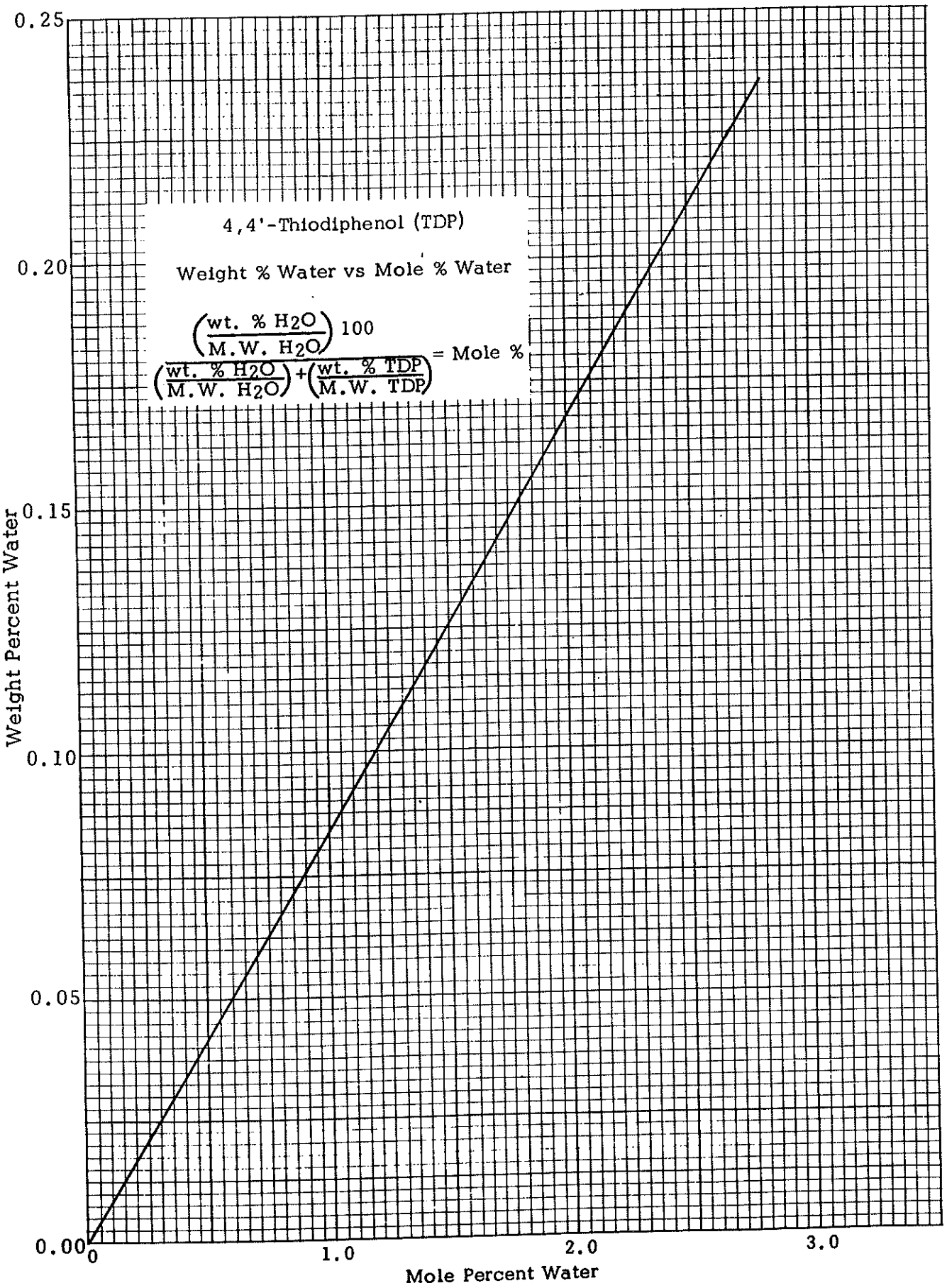
2. Determination of Water

Add 20 ml of anhydrous methanol and 5 ml of the pyridine-SO_2-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

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

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


4,4'-Thiodiphenol (TDP)
Weight % Water vs Mole % Water
$\frac{\left(\frac{\text{wt. \% } H_2O}{\text{M.W. } H_2O}\right) 100}{\left(\frac{\text{wt. \% } H_2O}{\text{M.W. } H_2O}\right)+\left(\frac{\text{wt. \% TDP}}{\text{M.W. TDP}}\right)}$ = Mole %
Weight Percent Water
0.25
0.20
0.15
0.10
0.05
0.00
0
1.0
2.0
3.0
Mole Percent Water

ANALYTICAL METHODS

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 (1 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.)

Preparation of Sample

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

Preparation of Standards

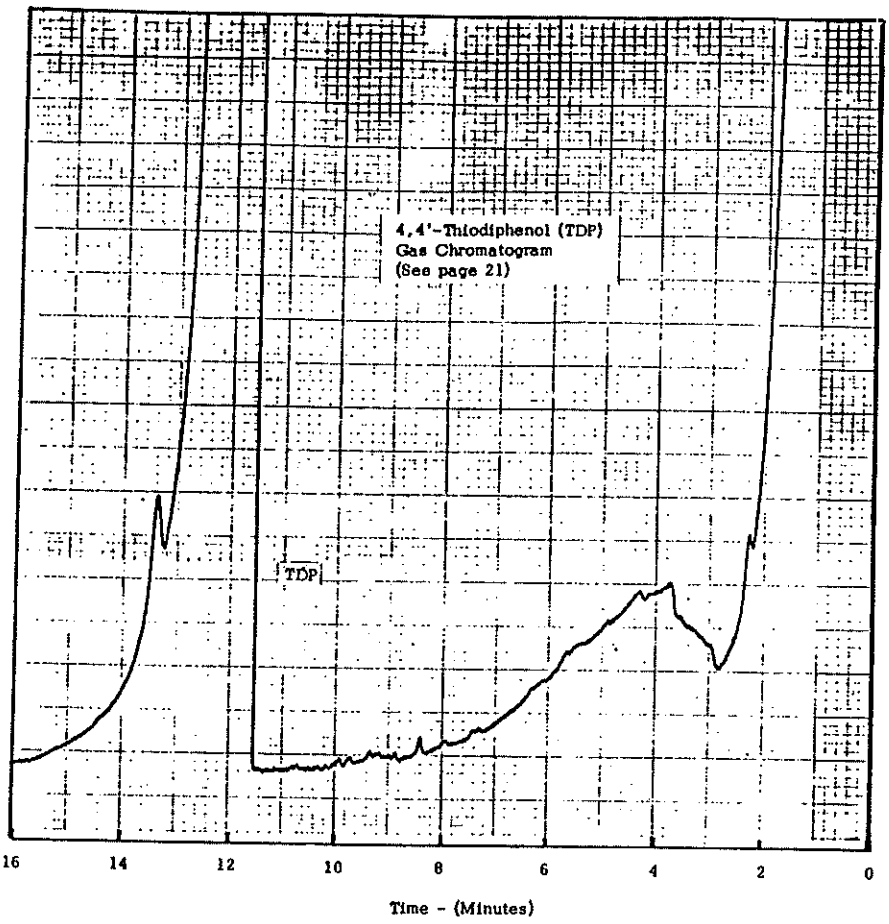
Into a small polyseal capped bottle, weigh approximately 0.006 gram (all weighings to 0.0001 gram) of phenol and 6 grams of purified TDP. Add 20 ml of ethyl ether. Cap the bottle and swirl to effect solution. 0.2 ml of this solution is transferred to a small septum closure vial and silylated and chromatographed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

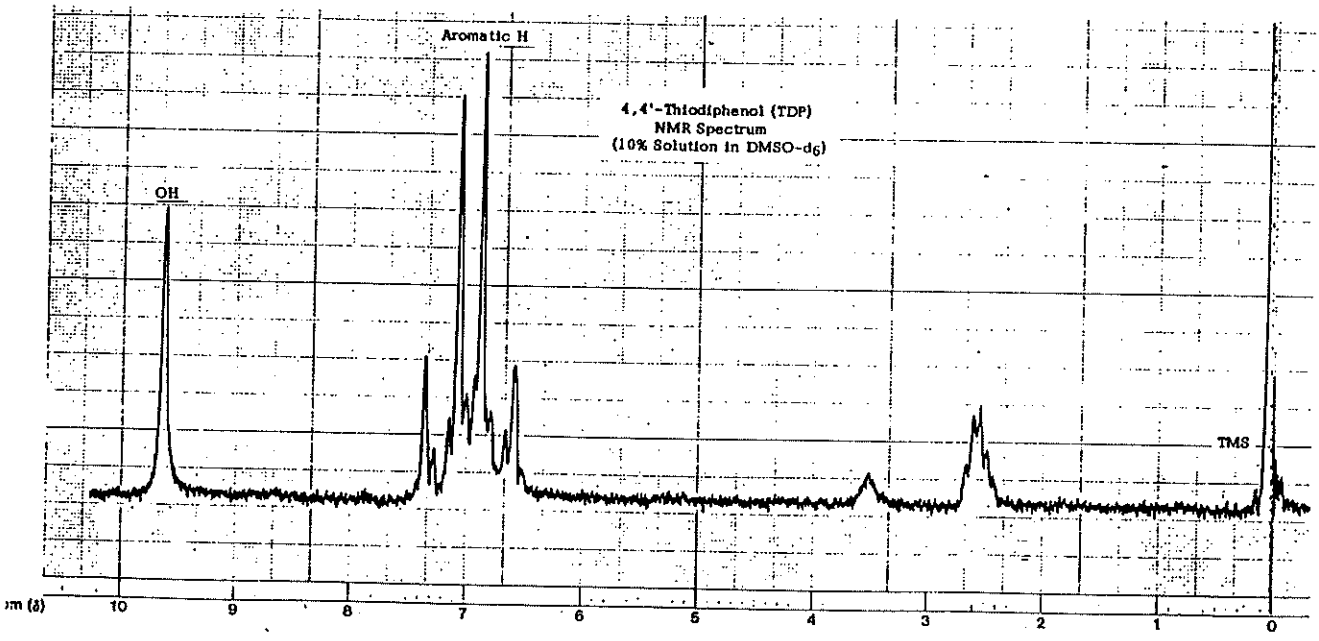
Calculations

$$\% \text{ Phenol} = \frac{(\text{TDP peak area of std})(\text{phenol peak area of test sample})(\% \text{ phenol in std})}{(\text{phenol peak area of std})(\text{TDP peak area of test sample})}$$

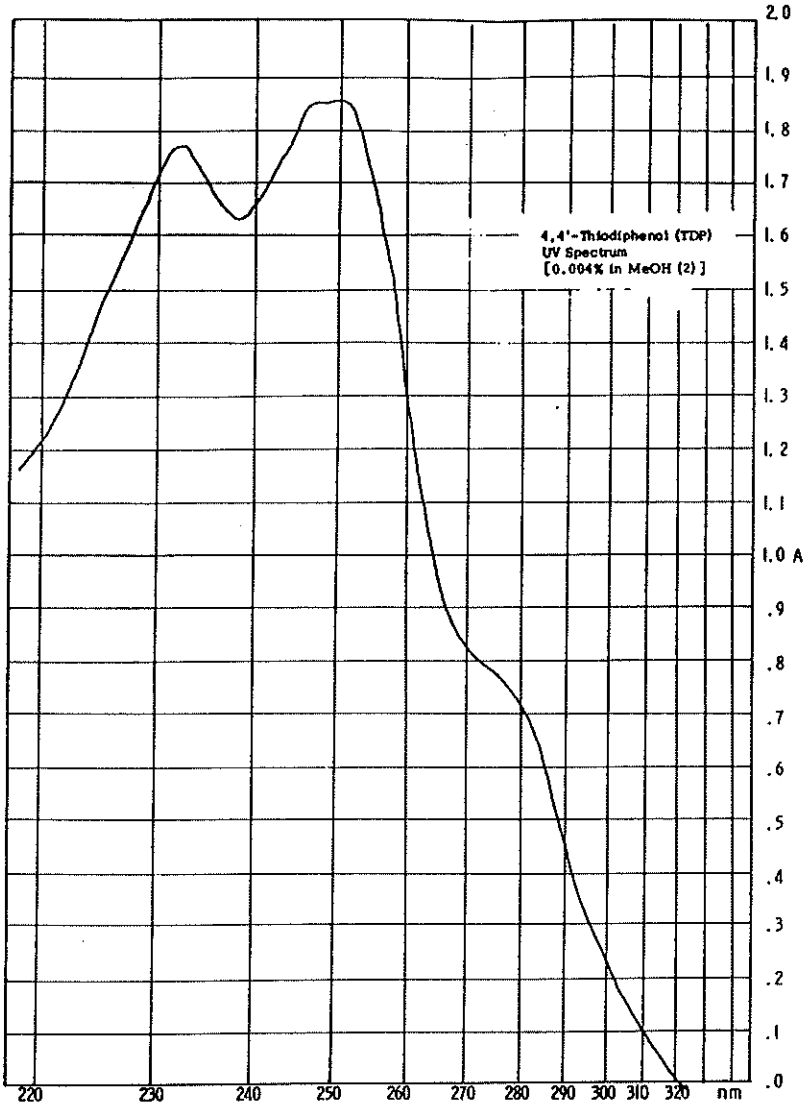
$$\% \text{ 2,4-Thiodiphenol} = \frac{(\text{2,4 peak area})(100)}{(\text{sum of peak areas excluding solvents})}$$

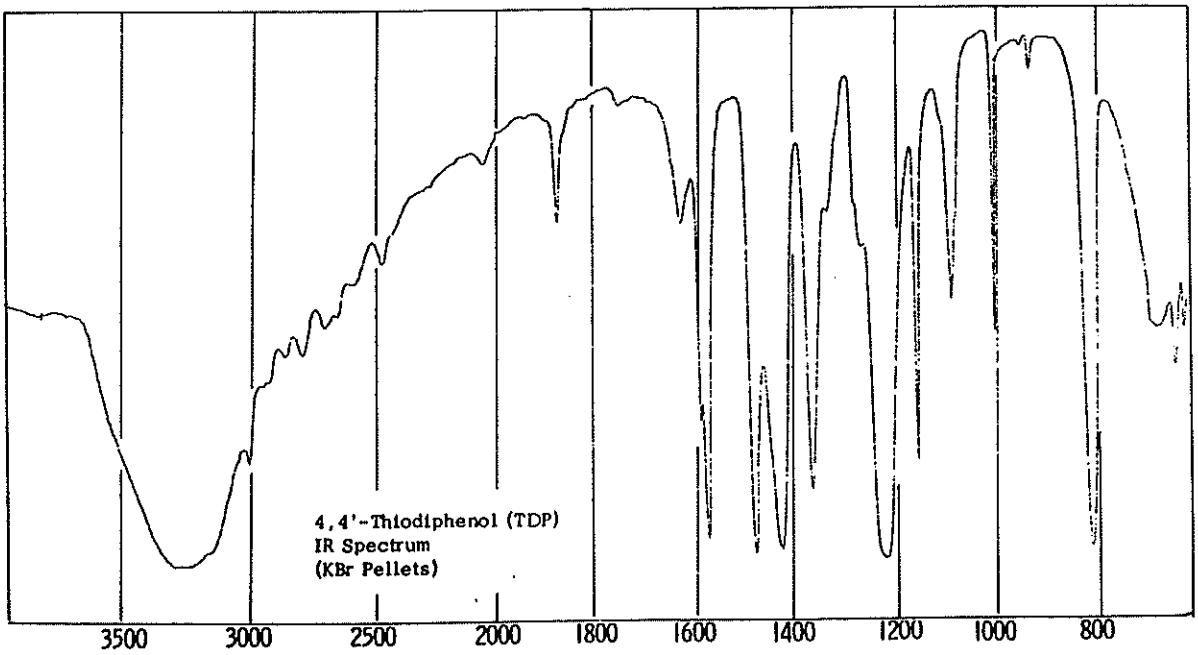
ANALYTICAL METHODS





ANALYTICAL METHODS





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 LD_{50} (Albino Rats)	3,362 mg/kg
Acute Dermal Toxicity LD_{50} (Albino Rabbits)	>10,250 mg/kg
Eye Irritation (Albino Rabbits)	Extremely irritating (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.

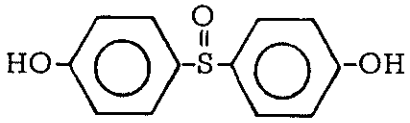
First Aid: In case of contact, immediately flush exposed area with plenty of water for at least 15 minutes. Call a physician.

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



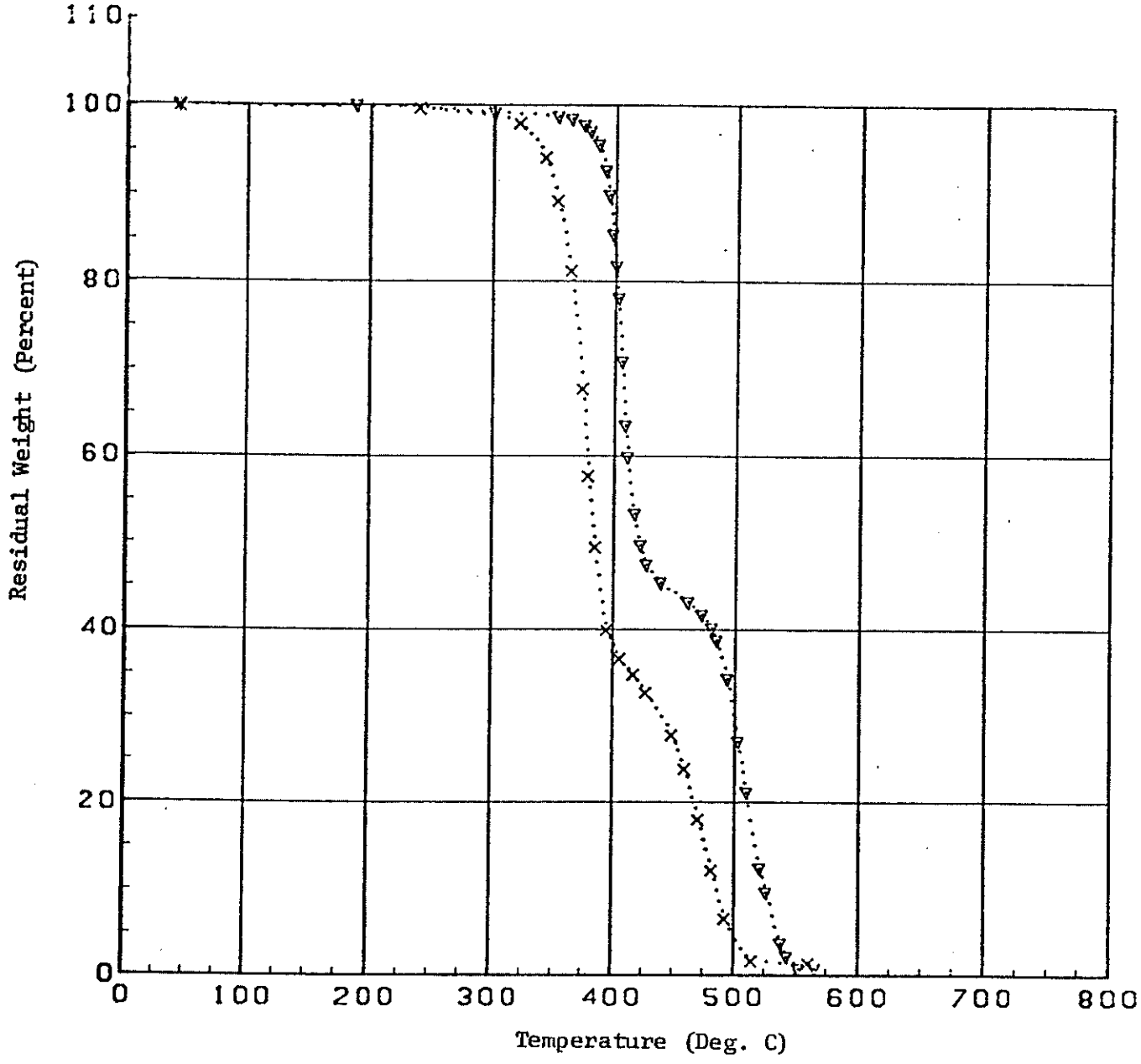
In a 600 ml beaker were placed 109 g (0.5 mole) 4,4'-thiodiphenol and 150 ml glacial acetic acid. The temperature was raised to about 80°C, when the thiodiphenol dissolved. Hydrogen peroxide, 34 g of 50% aqueous (0.5 mole) was added dropwise over one-half hour while maintaining the same temperature. 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

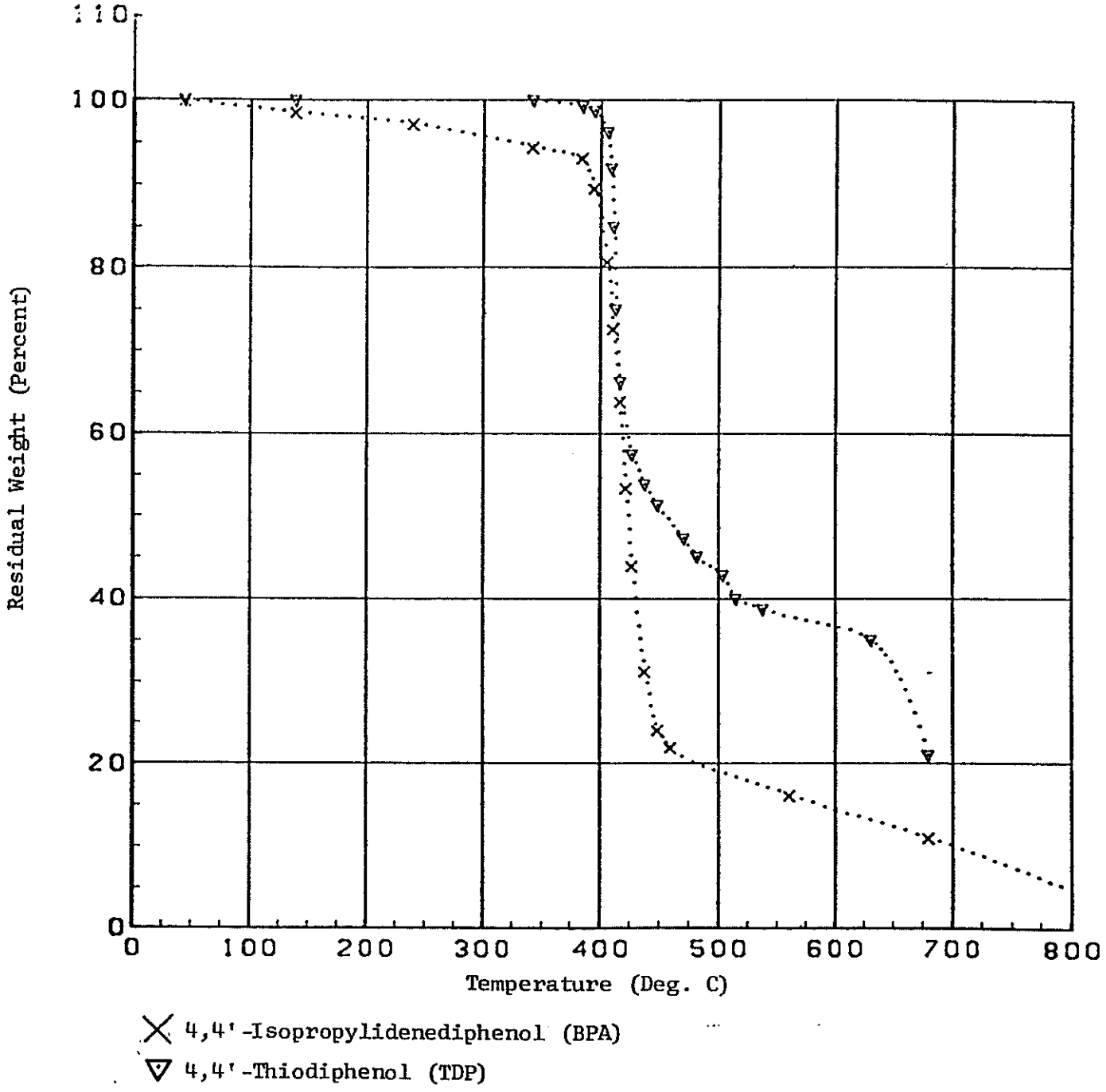


APPENDIX

POLYCARBONATE

(Phosgene and Indicated Monomer)

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

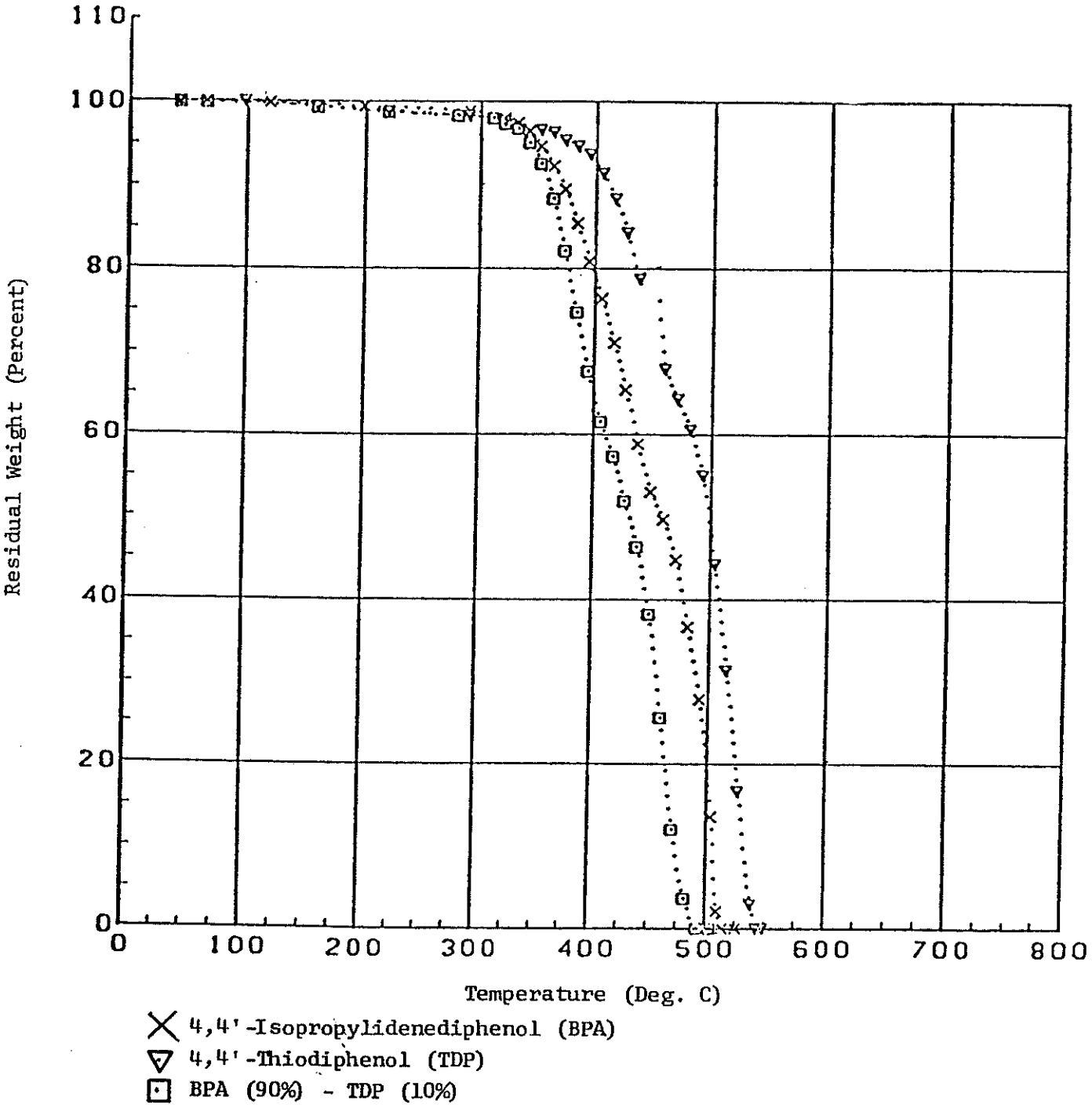


APPENDIX

POLYESTER

(Terephthalic Acid and Indicated Monomer)

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

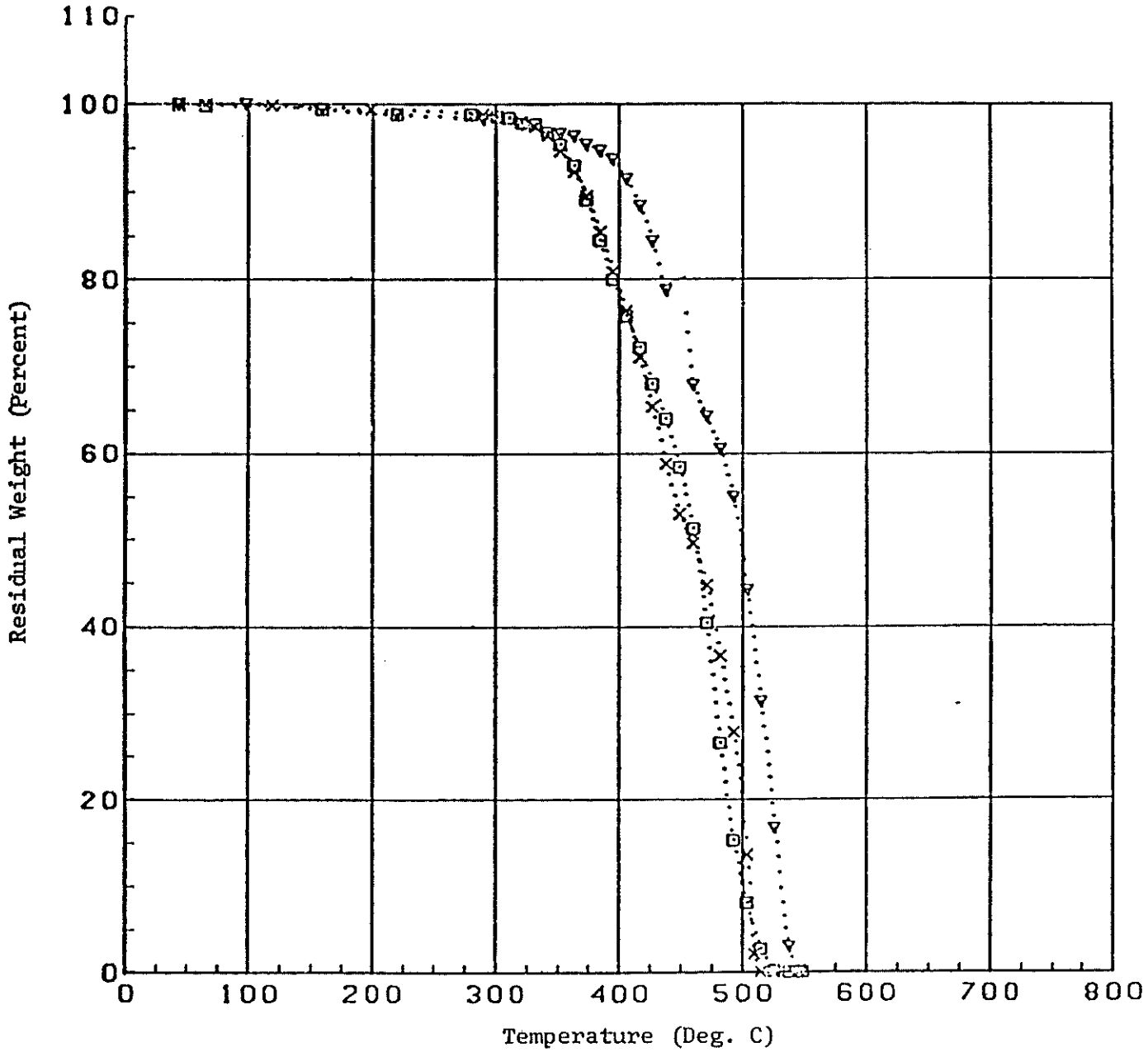


APPENDIX

POLYESTER

(Terephthalic Acid and Indicated Monomer)

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

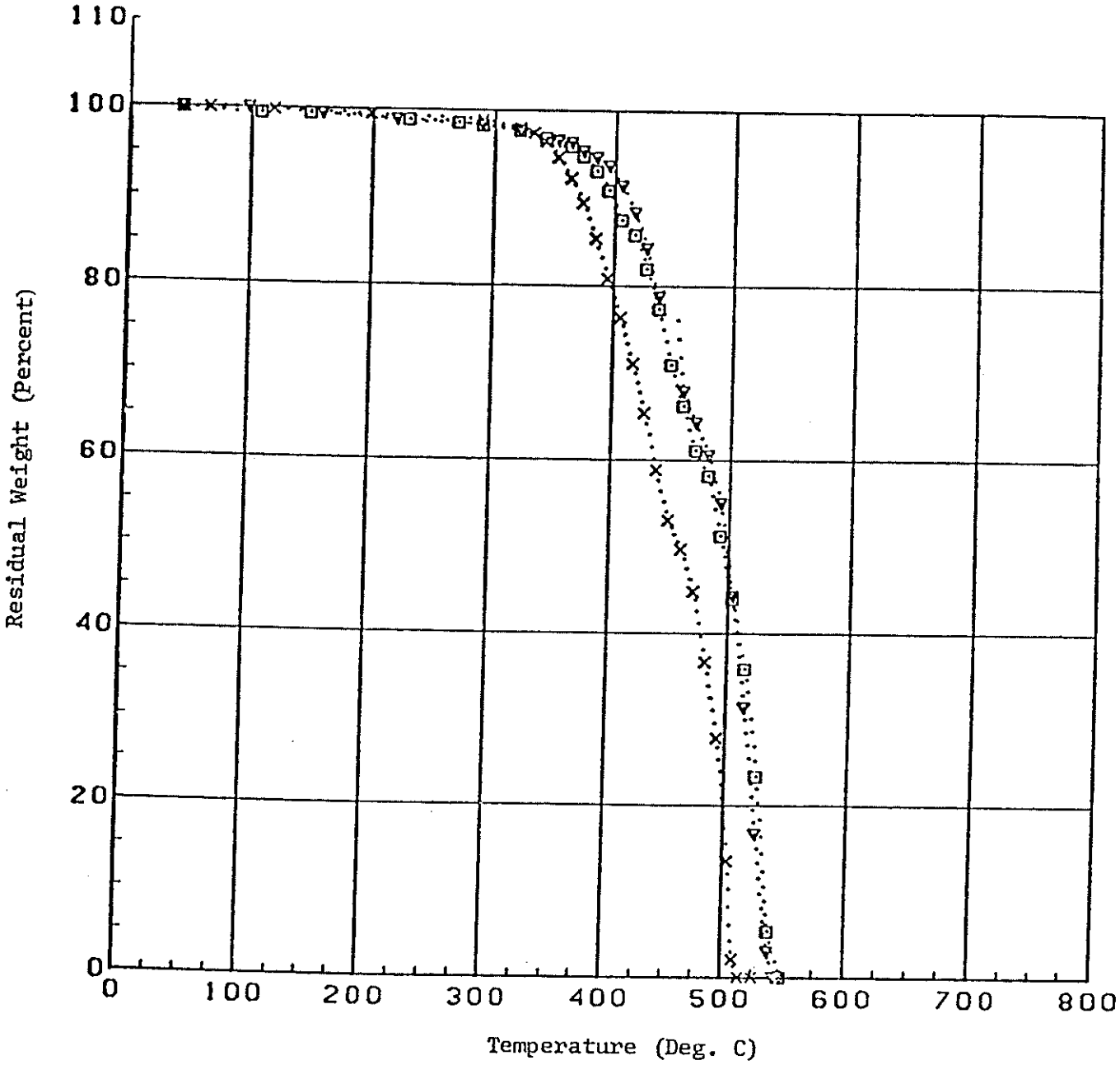


APPENDIX

POLYESTER

(Terephthalic Acid and Indicated Monomer)

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



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4,4'-DIHYDROXYDIPHENYL SULFONE TECHNICAL BULLETIN

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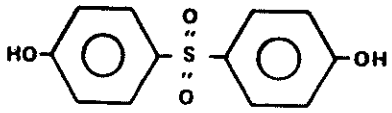
FORT JAMES
SPECIALTY CHEMICALS

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.

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Revised June 1998

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PHYSICAL PROPERTIES

Appearance		tan / white crystals
Molecular weight		250.3
Melting point, °C		242 - 248.5
Molal freezing point constant, °C *		16.6
Heat of fusion	Kcal per mole *	8.1
	calories/gram *	32.4
Acid dissociation constants (202)(203) *	pKa_1	8.52
(50% aq. ethanol, 25°C)	pKa_2	9.42

SPECTRA		Absorbance Peaks (nm)	Extinction Coefficient (log ε)
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 Dihydroxydiphenyl Sulfone (DDS) *

Solvent	grams per 100 grams Solvent 25°C	75°C	Indicated
Acetone	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	-	-
2-Ethyl-1-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% $NaHCO_3$, 1% Na_2CO_3 and 2% NaOH.

* Values for 100% 4,4' isomer.

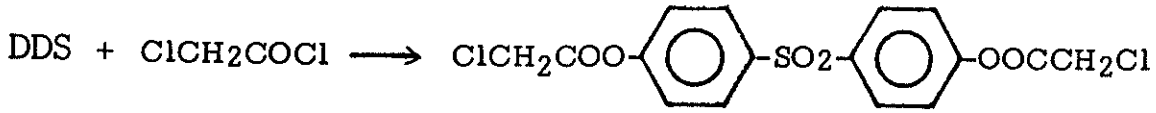
CHEMICAL PROPERTIES

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-chloroacetoxyphenyl)sulfone (1).

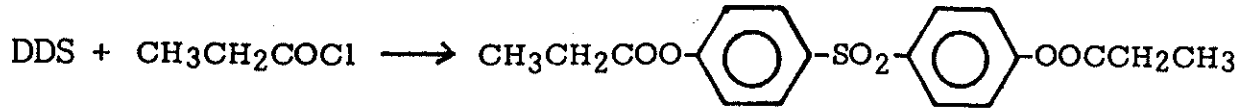


bis-(4-chloroacetoxyphenyl)sulfone
m.p. 150-160°C

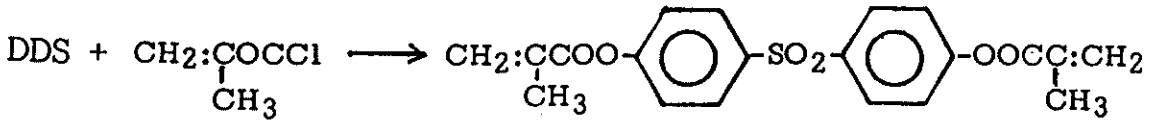
The synthesis of 4,4'-diacetoxydiphenyl sulfone from DDS has been reported (2,3).

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

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



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

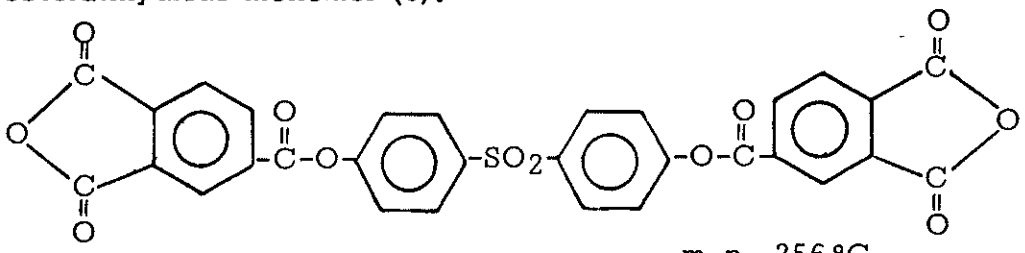


4,4'-dimethacryloyloxysulfonyldiphenol
m.p. 154-155°C

REACTIONS TO FORM ESTERS (cont)

From Acid Chlorides (cont)

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



m.p. 256°C

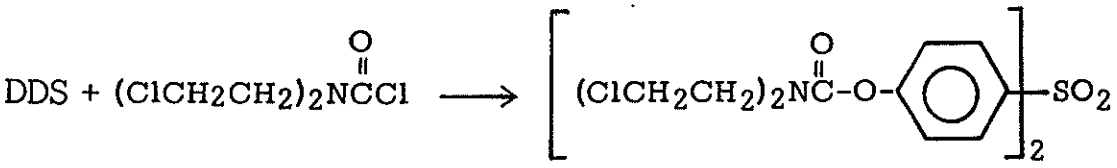
DDS reacts with o-aminobenzoyl chloride to form the diester (7). The reaction of 4-hydroxy-3,5-ditert-butyl-benzoyl chloride proceeds in a similar manner (8).

From Anhydrides

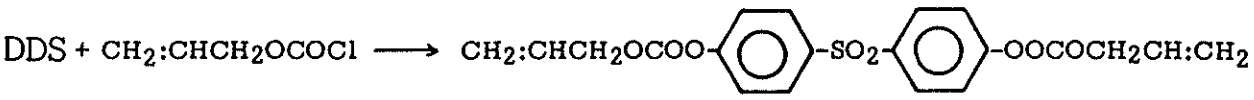
Acrylic anhydride or methacrylic anhydride react with DDS to give the corresponding diesters reported above (5).

From Chloroformates

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



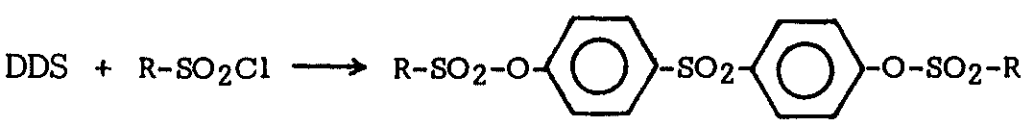
Alkenyl chloroformates react with DDS to give the bis ethers (10).



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

From Sulfonyl Chlorides

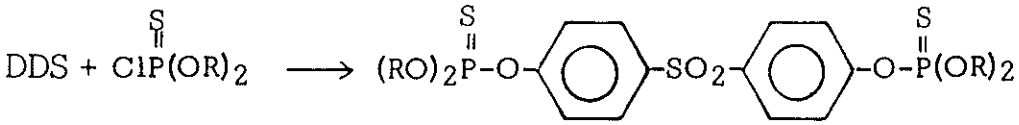
Two moles of 2-diazo-1-naphthol-5-sulfonyl chloride react with one mole of DDS in a dioxane-water mixture to form the diester (11), viz.



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).



R = $-CH_3$ or $-CH_2CH_3$

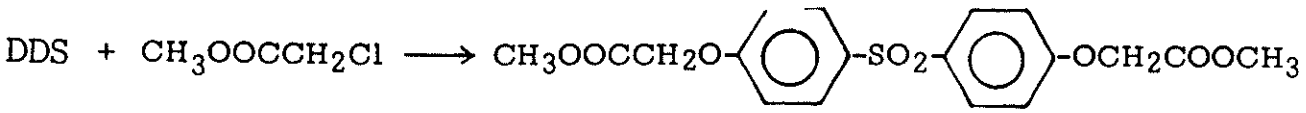
REACTIONS TO FORM ETHERS

Alkyl Ethers

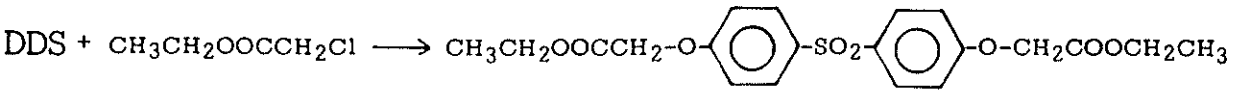
Several 4,4'-dialkoxydiphenylsulfones have been prepared (15).

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).



m.p. 151-152°C



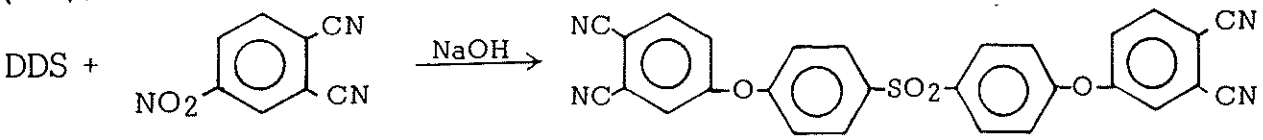
m.p. 87°C

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)

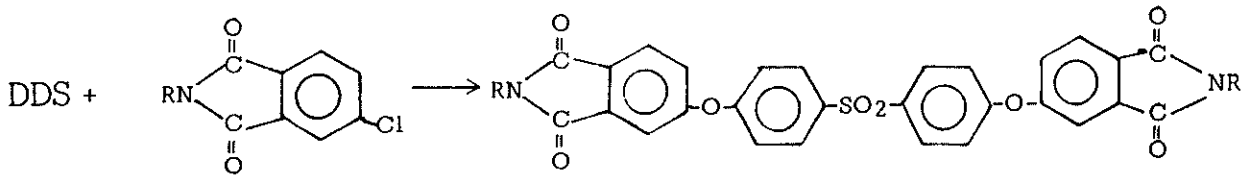
Aromatic Ethers

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



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

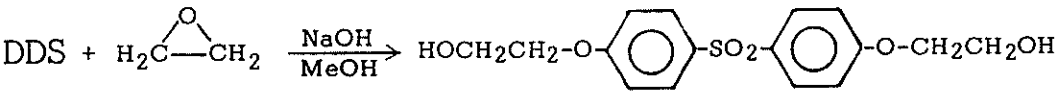
In a similar manner, 4-chloro-N-butylphthalimide reacts with DDS disodium salt to give the bis ether (18).



R = $-CH_2CH_2CH_2CH_3$ m.p. 128-131°C

Hydroxy Alkyl Ethers

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

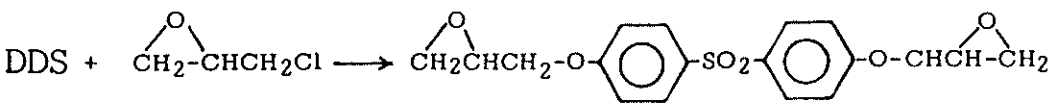


bis-(4-beta-hydroxyethoxyphenyl)sulfone
m.p. 184°C

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).

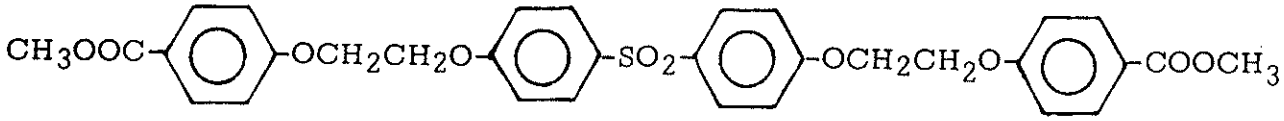


bis-(4-glycidyloxyphenyl)sulfone
m.p. 162-176°C

REACTIONS TO FORM ETHERS (cont)

Ethers from Tosylates

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



m.p. 132-135 °C

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:

3,3',5,5'-tetramethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 192 °C
3,3'-dimethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 177 °C
monomethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 150 °C

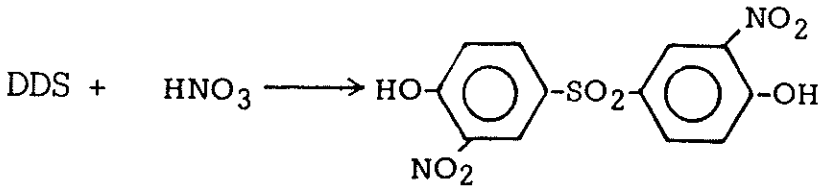
Pure methylol derivatives of DDS can be prepared by reducing the corresponding carboxylic acids with $LiAlH_4$. The derivatives were separated by chromatography on polyamide powder (27).

Condensing 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.

Nitration

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

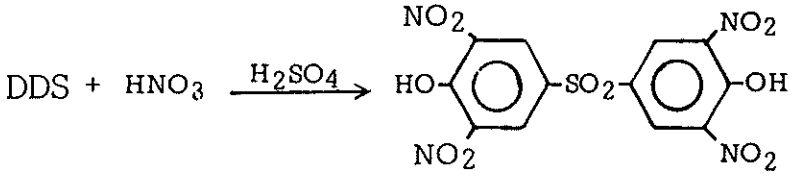


3,3'-dinitro-dihydroxydiphenyl sulfone
m.p. 238.5-240 °C

REACTIONS ON THE AROMATIC RINGS (cont)

Nitration (cont)

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



3,3',5,5'-tetranitro-4,4'-sulfonyldiphenol
m.p. 255-256°C

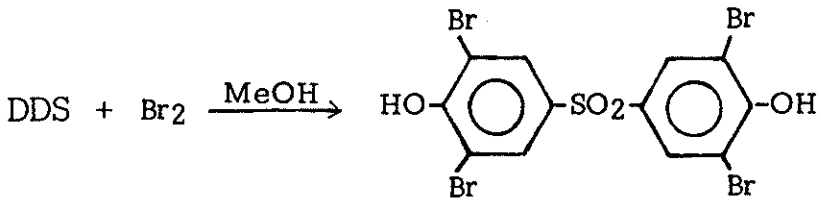
The determination of tetranitro-dihydroxydiphenyl sulfone impurity in the dinitro compound has been studied using potentiometric titrations (32).

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).

Halogenation

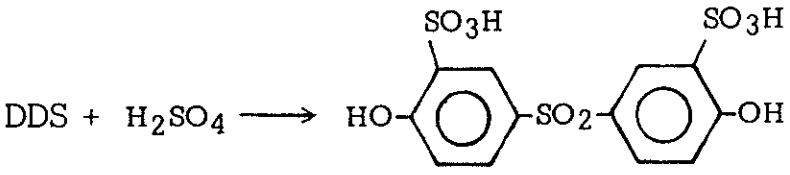
DDS is brominated in methanol to give the tetrabromo derivative (33).



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).



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)

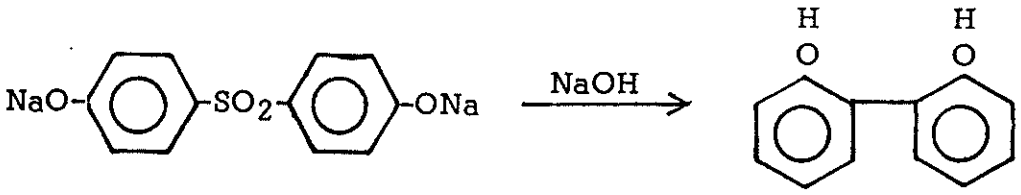
DDS and 98% sulfuric acid are mixed and heated at 110-120°C until a product entirely soluble in water is obtained (36,37).

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).



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 C_8-C_{18} 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

Bactericides: 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).

Fungicides: The condensation product of DDS, formaldehyde and a $NaHSO_3$ 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).

Pesticides: O,O,O',O'-tetramethyl-O,O'-sulfonyldi-p-phenylene phosphorothioate 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).

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 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 salt of DDS. The catalyst

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 formaldehyde 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-diisocyanate 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, 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 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-hydroxyphenoxy)-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).

Inks

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:

	Fibers	Films
Polyesters	25,71,120,121	6,72,127,128
Polyesters containing 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

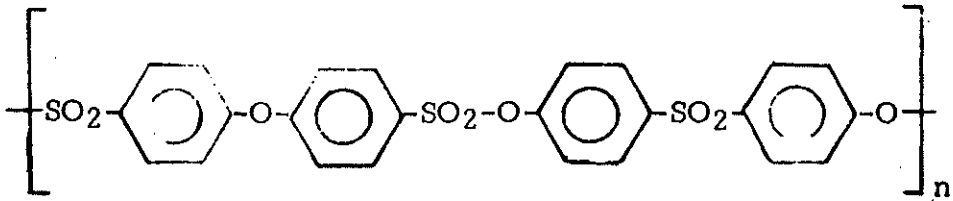
A variety of polyesters have been prepared from DDS and other monomers. The following diacid halide reactions have been reported:

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, 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 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).



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).

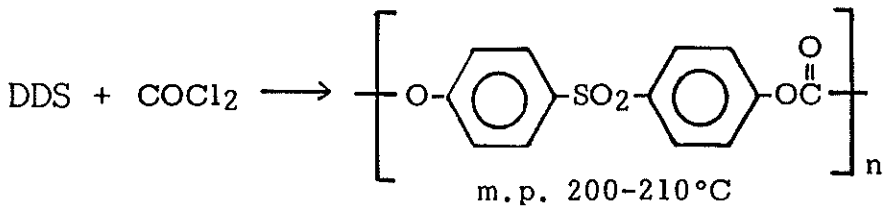
Incorporating DDS in a polyester reaction of tris(2-hydroxyalkyl)isocyanurate and a polycarboxylic acid reduces a gel formation and provides a thermal oxidatively stable polyester with excellent adhesion properties (69).

Poly(imidocarbonic esters) can be prepared when DDS and 2,2-bis(4-cyanatophenyl)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 dianion reacts with phosgene (131,132,146,147) or diphenyl carbonate (67,68) to form a polycarbonate.



m.p. 200-210°C

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)

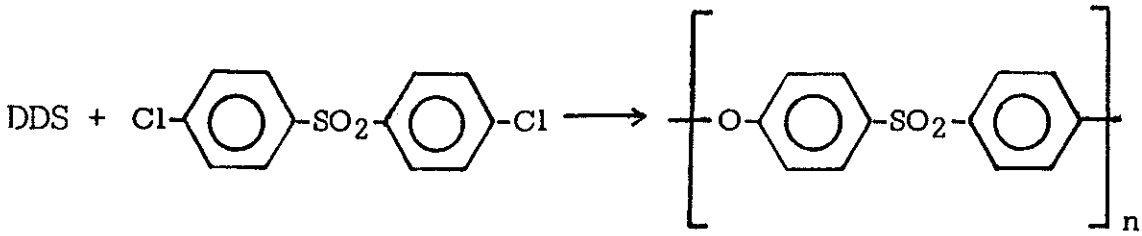
A derivative of DDS, 2,2'-(sulfonyl-bis(p-phenyleneoxy))diethanol reacts with di-n-butyl carbonate to form a polycarbonate having a melting range of 145-155 °C (124).

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-maleimidobenzoic acid (133).

Polyarylene Ether Sulfones

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



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 diisocyanate, 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 (oxyarylenesilanes) 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)

Printing Plates

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 naphthalenesulfonic 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.

Naphthalenesulfonic 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 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 irritating to eyes or skin.

Acute Oral Toxicity LD_{50} (Albino Rats)	4,556 mg/kg
Acute Dermal Toxicity LD_{50} (Albino Rabbits)	> 10,250 mg/kg
Eye Irritation (Albino Rabbits)	Moderately Irritating (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.

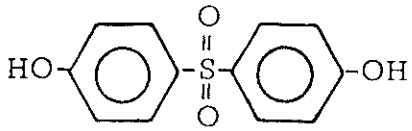
First Aid: In case of contact, immediately flush exposed area with plenty of water for at least 15 minutes. Call a physician.

MATERIAL SAFETY DATA SHEET

CHEMICAL NAME	4,4'-Dihydroxydiphenyl sulfone
SYNONYMS	p,p'-Dihydroxydiphenyl sulfone
TRADENAME	4,4DDS
CHEMICAL FAMILY	Phenol, Sulfone

FORT JAMES
SPECIALTY CHEMICALS
4TH AND ADAMS STREET
CAMAS, WASHINGTON 98607
PHONE: (360) 834-8134

FORMULA



I. PHYSICAL DATA

BOILING POINT	°C °F	MELTING POINT	247-249°C 477-480°F
VAPOR PRESSURE	- mm Hg	SPECIFIC GRAVITY (H_2O = 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 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) LD_{50} 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	AUTOIGNITION TEMP. Unknown		°C	°F
FLAMMABLE LIMITS IN AIR (% BY VOL) Unknown		LOWER		UPPER	
EXTINGUISHING MEDIA	Water, foams, CO_2, powder.				
SPECIAL FIRE FIGHTING PROCEDURES	-				
UNUSUAL FIRE HAZARDS	SO_2 formed on burning.				

VI. REACTIVITY DATA

STABILITY (THERMAL, LIGHT, ETC.)	STABLE	X	CONDITIONS TO AVOID
	UNSTABLE		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	
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 STORING	Prevent dusting.

IX. SHIPPING REGULATIONS

No special labeling or handling required.

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4,4'-SULFONYLDIPHENOL TECHNICAL BULLETIN

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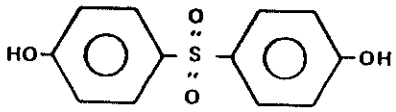
Crown Zellerbach

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.

Camas, Washington 98607 Phone: (206) 834-4444 TWX: 910 466 8450

June 1975

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PHYSICAL PROPERTIES

Appearance		white crystals
Molecular weight		250.3
Melting point, °C		248.5
Molal freezing point constant, °C		16.6
Heat of fusion	Kcal per mole	8.1
	calories/gram	32.4
Acid dissociation constants (202)(203) (50% aq. ethanol, 25°C)	pKa_1	8.52
	pKa_2	9.42

SPECTRA		Absorbance Peaks (nm)	Extinction Coefficient (log ε)
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)

Solvent	grams per 100 grams Solvent 25°C	75°C	Indicated
Acetone	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	-	-
2-Ethyl-1-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% $NaHCO_3$, 1% Na_2CO_3 and 2% NaOH

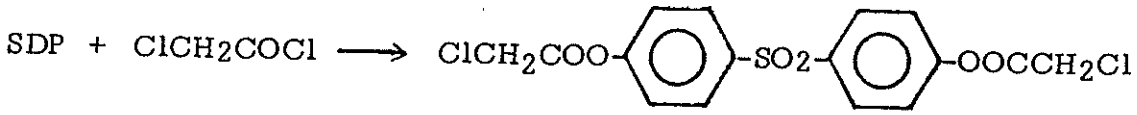
CHEMICAL PROPERTIES

REACTIONS TO FORM ESTERS

The dianion 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

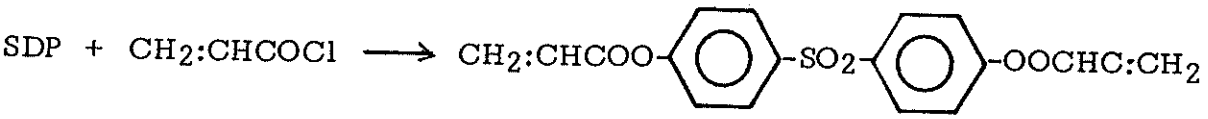
SDP reacts with chloroacetyl chloride to give a 99% yield of di-(4-chloroacetoxyphenyl)sulfone (1).



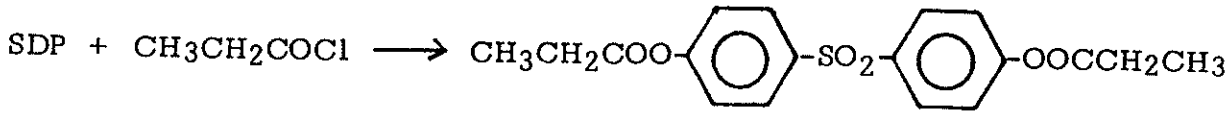
bis-(4-chloroacetoxyphenyl)sulfone
m.p. 150-160 °C

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

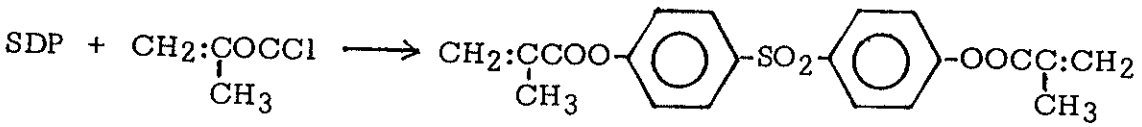
Acryloyl chloride, methacrylyl chloride, or propionyl chloride react with SDP to give the corresponding diesters (4,5).



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



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

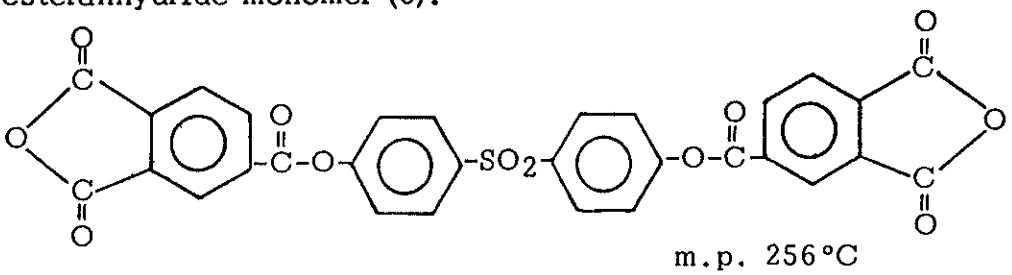


4,4'-dimethacryloyloxysulfonyldiphenol
m.p. 154-155 °C

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).



m.p. 256°C

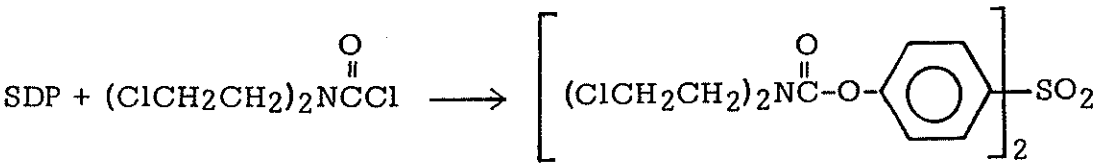
SDP reacts with o-aminobenzoyl chloride to form the diester (7). The reaction of 4-hydroxy-3,5-ditert-butyl-benzoyl chloride proceeds in a similar manner (8).

From Anhydrides

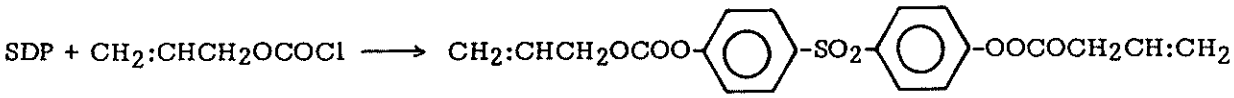
Acrylic anhydride or methacrylic anhydride react with SDP to give the corresponding diesters reported above (5).

From Chloroformates

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



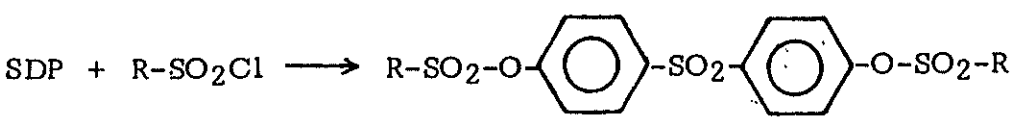
Alkenyl chloroformates react with SDP to give the bis ethers (10).



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

From Sulfonyl Chlorides

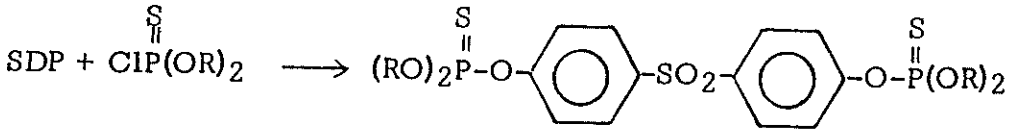
Two moles of 2-diazo-1-naphthol-5-sulfonyl chloride react with one mole of SDP in a dioxane-water mixture to form the diester (11), viz.



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).



R = $-CH_3$ or $-CH_2CH_3$

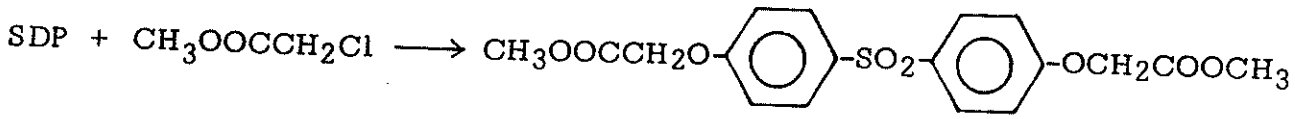
REACTIONS TO FORM ETHERS

Alkyl Ethers

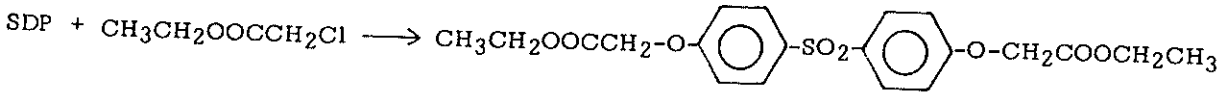
Several 4,4'-dialkoxydiphenylsulfones have been prepared (15).

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

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



m.p. 151-152°C



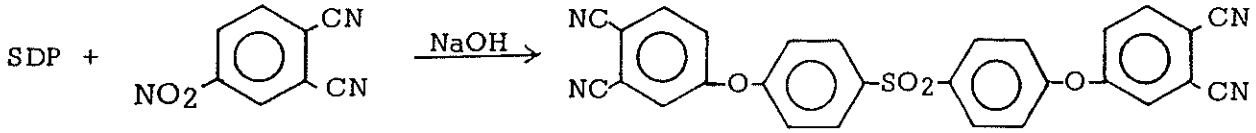
m.p. 87°C

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)

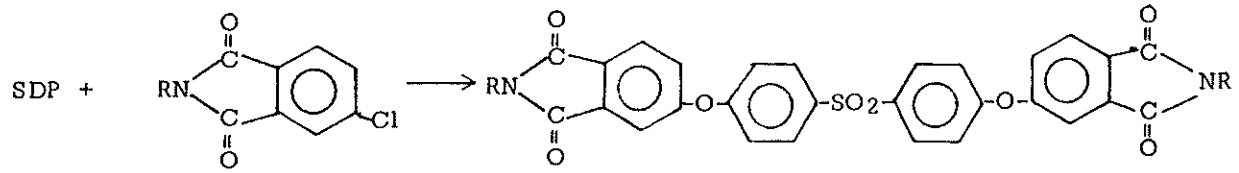
Aromatic Ethers

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



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

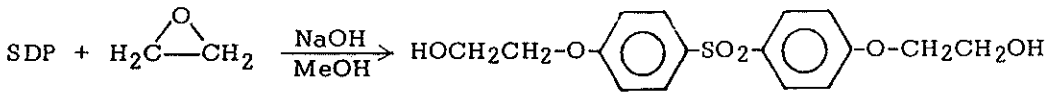
In a similar manner, 4-chloro-N-butylphthalimide reacts with SDP disodium salt to give the bis ether (18).



R = $-CH_2CH_2CH_2CH_3$ m.p. 128-131°C

Hydroxy Alkyl Ethers

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

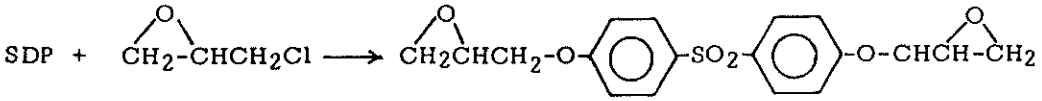


bis-(4-beta-hydroxyethoxyphenyl)sulfone
m.p. 184°C

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).

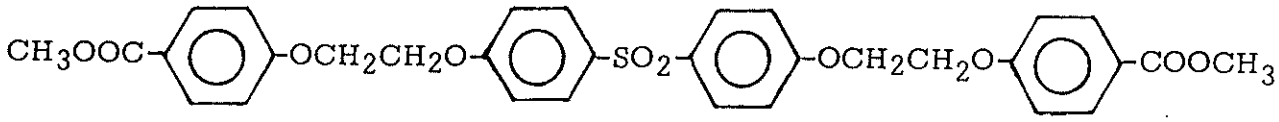


bis-(4-glycidyloxyphenyl)sulfone
m.p. 162-176°C

REACTIONS TO FORM ETHERS (cont)

Ethers from Tosylates

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



m.p. 132-135 °C

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:

3,3',5,5'-tetramethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 192 °C
3,3'-dimethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 177 °C
monomethylol-4,4'-dihydroxydiphenyl sulfone	m.p. 150 °C

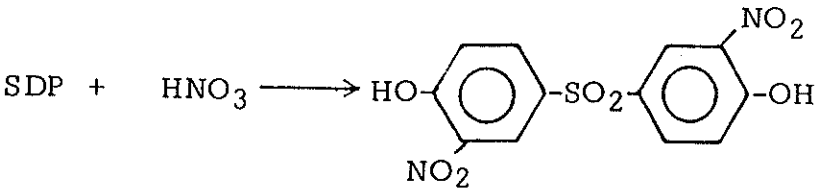
Pure methylol derivatives of SDP can be prepared by reducing the corresponding carboxylic acids with $LiAlH_4$. The derivatives were separated by chromatography on polyamide powder (27).

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).

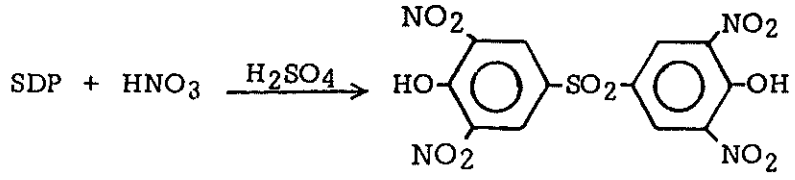


3,3'-dinitro-4,4'-sulfonyldiphenol
m.p. 238.5-240 °C

REACTIONS ON THE AROMATIC RINGS (cont)

Nitration (cont)

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



3,3',5,5'-tetranitro-4,4'-sulfonyldiphenol
m.p. 255-256°C

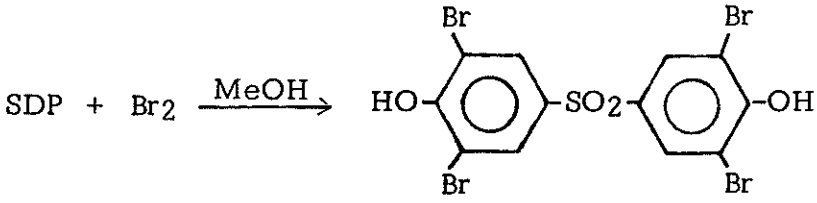
The determination of tetranitro-4,4'-sulfonyldiphenol impurity in the dinitro compound has been studied using potentiometric titrations (32).

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

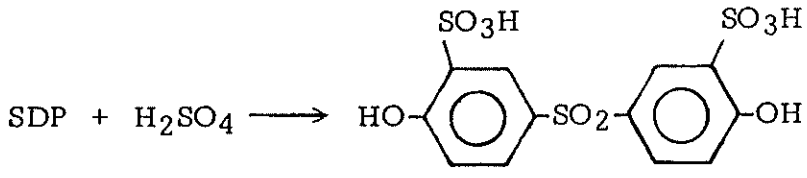
SDP is brominated in methanol to give the tetrabromo derivative (33).



3,3',5,5'-tetrabromo-4,4'-sulfonyldiphenol
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).



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)

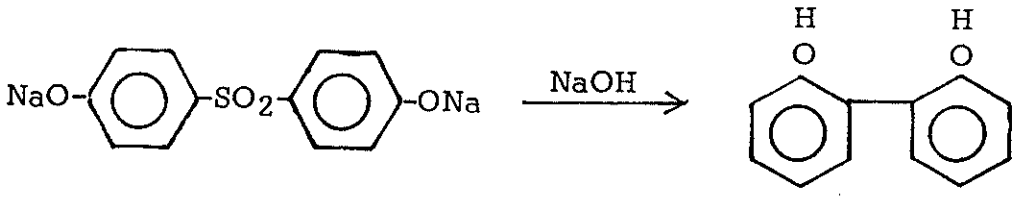
SDP and 98% sulfuric acid are mixed and heated at 110-120°C until a product entirely soluble in water is obtained (36,37).

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).



In a similar manner, the dipotassium salt of SDP 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 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 C_8-C_{18} 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).

Antioxidants and Stabilizers

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).

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

Bactericides: 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).

Fungicides: The condensation product of SDP, formaldehyde and a $NaHSO_3$ 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).

Pesticides: O,O,O',O'-tetramethyl-O,O'-sulfonyldi-p-phenylene phosphorothioate 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

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).

Deemulsifier

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 formaldehyde 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 r iple 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°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-diisocyanate 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).

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 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).

MISCELLANEOUS APPLICATIONS

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).

Inks

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:

	Fibers	Films
Polyesters	25,71,120,121	6,72,127,128
Polyesters containing 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

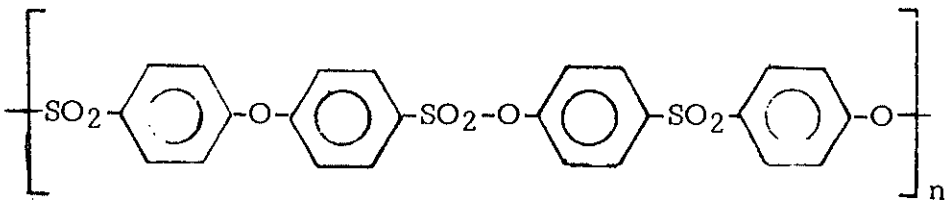
A variety of polyesters have been prepared from SDP and other monomers. The following diacid halide reactions have been reported:

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/sebacate) (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).



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).

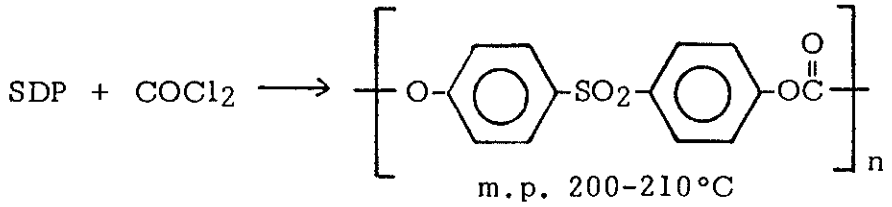
Incorporating SDP in a polyester reaction of tris(2-hydroxyalkyl)isocyanurate and a polycarboxylic acid reduces a gel formation and provides a thermal oxidatively stable polyester with excellent adhesion properties (69).

Poly(imidocarbonic esters) can be prepared when SDP and 2,2-bis(4-cyanatophenyl)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).

Polycarbonates

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



m.p. 200-210°C

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)
1,6-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)

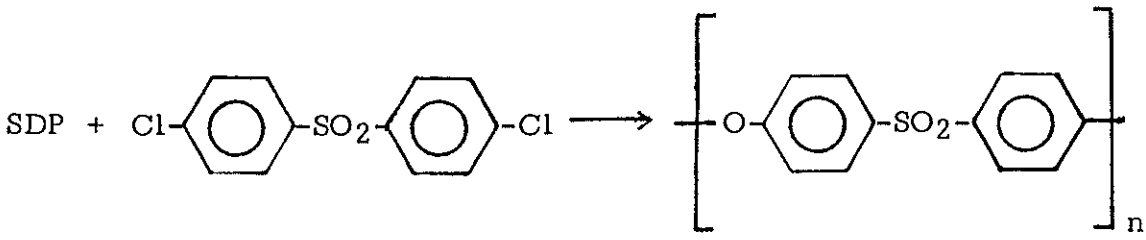
A derivative of SDP, 2,2'-(sulfonyl-bis(p-phenyleneoxy))diethanol reacts with di-n-butyl carbonate to form a polycarbonate having a melting range of 145-155 °C (124).

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-maleimidobenzoic acid (133).

Polyarylene Ether Sulfones

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



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).

Tanning

SDP 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 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.

Naphthalenesulfonic 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).

Vulcanizing Agents

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 LD_{50} (Albino Rats)	4,556 mg/kg
Acute Dermal Toxicity LD_{50} (Albino Rabbits)	> 10,250 mg/kg
Eye Irritation (Albino Rabbits)	Moderately Irritating (29.7/110.0)
Primary Skin Irritation (Albino Rabbits)	Minimally Irritating (0.5/8.0)

HANDLING

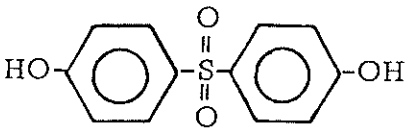
Care should be used in handling 4,4'-sulfonyldiphenol (SDP). The same precautions should be employed when handling SDP as when handling similar phenolic materials. SDP is less toxic than phenol.

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

FORMULA



I. PHYSICAL DATA

BOILING POINT	°C °F	MELTING POINT	247-249°C 477-480°F
VAPOR PRESSURE	- mm Hg	SPECIFIC GRAVITY (H_2O = 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 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) LD_{50} 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	AUTOIGNITION TEMP. Unknown		°C	°F
FLAMMABLE LIMITS IN AIR (% BY VOL) Unknown		LOWER		UPPER	
EXTINGUISHING MEDIA	Water, foams, CO_2, powder.				
SPECIAL FIRE FIGHTING PROCEDURES	-				
UNUSUAL FIRE HAZARDS	SO_2 formed on burning.				

VI. REACTIVITY DATA

STABILITY (THERMAL, LIGHT, ETC.)	STABLE	X	CONDITIONS TO AVOID
	UNSTABLE		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	
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 STORING	Prevent 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 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.

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 µg/L, compared with the MTCA Method B groundwater cleanup level of 1.82 µg/L. PCE was detected at 23.6 µg/L, compared with the MTCA Method B groundwater cleanup level of 0.858 µg/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 µg/L, which exceeded the MTCA Method B cleanup level of 6.25 µg/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 µg/L), chlorobenzene (3.36 µg/L), and 1,2-dichlorobenzene (8.46 µg/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.

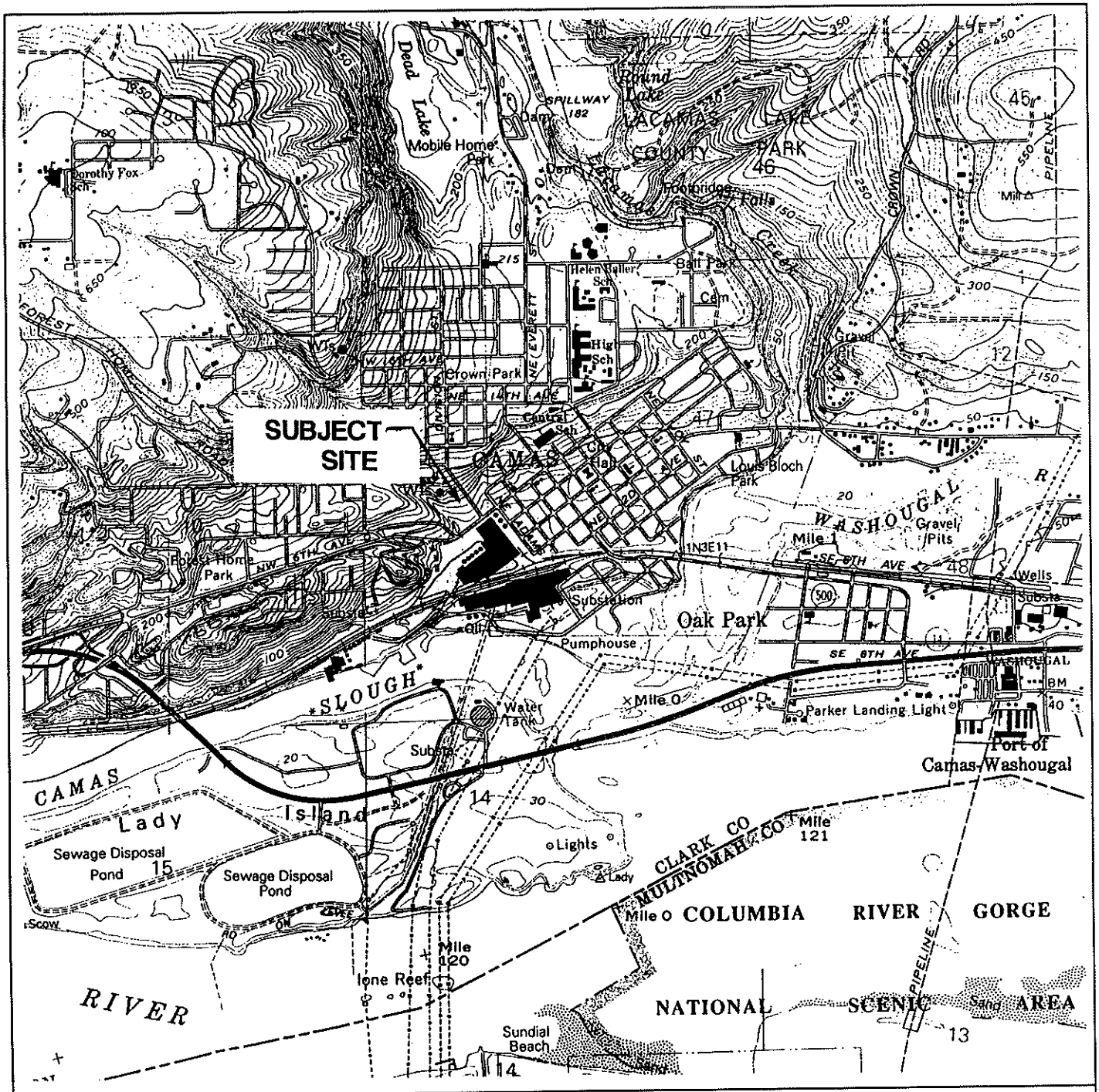
6.0 CONCLUSIONS

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



REFERENCE: USGS 7.5 MINUTE QUADRANGLE; CAMAS, WASHINGTON; 1993

SECOR International Incorporated
015

SITE LOCATION MAP

FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **1**

JOB#: 015.08860.003 APPR: CTH DWN: KPM DATE: 12/08/00

DWG: 15-8860-003(1)

F:/FILES/PORTLAND/FORT JAMES

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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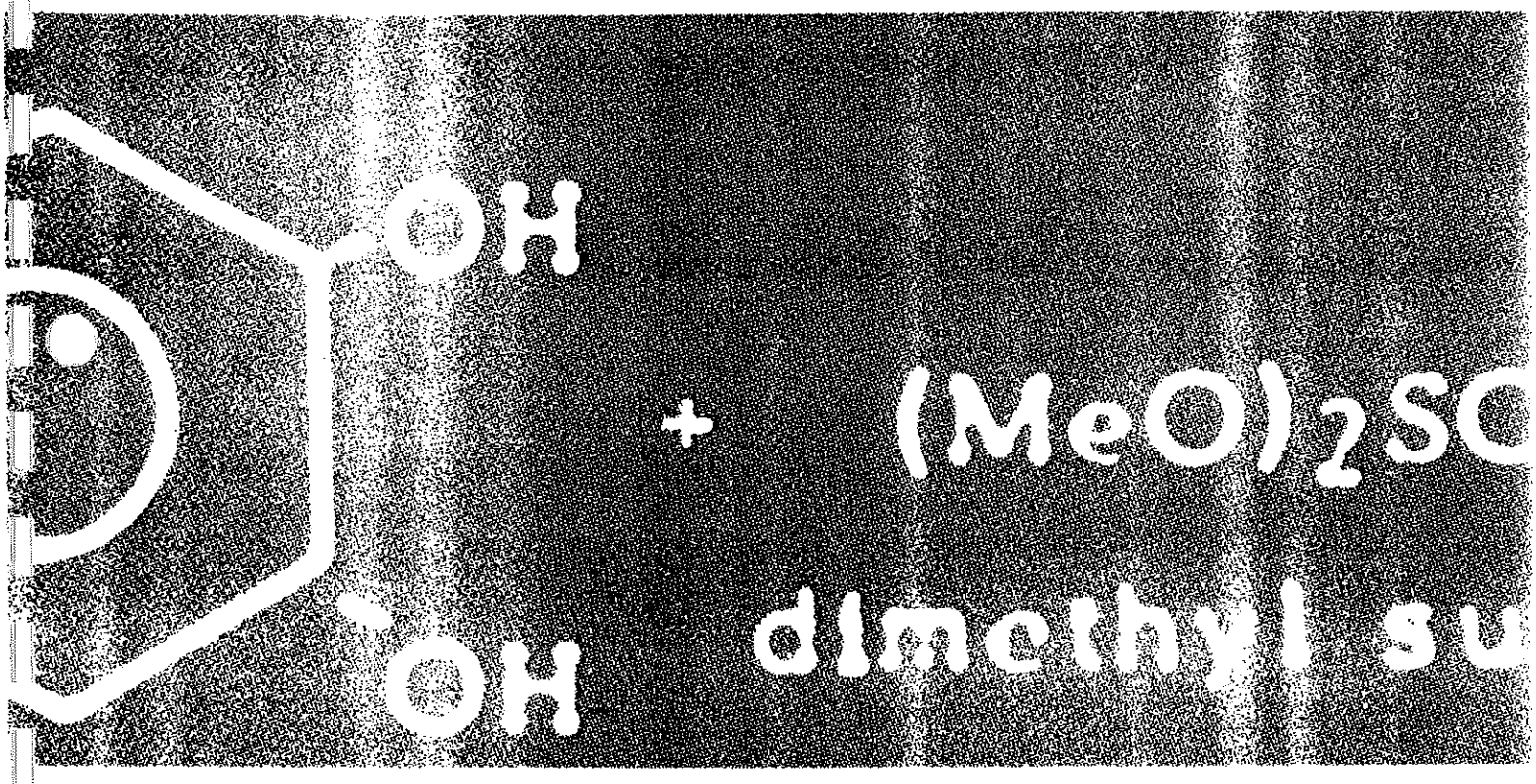
REACTIONS OF CATECHOL



FORT JAMES
SPECIALTY CHEMICALS
4th and Adams Street
Camas, Washington 98607
U.S.A.

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GLOSSARY

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

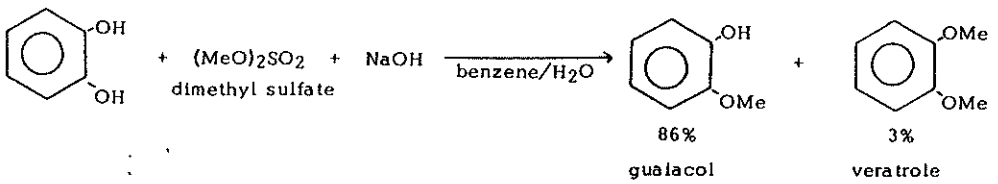
Catechol takes part in a wide variety of chemical reactions, showing essentially three types of activity. It functions as:

1. a benzenoid,
2. a phenol, and
3. 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.



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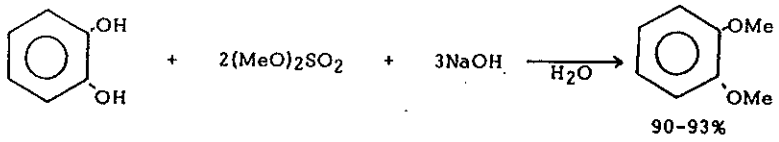
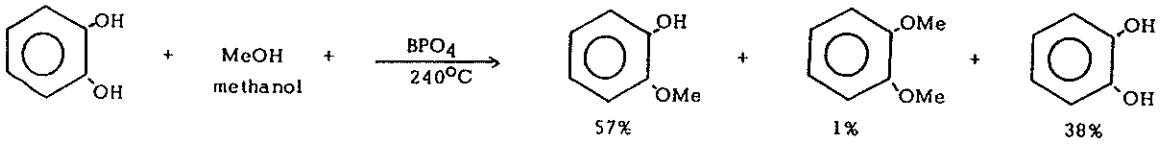


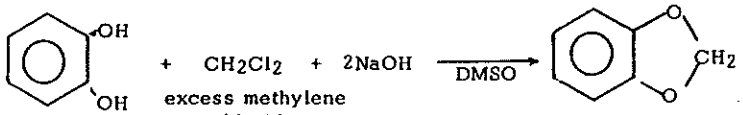
90-93%

(2)



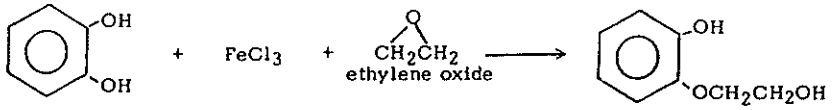
57% 1% 38%

(3)



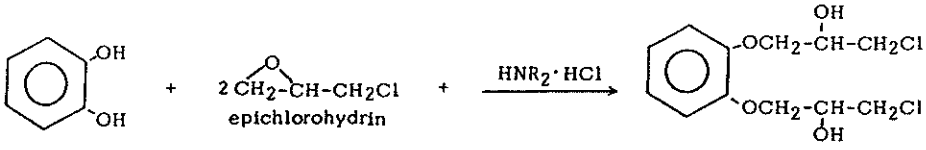
91%
methylenedioxybenzene

(4)



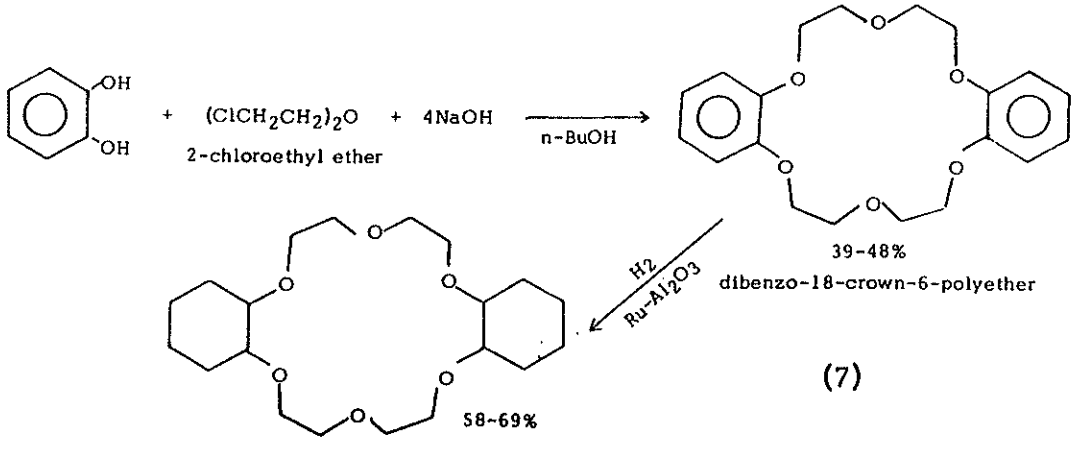
>95%
catechol monohydroxyethyl ether

(5)



74%
catechol 3-chloro-2-hydroxy-propyl diether

(6)



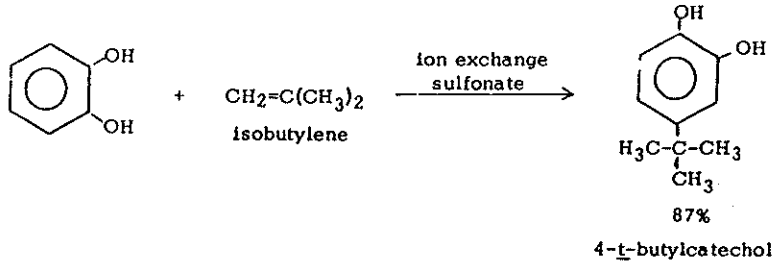
39-48%
dibenzo-18-crown-6-polyether

(7)

58-69%
dicyclohexyl-18-crown-6-polyether

ALKYLATION

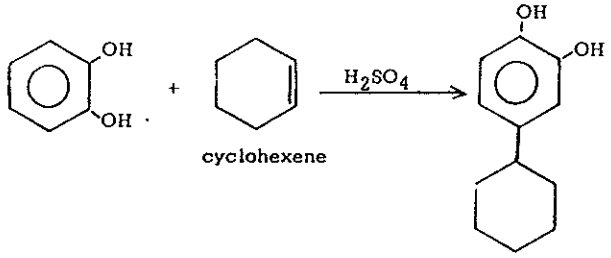
Catechol can be alkylated by all of the common agents which alkylate phenol (olefins, alcohols, alkyl halides). The usual Friedel-Crafts catalysts, like sulfuric acid, boron trifluoride or aluminum chloride, can be used in the alkylation. Mono-substitution usually occurs in the para- or 4-position of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



(8)

87%

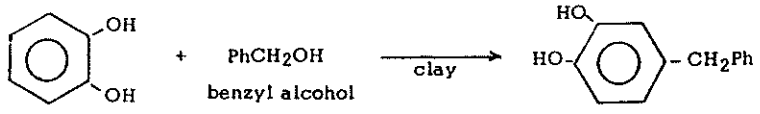
4-t-butylcatechol



(9)

38%

4-cyclohexylcatechol

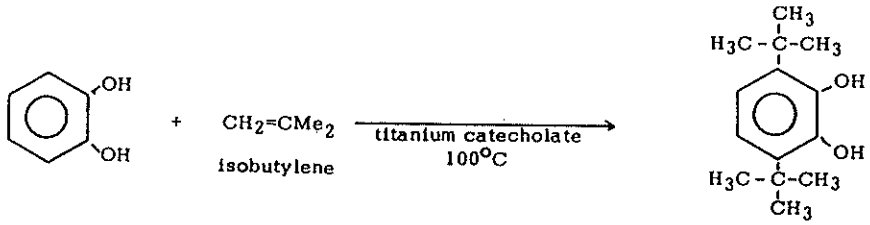


(10)

18%

4-benzylcatechol

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



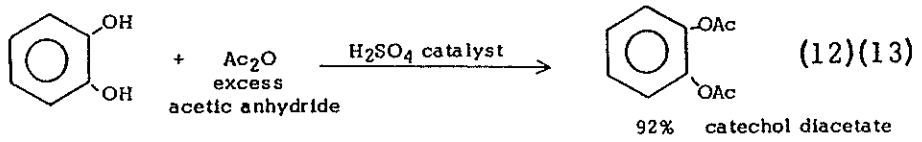
(11)

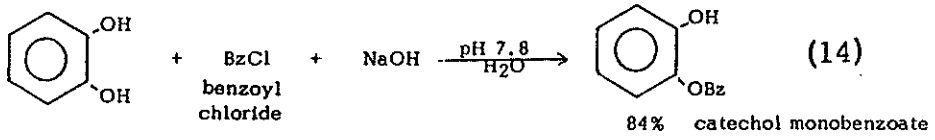
96%

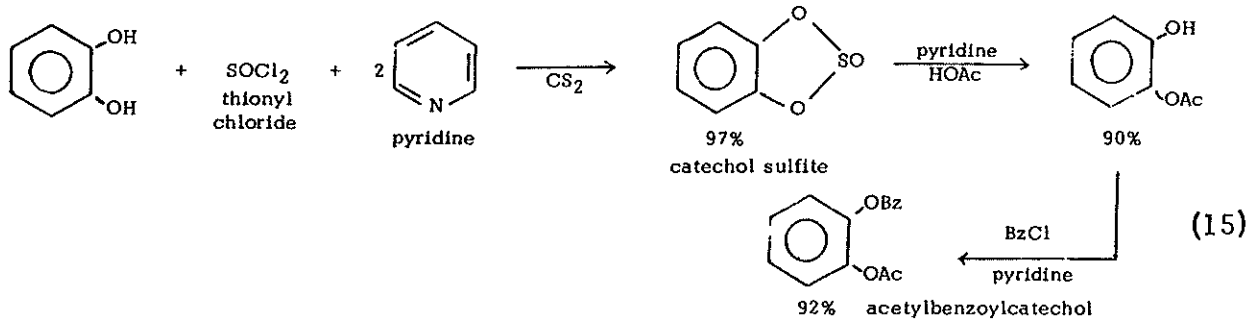
3,6-di-t-butylcatechol

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.

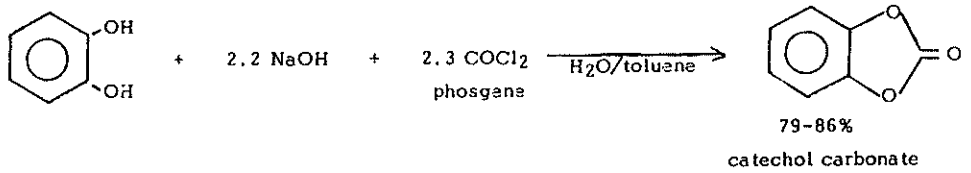


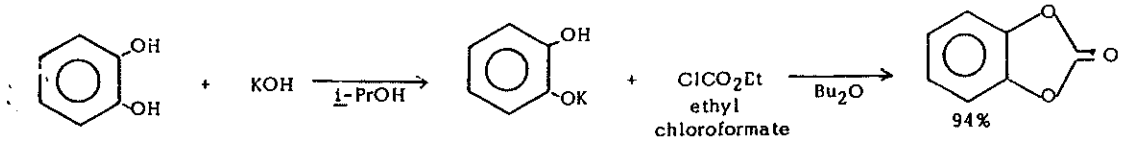




Carbonates

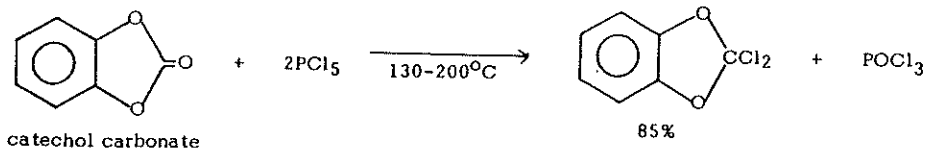
Carbonate esters of catechol are easily prepared from phosgene or ethyl chloroformate.





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

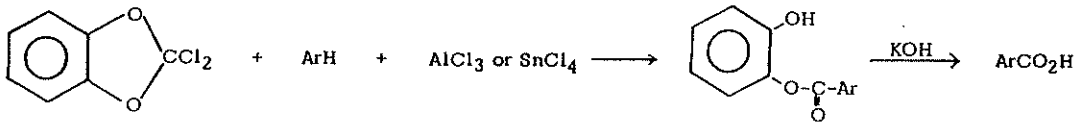
Reaction of catechol carbonate with phosphorus pentachloride gives the dichloromethylene ether of catechol which is very useful in the synthesis of unusual aromatic carboxylic acids ($ArCO_2H$).



catechol carbonate

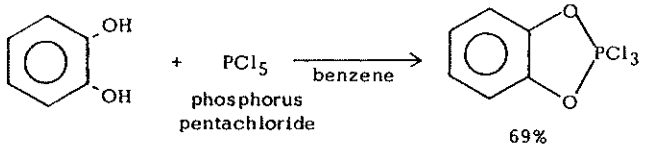
85%

catechol dichloromethylene ether (18)



Phosphates

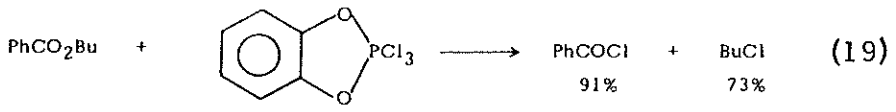
Catechyl phosphorus trichloride (CPT) reacts with oxygen-containing compounds as a halogen transfer agent. With carbonyl compounds CPT gives gem dichlorides or chloro-olefins. With carboxylic acids it gives acid chlorides while with esters it gives acid chlorides, and the alkyl chloride. Acid amides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



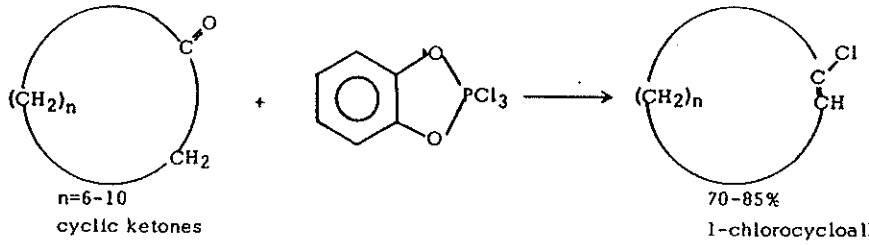
phosphorus pentachloride

69%

catechyl phosphorus trichloride (CPT) (19)



91% 73% (19)



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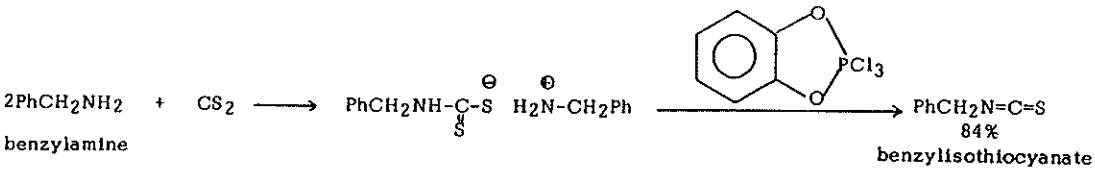
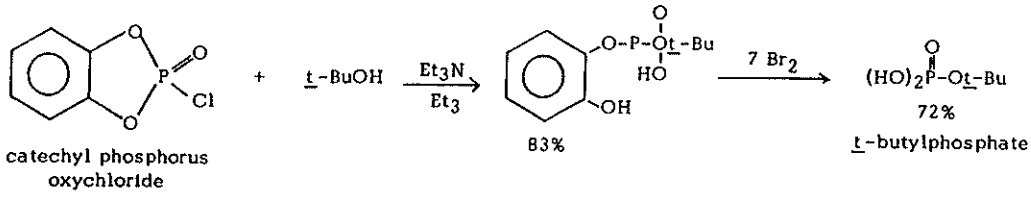


(20)

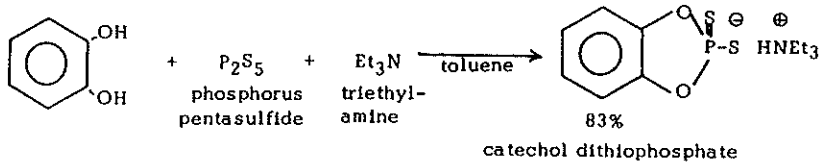
When catechyl phosphorus trichloride is treated with acetic anhydride, a nearly quantitative yield of acetyl chloride may be obtained. Distillation of the residue gives 88% catechyl phosphorus oxychloride, a very useful phosphorylating agent which has been used to phosphorylate adenosine, uridine and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



(23)

Miscellaneous Esters

Catechol can also form thiophosphates and borates.



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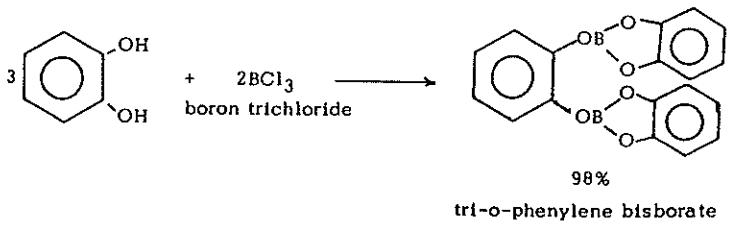
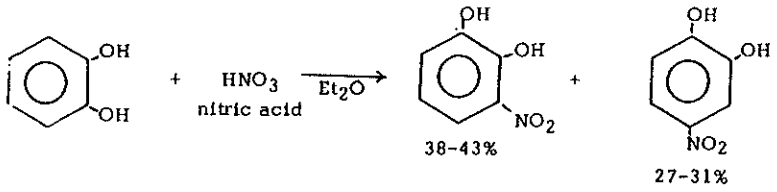


(25)

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).



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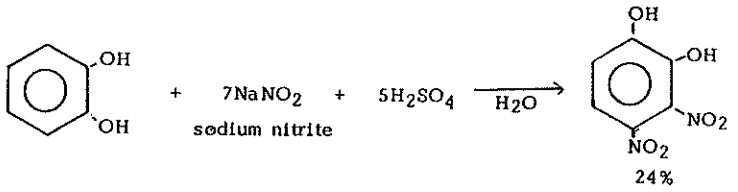

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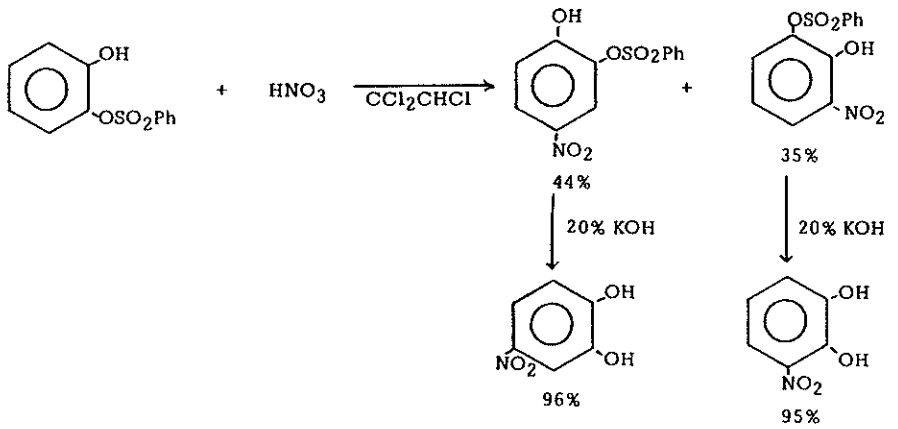
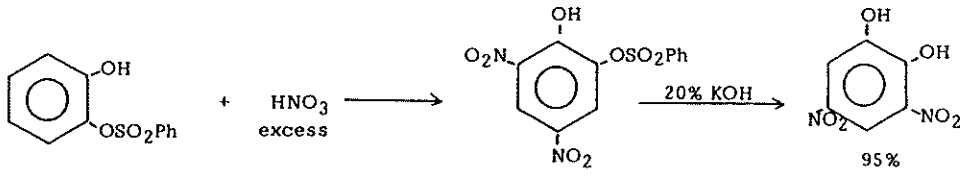


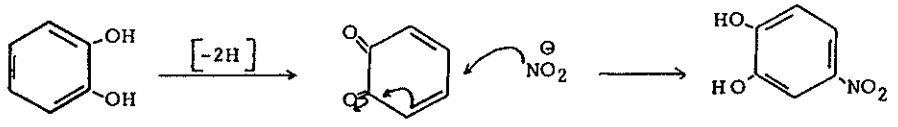
(27)

(27)



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

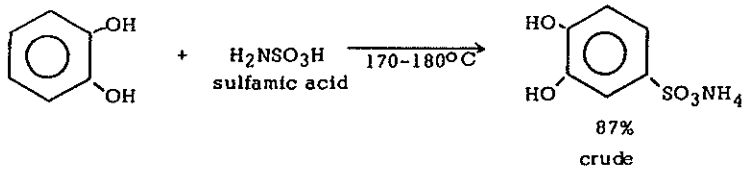
In nitrations of catechol involving nitrite, the nitrous acid is believed to play the double role of dehydrogenating (or oxidizing) agent and nucleophile. Wanzlick has verified that nitration proceeds by way of an intermediate o-benzoquinone (31).



(31)

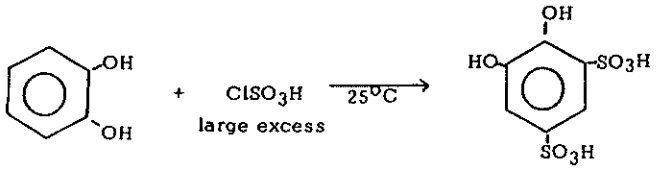
SULFONATION

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

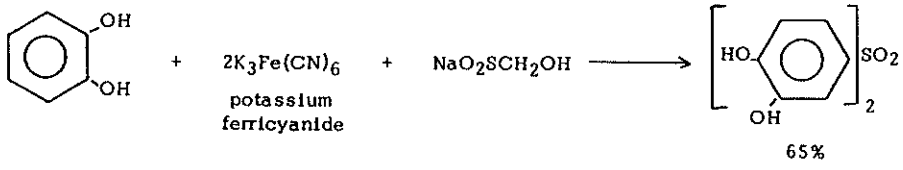


(32)

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).



(33)

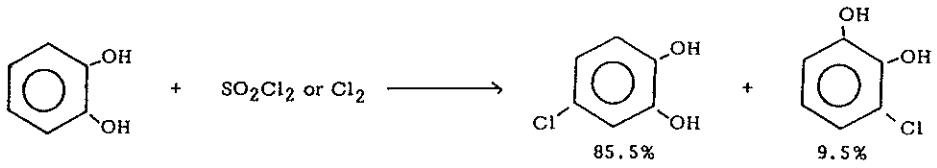


(34)

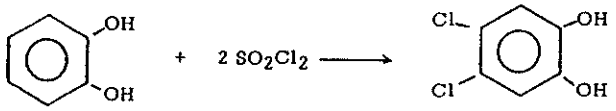
HALOGENATION

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).

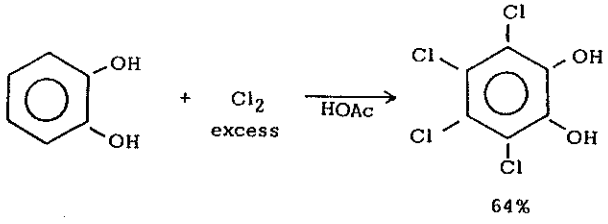


(36)



(37)

Excess chlorine in acetic acid will chlorinate catechol to form the tetrachlorocatechol 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).



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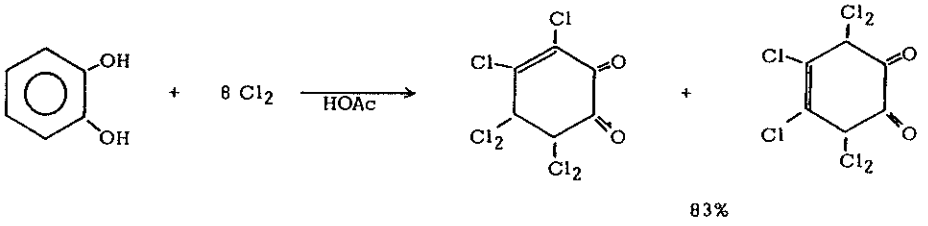
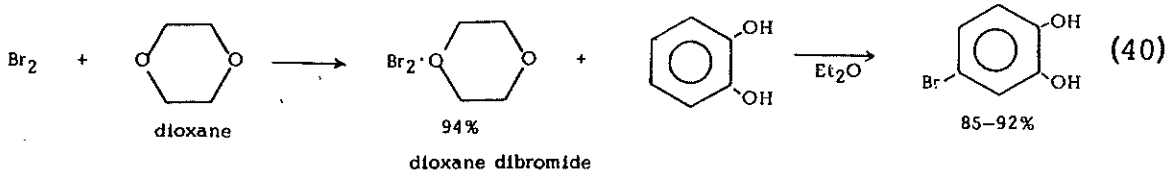


(39)

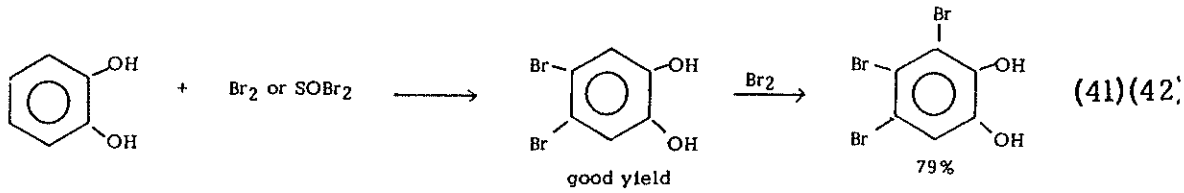
Bromination

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

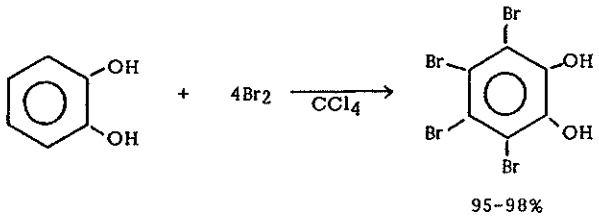


(40)

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.



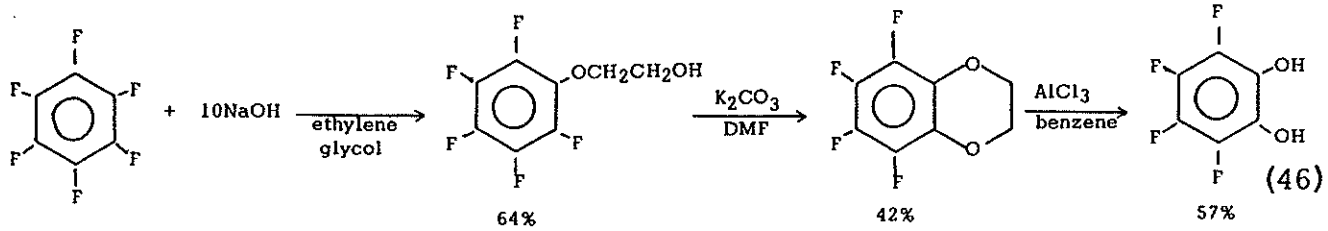
(41)(42)



(43)

Iodination and Fluorination

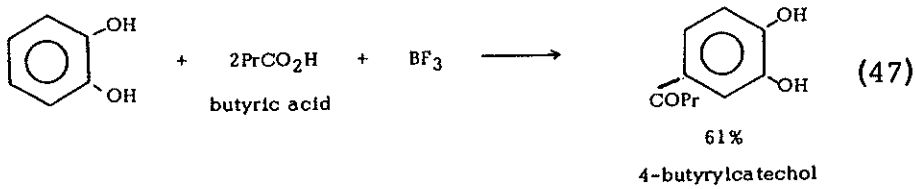
The iodo- and fluorocatechols are prepared in the usual manner from diazonium salts of aminocatechol diethers or diesters (44)(45). Tetrafluorocatechol can be prepared from hexafluorobenzene (46).



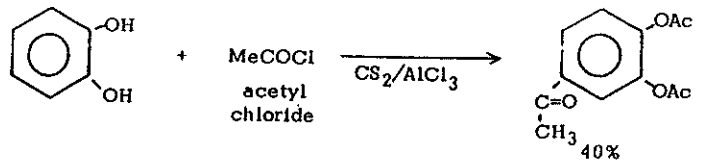
(46)

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).

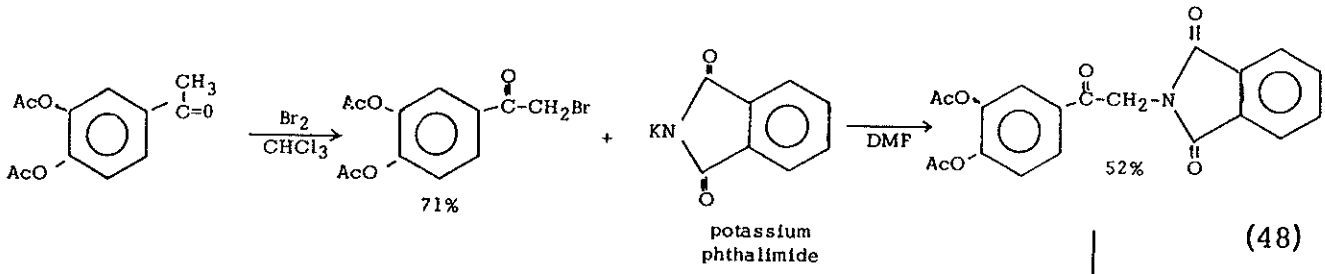


(47)

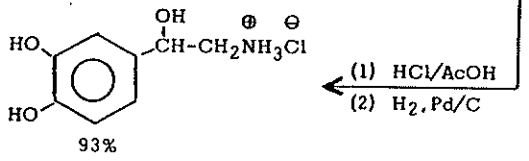


4-acetylcatechol diacetate

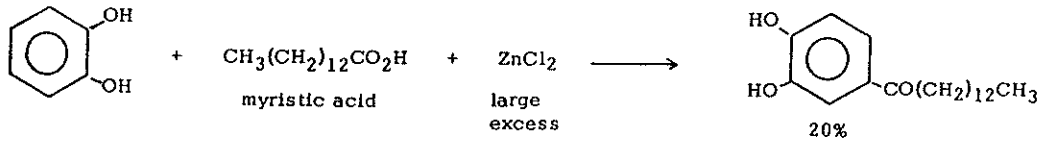
(48)



(48)



norepinephrine

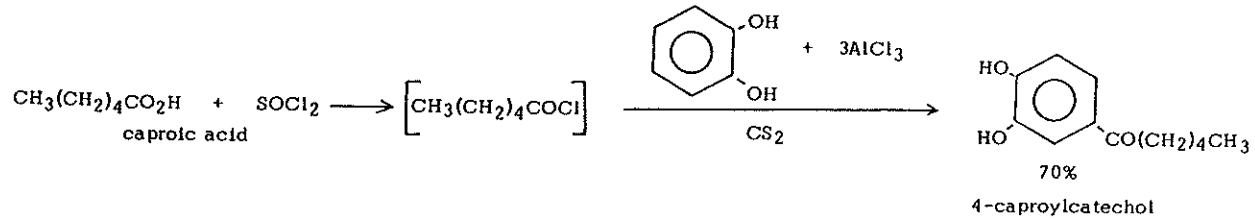


(49)

4-myristylcatechol

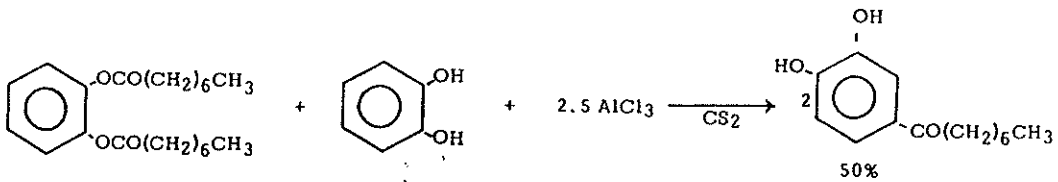
Fries Rearrangement

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).

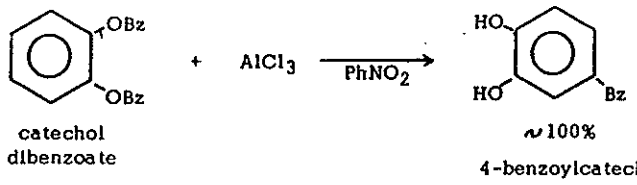


4-caproylcatechol

(50)



4-capryloylcatechol



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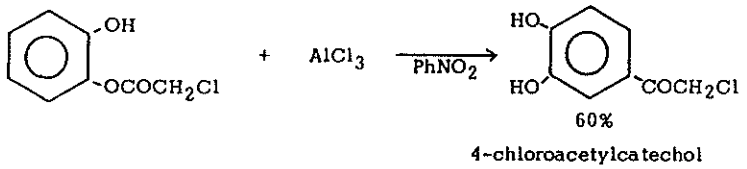
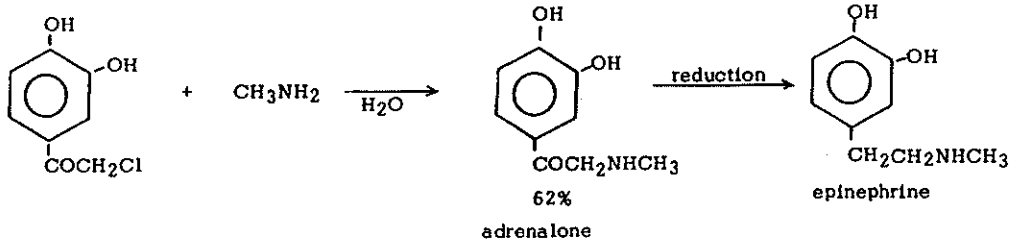
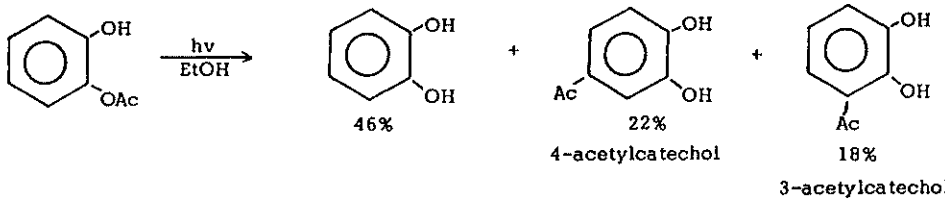


(51)

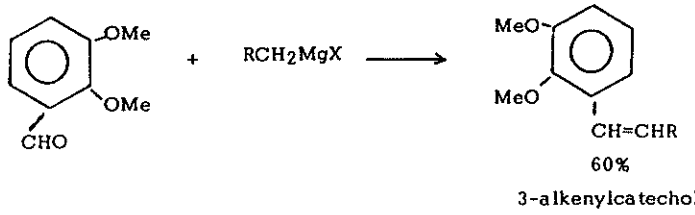


When the Fries reaction is carried out photochemically, much more substitution in the 3-position results.



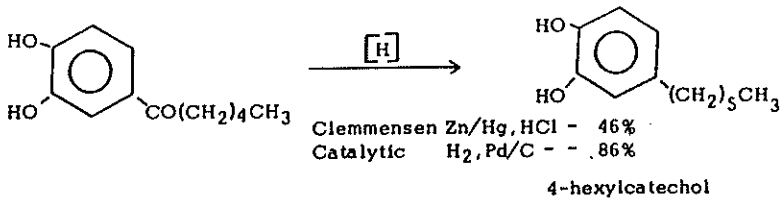
(52)

Exclusive 3-substitution can be obtained if desired by reaction of the appropriate aldehyde with Grignard reagents. These aldehydes are not available from catechol.



(49)

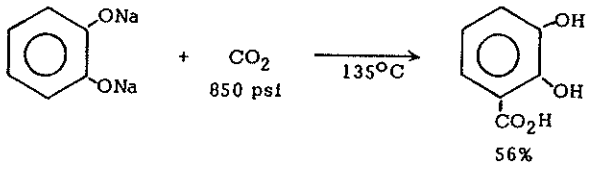
Alkylated catechols can be obtained from the acyl catechols by Clemmensen or catalytic reduction.



(50)

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.



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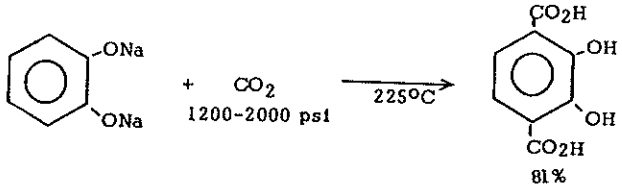
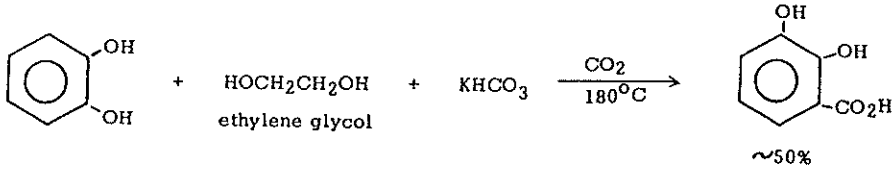
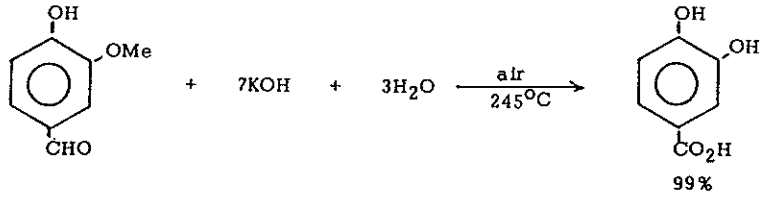


(54)



(55)

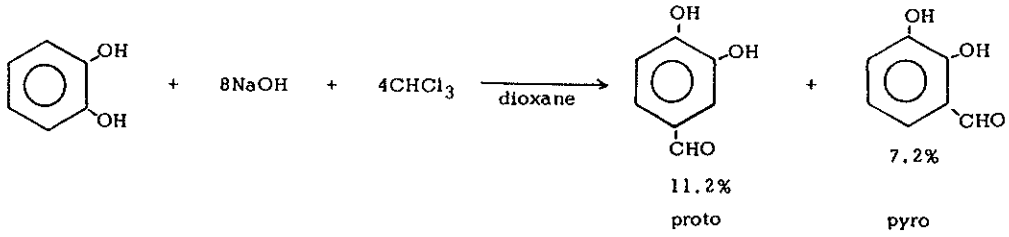
Protocatechuic acid, the 4-isomer, is not available directly from catechol. It is best obtained by the caustic fusion of vanillin.



(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.

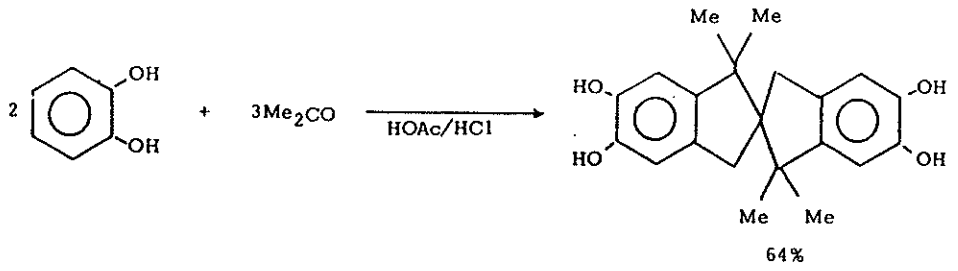


(57)

CONDENSATION WITH CARBONYL COMPOUNDS

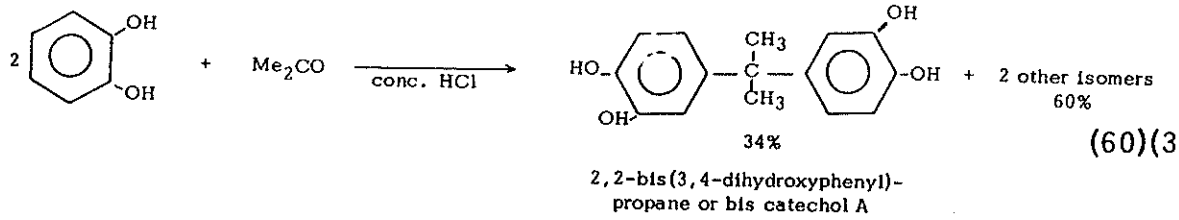
Acetone

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).



(58)

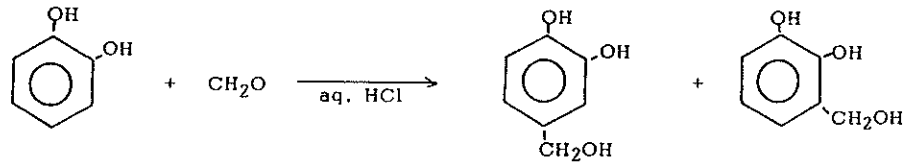
Reaction with excess catechol and a smaller amount of concentrated hydrochloric acid gives a much different result:



(60)(36)

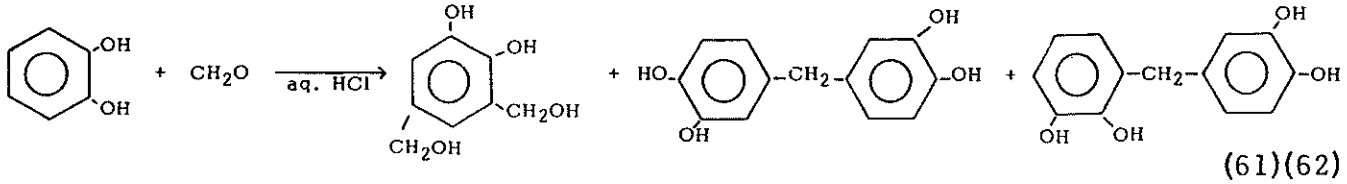
Formaldehyde

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).



(61)

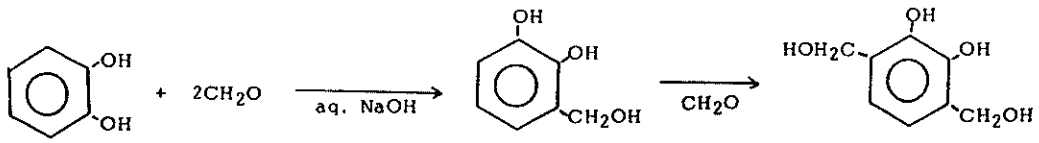
The only dimethylol tends to be the 3,5-isomer (62), while the two-ring components are the 3,4,3',4'- and 3,4,2',3'-tetrahydroxydiphenylmethanes. None of the 2,3,2',3'-isomer is present (61).



(61)(62)

Catechol has been reported to condense 2.3 times as fast as phenol with formaldehyde 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).



(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.

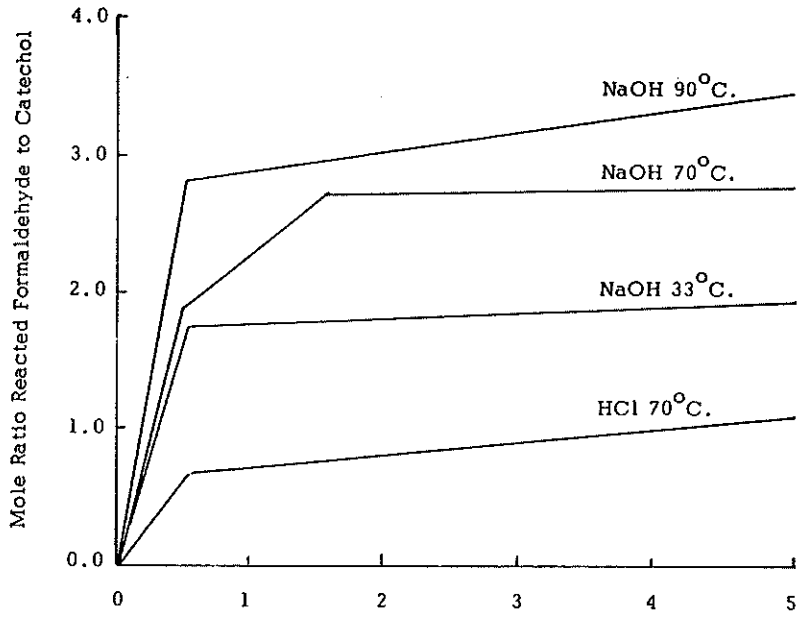


Figure 1

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).

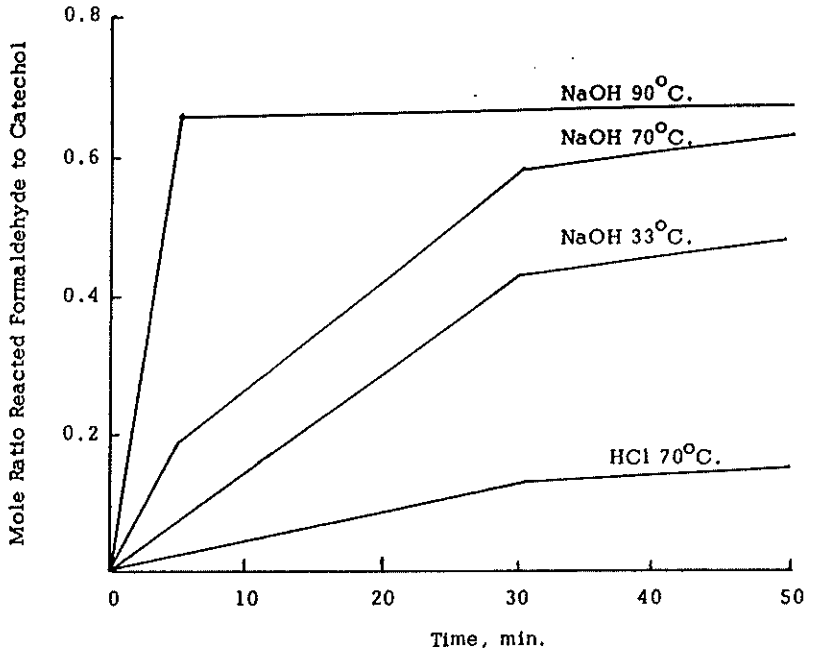


Figure 2

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).

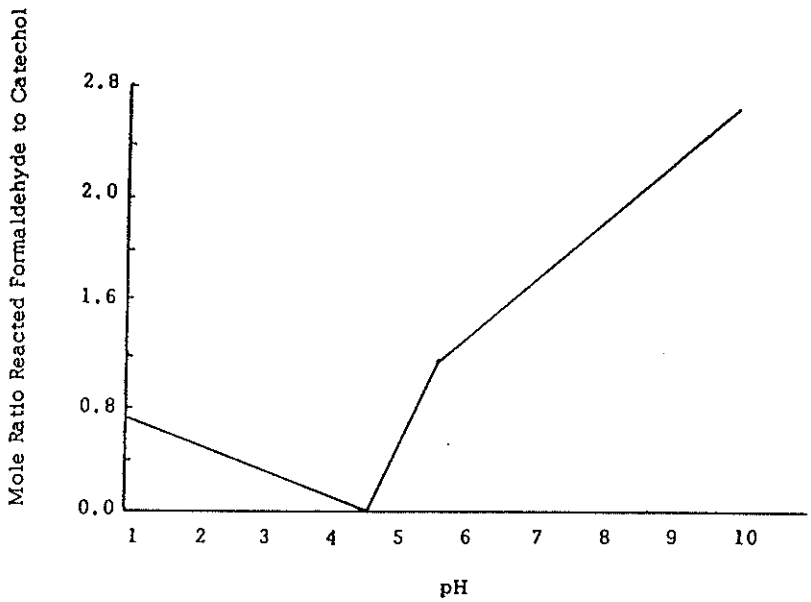
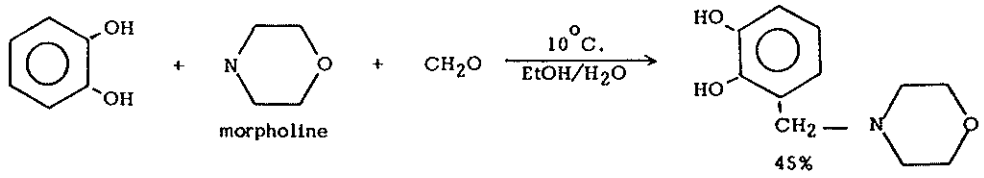


Figure 3

Effect of pH on Formaldehyde Uptake by Catechol in Aqueous Solution at 100° for 3 hrs. at a Mole Ratio of Catechol/Formaldehyde of 1.0/4.0.

AMINO- AND CHLOROMETHYLATION

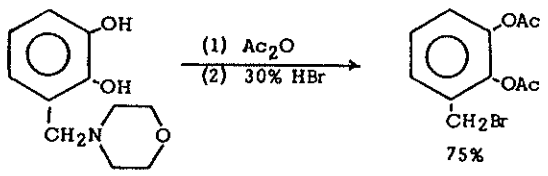
Like most other phenols, catechol and its derivatives undergo the Mannich (aminomethylation) reaction. On the basic side, the products are ortho isomers either to the hydroxy group or, if no free hydroxy groups are present, to an ether group.



3-morpholinomethylcatechol

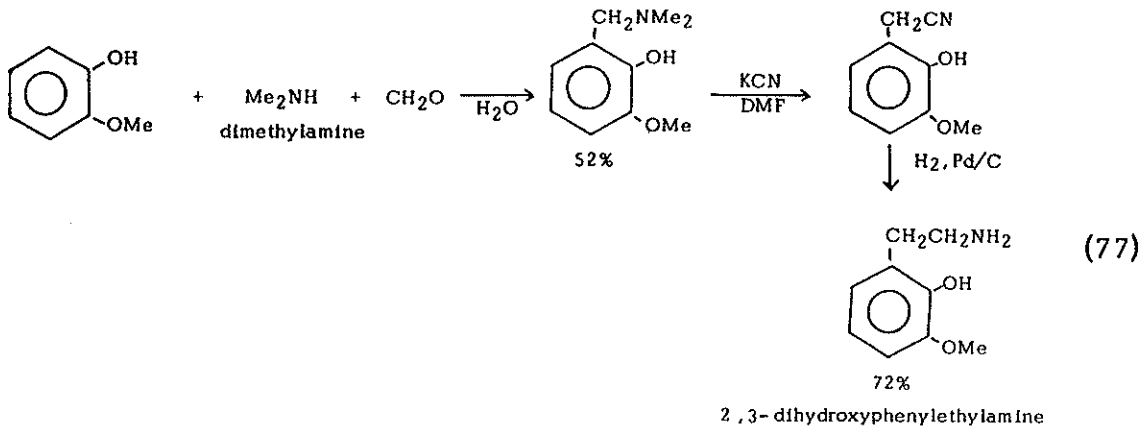
(76)

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.



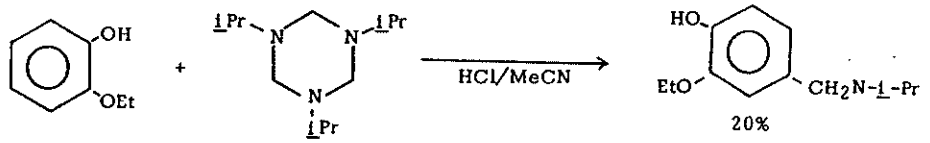
3-bromomethylcatechol diacetate

(76)



(77)

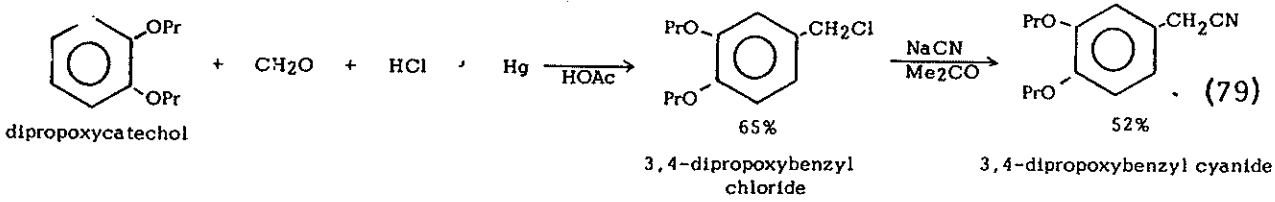
The Mannich reaction under acidic conditions gives mainly <u>para</u> substitution (78).



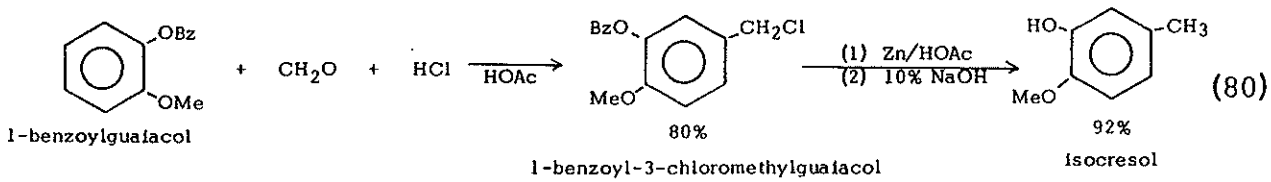
(78)

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 <u>para</u>-substituted products.

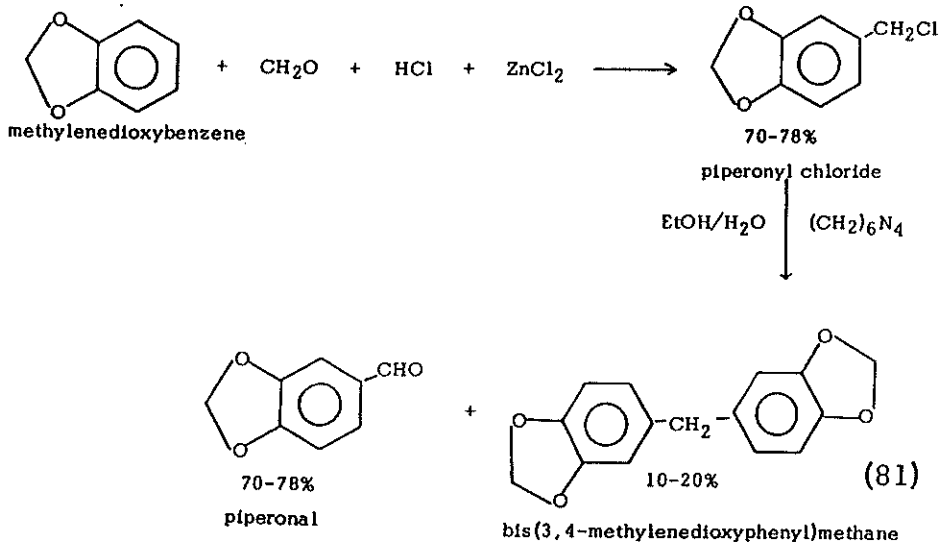


(79)



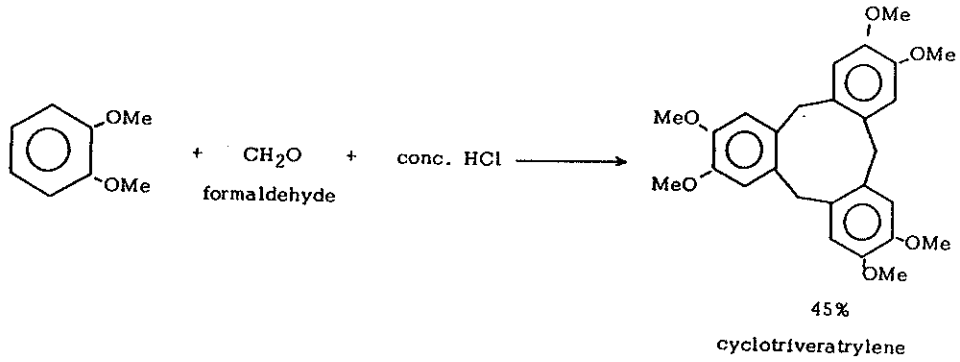
(80)

Treatment of the catechol benzyl chlorides with hexamethylenetetramine ($(CH_2)_6N_4$) gives aldehydes like piperonal (81)(82), together with some halide dimerization products.



(81)

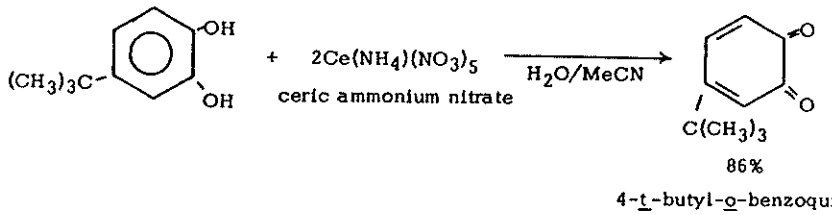
With veratrole, trimerization occurs in the halomethylation reaction to give an unusual 9-membered ring compound.



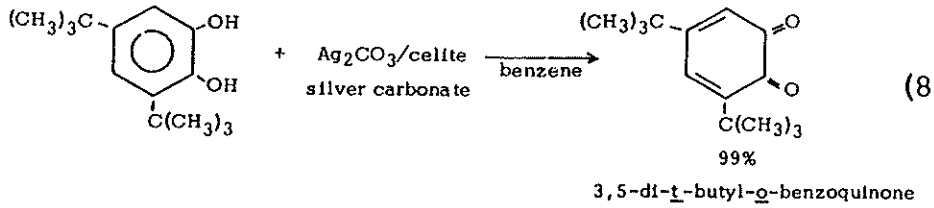
(84)

OXIDATION

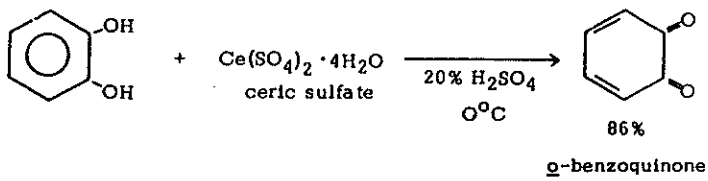
Catechols can be oxidized to orthobenzoquinones in excellent yield by a number of different oxidizing agents.



(85)

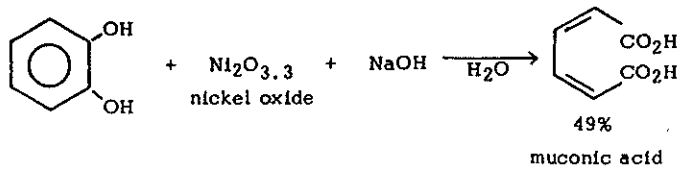


(86)



(87)

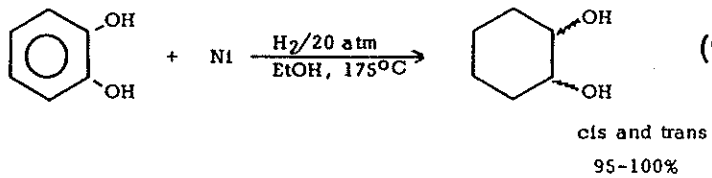
Both catalytic (88) and photochemical oxidations (89) have also been reported. Certain plant enzymes oxidize catechol to 3,4,3',4'-tetrahydroxydiphenyl (90). Under more vigorous conditions, catechol is oxidized to muconic acid and finally to degradation products.



(91)

HYDROGENATION

Catechol can be hydrogenated with a nickel catalyst at high hydrogen pressures and at high temperature to give the dihydroxycyclohexanes.

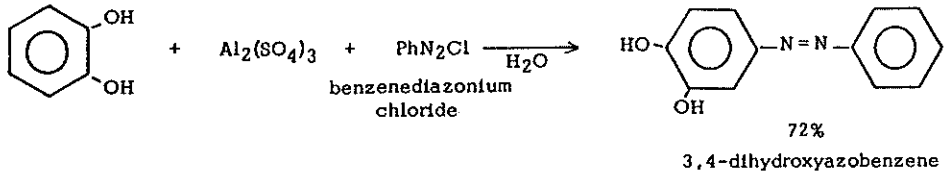


(92)

MISCELLANEOUS RING SUBSTITUTION REACTIONS

Azo Coupling

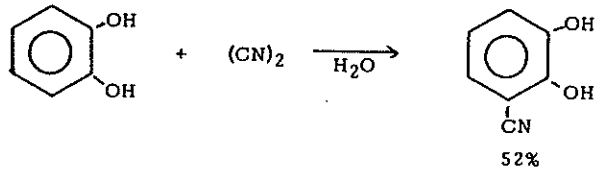
Catechol readily couples with aryldiazonium salts to give azo dyes.



(93)

Cyanation

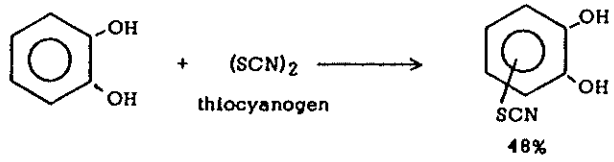
Cyanogen reacts with catechol in water to give the 3-cyanocatechol.



(94)

Thiocyanation

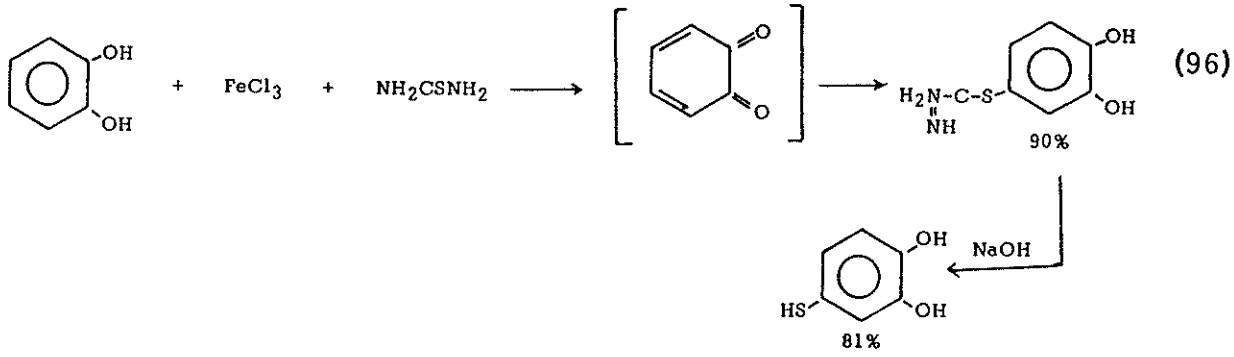
Thiocyanation gives a fair yield of unspecified thiocyanocatechol.



(95)

Mercaptocatechol

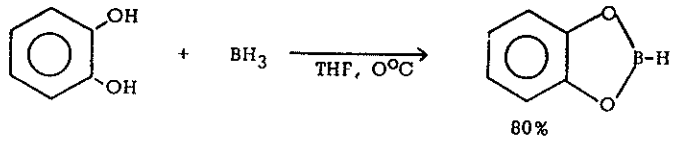
A route to 4-mercaptocatechols is the addition of thiourea to the corresponding orthobenzoquinone formed in situ (96).



(96)

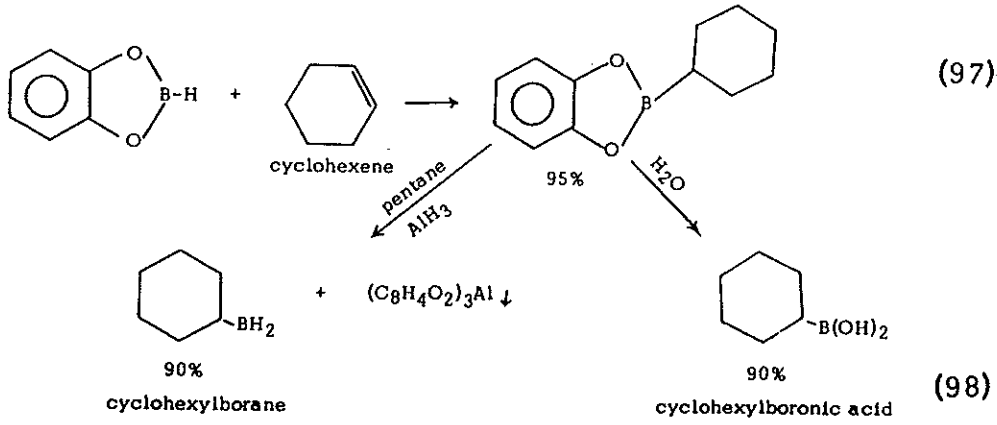
CATECHOLBORANE

1,3,2-Benzodioxaborole (catecholborane) is made easily from catechol and borane in tetrahydrofuran (97). It is an excellent monohydroborating reagent.



(97)

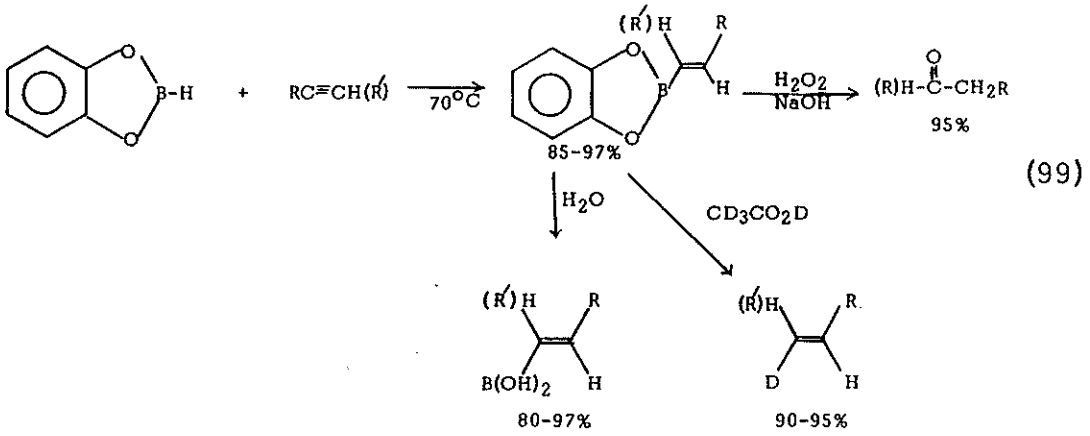
This reagent readily reacts with olefins at 100°C. to give the corresponding alkyl borole from which alkaneboronic acids and esters (97) as well as monoalkylboranes and mixed organoboranes can be derived (98).



(97)

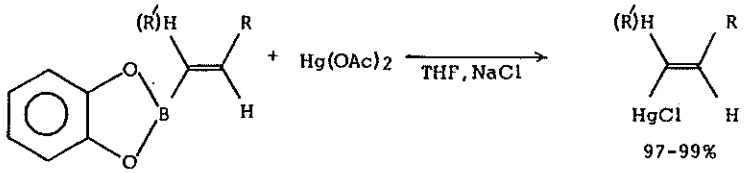
(98)

Catecholborane reacts with acetylenes at 70°C. to give stereospecific cis 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, cis olefins, and aldehydes and ketones can be obtained.

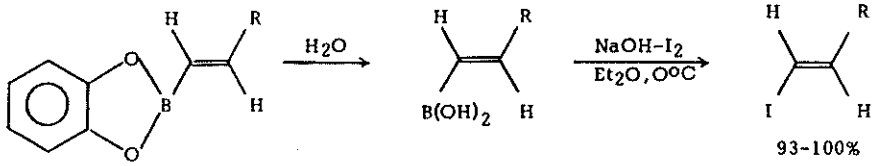


(99)

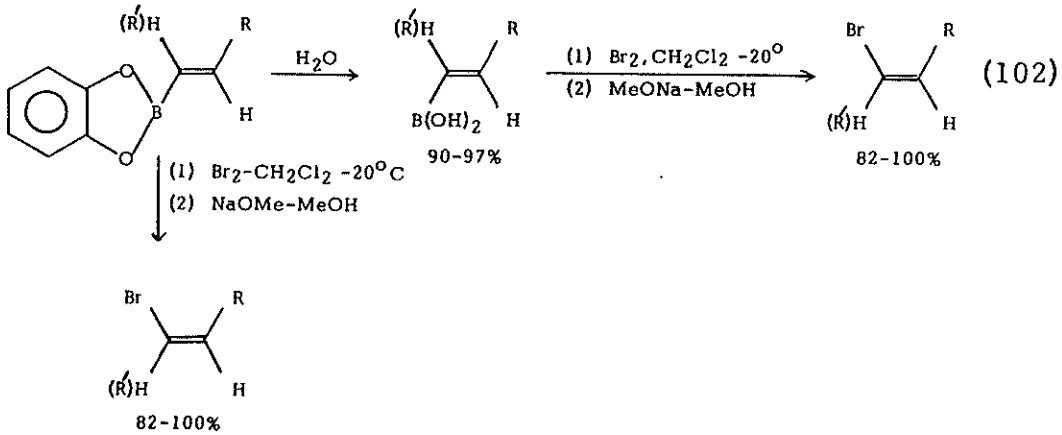
The alkenylboroles are also very useful for the preparation of alkenylmercuric salts (100), as well as trans-1-alkenyl iodides (101) and cis-1-alkenyl bromide and internal vinyl bromides (102).



(100)



(101)

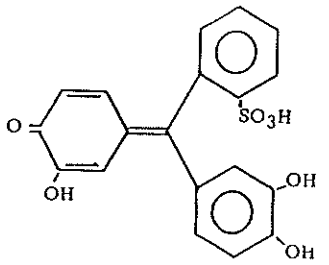


(102)

CATECHOL COMPLEXES

Metals and Rare Earths

Catechol and catechol derivatives, especially pyrocatechol violet (pyrocatecholsulfonephthalein 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).



(I)

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 $\rightleftharpoons$ Catechol-Metal Ion Complex

Metal	Catechol = H_2L	Log of Equilibrium Constant		Reference
H^{+1}		K_1=12.89	K_{12}=9.45	104
Al^{+3}		$[AlL]^{+1}$	K = 16.27	105
		$[AlL_2]^{-1}$	K = 13.48	105
		$[AlL_3]^{-3}$	K = 9.00	105
As^{+3}		$[AsOL]^{-1}$	K = 2.04	106
B^{+3}		$[BOL]^{-1}$	K = 3.89	106
		$[BL_2]^{-1}$	K = 4.15	106
Be^{+2}		$[BeL]$	K = 13.42	107
Cd^{+2}		$[CdL]$	K = 10.8	109
Co^{+2}			K = 8.31	110
Cu^{+2}		$[CuLH]^{+1}$	K = 5.35	111
		$[CuL]$	K = 13.88	111
		$[CuL_2]^{-2}$	K = 10.43	111
Fe^{+2}			K = 14.3	112
Mn^{+2}			K = 7.61	112
Mo^{+6}		$[MoO_2L_2]^{-2}$	K = 4.05	113
Ni^{+2}			K = 8.42	110
Si^{+4}		$[SiL_3]^{-2}$	K = 18.1	114
Sn^{+4}		$[SnL]^{+2}$	K = 26.5	114
Ti^{+4}		$[Ti(OMe)_2L]$	K = 27.35	114
W^{+6}		$[WO_2L_2]^{-2}$	K = 6.53	115, 116
Zn^{+2}			K = 9.00	110

Metal Ion + Catechol $\rightleftharpoons$ Catechol-Metal Ion Complex (cont'd)

Metal Rare Earth Metals	Log of Equilibrium Constant	Reference
La^{+3}	K = 9.46	117
Pr^{+3}	K = 10.31	117
Nd^{+3}	K = 10.50	117
Sm^{+3}	K = 1.06	117
Eu^{+3}	K = 11.17	117
Gd^{+3}	K = 11.20	117
Dy^{+3}	K = 11.34	117
Ho^{+3}	K = 11.42	117
Er^{+3}	K = 11.43	117
Tm^{+3}	K = 11.56	117
Yb^{+3}	K = 11.67	117
Lu^{+3}	K = 11.31	117
Ion		
Cl^-	$[ClH_2L]^{-1}$ K = 2.62	118
Br^-	$[BrH_2L]^{-1}$ K = 2.27	118
I^-	$[IH_2L]^{-1}$ K = 1.45	118
ClO_4^-	$[ClO_4H_2L]^{-1}$ K = 1.05	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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INDEX

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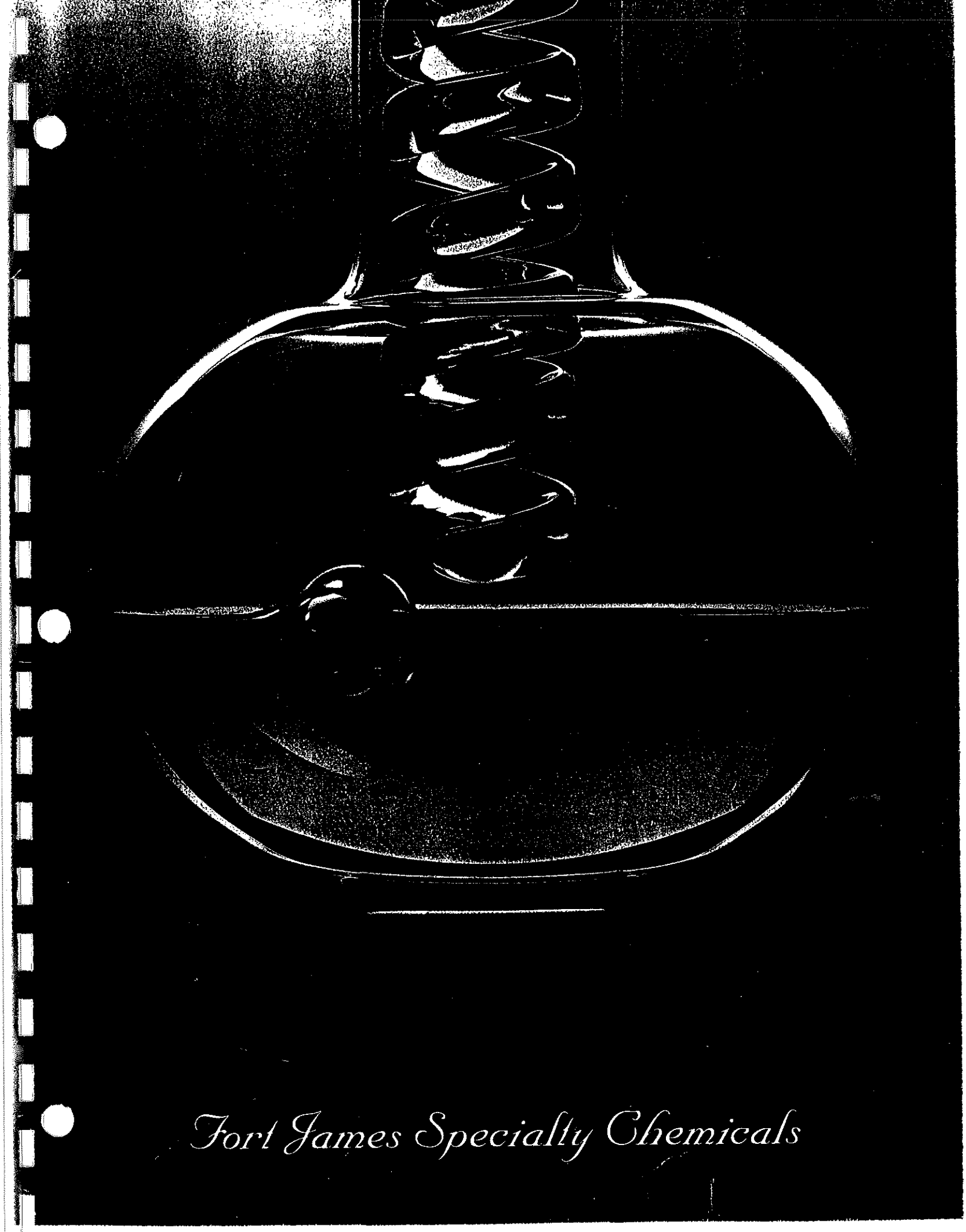
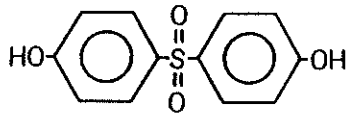


Fort James Specialty Chemicals

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 polyethylene liners		

SUGGESTED USES

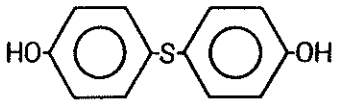
DDS
Monomer or chemical intermediate for:
Agricultural Chemicals —Antioxidants—Flame retardants—Stabili
Textile chemicals—Specialty chemicals

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 drums with polyethylene liners		

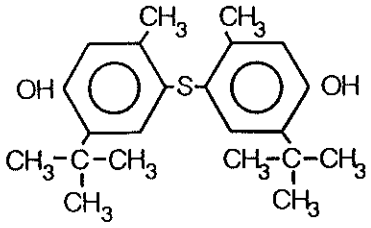
SUGGESTED USES

TDP
Monomer or chemical intermediate for:
Polycarbonates—Polyesters—Polyethers—Polysu
Polyurethanes—Epoxy resins—Larvicide Interme

LITERATURE

4,4'-THIODIPHENOL (TDP) TECHNICAL BULLETI
physical and chemical data and suggested uses.

CAS Registry Number 96-69-5



SHIPPING SPECIFICATIONS

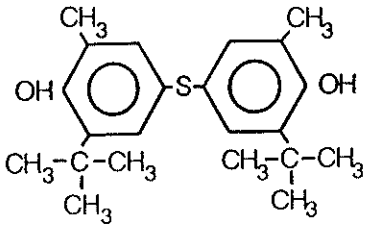
TB (TBMC)	
Melting Point, °C, min.	*160*
Water (Karl Fischer) % Max.	*0.5*
Color Absorbance 20% in methanol, 420 nm	*0.2*

Shipped in fiber drums with polyethylene liner.

SUGGESTED USES

TB(TBMC)
Monomer, chemical intermediate for antioxidants, UV absorber, stablizer.

Also called 4,4'-Thiobis (6-tert-butyl-o-cresol)
CAS Registry Number 96-66-2



SHIPPING SPECIFICATIONS

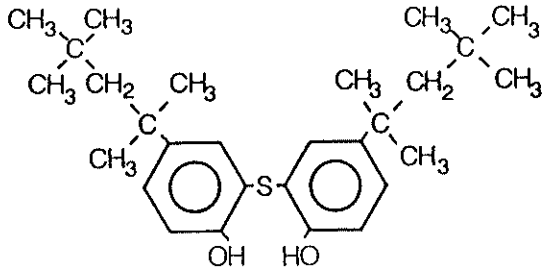
TB(MTBP)	
Melting Point, °C, min.	122.7
Water % max	0.5
Shipped in fiber drum with polyethylene liner.	

SUGGESTED USES

TB(MTBP)
Monomer or intermediate for antioxidants, UV absorbers, stabilizers

2,2'-THIOBIS (PARA-TERTIARY-OCTYL PHENOL) [TB(PTOP)]

Also called: 2,2' Thiobis (4-t-octyl phenol)
CAS Registry number 3294-03-9



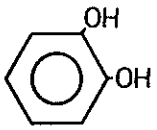
SHIPPING SPECIFICATIONS

2,2' TB (PTOP), % Min. By G.C.	*96*
Color, transmission 2.35% in Toluene/Butylamine 420 nm.	*70*
Shipped as wet cake (H_2O) or as dry powder in fiber drums with polyethylene liner.	

SUGGESTED USES

TB(PTOP)
Monomer or intermediate for antioxidants, UV absorbers, stabilizers.

Also called: pyrocatechol, o-dihydroxybenzene, pyrocatechin
CAS Registry Number 120-80-9



SHIPPING SPECIFICATIONS

Catechol available in two grades, Purified (XP) and Technical

Grade:	XP	Technical
% min. by G.C.	99.5	99.0
Melting point, °C, min.	103.5	103.0
Water, % max.	0.3	—
Shipped in fiber drums with polyethylene liner.		

SUGGESTED USES

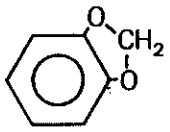
CATECHOL TECHNICAL GRADE
General Synthesis for:
Rubber Chemicals—Resins—Antioxidant—Adhesives—Insecticid
Electroplating—Flavors and Fragrances
CATECHOL XP GRADE
General Synthesis for:
Photographic Chemicals—Pharmaceutical Synthesis—Facsimile Paper—Dyes

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	

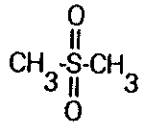
SUGGESTED USES

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 SULFONE	
% 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

$DMSO_2$

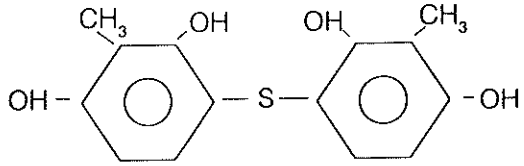
High temperature solvent and reaction medium for:
Displacement and polymerization reactions—Friedel-Crafts a... n
reactions—Intermediate for synthesis—Extraction solvent for olefi
and dienes

LITERATURE

DIMETHYL SULFONE TECHNICAL BULLETIN Gives physical anc
chemical data and suggested uses.

4,4'-THIOBIS (2 METHYL RESORCINOL) [TBMR]

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

FORT JAMES
SPECIALTY CHEMICALS
[illegible] & Adams Street
Camas, Washington 98607
Phone (360) 834-8134
FAX (360) 834-8278

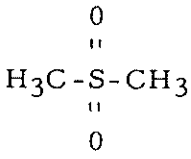
$DMSO_2$

DIMETHYL SULFONE TECHNICAL BULLETIN

FORT JAMES
SPECIALTY CHEMICALS
4th and Adams Street
Camas, Washington 98607 U.S.A.
Phone: (360) 834-3134

FORT JAMES
SPECIALTY CHEMICALS

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.

Phone: (206) 834-8134 TWX: 152845 FAX: (206) 834-8278
Mailing Address: Fourth and Adams Street, Camas, WA 98607
Street Address: 906 N.W. Drake Street, Suite B, Camas, WA 98607

Revised June 1998

Technical and Use Information

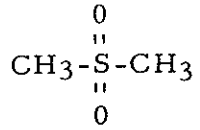
on

DIMETHYL SULFONE
(DMSO2)

TABLE OF CONTENTS

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^{110}_{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

SOLVENT CHARACTERISTICS OF DIMETHYL SULFONE ABOVE ITS MELTING POINT OF 109°C.

Acids

Acetic	sol.	Fumaric	mod. sol.
Adipic	sol.	Malonic	sol.
Anisic	sol.	Succinic	sol.
Benzoic	sol.	Terephthalic	sl. sol.
Caprylic	sl. sol.		

Anhydrides

Benzoic	sol.
Phthalic	sol.
Succinic	sol.

Alcohols and Glycols

Butyl alcohol	sol.	Glycerol	sol.
Cyclohexanol	sol.	1,5-Pentanediol	sol.
Ethylene glycol	sol.	Propylene glycol	sol.
Ethylene glycol monomethyl ether	sol.	Triethylene glycol	sol.

Phenols

Catechol	sol.	Phloroglucinol	sol.
Naphthol	sol.	Pyrogallol	sol.
Phenol	sol.	Resorcinol	sol.
o-Phenylphenol	sol.		

Ethers

Amyl	sol.
Ethylene glycol dimethyl ether	sol.

Esters

Amyl acetate	sol.	Methyl hexanoate	sol.
Benzyl salicylate	sol.	Methyl stearate	v. sl. sol.
Benzyl succinate	sol.	Monacetin	sol.
Butyl hexanoate	sol.	Triacetin	sol.

SOLVENT CHARACTERISTICS OF DIMETHYL SULFONE ABOVE M. P. 109°C. - cont'd

Amines

Aniline	sol.	Hexamethylenetetramine	decomposes
Benzylamine	sol.	Propylenediamine	sol.
Carbazole	sol.	Pyridine	sol.
Dicyclohexylamine	sl. sol.	Tetraethylenepentamine	sol.
N,N-Dimethylaniline	sol.	Triethylamine	sol.
Diphenylamine	sol.	Triethylenetetramine	sol.

Hydrocarbons

Biphenyl	sol.
Mineral oil	insol.
Naphthalene	sol.

Halogenated Compounds

Pentachlorobenzene	sl. sol.	1,1,2,2,-Tetrabromoethane	sol.
Pentachlorophenol	sol.	1,2,4-Trichlorobenzene	sol.
		Trichlorocumene	sol.

Ketones

Anthraquinone	sol.
Benzil	sol.
Benzophenone	sol.
Diisobutylketone	sol.

Salts

Ammonium chloride	v. sl. sol.	Potassium bromide	sl. sol.
Calcium chloride	insol.	Potassium chloride	insol.
Chromous chloride	sol.	Potassium ferricyanide	insol.
Cobaltous acetate	sl. sol.	Potassium iodide	sol.
Cobaltous chloride	sol.	Sodium acetate	v. sl. sol.
Copper sulfate	insol.	Sodium bromide	sl. sol.
Ferric chloride	sol.	Sodium iodide	sol.
Manganous chloride	very sol.	Sodium stearate	insol.
Nickelous chloride	decomp.	Uranyl nitrate	very sol.

Other Compounds

Acetamide	sol.	Nitrobenzene	sol.
Benzaldehyde	sol.	p-Phenylnitrobenzene	sol.
Butyraldehyde	sol.	Propionamide	sol.
3,4-Dimethoxyphenyl-acetonitrile	sol.		

SOLVENT CHARACTERISTICS OF DIMETHYL SULFONE ABOVE M. P. OF 109°C. - cont'd

Resins and Polymers

Amrez 1410 (phenol-formaldehyde)	insol.
Bakelite (phenol-formaldehyde), advanced	insol.
Butylmethacrylate polymer	insol.
Epon Resin #1007	sol.
Expandable polystyrene	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

Water

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.

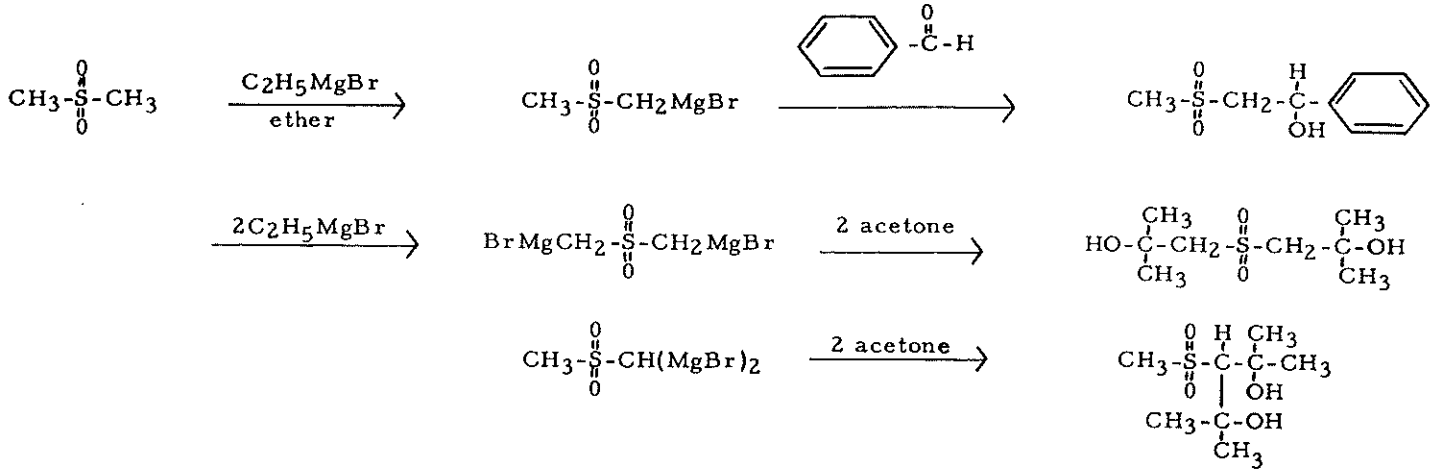
SOLUBILITY OF DIMETHYL SULFONE IN WATER AND ORGANIC SOLVENTS - cont'd

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°C.
Butyl cellusolve	12.2	
Carbon tetrachloride	insol.	
Chloroform	9.4	
Cyclohexane	trace	4.7 @ 75°C.
Diethyl ether	trace	
Diethylene glycol	insol.	v.s. @ 76°C.
Dimethyl formamide	31.3	
Dimethyl sulfide	7.03	
Dimethyl sulfoxide	48.5	
Dioxane	12.4	
Ethyl alcohol	insol.	v.s. @ 65-70°C.
Formaldehyde, 37%	32.4	
Isopropyl alcohol	1.03	4.52 @ 55°C.
Methyl alcohol	7.78	67.6 @ 60°C.
Methyl ethyl ketone	10.0	22.8 @ 65°C.
Methyl isobutyl ketone	1.93	8.8 @ 60° C.
2-Nitropropane	7.62	43.6 @ 70°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

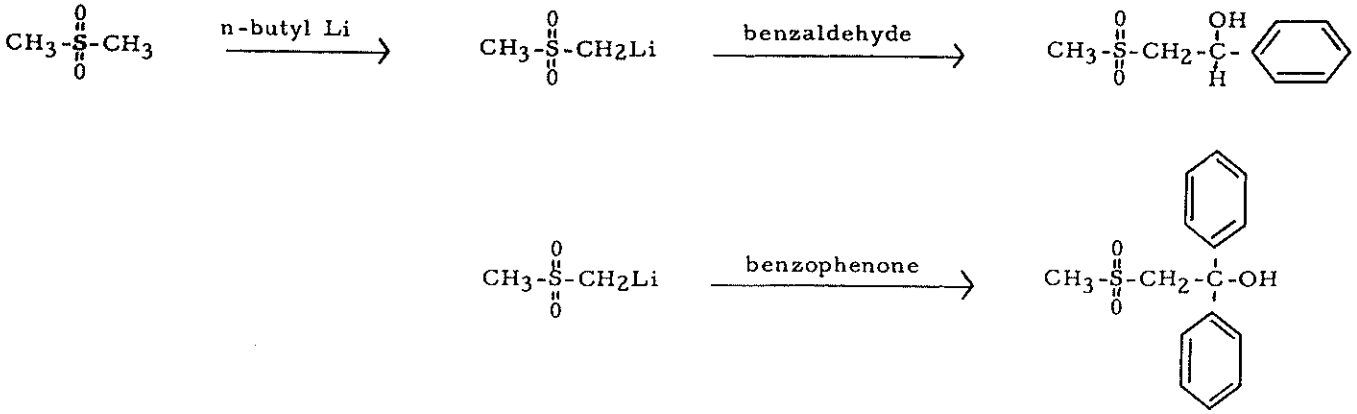
1. Grignard Reagents of Sulfones



Lamar Field and J. W. McFarland. J. Am. Chem. Soc. 75, 5582-6, (1953). C.A.:49, 933h (1955).

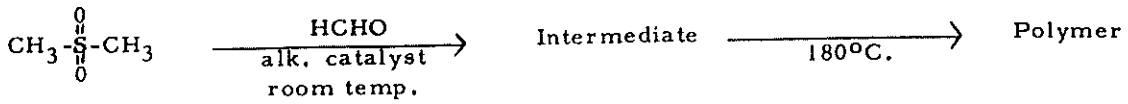
Wm. E. Truce and K. R. Buser. J. Am. Chem. Soc. 76, 3577-9 (1954). C.A.:49, 12268f (1955).

2. The Metalation of Dialkyl Sulfones



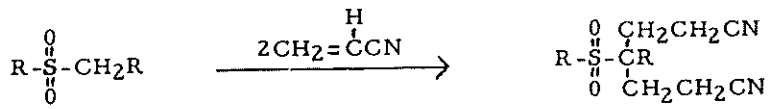
Wm. E. Truce and K. R. Buser. J. Am. Chem. Soc. 76, 3577-9 (1954). C.A.:49, 12268f (1955).

3. Resinous Compositions from Sulfones and Formaldehyde



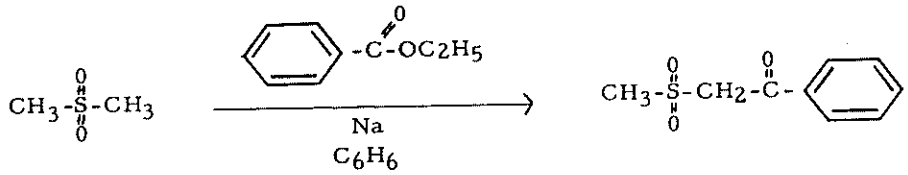
E. M. Evans and H. T. Hookway. U. S. Patent 2,543,237, Feb. 27, (1951). C.A.:45, 4485c (1951).

4. Cyanoethylation of Sulfones



H. A. Bruson and T. W. Riener. J. Am. Chem. Soc. 70, 214-7 (1948). C.A.:42, 2231g (1948).

5. The Preparation of β-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). $LiAlH_4$ 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 $LiAlH_4$ to 1 mole of DMSO2 at 35°C. and 12 hours gave only trace of Me_2S. 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

1. 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).

5. 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 N_2O_4 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).

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).

3. 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, 5421^3 (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.

SITE INVESTIGATION REPORT

SECOR
International Incorporated

COPY

2000 SITE INVESTIGATION REPORT

Former Fort James Specialty Chemicals
906 NW Drake Street
Camas, Washington

SECOR PN: 015.08860.002

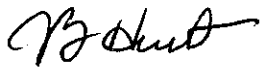
Submitted by:
SECOR International Incorporated

for:

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

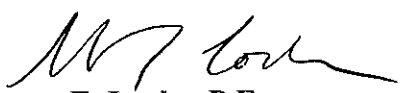
January 17, 2001

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 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 ($DMSO_2$) 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
- $DMSO_2$
- 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. $DMSO_2$ 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.

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), a 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, andesitic, 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

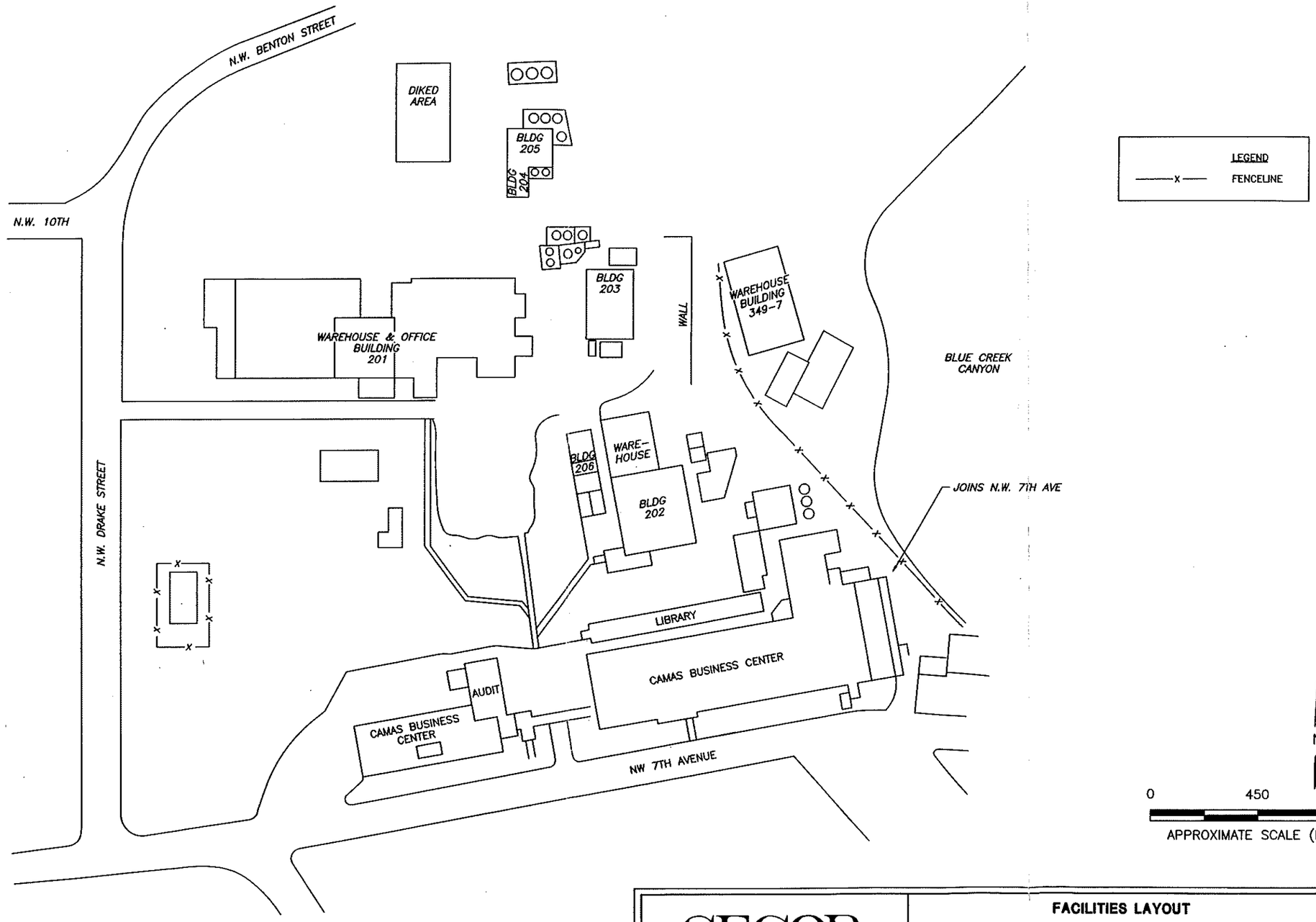
At each sample location, a private utility locator was used to evaluate the locations of underground utilities prior to initiating drilling activities. During each boring, continuous soil samples were field-screened via visual observation and photoionization detector (PID) evaluation. PID evaluation 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



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FACILITIES LAYOUT

FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **2**

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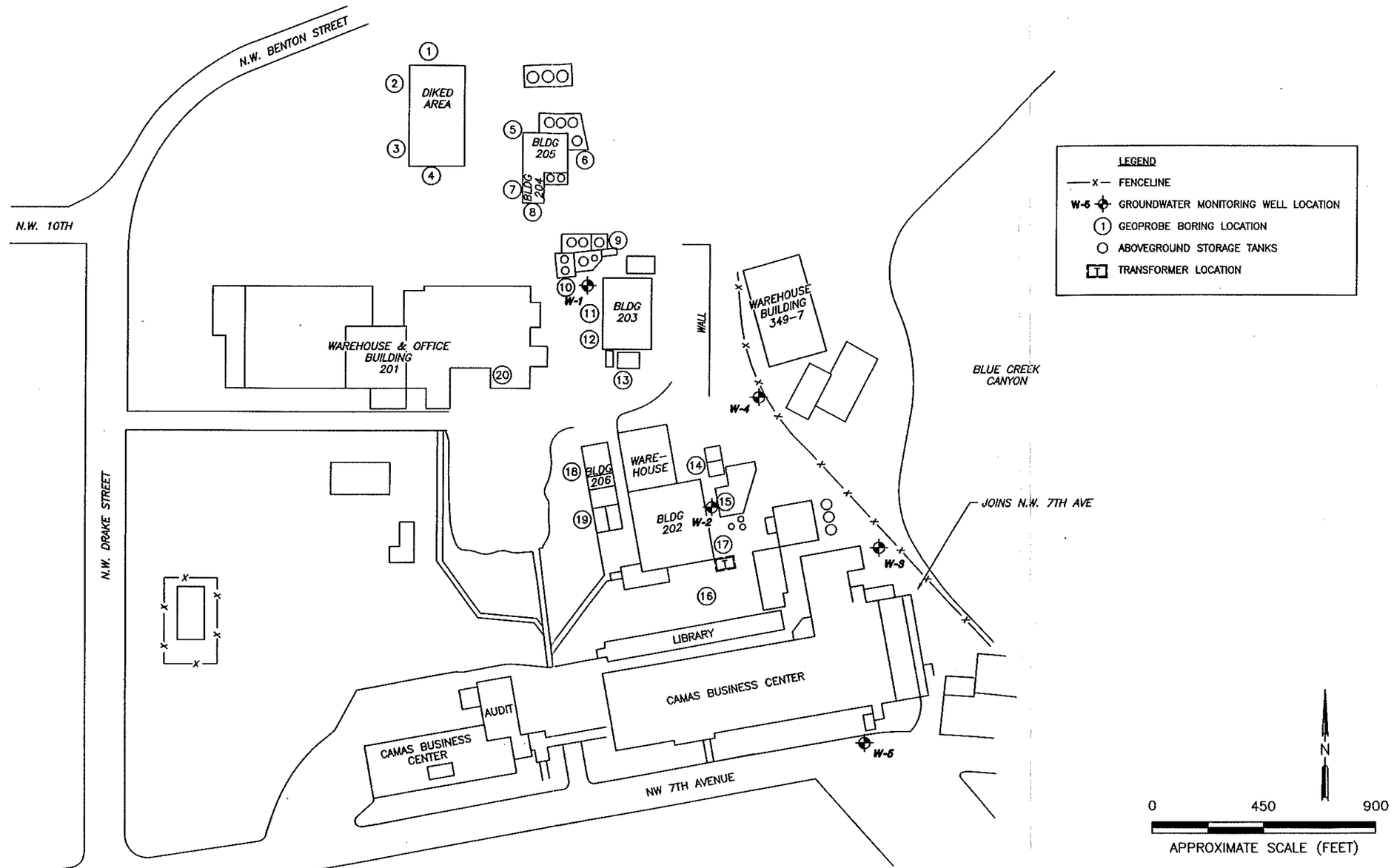

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SOIL AND GROUNDWATER SAMPLING LOCATIONS
FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **3**

JOB#: **015.08860.003** APPR: KPM DWN: **KPM** DATE: **12/06/00**

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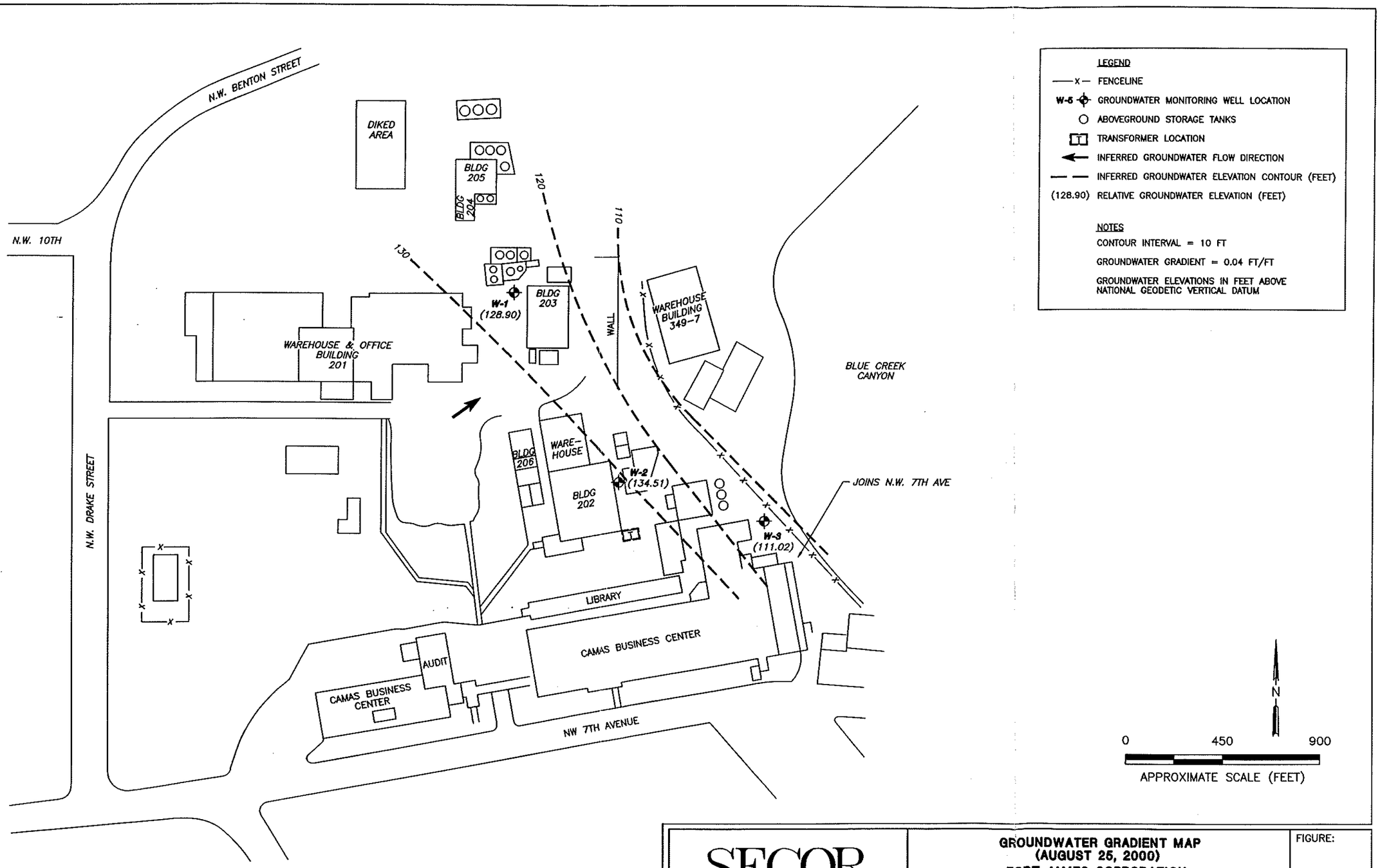

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GROUNDWATER GRADIENT MAP (AUGUST 25, 2000)
FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **4**

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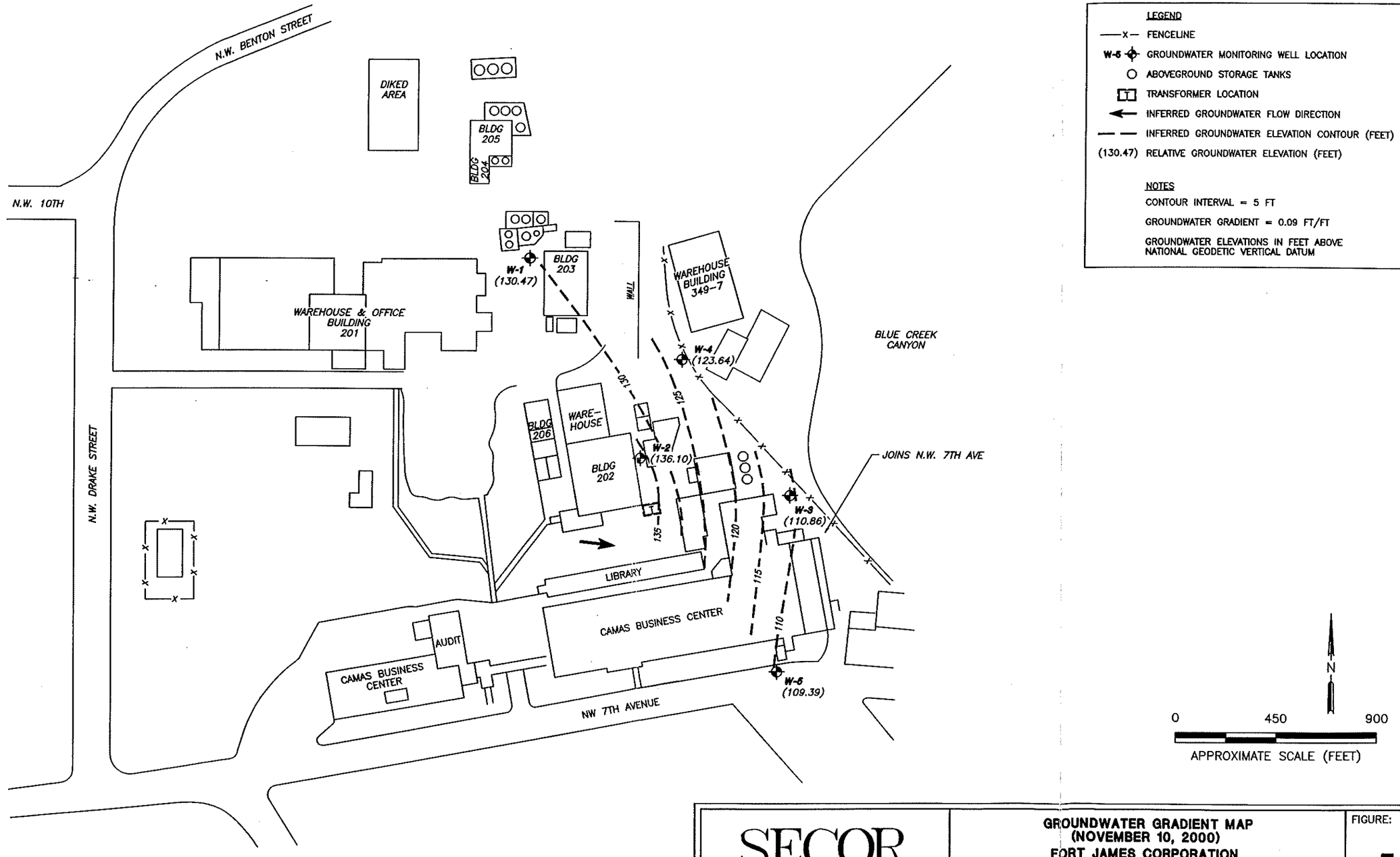

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GROUNDWATER GRADIENT MAP (NOVEMBER 10, 2000)
FORT JAMES CORPORATION
SPECIALTY CHEMICALS
CAMAS, WASHINGTON

FIGURE: **5**

JOB#: 015.08860.003 APPR: DWN: KPM DATE: 12/06/00

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DWG: 15-8860-0035-1100

TABLES

Table 1. Major Chemicals Used, Stored, or Manufactured
2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

Building No.	Chemical Materials [a]		
	Products	Raw Materials	
201	Originally a non-woven fabric manufacturing plant; later a warehouse for the storage of chemical products and a blending facility for napkin/towel printing inks.		
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 $DMSO_2$ 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

Potential On-Site Source Area/Building		Chemicals of Concern	Soil Sample Location	Analytical Suites
1	Diked Storage Area	VOCs, Phenols, PAH, Metals, Oil	1, 2, 3, 4	VOCs, SVOCs, Metals, TPH
2	Building 205	TPH, Metals	5, 6, 7	TPH, Metals
3	Building 204	Cresol	8	SVOCs (Phenols)
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
6	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)
8	Building 202 (Transformers)	PCB, VOCs, Phenols, MDB	17	PCB, VOCs, SVOCs, MDB
9	Building 206	VOCs, Phenols, PAH, Metals	18, 19	VOCs, SVOCs, Metals
10	Building 201	TPH	20	TPH

Table 3. Groundwater Sampling/Analysis Strategy
2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

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

Table 4. Organic Soil Analytical Results
2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

Sample No./ Depth (feet bgs) [a]		TPH-HCID [b] (mg/Kg)			VOCs [c] (mg/Kg)					A+Bn/E [d] SVOCs (mg/Kg)	A/E SVOCs [e] (mg/Kg)	PCBs [f] (mg/Kg)	TDP [g] (mg/Kg)	MDB [h] (mg/Kg)
		Gas	Diesel	Oil	PCE	Acetone	1,2-DCB	1,4-DCB	MC					
GP 1	2.5	<20 [i]	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	-- [j]	--	--	--
GP 2 B	7.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 3	14	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 4	19	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<1.65 - 10.0	--	--	--	--
GP 5	4.5	<20	<50	<100	--	--	--	--	--	--	--	--	--	--
GP 6	17.5	<20	<50	<100	--	--	--	--	--	--	--	--	--	--
GP 7 C	6	<20	<50	<100	--	--	--	--	--	--	--	--	--	--
GP 8	31.5	<20	<50	<100	--	--	--	--	--	--	<0.33 - 2.0	--	--	--
GP 9 @ 12	12	<20	<50	<100	2.950	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 9 @ 27.5	27.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 10	21.5	<20	<50	<100	0.250	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 11	10.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	--	<0.66 - 4.0	--	ND	--
GP 12	14.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	--	<0.33 - 2.0	--	ND	--
GP 13	6.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	--	<0.66 - 4.0	--	ND	--
GP 14 @ 8	8	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	--	<0.33 - 2.0	--	--	--
GP 15	7.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--
GP 16	2.7	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	--	<0.33 - 2.0	--	--	--
GP 17 @ 6	6	<20	<50	<100	<0.1	5.13	50.1	1.1	0.750	946 (1,2 -DCB)	--	0.289	--	31
GP 17C @ 11.5	11.5	<20	<50	<100	<0.1	<1.0	0.382	<0.1	<0.5	<0.33 - 2.0	--	<0.067 - <0.134	--	--
GP 18	1.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<0.33 - 2.0	--	--	--	--

Table 4. Organic Soil Analytical Results
2000 Site Investigation
Former Specialty Chemicals, Inc.
Fort James Corporation
Camas, Washington

Sample No./ Depth (feet bgs) [a]		TPH-HCID [b] (mg/Kg)			VOCs [c] (mg/Kg)					A+Bn/E [d] SVOCs (mg/Kg)	A/E SVOCs [e] (mg/Kg)	PCBs [f] (mg/Kg)	TDP [g] (mg/Kg)	MDB [h] (mg/Kg)
		Gas	Diesel	Oil	PCE	Acetone	1,2-DCB	1,4-DCB	MC					
GP 19	1.5	<20	<50	<100	<0.1	<1.0	<0.1	<0.1	<0.5	<1.65 - 10.0	--	--	--	--
GP 20	5.5	<20	<50	<100	--	--	--	--	--	--	--	--	--	--
MTCA A [k]		NE [l]	NE	NE	0.5	NE	NE	NE	0.5	NE	NA [m]	10	NE	NE
MTCA B [n]		NE	NE	NE	800	8,000	7,200	41.7	NE	7200 (1,2 DCB)	NA	0.013	NE	NE
Region IX PRGs [o] Residential/Industrial		NE	NE	NE	5.7/19	1,600/6,200	3,700/3,700	3.4/8.1	8.9/21	3,700/3,700 (1,2 - DCB)	NA	0.22/1.0	NE	NE

[a] 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.
[e] Acid Extractable Semivolatile Organic Compounds (A/E SVOCs) by EPA Method 8270C. Results in mg/Kg.
[f] Polychlorinated Biphenyls (PCBs) by EPA Method 8082. Results in mg/Kg.
[g] 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.
[i] < = Not detected at or above the laboratory method reporting limit.
[j] -- = Not analyzed.
[k] Washington Department of Ecology Model Toxics Control Act (MTCA) Method A Industrial Soil Cleanup Levels.
[l] Not Established.
[m] Not Applicable.
[n] Washington Department of Ecology MTCA Method B Soil Cleanup Levels.
[o] U.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 RCRA Metals [b] (mg/Kg)							
		Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver	Selenium
GP1	2.5	5.20	145	0.542	20.7	<10.0 [c]	<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	--	--	--	--	--	--	--	--
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 [e]		20	--	2	100	250	1	NE	NE
MTCA B [f]		1.67	5,600	30	NE	NE	24	400	400
REGION IX PRGs [g] Residential/Industrial		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)

[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.

[g] 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)
W-1	08/25/00	161.33	32.35	128.90
	11/10/2000		30.86	130.47
W-2	08/25/00	156.00	21.49	134.51
	11/10/2000		19.9	136.1
W-3	8/25/2000	125.82	14.8	111.02
	11/10/2000		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 Number	Sample Date	TPH-HCID [a] (mg/L)			TPI (µg/L)	SVOCs [d] (µg/L)		PCB [e] (µg/L)	TDP [f] (µg/L)	MDB [g] (µg/L)
		Gas	Diesel	Oil		1,2-DCB	B(2-EH)P			
W-1	08/25/00	<0.250	<0.630	<0.630	0	<5.0	<10.0	<0.5	--	ND
W-2	08/25/00	DET	<0.630	<0.630	7	74.4	**10.1**	<0.5	ND	ND
W-3	08/25/00	<0.250	<0.630	<0.630	0	<5.0	**22**	<0.5	ND	ND
W-4	11/10/00	--	--	--	0	<5.0	<10.0	--	--	--
W-5	11/10/00	--	--	--	0	<5.0	<10.0	--	--	--
MTCA A [h]		NE	NE	NE	1,(	NE	NE	0.1	NE	NE
MTCA B [k]		NE	NE	NE		720	6.25	0.0114	NE	NE

[a] Total Petroleum Hydrocarbon - Hydrocarbon Identification as gasol
[b] Total Petroleum Hydrocarbons as Gasoline by Northwest Series Me
[c] Volatile Organic Compounds by EPA Method 8260B. Results in µg
[d] Semivolatile Organic Compounds by EPA Method 8270C. Results
[e] Polychlorinated Biphenyls by EPA Method 8082. Results in µg/L.
[f] Thiodiphenol 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)								Acidity [b] (mg/L)	Alkalinity [c] (mg/L)
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver	Selenium		
W-1	<0.001 [d]	0.00362	<0.001	<0.001	<0.001	<0.00125	<0.001	<0.001	17.1	52.8
W-2	0.00268	0.0625	<0.001	0.00344	0.00367	<0.00125	<0.001	0.00133	15.4	63.1
W-3	<0.001	0.00777	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	16.1	89.9
MTCA A [e]	0.005	NE [f]	0.005	0.050	0.005	0.002	NE	NE	NE	NE
MTCA B [g]	5.83E-05	1	0.008	NE	NE	0.0048	0.08	0.08	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.

[c] Alkalinity by EPA Method 310.1. Results in mg/L.

[d] < = Not detected at or above the laboratory method reporting limit.

[e] Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Level in mg/L.

[f] NE = Not Established.

[g] 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

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-1**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0809 08/01/00** FINISH **0819 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 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	Grass		0	
		0.0		0	Gravelly SAND, orange, gravel is fine to very coarse, sand is fine grained, loose, dry	SP	0	
				2.5	Boring terminated at 2.5 feet (refusal). (GP1B – refusal @ 3.5' bgs.) (GP1C – refusal @ 3.2' bgs.)			
				5			5	
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-2**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0831 08/01/00** FINISH **0835 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 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	Grass		0	
	0-3.5	2.9		0	SAND w/ gravel, orange/tan, gravel is fine to coarse, sand is fine to medium grained, trace silt, loose, dry	SP	0	
				5	Boring terminated at 3.5 feet (refusal).		5	
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-2B**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1700 08/02/00** FINISH **1717 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Grass		0	
					No recovery in sampler			
		0.0		5	Silt, SAND, gravel aggregate, gravels are fine to coarse, sand is fine–to medium–grained, mottled color, dense, dry	GM	5	
					Boring terminated at 7.5 feet (refusal).			
					(GP2C – refusal @ 4.3' bgs)			
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-3**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0845 08/01/00** FINISH **0900 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 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
				5			5	
				0	Grass		0	
		0.9			SAND, orange/tan, fine-to medium-grained, few gravels, root debris present, loose, dry	SP		
		1.4		5	SAND and silt, green/gray, fine grained, firm, dry	SM	5	
		0.3			Becomes damp			
		2.1			SILT, dark brown, root debris, firm, damp			
		9.7		10	Becomes wet	ML	10	
		21.0			Color changes to brown/tan			
		8.0			Gravel present at base of sampler			
				15	Boring terminated at 14 feet (refusal).		15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

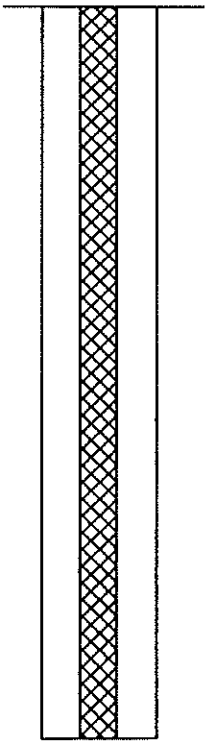
DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-4**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0915 08/01/00** FINISH **0945 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 6"/6"/6"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet
				5			5
				0	Grass		0
		1.5			SAND and silt, tan, sand is fine grained, firm, dry	SM	
		3.1			SILT, gray, root debris present, firm, damp	ML	
		1.4		5	Sandy SILT, green/gray, sand is fine grained, trace small gravels, firm, damp		5
		1.2				SM	
		1.2		10	Silty SAND, dark brown, sand is fine grained, trace small gravel, root debris present, firm, damp		10
		0.6					
		1.1			SILT, sand, gravel aggragate, dark brown, gravels are fine to medium, sand is fine to medium, a lot of root debris, loose, wet	GM	
				15			15
		1.1			SILT, gray/green, firm, damp	ML	
		1.2			Silty SAND w/gravel, mottled, gravels are fine to medium, sand is fine to medium, dense, damp	GM	
		1.7					
					Boring terminated at 19 feet (refusal).		
				20			20
				25			25

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-5**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0956 08/01/00** FINISH **1022 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 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	Asphalt surface		0	
		1.3		0	Silty SAND, gravel, cobble aggregate, brown, brick debris present, dense, dry	GM	0	
				5	Boring terminated at 4.5 feet (refusal). (GP5B – refusal @ 2.0' bgs) (GP5C – refusal @ 5.6' bgs)		5	
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-6**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1257 08/01/00** FINISH **1318 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 6"/6"/6")	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet
				0	Asphalt surface		0
		1.9		5	Silt, SAND, gravel aggregate, brown, medium dense, dry	GM	5
		1.6		10	SAND and silt, brown, sand is fine-to medium-grained, trace gravel, loose, soft (no good recovery in sampler)	SM	10
				15	SILT, brown, damp, firm	ML	15
		1.6			SILT w/ sand and gravel, gravels are fine to coarse, sand is fine, medium dense, damp	GM	
		0.7			Boring terminated at 17.5 feet (refusal).		
				20			20
				25			25

Well Construction Schematic

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-7**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1035 08/01/00** FINISH **1041 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 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	Asphalt surface		0	
		2.6		0	Silt, SAND, gravel, cobble aggregate, brown, loose, dry	GM	0	
				3	Boring terminated at 3 feet (refusal).			

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slot
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-7B**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1241 08/01/00** FINISH **1347 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 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	Asphalt surface		0	
	0 - 2.5	0.5		0	Silt, SAND, gravel, cobble aggregate, brown, loose, dry	GM	0	
				2.5	Boring terminated at 2.5 feet (refusal).			

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-7C**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1355 08/01/00** FINISH **1403 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 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	Asphalt surface		0	
	0-5	1.2		5	Silt, SAND, gravel, cobble aggragate, brown, medium dense, dry	GM	5	
					Boring terminated at 6 feet (refusal).			
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

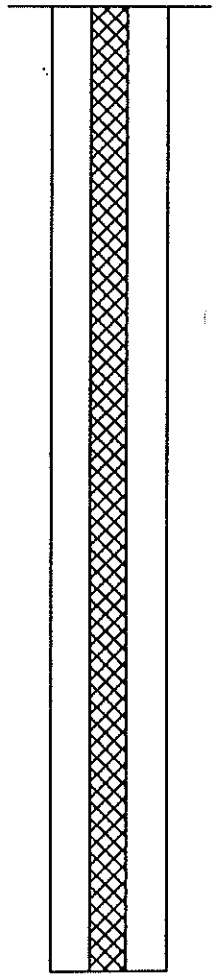
DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-8**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1050 08/01/00** FINISH **1150 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 6"/6"/6"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet
				5			5
				0	Asphalt surface		0
		2.5			SILT w/ sand and gravels, dark brown, gravels are fine to coarse, sand is fine grained, root debris present, firm, damp	GM	
				5			5
		2.4			Silty SAND, orange/tan, sand is fine to medium, loose, dry	SM	
					SILT w/ trace small gravels	ML	
		0.0		10	SAND and silt, brown, sand is fine-to medium-grained, loose, dry		10
				15			15
		0.6			Cobbles at base of sampler	SM	
		1.0		20	Very dense and hard - no cobbles		20
		1.7			SAND w/ silt and gravels, mottled orange, sand is fine-to medium-grained, very dense, hard	GM	
				25			25

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY FT JAMES SPECIALTY CHEMICAL JOB # 015.08716.003 BORING/WELL GP-8
LOCATION CAMAS, WASHINGTON SURFACE ELEVATION NA
START 1050 08/01/00 FINISH 1150 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 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
		0.4		25		GC	25	
		0.5		30	Clayey, gravelly, SILT, orange/brown, firm, moist		30	
					Boring terminated at 31.5 feet (refusal).			
				35			35	
				40			40	
				45			45	
				50			50	
				55			55	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-9**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
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 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
				5			5	
				0	Asphalt surface		0	
		0.0		5	Gravelly SILT w/ sand, brown, gravels are fine to coarse, sand is fine-to medium-grained, medium dense, wet		5	
		24.2		10	Silty SAND w/ gravels, tan/brown, gravel is fine to medium, sand is fine to medium, medium dense, damp	GM	10	
		30.1		15			15	
		14.8		20	Sandy SILT w/gravel, brown, wet		20	
		1.4		25			25	
		0.9						

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-9**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
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 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
		0.8		25	Gravelly SAND, brown, gravel is fine to coarse, sand is fine to coarse, trace silt, medium dense, moist	GM	25	
				30	Boring terminated at 27.5 feet (refusal).		30	
				35			35	
				40			40	
				45			45	
				50			50	
				55			55	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-10**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1520 08/01/00** FINISH **1543 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 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	Asphalt surface		0	
		0.5		5	Silty SAND and gravel, mottled brown, gravels are fine to coarse, sand is fine to medium, dense, dry	GM	5	
		1.1			Sand grades coarser			
		0.5		10	Same w/ cobbles present		10	
		0.0		15	Sandy, silty GRAVELS w/cobbles, brown, gravels are fine to coarse, sand is fine to coarse, loose, dry		15	
		0.4		20	Clayey, gravelly SILT, brown, gravels are fine to coarse, trace fine sand, firm, wet		20	
					Boring terminated at 21.5 feet (refusal).			
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-11**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1600 08/01/00** FINISH **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 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	Asphalt surface		0	
		0.5		5	Silty SAND, brown, sand is medium grained, few gravels fine to medium, loose, dry	SM	5	
					No recovery (4–8' bgs)			
				10	Silty, sandy, GRAVEL, brown, gravel is medium to coarse, sand is fine, loose, dry	GM	10	
					Boring terminated at 10.5 feet (refusal).			
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-12**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Asphalt surface		0	
		0.9		5	Gravelly SAND, gray, sand is fine to medium, loose, dry	GM	5	
		1.0			SILT, dark brown, trace fine sand, wood debris present, firm, dry	ML		
		0.9		10	SILT w/sand and gravel in varying quantities, multicolored, damp	SM	10	
		1.0			SILT, brown, trace small to medium gravels, firm, damp	ML		
				15	SILT w/ gravels, brown, gravel is fine to coarse, firm/dense, damp	GM	15	
					Boring terminated at 14.5 feet (refusal).			
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-13**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0830 08/02/00** FINISH **0848 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Asphalt surface		0	
					SILT, brown, some gravels and cobbles, gravels are fine to coarse, trace fine sand, soft, damp	ML		
		0.0		5	GRAVEL w/sand, gray, gravels are fine to coarse, sand is fine to medium, loose, dry	SW	5	
					Boring terminated at 6.5 feet (refusal). (GP13B – refusal @ 6.5' bgs) (GP13C – refusal @ 6.3' bgs)			
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-14**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0923 08/02/00** FINISH **0955 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				5			5	
				0	Asphalt surface		0	
		22.8			Clayey SILT, brown, trace medium gravels, firm, damp	ML		
				5	SILT and gravels, gray, gravels are medium to coarse, dense/ firm, dry	GM	5	
		25.4			SILT, dark gray, very stiff, dry	ML		
					Boring terminated at 8 feet (refusal).			
				10	(GP14B – refusal @ 7.0' bgs) (GP14C – refusal @ 7.0' bgs)		10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-15**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1400 08/02/00** FINISH **1420 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Concrete surface		0	
		1.8			Brick debris SILT w/gravel, dark brown, gravels are fine to medium, root debris present, medium dense, damp	GM		
		0.8		5	SILT, oxidized red/brown, trace gravels, hard, dry	ML	5	
				10	Boring terminated at 7.5 feet (refusal). (GP15B – refusal @ 7.5' bgs) (GP15C – refusal @ 6.7' bgs)		10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-16**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0800 08/03/00** FINISH **0810 08/03/00** 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				5			5	
				0	Grass		0	
		0.7			Gravelly SILT, brown, gravels are fine to medium, loose, dry	GM		
					Boring terminated at 2.7 feet (refusal).			
					(GP16B – refusal @ 2.5' bgs) (GP16C – refusal @ 2.5' bgs)			
				5			5	
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-17**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1015 08/02/00** FINISH **1035 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				5			5	
				0	Concrete surface w/ fiberglass		0	
		82.8			SILT and gravel, brown, gravels are fine to coarse, odor present, medium dense/firm, damp	GM		
		792		5			5	
		7.0			SILT, sand, and gravel, brown/gray, gravel is fine to coarse, sand is fine to medium, strong odor present, medium dense, damp			
				10	Boring terminated at 9 feet (refusal). (GP17B – refusal @ 7.5' bgs)		10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08718.003** BORING/WELL **GP-17C**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1115 08/02/00** FINISH **1150 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")	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Asphalt/fiberglass surface		0	
		1.2		5	SILT, sand and gravel, brown/gray, gravel is fine to coarse, sand is fine to medium, no odor, medium dense, damp	GM	5	
		17.1		10	Zeolite present SILT, black, some small gravels, hard, dry	ML	10	
				11.5	Boring terminated at 11.5 feet (refusal). (GP17B – refusal @ 7.5' bgs)			
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8718-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-18**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **08/03/00** FINISH **08/03/00** 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")	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Basalt		0	
		1.0		0	Sand, SILT w/gravel, loose, damp	GM	0	
				1.5	Boring terminated at 1.5 feet (refusal). (GP18B – refusal @ 1.5' bgs) (GP18C – refusal @ 1.5' bgs)			

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-19**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **08/03/00** FINISH **08/03/00** 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Basalt		0	
		0.6		0	Sandy SILT w/gravel, loose, damp	GM	0	
					Boring terminated at 1 feet (refusal).			
					(GP19B – refusal @ 1.0' bgs) (GP19C – refusal @ 1.0' bgs)			

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

SECOR
International Incorporated

FACILITY **FT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.003** BORING/WELL **GP-20**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0945 08/03/00** FINISH **1000 08/03/00** 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"	Sample Depth Interval, feet	PID Reading	Sheen	Depth Below Surface, feet	Lithologic Description	Unified Soil Classification	Depth Below Surface, feet	Well Construction Schematic
				0	Planter rocks over fabric screen		0	
		0.7		0	SILT, brown, trace small gravel, some organic debris, loose, dry	ML	0	
				5	Boring terminated at 6 feet (refusal). (GP20B – refusal @ 5.5' bgs) (GP20C – refusal @ 2.5' bgs)		5	
				10			10	
				15			15	
				20			20	
				25			25	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

DWG: 15-8716-3L

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

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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	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 16:0C
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

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

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Decor 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
GP1 (P008088-01) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*109 %*	*50-150*							
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*114 %*	*50-150*							
GP4 (P008088-04) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
vy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*105 %*	*50-150*							
GP5 (P008088-05) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*106 %*	*50-150*							
GP6 (P008088-06) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*93.5 %*	*50-150*							

Lisa Domenighini, Project Manager

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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	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 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*99.1 %*	*50-150*							
GP9 @ 12' (P008088-12) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*100 %*	*50-150*							
GP9 @ 27.5' (P008088-13) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*102 %*	*50-150*							
GP10 (P008088-14) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*108 %*	*50-150*							
GP14 @ 8' (P008088-19) Soil					Sampled: 08/02/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*98.0 %*	*50-150*							

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Decor 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 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*111 %*	*50-150*							
GP2B (P008088-29) Soil					Sampled: 08/02/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*98.0 %*	*50-150*							

North Creek Analytical - Portland

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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	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
GP1 (P008088-01) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**5.20**	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**145**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	**0.542**	0.500	"	"	"	"	"	"	
Chromium	**20.7**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.988**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**6.46**	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**114**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**24.8**	0.500	"	"	"	"	"	"	
Lead	**14.5**	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.588**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP4 (P008088-04) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**5.76**	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**155**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**48.3**	0.500	"	"	"	"	"	"	
Lead	**17.7**	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.939**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	

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Secor 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	Notes
GP5 (P008088-05) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**1.32**	0.500	mg/kg dry	1	EPA 6020	08/11/00	08/17/00	0080303	
Barium	**91.9**	0.500	"	"	EPA 6010A	08/11/00	08/14/00	0080304	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**4.54**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**1.37**	0.500	"	"	EPA 6020	08/11/00	08/17/00	0080303	
Silver	ND	1.00	"	"	EPA 6010A	08/11/00	08/14/00	0080304	
GP6 (P008088-06) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**5.46**	0.500	mg/kg dry	1	EPA 6020	08/11/00	08/22/00	0080303	
Barium	**126**	0.500	"	"	EPA 6010A	08/11/00	08/14/00	0080304	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**29.4**	0.500	"	"	"	"	"	"	
Lead	**12.5**	10.0	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.921**	0.500	"	"	EPA 6020	08/11/00	08/17/00	0080303	
Silver	ND	1.00	"	"	EPA 6010A	08/11/00	08/14/00	0080304	
GP7C (P008088-09) Soil					Sampled: 08/01/00 Received: 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	"	"	EPA 6010A	08/11/00	08/14/00	0080304	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**3.01**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	"	"	
Mercury	**0.442**	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.824**	0.500	"	"	EPA 6020	08/11/00	08/17/00	0080303	
Silver	ND	1.00	"	"	EPA 6010A	08/11/00	08/14/00	0080304	

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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	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: 08/01/00 Received: 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	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**88.3**	0.500	"	"	"	"	"	"	
Lead	**10.4**	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.769**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP9 @ 27.5' (P008088-13) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	**0.687**	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**74.1**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**59.0**	0.500	"	"	"	"	"	"	
Lead	**11.9**	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.874**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP10 (P008088-14) Soil					Sampled: 08/01/00 Received: 08/03/00				
Arsenic	ND	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**120**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**116**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**1.06**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	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	Notes
GP14 @ 8' (P008088-19) Soil					Sampled: 08/02/00 Received: 08/03/00				
Arsenic	ND	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**41.8**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**1.40**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	ND	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP18 (P008088-26) Soil					Sampled: 08/03/00 Received: 08/03/00				
Arsenic	**4.04**	0.500	mg/kg dry	1	EPA 6020	08/08/00	08/17/00	0080209	
Barium	**499**	0.500	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	**1.73**	0.500	"	"	"	"	"	"	
Chromium	**19.3**	0.500	"	"	"	"	"	"	
...ad	**25.6**	10.0	"	"	"	"	08/14/00	"	
...cury	**0.676**	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.560**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
GP19 (P008088-27) Soil					Sampled: 08/03/00 Received: 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	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	**1.54**	0.500	"	"	"	"	"	"	
Chromium	**23.6**	0.500	"	"	"	"	"	"	
Lead	**29.6**	10.0	"	"	"	"	08/14/00	"	
Mercury	**0.194**	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.737**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	

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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	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					Sampled: 08/02/00 Received: 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	"	"	EPA 6010A	08/07/00	08/14/00	0080175	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**23.0**	0.500	"	"	"	"	"	"	
Lead	ND	10.0	"	"	"	"	08/14/00	"	
Mercury	ND	0.100	"	"	EPA 7471A	08/11/00	08/11/00	0080296	
Selenium	**0.637**	0.500	"	"	EPA 6020	08/08/00	08/17/00	0080209	
Silver	ND	1.00	"	"	EPA 6010A	08/07/00	08/14/00	0080175	

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Decor 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

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					Sampled: 08/02/00 Received: 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	"	"	"	"	"	"	
Aroclor 1232	ND	67.0	"	"	"	"	"	"	
Aroclor 1242	ND	67.0	"	"	"	"	"	"	
Aroclor 1248	**289**	67.0	"	"	"	"	"	"	
Aroclor 1254	ND	67.0	"	"	"	"	"	"	
Aroclor 1260	ND	67.0	"	"	"	"	"	"	
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					Sampled: 08/02/00 Received: 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	"	"	"	"	"	"	
Aroclor 1232	ND	67.0	"	"	"	"	"	"	
Aroclor 1242	ND	67.0	"	"	"	"	"	"	
Aroclor 1248	ND	67.0	"	"	"	"	"	"	
Aroclor 1254	ND	67.0	"	"	"	"	"	"	
Aroclor 1260	ND	67.0	"	"	"	"	"	"	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*100 %*	*63-119*							
Surr: Decachlorobiphenyl	*92.6 %*	*52-131*							

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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	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: 08/01/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

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...cor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP1 (P008088-01) Soil					Sampled: 08/01/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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Secor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

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Decor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP3 (P008088-03) Soil					Sampled: 08/01/00	Received: 08/03/00			
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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541.383.9310 fax 541.382.7588

Secor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP4 (P008088-04) Soil					Sampled: 08/01/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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...ecor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP4 (P008088-04) Soil					Sampled: 08/01/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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*							

North Creek Analytical - Portland

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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	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					Sampled: 08/01/00	Received: 08/03/00			
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

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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	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					Sampled: 08/01/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	**2950**	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*93.6 %*	*70-130*							
Surr: 1,2-DCA-d4	*91.4 %*	*70-130*							
Surr: Dibromofluoromethane	*86.9 %*	*70-130*							
Surr: Toluene-d8	*88.8 %*	*70-130*							

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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	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: 08/01/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

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Lisa Domenighini, Project Manager

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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

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: 08/01/00	Received: 08/03/00			
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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*							

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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	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: 08/01/00	Received: 08/03/00			**I-02**
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Decor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP10 (P008088-14) Soil					Sampled: 08/01/00	Received: 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	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	**250**	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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Secor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP11 (P008088-15) Soil					Sampled: 08/01/00	Received: 08/03/00			**I-02**
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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

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				**I-02**
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
-Trichlorobenzene	ND	100	"	"	"	"	"	"	
,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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*							

North Creek Analytical - Portland

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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	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
GP12 (P008088-16) Soil					Sampled: 08/02/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Decor
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
GP12 (P008088-16) Soil					Sampled: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*91.4 %*	*70-130*							
Surr: 1,2-DCA-d4	*93.4 %*	*70-130*							
Surr: Dibromofluoromethane	*89.5 %*	*70-130*							
Surr: Toluene-d8	*93.0 %*	*70-130*							

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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	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: 08/02/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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...ecor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP13 (P008088-17) Soil					Sampled: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1 2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*105 %*	*70-130*							
Surr: 1,2-DCA-d4	*103 %*	*70-130*							
Surr: Dibromofluoromethane	*98.2 %*	*70-130*							
Surr: Toluene-d8	*107 %*	*70-130*							

North Creek Analytical - Portland

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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	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					Sampled: 08/02/00	Received: 08/03/00			
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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...ecor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP14 @ 8' (P008088-19) Soil					Sampled: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*109 %*	*70-130*							
Surr: 1,2-DCA-d4	*97.5 %*	*70-130*							
Surr: Dibromofluoromethane	*95.1 %*	*70-130*							
Surr: Toluene-d8	*100 %*	*70-130*							

North Creek Analytical - Portland

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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	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					Sampled: 08/02/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Decor 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
GP15 (P008088-20) Soil					Sampled: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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*							

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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	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: 08/03/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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...cor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP16 (P008088-21) Soil					Sampled: 08/03/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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Lisa Domenighini, Project Manager

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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	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: 08/02/00	Received: 08/03/00			
Acetone	**5130**	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
1,2-Dichlorobenzene	**50100**	500	"	5	"	"	08/18/00	"	I-02
1,3-Dichlorobenzene	ND	100	"	1	"	"	08/15/00	"	
1,4-Dichlorobenzene	**1100**	100	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	500	"	"	"	"	"	"	
1,1-Dichloroethane	ND	100	"	"	"	"	"	"	
1,2-Dichloroethane	ND	100	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Decor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP17 @ 6' (P008088-23) Soil					Sampled: 08/02/00	Received: 08/03/00			
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/15/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
p-Isopropyltoluene	ND	200	"	"	"	"	"	"	
4-Methyl-2-pentanone	ND	500	"	"	"	"	"	"	
Methyl tert-butyl ether	ND	100	"	"	"	"	"	"	
Methylene chloride	**750**	500	"	"	"	"	"	"	
Naphthalene	ND	200	"	"	"	"	"	"	
n-Propylbenzene	ND	100	"	"	"	"	"	"	
Styrene	ND	100	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*63.9 %*	*70-130*							*S-01*
Surr: 1,2-DCA-d4	*89.1 %*	*70-130*							
Surr: Dibromofluoromethane	*84.2 %*	*70-130*							
Surr: Toluene-d8	*88.1 %*	*70-130*							

Lisa Domenighini, Project Manager

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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	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: 08/02/00	Received: 08/03/00			
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
1,2-Dichlorobenzene	**382**	100	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	100	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	100	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	500	"	"	"	"	"	"	
1,1-Dichloroethane	ND	100	"	"	"	"	"	"	
1,2-Dichloroethane	ND	100	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

Lisa Domenighini, Project Manager

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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: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*81.6 %*	*70-130*							
Surr: 1,2-DCA-d4	*90.0 %*	*70-130*							
Surr: Dibromofluoromethane	*84.0 %*	*70-130*							
Surr: Toluene-d8	*91.2 %*	*70-130*							

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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	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: 08/03/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Decor
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
GP18 (P008088-26) Soil					Sampled: 08/03/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/16/00	0080135	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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Lisa Domenighini, Project Manager

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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	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: 08/03/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/06/00	0080136	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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

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: 08/03/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/06/00	0080136	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
...4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*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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Secor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**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
GP2B (P008088-29) Soil					Sampled: 08/02/00 Received: 08/03/00				
Acetone	ND	1000	ug/kg dry	1	EPA 8260B	08/04/00	08/06/00	0080136	
Benzene	ND	100	"	"	"	"	"	"	
Bromobenzene	ND	100	"	"	"	"	"	"	
Bromochloromethane	ND	100	"	"	"	"	"	"	
Bromodichloromethane	ND	100	"	"	"	"	"	"	
Bromoform	ND	100	"	"	"	"	"	"	
Bromomethane	ND	500	"	"	"	"	"	"	
2-Butanone	ND	1000	"	"	"	"	"	"	
n-Butylbenzene	ND	500	"	"	"	"	"	"	
sec-Butylbenzene	ND	100	"	"	"	"	"	"	
tert-Butylbenzene	ND	100	"	"	"	"	"	"	
Carbon disulfide	ND	1000	"	"	"	"	"	"	
Carbon tetrachloride	ND	100	"	"	"	"	"	"	
Chlorobenzene	ND	100	"	"	"	"	"	"	
Chloroethane	ND	100	"	"	"	"	"	"	
Chloroform	ND	100	"	"	"	"	"	"	
Chloromethane	ND	500	"	"	"	"	"	"	
2-Chlorotoluene	ND	100	"	"	"	"	"	"	
4-Chlorotoluene	ND	100	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	500	"	"	"	"	"	"	
Dibromochloromethane	ND	100	"	"	"	"	"	"	
1,2-Dibromoethane	ND	100	"	"	"	"	"	"	
Dibromomethane	ND	100	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1-Dichloroethene	ND	100	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	100	"	"	"	"	"	"	
1,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,3-Dichloropropane	ND	100	"	"	"	"	"	"	
2,2-Dichloropropane	ND	100	"	"	"	"	"	"	
1,1-Dichloropropene	ND	100	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	100	"	"	"	"	"	"	
Ethylbenzene	ND	100	"	"	"	"	"	"	

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Secor
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
GP2B (P008088-29) Soil					Sampled: 08/02/00 Received: 08/03/00				
Hexachlorobutadiene	ND	200	ug/kg dry	1	EPA 8260B	08/04/00	08/06/00	0080136	
2-Hexanone	ND	1000	"	"	"	"	"	"	
Isopropylbenzene	ND	200	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	100	"	"	"	"	"	"	
Tetrachloroethene	ND	100	"	"	"	"	"	"	
Toluene	ND	100	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	100	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	100	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	100	"	"	"	"	"	"	
Trichloroethene	ND	100	"	"	"	"	"	"	
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	*100 %*	*70-130*							
Surr: 1,2-DCA-d4	*89.9 %*	*70-130*							
Surr: Dibromofluoromethane	*87.3 %*	*70-130*							
Surr: Toluene-d8	*88.2 %*	*70-130*							

North Creek Analytical - Portland

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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	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: 08/01/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/16/00	0080345	
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	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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...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
GP1 (P008088-01) Soil					Sampled: 08/01/00 Received: 08/03/00				
Fluorene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/16/00	0080345	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
itrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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	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
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/15/00	0080345	
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	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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...ecor	Project: Fort James Specialty Chemicals	
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
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 08/03/00				
Fluorene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/15/00	0080345	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
...itrophenol	ND	0.330	"	"	"	"	"	"	
...-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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*							

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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	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	Received: 08/03/00			**R-05**
Acenaphthene	ND	1.65	mg/kg dry	1	EPA 8270C	08/14/00	08/15/00	0080345	
Acenaphthylene	ND	1.65	"	"	"	"	"	"	
Anthracene	ND	1.65	"	"	"	"	"	"	
Benzo (a) anthracene	ND	1.65	"	"	"	"	"	"	
Benzo (a) pyrene	ND	1.65	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	1.65	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzoic Acid	ND	5.00	"	"	"	"	"	"	
Benzyl alcohol	ND	1.65	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	1.65	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	1.65	"	"	"	"	"	"	
4-Chloroaniline	ND	10.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	1.65	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	1.65	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	1.65	"	"	"	"	"	"	
2-Chloronaphthalene	ND	1.65	"	"	"	"	"	"	
2-Chlorophenol	ND	1.65	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Chrysene	ND	1.65	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	5.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	1.65	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	1.65	"	"	"	"	"	"	
Dibenzofuran	ND	1.65	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	1.65	"	"	"	"	"	"	
Diethyl phthalate	ND	1.65	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	5.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	1.65	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	5.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	10.0	"	"	"	"	"	"	
Fluoranthene	ND	1.65	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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Secor 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 Received: 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	"	"	"	"	"	"	
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	5.00	"	"	"	"	"	"	
Hexachloroethane	ND	5.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	1.65	"	"	"	"	"	"	
Isophorone	ND	1.65	"	"	"	"	"	"	
2-Methylnaphthalene	ND	1.65	"	"	"	"	"	"	
2-Methylphenol	ND	1.65	"	"	"	"	"	"	
3-,4-Methylphenol	ND	1.65	"	"	"	"	"	"	
Naphthalene	ND	1.65	"	"	"	"	"	"	
2-Nitroaniline	ND	1.65	"	"	"	"	"	"	
3-Nitroaniline	ND	5.00	"	"	"	"	"	"	
4-Nitroaniline	ND	1.65	"	"	"	"	"	"	
Nitrobenzene	ND	1.65	"	"	"	"	"	"	
itrophenol	ND	1.65	"	"	"	"	"	"	
4-Nitrophenol	ND	5.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	1.65	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	1.65	"	"	"	"	"	"	
Pentachlorophenol	ND	5.00	"	"	"	"	"	"	
Phenanthrene	ND	1.65	"	"	"	"	"	"	
Phenol	ND	1.65	"	"	"	"	"	"	
Pyrene	ND	1.65	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.65	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
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	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
GP8 (P008088-10) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
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-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenol	ND	0.330	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
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					Sampled: 08/01/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/15/00	0080345	
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	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	

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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
GP9 @ 12' (P008088-12) Soil					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	
Fluorene	ND	0.330	"	"	"	"	"	"	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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541.383.9310 fax 541.382.7588

Secor	Project: Fort James Specialty Chemicals	
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
GP9 @ 12' (P008088-12) Soil					Sampled: 08/01/00 Received: 08/03/00				
Pentachlorophenol	ND	1.00	mg/kg dry	1	EPA 8270C	08/14/00	08/15/00	0080345	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-Fluorobiphenyl	*63.8 %*	*44-146*							
Surr: 2-Fluorophenol	*56.5 %*	*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: 08/01/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/16/00	0080345	
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	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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Secor
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
GP9 @ 27.5' (P008088-13) Soil					Sampled: 08/01/00	Received: 08/03/00			
Dibenzo (a,h) anthracene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/16/00	0080345	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	
Fluorene	ND	0.330	"	"	"	"	"	"	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
Phenol	ND	0.330	"	"	"	"	"	"	
Pyrene	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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	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					Sampled: 08/01/00 Received: 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	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
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					Sampled: 08/01/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/14/00	08/16/00	0080345	
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	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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Decor	Project: Fort James Specialty Chemicals	
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
GP10 (P008088-14) Soil					Sampled: 08/01/00 Received: 08/03/00				
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	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	
Fluorene	ND	0.330	"	"	"	"	"	"	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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	"	"	"	"	"	"	

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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	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: 08/01/00	Received: 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: 08/01/00	Received: 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	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.660	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	2.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	4.00	"	"	"	"	"	"	
2-Methylphenol	ND	0.660	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.660	"	"	"	"	"	"	
2-Nitrophenol	ND	0.660	"	"	"	"	"	"	
4-Nitrophenol	ND	2.00	"	"	"	"	"	"	
Pentachlorophenol	ND	2.00	"	"	"	"	"	"	
Phenol	ND	0.660	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	0.660	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.660	"	"	"	"	"	"	
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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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

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					Sampled: 08/02/00 Received: 08/03/00				
4-Chloro-3-methylphenol	ND	0.330	mg/kg dry	1	EPA 8270C	08/15/00	08/17/00	0080365	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
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-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenol	ND	0.330	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
r: 2-Fluorophenol	*80.0 %*	*42-126*							
r: Phenol-d6	*88.7 %*	*42-131*							
Surr: 2,4,6-Tribromophenol	*77.3 %*	*48-119*							
GP13 (P008088-17) Soil					Sampled: 08/02/00 Received: 08/03/00				**R-05**
4-Chloro-3-methylphenol	ND	0.660	mg/kg dry	2	EPA 8270C	08/15/00	08/17/00	0080365	
2-Chlorophenol	ND	0.660	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.660	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	2.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	4.00	"	"	"	"	"	"	
2-Methylphenol	ND	0.660	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.660	"	"	"	"	"	"	
2-Nitrophenol	ND	0.660	"	"	"	"	"	"	
4-Nitrophenol	ND	2.00	"	"	"	"	"	"	
Pentachlorophenol	ND	2.00	"	"	"	"	"	"	
Phenol	ND	0.660	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	0.660	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.660	"	"	"	"	"	"	
Surr: 2-Fluorophenol	*82.7 %*	*42-126*							
Surr: Phenol-d6	*89.2 %*	*42-131*							
Surr: 2,4,6-Tribromophenol	*82.3 %*	*48-119*							

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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	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
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	"	"	"	"	"	"	
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	"	"	"	"	"	"	

North Creek Analytical - Portland

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.cor	Project: Fort James Specialty Chemicals	
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
GP15 (P008088-20) Soil					Sampled: 08/02/00	Received: 08/03/00			
4-Chloroaniline	ND	2.00	mg/kg dry	1	EPA 8270C	08/15/00	08/16/00	0080365	
Bis(2-chloroethoxy)methane	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
·Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	
Fluorene	ND	0.330	"	"	"	"	"	"	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	

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Lisa Domenighini, Project Manager

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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	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					Sampled: 08/02/00 Received: 08/03/00				
4-Nitroaniline	ND	0.330	mg/kg dry	1	EPA 8270C	08/15/00	08/16/00	0080365	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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					Sampled: 08/03/00 Received: 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	"	"	"	"	"	"	
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-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenol	ND	0.330	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
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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ɔor 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
GP17 @ 6' (P008088-23) Soil					Sampled: 08/02/00	Received: 08/03/00			**R-05**
Acenaphthene	ND	13.2	mg/kg dry	20	EPA 8270C	08/15/00	08/16/00	0080365	
Acenaphthylene	ND	13.2	"	"	"	"	"	"	
Anthracene	ND	13.2	"	"	"	"	"	"	
Benzo (a) anthracene	ND	13.2	"	"	"	"	"	"	
Benzo (a) pyrene	ND	13.2	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	13.2	"	"	"	"	"	"	
Benzo (ghi) perylene	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	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	13.2	"	"	"	"	"	"	
2-chloroethyl)ether	ND	13.2	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	13.2	"	"	"	"	"	"	
2-Chloronaphthalene	ND	13.2	"	"	"	"	"	"	
2-Chlorophenol	ND	13.2	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	13.2	"	"	"	"	"	"	
Chrysene	ND	13.2	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	40.0	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	13.2	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	13.2	"	"	"	"	"	"	
Dibenzofuran	ND	13.2	"	"	"	"	"	"	
1,2-Dichlorobenzene	**946**	200	"	100	"	"	08/17/00	"	
1,3-Dichlorobenzene	ND	40.0	"	20	"	"	08/16/00	"	
1,4-Dichlorobenzene	ND	40.0	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	40.0	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	13.2	"	"	"	"	"	"	
Diethyl phthalate	ND	13.2	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	40.0	"	"	"	"	"	"	
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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Secor	Project: Fort James Specialty Chemicals	
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
GP17 @ 6' (P008088-23) Soil					Sampled: 08/02/00 Received: 08/03/00				**R-05**
Fluoranthene	ND	13.2	mg/kg dry	20	EPA 8270C	08/15/00	08/16/00	0080365	
Fluorene	ND	13.2	"	"	"	"	"	"	
Hexachlorobenzene	ND	13.2	"	"	"	"	"	"	
Hexachlorobutadiene	ND	40.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	40.0	"	"	"	"	"	"	
Hexachloroethane	ND	40.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	13.2	"	"	"	"	"	"	
Isophorone	ND	13.2	"	"	"	"	"	"	
2-Methylnaphthalene	ND	13.2	"	"	"	"	"	"	
2-Methylphenol	ND	13.2	"	"	"	"	"	"	
3-,4-Methylphenol	ND	13.2	"	"	"	"	"	"	
Naphthalene	ND	13.2	"	"	"	"	"	"	
2-Nitroaniline	ND	13.2	"	"	"	"	"	"	
3-Nitroaniline	ND	40.0	"	"	"	"	"	"	
4-Nitroaniline	ND	13.2	"	"	"	"	"	"	
Nitrobenzene	ND	13.2	"	"	"	"	"	"	
2-Nitrophenol	ND	13.2	"	"	"	"	"	"	
4-Nitrophenol	ND	40.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	13.2	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	13.2	"	"	"	"	"	"	
Pentachlorophenol	ND	40.0	"	"	"	"	"	"	
Phenanthrene	ND	13.2	"	"	"	"	"	"	
Phenol	ND	13.2	"	"	"	"	"	"	
Pyrene	ND	13.2	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	13.2	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	13.2	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	13.2	"	"	"	"	"	"	
Surr: 2-Fluorobiphenyl	*NR*	*44-146*							*S-03*
Surr: 2-Fluorophenol	*77.9 %*	*42-126*							
Surr: Nitrobenzene-d5	*NR*	*42-126*							*S-01*
Surr: Phenol-d6	*87.1 %*	*42-131*							
Surr: p-Terphenyl-d14	*NR*	*49-150*							*S-01*
Surr: 2,4,6-Tribromophenol	*78.6 %*	*48-119*							

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Decor	Project: Fort James Specialty Chemicals	
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
GP17C @ 11.5' (P008088-25) 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	"	"	"	"	"	"	
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	"	"	"	"	"	"	
(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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	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					Sampled: 08/02/00	Received: 08/03/00			
Fluorene	ND	0.330	mg/kg dry	1	EPA 8270C	08/15/00	08/16/00	0080365	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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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Lisa Domenighini, Project Manager

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Secor
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
GP18 (P008088-26) Soil					Sampled: 08/03/00 Received: 08/03/00				
Acenaphthene	ND	0.330	mg/kg dry	1	EPA 8270C	08/15/00	08/17/00	0080365	
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	"	"	"	"	"	"	
(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	

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Lisa Domenighini, Project Manager

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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	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	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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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ecor	Project: Fort James Specialty Chemicals	
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
GP19 (P008088-27) Soil					Sampled: 08/03/00 Received: 08/03/00				**R-05**
Acenaphthene	ND	1.65	mg/kg dry	5	EPA 8270C	08/15/00	08/17/00	0080365	
Acenaphthylene	ND	1.65	"	"	"	"	"	"	
Anthracene	ND	3.30	"	10	"	"	08/17/00	"	S-01
Benzo (a) anthracene	ND	1.65	"	5	"	"	08/17/00	"	
Benzo (a) pyrene	ND	1.65	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	1.65	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzoic Acid	ND	5.00	"	"	"	"	"	"	
Benzyl alcohol	ND	1.65	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	1.65	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	1.65	"	"	"	"	"	"	
4-Chloroaniline	ND	10.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	1.65	"	"	"	"	"	"	
2-chloroethyl)ether	ND	1.65	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	1.65	"	"	"	"	"	"	
2-Chloronaphthalene	ND	1.65	"	"	"	"	"	"	
2-Chlorophenol	ND	1.65	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Chrysene	ND	1.65	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	5.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	1.65	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	1.65	"	"	"	"	"	"	
Dibenzofuran	ND	1.65	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	1.65	"	"	"	"	"	"	
Diethyl phthalate	ND	1.65	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	5.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	1.65	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	5.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	10.0	"	"	"	"	"	"	
Fluoranthene	ND	1.65	"	"	"	"	"	"	

North Creek Analytical - Portland

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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	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					Sampled: 08/03/00 Received: 08/03/00				**R-05**
Fluorene	ND	1.65	mg/kg dry	5	EPA 8270C	08/15/00	08/17/00	0080365	
Hexachlorobenzene	ND	1.65	"	"	"	"	"	"	
Hexachlorobutadiene	ND	5.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	5.00	"	"	"	"	"	"	
Hexachloroethane	ND	5.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	1.65	"	"	"	"	"	"	
Isophorone	ND	1.65	"	"	"	"	"	"	
2-Methylnaphthalene	ND	1.65	"	"	"	"	"	"	
2-Methylphenol	ND	1.65	"	"	"	"	"	"	
3-,4-Methylphenol	ND	1.65	"	"	"	"	"	"	
Naphthalene	ND	1.65	"	"	"	"	"	"	
2-Nitroaniline	ND	1.65	"	"	"	"	"	"	
3-Nitroaniline	ND	5.00	"	"	"	"	"	"	
4-Nitroaniline	ND	1.65	"	"	"	"	"	"	
Nitrobenzene	ND	1.65	"	"	"	"	"	"	
2-Nitrophenol	ND	1.65	"	"	"	"	"	"	
4-Nitrophenol	ND	5.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	1.65	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	1.65	"	"	"	"	"	"	
Pentachlorophenol	ND	5.00	"	"	"	"	"	"	
Phenanthrene	ND	1.65	"	"	"	"	"	"	
Phenol	ND	1.65	"	"	"	"	"	"	
Pyrene	ND	1.65	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.65	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
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*							

North Creek Analytical - Portland

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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

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					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	"	"	"	"	"	"	
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	"	"	"	"	"	"	
2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.00	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenzo (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	1.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.00	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	1.00	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	2.00	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	2.00	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	

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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	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					Sampled: 08/02/00 Received: 08/03/00				
Fluorene	ND	0.330	mg/kg dry	1	EPA 8270C	08/15/00	08/16/00	0080365	
Hexachlorobenzene	ND	0.330	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.00	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	1.00	"	"	"	"	"	"	
Hexachloroethane	ND	1.00	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3-,4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.330	"	"	"	"	"	"	
3-Nitroaniline	ND	1.00	"	"	"	"	"	"	
4-Nitroaniline	ND	0.330	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	1.00	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	1.00	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
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-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	Prepared	Analyzed	Batch	Notes
GP1 (P008088-01) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**83.0**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP3 (P008088-03) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**77.4**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP4 (P008088-04) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**75.6**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP5 (P008088-05) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**87.1**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP6 (P008088-06) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**73.9**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
/C (P008088-09) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**89.8**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP8 (P008088-10) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**75.9**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP9 @ 12' (P008088-12) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**74.8**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP9 @ 27.5' (P008088-13) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**83.0**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	

North Creek Analytical - Portland

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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	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
GP10 (P008088-14) Soil					Sampled: 08/01/00 Received: 08/03/00				
% Solids	**65.6**	1.00	% by Weight	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 Weight	1	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 Weight	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 Weight	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 Weight	1	NCA SOP	08/04/00	08/04/00	0080120	
GP15 (P008088-20) Soil					Sampled: 08/02/00 Received: 08/03/00				
% Solids	**80.2**	1.00	% by Weight	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 Weight	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 Weight	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 Weight	1	NCA SOP	08/04/00	08/04/00	0080120	

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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	Prepared	Analyzed	Batch	Notes
GP18 (P008088-26) Soil					Sampled: 08/03/00 Received: 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: 08/03/00 Received: 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: 08/03/00 Received: 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 Received: 08/03/00				
% Solids	**87.9**	1.00	% by Weight	1	NCA SOP	08/04/00	08/04/00	0080120	

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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	08/24/00 08:39

Hydrocarbon Identification per NWTPH Methodology - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	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*		"	*4.00*		*121*	*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	50.0	"		ND				50	
Heavy Oil Range Hydrocarbons	ND	100	"		ND				50	
Surr: 1-Chlorooctadecane	*DET*		"	*4.82*		*114*	*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	362	"		DET			129	50	
Heavy Oil Range Hydrocarbons	DET	723	"		DET			119	50	
Surr: 1-Chlorooctadecane	*DET*		"	*28.9*		*55.0*	*50-150*			

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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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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	"							
Chromium	ND	0.500	"							
Lead	ND	10.0	"							
Silver	ND	1.00	"							
LCS (0080175-BS1)				Prepared: 08/07/00 Analyzed: 08/14/00						
Barium	49.1	0.500	mg/kg wet	50.0		98.2	80-120			
Cadmium	18.7	0.500	"	20.0		93.5	80-120			
Chromium	47.9	0.500	"	50.0		95.8	80-120			
Lead	92.5	10.0	"	100		92.5	80-120			
Silver	43.2	1.00	"	50.0		86.4	80-120			
Duplicate (0080175-DUP1)		Source: P008088-01		Prepared: 08/07/00 Analyzed: 08/14/00						
.um	153	0.500	mg/kg dry		145			5.37	40	
Cadmium	0.542	0.500	"		0.542			0	40	
Chromium	21.5	0.500	"		20.7			3.79	40	
Lead	ND	10.0	"		ND			10.1	40	
Silver	ND	1.00	"		ND				40	
Matrix Spike (0080175-MS1)		Source: P008088-01		Prepared: 08/07/00 Analyzed: 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	"	60.3	20.7	82.6	75-125			
Lead	118	10.0	"	121	ND	91.0	75-125			
Silver	47.4	1.00	"	60.3	ND	78.6	75-125			
Matrix Spike (0080175-MS2)		Source: P008088-27		Prepared: 08/07/00 Analyzed: 08/14/00						
Barium	160	0.500	mg/kg dry	57.2	99.5	106	75-125			
Cadmium	21.4	0.500	"	22.9	1.54	86.7	75-125			
Chromium	73.7	0.500	"	57.2	23.6	87.6	75-125			
Lead	130	10.0	"	114	29.6	88.1	75-125			
Silver	43.5	1.00	"	57.2	ND	75.5	75-125			

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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	08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods - Quality Control

North Creek Analytical - Portland

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: 08/17/00						
Arsenic	ND	0.500	mg/kg wet							
Selenium	ND	0.500	"							
LCS (0080209-BS1)				Prepared: 08/08/00 Analyzed: 08/17/00						
Arsenic	10.2	0.500	mg/kg wet	10.0		102	80-120			
Selenium	9.93	0.500	"	10.0		99.3	80-120			
Duplicate (0080209-DUP1)	**Source: P008088-01**			Prepared: 08/08/00 Analyzed: 08/17/00						
Arsenic	5.54	0.500	mg/kg dry		5.20			6.33	40	
Selenium	0.825	0.500	"		0.988			18.0	40	
Matrix Spike (0080209-MS1)	**Source: P008088-01**			Prepared: 08/08/00 Analyzed: 08/17/00						
Arsenic	16.3	0.500	mg/kg dry	12.1	5.20	91.7	75-125			
Selenium	14.3	0.500	"	12.1	0.988	110	75-125			
Matrix Spike (0080209-MS2)	**Source: P008088-27**			Prepared: 08/08/00 Analyzed: 08/17/00						
Arsenic	15.2	0.500	mg/kg dry	11.4	4.41	94.6	75-125			
Selenium	14.1	0.500	"	11.4	0.737	117	75-125			
Batch 0080296 - EPA 7471										
Blank (0080296-BLK1)				Prepared & Analyzed: 08/11/00						
Mercury	ND	0.100	mg/kg wet							
LCS (0080296-BS1)				Prepared & Analyzed: 08/11/00						
Mercury	0.988	0.100	mg/kg wet	1.00		98.8	80-120			

Lisa Domenighini, Project Manager

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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 5000/7000 Series Methods - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080296 - EPA 7471										
Duplicate (0080296-DUP1)		**Source: P008088-01**		Prepared & Analyzed: 08/11/00						
Mercury	ND	0.100	mg/kg dry		ND				40	
Matrix Spike (0080296-MS1)		**Source: P008088-01**		Prepared & Analyzed: 08/11/00						
Mercury	1.20	0.100	mg/kg dry	1.21	ND	99.2	75-125			
Matrix Spike (0080296-MS2)		**Source: P008088-19**		Prepared & Analyzed: 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: 08/17/00						
Arsenic	ND	0.500	mg/kg wet							
Selenium	ND	0.500	"							
LCS (0080303-BS1)				Prepared: 08/11/00 Analyzed: 08/17/00						
[illegible]nic	10.1	0.500	mg/kg wet	10.0		101	80-120			
[illegible]enium	10.1	0.500	"	10.0		101	80-120			
Duplicate (0080303-DUP1)		**Source: P008088-05**		Prepared: 08/11/00 Analyzed: 08/22/00						
Arsenic	0.855	0.500	mg/kg dry		1.32			42.8	40	Q-06
Selenium	0.884	0.500	"		1.37			43.1	40	Q-06
Matrix Spike (0080303-MS1)		**Source: P008088-05**		Prepared: 08/11/00 Analyzed: 08/22/00						
Arsenic	11.5	0.500	mg/kg dry	11.5	1.32	88.5	75-125			
Selenium	13.8	0.500	"	11.5	1.37	108	75-125			

North Creek Analytical - Portland

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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	08/24/00 08:39

Total Metals per EPA 6000/7000 Series Methods - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080304 - EPA 3050										
Blank (0080304-BLK1)				Prepared: 08/11/00 Analyzed: 08/14/00						
Barium	ND	0.500	mg/kg wet							
Cadmium	ND	0.500	"							
Chromium	ND	0.500	"							
Lead	ND	10.0	"							
Silver	ND	1.00	"							
LCS (0080304-BS1)				Prepared: 08/11/00 Analyzed: 08/14/00						
Barium	49.3	0.500	mg/kg wet	50.0		98.6	80-120			
Cadmium	18.6	0.500	"	20.0		93.0	80-120			
Chromium	46.9	0.500	"	50.0		93.8	80-120			
Lead	92.5	10.0	"	100		92.5	80-120			
Silver	44.1	1.00	"	50.0		88.2	80-120			
Duplicate (0080304-DUP1)		Source: P008088-05		Prepared: 08/11/00 Analyzed: 08/14/00						
Barium	79.8	0.500	mg/kg dry		91.9			14.1	40	
Cadmium	ND	0.500	"		ND			66.7	40	Q-06
Chromium	4.36	0.500	"		4.54			4.04	40	
Lead	ND	10.0	"		ND			11.3	40	
Silver	ND	1.00	"		ND			15.5	40	
Matrix Spike (0080304-MS1)		Source: P008088-05		Prepared: 08/11/00 Analyzed: 08/14/00						
Barium	171	0.500	mg/kg dry	57.4	91.9	138	75-125			Q-02
Cadmium	19.5	0.500	"	23.0	ND	83.8	75-125			
Chromium	56.2	0.500	"	57.4	4.54	90.0	75-125			
Lead	107	10.0	"	115	ND	88.5	75-125			
Silver	50.0	1.00	"	57.4	ND	86.4	75-125			
Matrix Spike (0080304-MS2)		Source: P008099-05		Prepared: 08/11/00 Analyzed: 08/14/00						
Barium	320	0.500	mg/kg dry	64.5	170	NR	75-125			Q-02
Cadmium	24.6	0.500	"	25.8	2.58	85.3	75-125			
Chromium	90.3	0.500	"	64.5	24.0	103	75-125			
Lead	422	10.0	"	129	236	144	75-125			Q-02
Silver	55.6	1.00	"	64.5	7.09	75.2	75-125			

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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

Polychlorinated Biphenyls per EPA Method 8082 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080178 - EPA 3550										
Blank (0080178-BLK1)				Prepared: 08/07/00 Analyzed: 08/10/00						
Aroclor 1016	ND	67.0	ug/kg wet							
Aroclor 1221	ND	134	"							
Aroclor 1232	ND	67.0	"							
Aroclor 1242	ND	67.0	"							
Aroclor 1248	ND	67.0	"							
Aroclor 1254	ND	67.0	"							
Aroclor 1260	ND	67.0	"							
Surr: 2,4,5,6-Tetrachloro-m-xylene	*33.3*		"	*33.3*		*100*	*63-119*			
Surr: Decachlorobiphenyl	*30.5*		"	*33.3*		*91.6*	*52-131*			
LCS (0080178-BS1)				Prepared: 08/07/00 Analyzed: 08/10/00						
Aroclor 1016	337	67.0	ug/kg wet	333		101	57-132			
Aroclor 1260	370	67.0	"	333		111	60-136			
Surr: 2,4,5,6-Tetrachloro-m-xylene	*30.9*		"	*33.3*		*92.8*	*63-119*			
Surr: Decachlorobiphenyl	*29.6*		"	*33.3*		*88.9*	*52-131*			
LCS Dup (0080178-BSD1)				Prepared: 08/07/00 Analyzed: 08/10/00						
Aroclor 1016	333	67.0	ug/kg wet	333		100	57-132	1.19	50	
Aroclor 1260	360	67.0	"	333		108	60-136	2.74	50	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*29.3*		"	*33.3*		*88.0*	*63-119*			
Surr: Decachlorobiphenyl	*28.7*		"	*33.3*		*86.2*	*52-131*			
Matrix Spike (0080178-MS1)		**Source: P008088-23**		Prepared: 08/07/00 Analyzed: 08/14/00						
Aroclor 1016	399	67.0	ug/kg dry	474	ND	84.2	57-132			
Aroclor 1260	390	67.0	"	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*			

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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	08/24/00 08:39

Polychlorinated Biphenyls per EPA Method 8082 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080178 - EPA 3550										
Matrix Spike Dup (0080178-MSD1)	**Source: P008088-23**			Prepared: 08/07/00 Analyzed: 08/14/00						
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*			

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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

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	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	"							
Bromobenzene	ND	100	"							
Bromochloromethane	ND	100	"							
Bromodichloromethane	ND	100	"							
Bromoform	ND	100	"							
Bromomethane	ND	500	"							
2-Butanone	ND	1000	"							
n-Butylbenzene	ND	500	"							
sec-Butylbenzene	ND	100	"							
tert-Butylbenzene	ND	100	"							
Carbon disulfide	ND	1000	"							
Carbon tetrachloride	ND	100	"							
robenzene	ND	100	"							
hloroethane	ND	100	"							
Chloroform	ND	100	"							
Chloromethane	ND	500	"							
2-Chlorotoluene	ND	100	"							
4-Chlorotoluene	ND	100	"							
1,2-Dibromo-3-chloropropane	ND	500	"							
Dibromochloromethane	ND	100	"							
1,2-Dibromoethane	ND	100	"							
Dibromomethane	ND	100	"							
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	"							
1,1-Dichloroethene	ND	100	"							
cis-1,2-Dichloroethene	ND	100	"							
trans-1,2-Dichloroethene	ND	100	"							
1,2-Dichloropropane	ND	100	"							
1,3-Dichloropropane	ND	100	"							
2,2-Dichloropropane	ND	100	"							
1,1-Dichloropropene	ND	100	"							

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Secor 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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080135 - EPA 5030										
Blank (0080135-BLK1)			Prepared: 08/04/00 Analyzed: 08/13/00							
cis-1,3-Dichloropropene	ND	100	ug/kg wet							
trans-1,3-Dichloropropene	ND	100	"							
Ethylbenzene	ND	100	"							
Hexachlorobutadiene	ND	200	"							
2-Hexanone	ND	1000	"							
Isopropylbenzene	ND	200	"							
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	"							
1,1,1,2-Tetrachloroethane	ND	100	"							
1,1,2,2-Tetrachloroethane	ND	100	"							
Tetrachloroethene	ND	100	"							
Toluene	ND	100	"							
1,2,3-Trichlorobenzene	ND	100	"							
1,2,4-Trichlorobenzene	ND	100	"							
1,1,1-Trichloroethane	ND	100	"							
1,1,2-Trichloroethane	ND	100	"							
Trichloroethene	ND	100	"							
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*		"	*2000*		*105*	*70-130*			
Surr: Dibromofluoromethane	*1860*		"	*2000*		*93.0*	*70-130*			
Surr: Toluene-d8	*1920*		"	*2000*		*96.0*	*70-130*			

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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

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080135 - EPA 5030										
LCS (0080135-BS1)				Prepared: 08/04/00 Analyzed: 08/13/00						
Benzene	2150	100	ug/kg wet	2500		86.0	80-135			
Chlorobenzene	2350	100	"	2500		94.0	80-135			
1,1-Dichloroethene	1700	100	"	2500		68.0	60-150			
Toluene	2180	100	"	2500		87.2	80-130			
Trichloroethene	1980	100	"	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*		"	*2000*		*92.5*	*70-130*			
Surr: Toluene-d8	*1880*		"	*2000*		*94.0*	*70-130*			
Matrix Spike (0080135-MS1)		**Source: P008099-01**		Prepared: 08/04/00 Analyzed: 08/13/00						**Q-02**
Benzene	7440	723	ug/kg dry	18100	ND	41.1	60-135			
Chlorobenzene	7400	723	"	18100	ND	40.9	65-125			
Dichloroethene	5120	723	"	18100	ND	28.3	60-135			
ene	7390	723	"	18100	ND	40.3	60-125			
Trichloroethene	6350	723	"	18100	ND	35.1	60-125			
Surr: 4-BFB	*6160*		"	*14500*		*42.5*	*70-130*			
Surr: 1,2-DCA-d4	*8300*		"	*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)		**Source: P008099-01**		Prepared: 08/04/00 Analyzed: 08/13/00						**Q-02**
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	"	18100	ND	41.3	60-125	2.41	25	
Trichloroethene	6680	723	"	18100	ND	36.9	60-125	5.07	25	
Surr: 4-BFB	*6100*		"	*14500*		*42.1*	*70-130*			*S-02*
Surr: 1,2-DCA-d4	*7570*		"	*14500*		*52.2*	*70-130*			*S-02*
Surr: Dibromofluoromethane	*6500*		"	*14500*		*44.8*	*70-130*			*S-02*
Surr: Toluene-d8	*6130*		"	*14500*		*42.3*	*70-130*			*S-02*

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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	08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080136 - EPA 5030										
Blank (0080136-BLK1)				Prepared: 08/04/00 Analyzed: 08/06/00						
Acetone	ND	1000	ug/kg wet							
Benzene	ND	100	"							
Bromobenzene	ND	100	"							
Bromochloromethane	ND	100	"							
Bromodichloromethane	ND	100	"							
Bromoform	ND	100	"							
Bromomethane	ND	500	"							
2-Butanone	ND	1000	"							
n-Butylbenzene	ND	500	"							
sec-Butylbenzene	ND	100	"							
tert-Butylbenzene	ND	100	"							
Carbon disulfide	ND	1000	"							
Carbon tetrachloride	ND	100	"							
Chlorobenzene	ND	100	"							
Chloroethane	ND	100	"							
Chloroform	ND	100	"							
Chloromethane	ND	500	"							
2-Chlorotoluene	ND	100	"							
4-Chlorotoluene	ND	100	"							
1,2-Dibromo-3-chloropropane	ND	500	"							
Dibromochloromethane	ND	100	"							
1,2-Dibromoethane	ND	100	"							
Dibromomethane	ND	100	"							
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	"							
1,1-Dichloroethene	ND	100	"							
cis-1,2-Dichloroethene	ND	100	"							
trans-1,2-Dichloroethene	ND	100	"							
1,2-Dichloropropane	ND	100	"							
1,3-Dichloropropane	ND	100	"							
2,2-Dichloropropane	ND	100	"							
1,1-Dichloropropene	ND	100	"							

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cor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**Reported:**
Tualatin, OR 97062	Project Manager: Joe Hunt	08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080136 - EPA 5030										
Blank (0080136-BLK1)				Prepared: 08/04/00 Analyzed: 08/06/00						
cis-1,3-Dichloropropene	ND	100	ug/kg wet							
trans-1,3-Dichloropropene	ND	100	"							
Ethylbenzene	ND	100	"							
Hexachlorobutadiene	ND	200	"							
2-Hexanone	ND	1000	"							
Isopropylbenzene	ND	200	"							
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	"							
,2-Tetrachloroethane	ND	100	"							
,,,2,2-Tetrachloroethane	ND	100	"							
Tetrachloroethene	ND	100	"							
Toluene	ND	100	"							
1,2,3-Trichlorobenzene	ND	100	"							
1,2,4-Trichlorobenzene	ND	100	"							
1,1,1-Trichloroethane	ND	100	"							
1,1,2-Trichloroethane	ND	100	"							
Trichloroethene	ND	100	"							
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	*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*			

North Creek Analytical - Portland

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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	08/24/00 08:39

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080136 - EPA 5030										
LCS (0080136-BS1)				Prepared: 08/04/00 Analyzed: 08/06/00						
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			
Trichloroethene	2530	100	"	2500		101	70-135			
Surr: 4-BFB	*2090*		"	*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*			
Matrix Spike (0080136-MS1)	**Source: P008088-27**			Prepared: 08/04/00 Analyzed: 08/06/00						
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*		"	*2290*		*92.1*	*70-130*			
Surr: 1,2-DCA-d4	*2050*		"	*2290*		*89.5*	*70-130*			
Surr: Dibromofluoromethane	*1980*		"	*2290*		*86.5*	*70-130*			
Surr: Toluene-d8	*1840*		"	*2290*		*80.3*	*70-130*			
Matrix Spike Dup (0080136-MSD1)	**Source: P008088-27**			Prepared: 08/04/00 Analyzed: 08/06/00						
Benzene	2570	100	ug/kg dry	2860	ND	89.9	60-135	1.16	25	
Chlorobenzene	2640	100	"	2860	ND	92.3	65-125	0.755	25	
1,1-Dichloroethene	2060	100	"	2860	ND	72.0	60-135	1.45	25	
Toluene	2550	100	"	2860	ND	89.2	60-125	0.391	25	
Trichloroethene	2680	100	"	2860	ND	93.7	60-125	0.749	25	
Surr: 4-BFB	*2110*		"	*2290*		*92.1*	*70-130*			
Surr: 1,2-DCA-d4	*2030*		"	*2290*		*88.6*	*70-130*			
Surr: Dibromofluoromethane	*1950*		"	*2290*		*85.2*	*70-130*			
Surr: Toluene-d8	*1830*		"	*2290*		*79.9*	*70-130*			

North Creek Analytical - Portland

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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

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080345 - EPA 3550										
Blank (0080345-BLK1)				Prepared: 08/14/00 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	"							
...loroaniline	ND	2.00	"							
...(2-chloroethoxy)methane	ND	0.330	"							
Bis(2-chloroethyl)ether	ND	0.330	"							
Bis(2-chloroisopropyl)ether	ND	0.330	"							
2-Chloronaphthalene	ND	0.330	"							
2-Chlorophenol	ND	0.330	"							
4-Chlorophenyl phenyl ether	ND	0.330	"							
Chrysene	ND	0.330	"							
Di-n-butyl phthalate	ND	1.00	"							
Di-n-octyl phthalate	ND	0.330	"							
Dibenzo (a,h) anthracene	ND	0.330	"							
Dibenzofuran	ND	0.330	"							
1,2-Dichlorobenzene	ND	1.00	"							
1,3-Dichlorobenzene	ND	1.00	"							
1,4-Dichlorobenzene	ND	1.00	"							
3,3'-Dichlorobenzidine	ND	1.00	"							
2,4-Dichlorophenol	ND	0.330	"							
Diethyl phthalate	ND	0.330	"							
2,4-Dimethylphenol	ND	1.00	"							
Dimethyl phthalate	ND	0.330	"							
4,6-Dinitro-2-methylphenol	ND	1.00	"							
2,4-Dinitrophenol	ND	2.00	"							
2,4-Dinitrotoluene	ND	0.500	"							

North Creek Analytical - Portland

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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	08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080345 - EPA 3550										
Blank (0080345-BLK1)			Prepared: 08/14/00 Analyzed: 08/16/00							
2,6-Dinitrotoluene	ND	0.500	mg/kg wet							
Bis(2-ethylhexyl)phthalate	ND	2.00	"							
Fluoranthene	ND	0.330	"							
Fluorene	ND	0.330	"							
Hexachlorobenzene	ND	0.330	"							
Hexachlorobutadiene	ND	1.00	"							
Hexachlorocyclopentadiene	ND	1.00	"							
Hexachloroethane	ND	1.00	"							
Indeno (1,2,3-cd) pyrene	ND	0.330	"							
Isophorone	ND	0.330	"							
2-Methylnaphthalene	ND	0.330	"							
2-Methylphenol	ND	0.330	"							
3-,4-Methylphenol	ND	0.330	"							
Naphthalene	ND	0.330	"							
2-Nitroaniline	ND	0.330	"							
3-Nitroaniline	ND	1.00	"							
4-Nitroaniline	ND	0.330	"							
Nitrobenzene	ND	0.330	"							
2-Nitrophenol	ND	0.330	"							
4-Nitrophenol	ND	1.00	"							
N-Nitrosodi-n-propylamine	ND	0.330	"							
N-Nitrosodiphenylamine	ND	0.330	"							
Pentachlorophenol	ND	1.00	"							
Phenanthrene	ND	0.330	"							
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-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*		"	*5.00*		*83.4*	*42-131*			
Surr: p-Terphenyl-d14	*1.74*		"	*2.50*		*69.6*	*49-150*			
Surr: 2,4,6-Tribromophenol	*3.73*		"	*5.00*		*74.6*	*48-119*			

North Creek Analytical - Portland

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cor	Project: Fort James Specialty Chemicals	
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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080345 - EPA 3550										
LCS (0080345-BS1)				Prepared: 08/14/00 Analyzed: 08/16/00						
Acenaphthene	1.79	0.330	mg/kg wet	2.50		71.6	47-145			
4-Chloro-3-methylphenol	3.62	0.330	"	5.00		72.4	22-147			
2-Chlorophenol	3.57	0.330	"	5.00		71.4	23-134			
1,4-Dichlorobenzene	1.77	1.00	"	2.50		70.8	20-124			
2,4-Dinitrotoluene	1.73	0.500	"	2.50		69.2	39-139			
4-Nitrophenol	3.67	1.00	"	5.00		73.4	0-132			
N-Nitrosodi-n-propylamine	1.71	0.330	"	2.50		68.4	0-230			
Pentachlorophenol	2.79	1.00	"	5.00		55.8	14-176			
Phenol	3.47	0.330	"	5.00		69.4	5-112			
Pyrene	1.53	0.330	"	2.50		61.2	52-130			
1,2,4-Trichlorobenzene	1.71	0.330	"	2.50		68.4	44-142			
Surr: 2-Fluorobiphenyl	*2.05*		"	*2.50*		*82.0*	*44-146*			
Surr: 2-Fluorophenol	*3.83*		"	*5.00*		*76.6*	*42-126*			
: Nitrobenzene-d5	*1.97*		"	*2.50*		*78.8*	*42-126*			
Surr: Phenol-d6	*4.13*		"	*5.00*		*82.6*	*42-131*			
Surr: p-Terphenyl-d14	*1.97*		"	*2.50*		*78.8*	*49-150*			
Surr: 2,4,6-Tribromophenol	*3.37*		"	*5.00*		*67.4*	*48-119*			
Matrix Spike (0080345-MS1)		**Source: P008088-01**		Prepared: 08/14/00 Analyzed: 08/16/00						
Acenaphthene	2.19	0.330	mg/kg dry	3.01	ND	72.8	47-145			
4-Chloro-3-methylphenol	4.46	0.330	"	6.03	ND	74.0	22-147			
2-Chlorophenol	4.34	0.330	"	6.03	ND	72.0	23-134			
1,4-Dichlorobenzene	2.00	1.00	"	3.01	ND	66.4	20-124			
2,4-Dinitrotoluene	2.22	0.500	"	3.01	ND	73.8	39-139			
4-Nitrophenol	4.26	1.00	"	6.03	ND	70.6	0-132			
N-Nitrosodi-n-propylamine	2.14	0.330	"	3.01	ND	71.1	0-230			
Pentachlorophenol	3.25	1.00	"	6.03	ND	53.9	14-176			
Phenol	4.32	0.330	"	6.03	ND	71.6	5-112			
Pyrene	1.84	0.330	"	3.01	ND	61.1	52-130			
1,2,4-Trichlorobenzene	2.05	0.330	"	3.01	ND	68.1	44-142			
Surr: 2-Fluorobiphenyl	*2.45*		"	*3.01*		*81.4*	*44-146*			
Surr: 2-Fluorophenol	*4.82*		"	*6.03*		*79.9*	*42-126*			
Surr: Nitrobenzene-d5	*2.39*		"	*3.01*		*79.4*	*42-126*			
Surr: Phenol-d6	*5.26*		"	*6.03*		*87.2*	*42-131*			
Surr: p-Terphenyl-d14	*2.21*		"	*3.01*		*73.4*	*49-150*			
Surr: 2,4,6-Tribromophenol	*4.90*		"	*6.03*		*81.3*	*48-119*			

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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	08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080345 - EPA 3550										
Matrix Spike Dup (0080345-MSD1)		**Source: P008088-01**		Prepared: 08/14/00 Analyzed: 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	"	3.01	ND	63.8	20-124	4.08	60	
2,4-Dinitrotoluene	2.06	0.500	"	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	"	3.01	ND	67.4	0-230	5.28	60	
Pentachlorophenol	3.46	1.00	"	6.03	ND	57.4	14-176	6.26	60	
Phenol	4.00	0.330	"	6.03	ND	66.3	5-112	7.69	60	
Pyrene	1.75	0.330	"	3.01	ND	58.1	52-130	5.01	60	
1,2,4-Trichlorobenzene	1.94	0.330	"	3.01	ND	64.5	44-142	5.51	60	
Surr: 2-Fluorobiphenyl	*2.33*		"	*3.01*		*77.4*	*44-146*			
Surr: 2-Fluorophenol	*4.74*		"	*6.03*		*78.6*	*42-126*			
Surr: Nitrobenzene-d5	*2.32*		"	*3.01*		*77.1*	*42-126*			
Surr: Phenol-d6	*5.14*		"	*6.03*		*85.2*	*42-131*			
Surr: p-Terphenyl-d14	*2.07*		"	*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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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

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080365 - EPA 3550										
Blank (0080365-BLK1)				Prepared: 08/15/00 Analyzed: 08/16/00						
Bis(2-chloroethyl)ether	ND	0.330	mg/kg wet							
Bis(2-chloroisopropyl)ether	ND	0.330	"							
2-Chloronaphthalene	ND	0.330	"							
2-Chlorophenol	ND	0.330	"							
4-Chlorophenyl phenyl ether	ND	0.330	"							
Chrysene	ND	0.330	"							
Di-n-butyl phthalate	ND	1.00	"							
Di-n-octyl phthalate	ND	0.330	"							
Dibenzo (a,h) anthracene	ND	0.330	"							
Dibenzofuran	ND	0.330	"							
1,2-Dichlorobenzene	ND	1.00	"							
1,3-Dichlorobenzene	ND	1.00	"							
1,4-Dichlorobenzene	ND	1.00	"							
Dichlorobenzidine	ND	1.00	"							
2,4-Dichlorophenol	ND	0.330	"							
Diethyl phthalate	ND	0.330	"							
2,4-Dimethylphenol	ND	1.00	"							
Dimethyl phthalate	ND	0.330	"							
4,6-Dinitro-2-methylphenol	ND	1.00	"							
2,4-Dinitrophenol	ND	2.00	"							
2,4-Dinitrotoluene	ND	0.500	"							
2,6-Dinitrotoluene	ND	0.500	"							
Bis(2-ethylhexyl)phthalate	ND	2.00	"							
Fluoranthene	ND	0.330	"							
Fluorene	ND	0.330	"							
Hexachlorobenzene	ND	0.330	"							
Hexachlorobutadiene	ND	1.00	"							
Hexachlorocyclopentadiene	ND	1.00	"							
Hexachloroethane	ND	1.00	"							
Indeno (1,2,3-cd) pyrene	ND	0.330	"							
Isophorone	ND	0.330	"							
2-Methylnaphthalene	ND	0.330	"							
2-Methylphenol	ND	0.330	"							
3-,4-Methylphenol	ND	0.330	"							
Naphthalene	ND	0.330	"							
2-Nitroaniline	ND	0.330	"							

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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541.383.9310 fax 541.382.7588

Secor	Project: Fort James Specialty Chemicals	
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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080365 - EPA 3550										
Blank (0080365-BLK1)				Prepared: 08/15/00 Analyzed: 08/16/00						
3-Nitroaniline	ND	1.00	mg/kg wet							
4-Nitroaniline	ND	0.330	"							
Nitrobenzene	ND	0.330	"							
2-Nitrophenol	ND	0.330	"							
4-Nitrophenol	ND	1.00	"							
N-Nitrosodi-n-propylamine	ND	0.330	"							
N-Nitrosodiphenylamine	ND	0.330	"							
Pentachlorophenol	ND	1.00	"							
Phenanthrene	ND	0.330	"							
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-Fluorobiphenyl	*1.94*		"	*2.50*		*77.6*	*44-146*			
Surr: 2-Fluorophenol	*3.93*		"	*5.00*		*78.6*	*42-126*			
Surr: Nitrobenzene-d5	*1.90*		"	*2.50*		*76.0*	*42-126*			
Surr: Phenol-d6	*4.30*		"	*5.00*		*86.0*	*42-131*			
Surr: p-Terphenyl-d14	*1.75*		"	*2.50*		*70.0*	*49-150*			
Surr: 2,4,6-Tribromophenol	*3.60*		"	*5.00*		*72.0*	*48-119*			
LCS (0080365-BS1)				Prepared: 08/15/00 Analyzed: 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	"	5.00		69.4	23-134			
1,4-Dichlorobenzene	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			
Phenol	3.50	0.330	"	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	"	2.50		66.8	44-142			
Surr: 2-Fluorobiphenyl	*1.95*		"	*2.50*		*78.0*	*44-146*			
Surr: 2-Fluorophenol	*4.02*		"	*5.00*		*80.4*	*42-126*			
Surr: Nitrobenzene-d5	*1.94*		"	*2.50*		*77.6*	*42-126*			

Lisa Domenighini, Project Manager

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541.383.9310 fax 541.382.7588

Secor
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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080365 - EPA 3550										
LCS (0080365-BS1)				Prepared: 08/15/00 Analyzed: 08/16/00						
Surr: Phenol-d6	*4.33*		*mg/kg wet*	*5.00*		*86.6*	*42-131*			
Surr: p-Terphenyl-d14	*1.74*		*"*	*2.50*		*69.6*	*49-150*			
Surr: 2,4,6-Tribromophenol	*3.80*		*"*	*5.00*		*76.0*	*48-119*			
Matrix Spike (0080365-MS1)		**Source: P008088-19**		Prepared: 08/15/00 Analyzed: 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	"	6.11	ND	69.2	22-147			
2-Chlorophenol	4.20	0.330	"	6.11	ND	68.7	23-134			
1,4-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			
4-Nitrophenol	3.95	1.00	"	6.11	ND	64.6	0-132			
N-Nitrosodi-n-propylamine	2.09	0.330	"	3.05	ND	68.5	0-230			
Pentachlorophenol	3.99	1.00	"	6.11	ND	65.3	14-176			
Phenol	4.30	0.330	"	6.11	ND	70.4	5-112			
Pyrene	1.75	0.330	"	3.05	ND	57.4	52-130			
1,2,4-Trichlorobenzene	1.96	0.330	"	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-d14	*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)		**Source: P008088-19**		Prepared: 08/15/00 Analyzed: 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	"	6.11	ND	66.6	22-147	3.86	60	
2-Chlorophenol	4.11	0.330	"	6.11	ND	67.3	23-134	2.17	60	
1,4-Dichlorobenzene	1.81	1.00	"	3.05	ND	59.3	20-124	4.32	60	
2,4-Dinitrotoluene	2.06	0.500	"	3.05	ND	67.5	39-139	5.66	60	
4-Nitrophenol	3.67	1.00	"	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	"	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	"	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*		*"*	*3.05*		*74.4*	*44-146*			

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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	08/24/00 08:39

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080365 - EPA 3550										
Matrix Spike Dup (0080365-MSD1)	**Source: P008088-19**			Prepared: 08/15/00 Analyzed: 08/16/00						
Surr: 2-Fluorophenol	*4.68*		*mg/kg dry*	*6.11*		*76.6*	*42-126*			
Surr: Nitrobenzene-d5	*2.26*		*"*	*3.05*		*74.1*	*42-126*			
Surr: Phenol-d6	*5.01*		*"*	*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*			

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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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0080120 - Dry Weight										
Blank (0080120-BLK1)				Prepared & Analyzed: 08/04/00						
% Solids	ND	5.00	% by Weight							
Blank (0080120-BLK2)				Prepared & Analyzed: 08/04/00						
% Solids	ND	5.00	% by Weight							
Blank (0080120-BLK3)				Prepared & Analyzed: 08/04/00						
% Solids	ND	5.00	% by Weight							
LCS (0080120-BS1)				Prepared & Analyzed: 08/04/00						
% Solids	100	5.00	% by Weight				95-105			
LCS (0080120-BS2)				Prepared & Analyzed: 08/04/00						
% Solids	100	5.00	% by Weight				95-105			
LCS (0080120-BS3)				Prepared & Analyzed: 08/04/00						
Solids	100	5.00	% by Weight				95-105			
Batch 0080232 - Dry Weight										
Blank (0080232-BLK1)				Prepared & Analyzed: 08/09/00						
% Solids	ND	5.00	% by Weight							
Blank (0080232-BLK2)				Prepared & Analyzed: 08/09/00						
% Solids	ND	5.00	% by Weight							
LCS (0080232-BS1)				Prepared & Analyzed: 08/09/00						
% Solids	100	5.00	% by Weight				95-105			

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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	08/24/00 08:39

Miscellaneous Physical/Conventional Chemistry Parameters - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	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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cor	Project: Fort James Specialty Chemicals	
P.O. Box 1508	Project Number: 015.08716.001	**Reported:**
Tualatin, OR 97062	Project Manager: Joe Hunt	08/24/00 08:39

Notes and Definitions

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
)	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
RPD	Relative Percent Difference

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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14.6

CHAIN OF CUSTODY REPORT

Work Order # P008088

REPORT TO: SECOR
ATTENTION: Joe Hunt
ADDRESS: 7730 SW. Mohawk St.
Tualatin, Oregon 97062
PHONE: 503-691-2030 FAX: 503-692-7074
PROJECT NAME: Fort James Specialty Chemicals
PROJECT NUMBER: 015.08716.001
SAMPLED BY: DEC

INVOICE TO:
ATTENTION:
ADDRESS:
P.O. NUMBER:
NCA QUOTE #:

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: 10 (Standard) | 7 | 5 | 4 | 3 | 2 | 1 | Same Day
Fuels & Hydrocarbon Analyses: 5 (Standard) | 3-4 | 2 | 1 | Same Day
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	EPA 8260B	EPA 8270 SIM	EPA 610/7000	WTPH-HCID + QUANT (6' HCID)	EPA 8082	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1. GP1	8/1/00 0809		X	X	X	X		S	3	EPA 8270 SIM (ACID + BASE/NEUTRAL)
2. GP2	0835								3	ARCHIVE
3. GP3	0900		X	X	X	X			3	"
4. GP4	0945		X	X	X	X			3	"
5. GP5	1022				X	X			1	
6. GP6	1318				X	X			1	
7. GP7	1041								1	ARCHIVE
8. GP7B	1347								1	ARCHIVE
9. GP7C	1403				X	X			1	
10. GP8	1150			X					1	EPA 8270 SIM (PHENOLS ONLY)

RELINQUISHED BY: D. Edward Cafferty — DATE: — TIME:
PRINT NAME: D. Edward Cafferty — FIRM: SECOR
RELINQUISHED BY: — DATE: — TIME:
PRINT NAME: — FIRM:

RECEIVED BY: — DATE: 8/3/00
PRINT NAME: Bob Fahsholz — FIRM: NCA — TIME: 1620
RECEIVED BY: — DATE:
PRINT NAME: — FIRM: — TIME:

ADDITIONAL REMARKS:

NORTH CREEK ANALYTICAL
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14.0

CHAIN OF CUSTODY REPORT

Work Order # 1008088

REPORT TO: SECOR
ATTENTION: Joe Hunt
ADDRESS: 7730 SW. Mohawk St.
Tualatin, Oregon 97062
PHONE: 503-691-2030 FAX: 503-692-7074
PROJECT NAME: Fort James Specialty Chemicals
PROJECT NUMBER: 015.08716.001
SAMPLED BY: DEC

INVOICE TO:
ATTENTION:
ADDRESS:
P.O. NUMBER: NCA QUOTE #:

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: (10 Standard) 7 5 4 3 2 1 Same Day
Fuels & Hydrocarbon Analyses: 5 Standard 3-4 2 1 Same Day
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	Analysis Request: EPA 8260B	EPA 8270 SIM	EPA 6010/7000	WTPH-HCID + quarry	EDA 8082	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1. GP9 @ 8'	8/1/00 1430							S	2	ARCHIVE
2. GP9 @ 12'	1435		X	X	X	X			3	EPA 8270 SIM ACID EXTRACT ONLY
3. GP9 @ 27.5'	1500		X	X	X	X			3	"
4. GP10	1543		X	X	X	X			3	"
5. GP11	1612		X	X					2	EPA 8270 SIM ACID EXTRACT ONLY
6. GP12	8/2/00 0815		X	X					2	"
7. GP13	0848		X	X					2	"
8. GP14 @ 4'	0935								3	ARCHIVE
9. GP14 @ 8'	0950		X	X	X	X			3	"
10. GP15	1420		X	X					2	"

RELINQUISHED BY: D. Edward Cafferty DATE:
PRINT NAME: D. Edward Cafferty FIRM: SECOR TIME:
RELINQUISHED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: Bob Fahlsholz DATE: 8/3/
PRINT NAME: Bob Fahlsholz FIRM: NCA TIME: 16:3
RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS:

NORTH CREEK ANALYTICAL
Environmental Laboratory Services

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14.6

CHAIN OF CUSTODY REPORT

Work Order # 0008086

REPORT TO: SECOR
ATTENTION: Joe Hunt
ADDRESS: 7730 SW. Mohawk St.
Tualatin, Oregon 97062
PHONE: 503-691-2030 FAX: 503-692-7074
PROJECT NAME: Fort James Specialty Chemicals
PROJECT NUMBER: 015.08716.001
SAMPLED BY: DEC

INVOICE TO:
ATTENTION:
ADDRESS:
P.O. NUMBER: NCA QUOTE #:

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: 10 Standard | 7 | 5 | 4 | 3 | 2 | 1 | Same Day
Fuels & Hydrocarbon Analyses: 5 Standard | 3-4 | 2 | 1 | Same Day
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges

Analysis Request: EPA 8260B; EPA 8270 SIM; EPA 6010/7000; WTPH-HCID +; EPA 8082; BTEX 8021B; PAH (8270 SIM)

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1.	GP16	8/3/00 0810		S	2	EPA 8270 SIM (ACID EXTRACTION
2.	GP17 @ 4'	8/2/00 1027			2	ARCHIVE
3.	GP17 @ 6'	1035			2	"
4.	GP17C @ 8'	1128			2	ARCHIVE
5.	GP17C @ 11.5'	1148			2	"
6.	GP18	8/3/00 0915			2	EPA 8270 SIM (ACID/BASE NEU EXTRACTION
7.	GP19	0855			2	EPA 8270 SIM (ACID/BASE/NEU EXTRACT
8.	GP20	0950			2	⊗ RUN IF TPHd QUANT IS ⊕
9.	GP28	8/2/00 1717			3	EPA 8270 SIM ACID + BASE/NEU
10.						

RELINQUISHED BY: D. Edward Caffrey DATE:
PRINT NAME: D. Edward Caffrey FIRM: SECOR TIME:

RECEIVED BY: Bob Fahs DATE: 8/3
PRINT NAME: Bob Fahs FIRM: NCA TIME: 16

RELINQUISHED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS:

Columbia Analytical Services INC.
An Employee-Owned Company

August 23, 2000

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

Joe Hunt
SECOR
7730 SW Mohawk St.
Tualatin, OR 97062

RE: Project No.: 015.08716 Task # 003
Project Name: Fort James

Dear Joe Hunt:

Enclosed are the results of the samples(s) submitted to our laboratory on August 11, 2000. For your reference, these analyses have been assigned our service request number: J2002672.

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. Myers

Craig Myers
Project Manager

CM/jg

8540 Baycenter Rd. ▪ Jacksonville, FL 32256 ▪ (904) 739-2277 ▪ Fax (904) 739-2011

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James / 015.08716 Task # 003	**Date Collected:**	8/2/00
Sample Matrix:	Soil	**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

CAS Number	TIC	Retention Time (minutes)	Estimated Concentration
274-09-9	1,3-Benzodioxole	28.82	31000

Approved By: Craig R. Hyman Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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 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: GP11
Lab Code: J2002672-001

CAS Number	TIC	Retention Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James / 015.08716 Task # 003	**Date Collected:**	8/1/00
Sample Matrix:	Soil	**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 Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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: GP13
Lab Code: J2002672-003

CAS Number	TIC	Retention Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James / 015.08716 Task # 003	**Date Collected:**	8/1/00
Sample Matrix:	Soil	**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

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James/015.08716 Task # 003	**Date Collected:**	8/1-2/00
Sample Matrix:	Soil	**Date Received:**	8/11/00 1000
		Date Extracted:	NA

Inorganic Parameters

				Sample Name:	GP11	GP12	GP13
				Lab Code:	J2002672-001	J2002672-002	J2002672-003
Analyte	**Units**	**EPA Method**	**MRL**	**Date/Time Analyzed**			
Solids, Total	%	160.3	10	8/14/00 1200	82.2	80.9	92.0

Approved By: Craig R. Hyman Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James/015.08716 Task # 003	**Date Collected:**	8/1-2/00
Sample Matrix:	Soil	**Date Received:**	8/11/00 1000
		Date Extracted:	NA

Inorganic Parameters

Sample Name: **GP17 @ 6'**
Lab Code: J2002672-004

Analyte	Units	EPA Method	MRL	Date/Time Analyzed	
Solids, Total	%	160.3	10	8/14/00 1200	80.0

Approved By: Craig R. Hyman Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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: NA
Date Analyzed: 8/18-19/00

Surrogate Recovery Summary
Volatile Organic Compounds
EPA Method 8260B

Sample Name	Lab Code	Percent Recovery		
		Dibromofluoromethane	Toluene-d_8	4-Bromofluorobenzene
GP17 @ 6'	J2002672-004	104	97	101
Method Blank	J200818-MB	96	99	98
Laboratory Control Sample	J200818-LCS	109	96	100
Batch QC	J2002686-001MS	109	96	97
Batch QC	J2002686-001MSD	107	96	98
CAS Acceptance Limits:		82-119	86-121	74-130

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: SECOR
Project: 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

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	CAS cceptanc 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: Craig R. Myers Date: 8/23/00

QA/QC Report

Client: SECOR
Project: 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

Approved By: Craig R. Hyer Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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

		Percent Recovery					
Sample Name	**Lab Code**	NBZ	FBP	TPH	PHL	2FP	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: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent 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
Acenaphthene	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.

Approved By: Craig R. Myers Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	SECOR	**Service Request:**	J2002672
Project:	Fort James / 015.08716 Task # 003	**Date Collected:**	NA
LCS Matrix:	Soil	**Date Received:**	NA
		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)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Phenol	3300	3000	91	40-116
2-Chlorophenol	3300	2900	88	47-113
1,4-Dichlorobenzene	1650	1500	91	50-120
N-Nitroso-di-n-propylamine	1650	1700	103	51-121
1,2,4-Trichlorobenzene	1650	1500	91	53-121
4-Chloro-3-methylphenol	3300	3200	97	47-128
Acenaphthene	1650	1600	97	50-121
4-Nitrophenol	3300	2700	82	36-135
2,4-Dinitrotoluene	1650	1600	97	51-125
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: Craig R. Hyman Date: 8/23/00

COLUMBIA ANALYTICAL SERVICES, INC.

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: NA
Date Analyzed: 8/14/00 1200

Duplicate Summary
Inorganic Parameters

Sample Name: Batch QC
Lab Code: Batch QC

Analyte	Units	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Solids, Total	%	160.3	10	89.8	91.6	90.7	1.98

Approved By: Craig R. Hyman Date: 8/23/00

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: SECOR Work order: J2002672

Project: Fort James / 015.08716 Task # 003

Cooler received on 8/11/00 and opened on 8/11/00 by THT

		Yes	No	N/A
1	Were custody seals on outside of cooler?	☒	☐	☐
	If yes, how many and where? One on lid			☐
	Were signature and date correct?	☒	☐	☐
2	Were custody papers properly filled out (ink, signed, etc....)?	☒	☐	☐
3	Did all bottles arrive in good condition (unbroken, etc....)?	☒	☐	☐
4	Were all bottle labels correct (analysis, preservation, etc....)?	☒	☐	☐
5	Did all bottle labels and tags agree with custody papers?	☒	☐	☐
6	Were correct bottles used for test indicated?	☒	☐	☐
7	Did all samples arrive within appropriate holding times?	☒	☐	☐
8	Were VOA vials checked for absence of air bubbles, and noted?	☐	☐	☒
9	Temperature of cooler upon receipt	3.4 Degrees C		

Explain any discrepancies:

		Yes	No
pH	Reagent		
12	NaOH		
2	HNO_3		
2	H_2SO_4		

Yes = all samples OK

No = Samples were preserved at lab as listed

Comments:

Sample I.D.	Reagent	Vol.

Chain-of Custody Number:

SECOR Chain-of Custody Record

Field Office: SECOR
Address: 7730 SW MOHAWK ST.
TUALATIN, OR 97062

☐ Additional documents are attached, and are a part of this Record.

Job Name: FORT JAMES
Location: CAMAS, WASHINGTON

Project # 015.08716 Task # 003
Project Manager HUNT
Laboratory COLUMBIA ANALYTICAL
Turnaround Time

Sampler's Name D. Edward Caffey
Sampler's Signature D. Edward Caffey

Sample ID	Date	Time	Matrix	HCID	TPHg/BTEX/WTPH-G 8015 (modified)/8020	TPHd/WTPH-D 8015 (modified)	TPH 418.1/WTPH 418.1	Aromatic Volatiles 602/8020	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Semi-volatile Organics 625/8270 (GC/MS)	Pesticides/PCBs 608/8080	Total Lead 7421	Priority Pollutant Metals (13)	TCLP Metals	METHYLENE DICHLOROBENZENE	THIODIPHENOL	Comments/ Instructions	Number of Containers
GP 11	8/1	1612	S														X		1
GP 12	8/2	0815	S														X		1
GP 13	8/2	0848	S														X		1
GP-17 @ 6	8/2	1035	S													X			1

Special Instructions/Comments:

2672

Relinquished by: DEC
Sign D. Edward Caffey
Print D. Edward Caffey
Company SECOR
Time 1500 Date 8/10/00

Received by: Re
Sign Travis Trades
Print Travis Trades
Company CAS
Time 1000 Date 8/11/00

Sample Receipt
Total no. of containers:
Chain of custody seals:
Rec'd in good condition/cold:
Conforms to record:

Relinquished by:
Sign
Print
Company
Time Date

Received by:
Sign
Print
Company
Time Date

Client:
Client Contact:
Client Phone:

SECOR CUSTREC Rev. 2/99

Date: 8 / 10 / 00 Page 1 of 1

Columbia Analytical Services INC.
An Employee-Owned Company

September 08, 2000

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

Joe Hunt
Secor
7730 SW Mohawk St.
Tualatin, OR 97062

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. Myers

Craig Myers
Project Manager

CM/jg

8540 Baycenter Rd. ▪ Jacksonville, FL 32256 ▪ (904) 739-2277 ▪ Fax (904) 739-2011

COLUMBIA ANALYTICAL SERVICES, INC.

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

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Secor	**Service Request:**	J2002890
Project:	Fort James / 015.08716	**Date Collected:**	8/25/00
Sample Matrix:	Water	**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 Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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: MW1-082500
Lab Code: J2002890-001

CAS Number	TIC	Retention Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Secor	**Service Request:**	J2002890
Project:	Fort James / 015.08716	**Date Collected:**	8/25/00
Sample Matrix:	Water	**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 Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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: MW3-082500
Lab Code: J2002890-003

CAS Number	TIC	Retention Time	Estimated Concentration

NO TENTATIVELY IDENTIFIED COMPOUNDS DETECTED

Approved By: _____ Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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

		Percent Recovery		
Sample Name	**Lab Code**	Dibromofluoromethane	Toluene-d_8	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	J2002926-001MSD	91	97	105
CAS Acceptance Limits:		82-119	86-121	74-130

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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

Matrix Spike/Duplicate Matrix Spike Summary
Volatile Organic Compounds
EPA Method 8260B
Units: µg/L (ppb)

Sample Name: Batch QC
Lab Code: Batch QC

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	CAS cceptanc 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	U	208	210	104	105	61-135	1	30

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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)

Analyte	True Value	Result	Percent Recovery	EPA Percent Recovery Acceptance Limits
1,1-Dichloroethene	20	19	95	61-129
Benzene	20	22	110	63-130
Trichloroethene	20	22	110	72-127
Toluene	20	22	110	70-133
Chlorobenzene	20	22	110	66-132

Approved By: Craig R. Hyman Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC 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

Surrogate Recovery Summary
Base Neutral/ Acid Semivolatile Organic Compounds
EPA Methods 3510/8270

		Percent Recovery					
Sample Name	**Lab Code**	NBZ	FBP	TPH	PHL	2FP	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
FBP	2-Fluorobiphenyl
TPH	Terphenyl-d14
PHL	Phenol-d6
2FP	2-Fluorophenol
TBP	2,4,6-Tribromophenol

(a) Outside of acceptance limits because of matrix effects. The sample produced an emulsion during the preparation steps.

Approved By: Craig R. Myers Date: 9/8/00

COLUMBIA ANALYTICAL SERVICES, INC.

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)

Analyte	Spike Level LCS	Spike Level DLCS	Spike Result LCS	Spike Result DLCS	Percent Recovery LCS	Percent Recovery DLCS	CAS Acceptance Limits	Relative Percent 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: Craig R. Myers Date: 9/8/00

Figure 8-1
Cooler Receipt and Preservation Form

Project/Client Fort James/SECOR Service Request Number J2002890

Cooler received on 8/29/00 by: RJG COURIER: CAS (UPS) FEDEX CD&L CLIENT

1.	Were custody seals on outside of cooler?	(YES)/NO				
2.	Were custody papers properly filled out (ink, signed, etc.)?	(YES) NO				
3.	Did all bottles arrive in good condition (unbroken)?	(YES) NO				
4.	Did any VOA vials contain significant air bubbles?	YES NO (NA)				
5.	Were Ice or Ice packs present?	(YES) NO				
6.	Where did the bottles originate?	CAS/JAX, (CLIENT)				
7.	Temperature of cooler(s) upon receipt:	5.6°C				
	Is the temperature within 0° - 6° C?:	(Yes?)	Yes?	Yes?	Yes?	Yes?
	If No, Explain Below	No?	No?	No?	No?	No?

Date/Time Temperatures Taken: 8/29/00 @ 1005

Thermometer ID: _____ Temp Blank Sample Bottle Cooler Temp. (IR. Gun)

If out of Temperature, Client Approval to Run Samples _____

Cooler Breakdown: Date: 8/29/00 by: RJG

1.	Were all bottle labels complete (*i.e.* analysis, preservation, etc.)?	(YES)	NO
2.	Did all bottle labels and tags agree with custody papers?	(YES)	NO
3.	Were correct containers used for the tests indicated?	YES	(NO)
4.	Air samples: Cassettes/Tubes Intact Canisters Pressurized Tedlar® Bags Inflated		(NA)

Explain any discrepancies: Volatiles testing indicated on COC, no vials rec'd; split into VOA vials per Joe Hunt

		YES	NO	Sample I.D.	Reagent	Vol. Added
pH	Reagent					
12	NaOH					
2	HNO_3					
2	H_2SO_4					
5-9*	P/PCBs (608 only)					

YES = All samples OK NO = Samples were preserved at lab as listed PC OK to adjust pH _____

*If pH adjustment is required, use NaOH and/or H_2SO_4

VOC Vial pH Verification (Tested after Analysis) Following Samples Exhibited pH > 2				

Other Comments:

Chain-of Custody Number:

SECOR Chain-of Custody Record

Field Office: SECOR

Address: 7730 SW. Mohawk St.
Tualatin, Oregon 97062
503-691-2030 503-692-7074

☐ Additional documents are attached, and are a part of this Record.

Job Name: Fort James

Location: Camas, Washington

Project # 015. 08716 Task #

Project Manager Joe Hunt

Laboratory Columbia Analytical

Turnaround Time

Sampler's Name D. Edward Cafferty

Sampler's Signature D. Edward Cafferty

Sample ID	Date	Time	Matrix
MW1 - 082500	8/25/00	1315	W
MW2 - 082500	↓	1237	↓
MW3 - 082500	↓	1400	↓

Analysis Request

HCID	TPHg/BTEX/WTPH-G 8015 (modified)/8020	TPHd/WTPH-D 8015 (modified)	TPH 418.1/WTPH 418.1	Aromatic Volatiles 602/8020	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Semi-volatile Organics 625/8270 (GC/MS)	Pesticides/PCBs 608/8080	Total Lead 7421	Priority Pollutant Metals (13)	TCLP Metals	Thio diphenol 8270C + TIC's	Methylene Oxygenates EPA 8260B + TIC's	Comments/ Instructions	Number of Containers
												X		HCl	1
												X	X	↓	1
												X	X	↓	1

Special Instructions/Comments:

2890
Temp 5.6°C RJG

Relinquished by: DEC
Sign D. Edward Cafferty
Print D. Edward Cafferty
Company SECOR
Time _____ Date 8/28/00

Received by: Raima General
Sign Raima General
Print Raima General
Company GAS
Time 1000 Date 8/29/00

Sample Receipt
Total no. of containers: 3
Chain of custody seals:
Rec'd in good condition/cold: ✓
Conforms to record:

Relinquished by: _____
Sign _____
Print _____
Company _____
Time _____ Date _____

Received by: _____
Sign _____
Print _____
Company _____
Time _____ Date _____

Client: _____
Client Contact: _____
Client Phone: _____

SECOR CUSTREC Rev. 2/99

Date: ___/___/___ Page ___ of ___

APPENDIX C
MONITORING WELL CONSTRUCTION LOGS

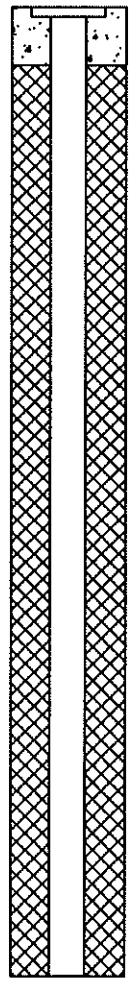
2000 Site Investigation Report
Former Fort James Specialty Chemicals
906 NW Drake Street
Camas, Washington
SECOR PN: 015.08860.002
January 17, 2001

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.008** BORING/WELL **W-1**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1252 08/22/00** FINISH **1700 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)**

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
				5			5
				0	Asphalt surface		0
		2.1	NS	5	Sandy SILT, brown, sand is fine grained, trace small gravels, dry	SP	5
		1.9	NS	10	Silty SAND, brown, sand is fine-to medium-grained, grades coarser, damp		10
		2.2	NS	15	Same w/ slightly more gravels; gravels are fine to coarse, subrounded to angular		15
		2.8	NS	20	Gravel/basalt fragments, gray, fine to coarse in size, subrounded to subangular, lots of loose, powdery silt, dry	GM	20
		1.9	NS	25	Same, mostly subrounded fragments		25
					To be continued on the next page...		

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

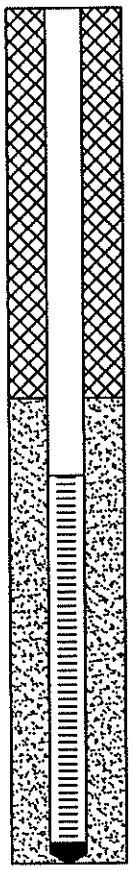
F:/FILES/PORTLAND/08716

DWG: 15-8716-6L

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.006** BORING/WELL **W-1**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1252 08/22/00** FINISH **1700 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)**

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
				25			25
		4.4	NS	30	Contains higher percentage of silt/powder material, dry		30
		3.8	NS	35	Powdery content diminishes, basalt fragments become fine to coarse, subangular to subrounded, dry	GM	35
		3.3	NS	40	Basalt fragments w/cinder (tuff) fragments, gray, fine to coarse, subangular to subrounded, tuff is red/brown, rounded, pelletlike, powdered, hard, dry		40
		2.1	NS	45	Cinder (tough) fragments, reddish brown, fine to coarse, subrounded to subangular, hand dry, some small subrounded basalt fragments		45
					Boring terminated at 47 feet. Groundwater encountered at approximately 41 feet during drilling.		
				50			50
				55			55

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

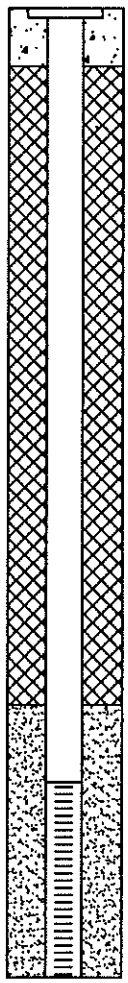
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.006** BORING/WELL **W-2**
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)**

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
				5			5
				0	Concrete surface w/ smaller rebar (approximately 6" thick)		0
		17.3	NS	5	SILT, brown, few small to medium subrounded gravels, damp	ML	5
		22.6	NS	10	Color changes to dark, reddish brown, cinder type material, hard where not powdered, subrounded to subangular fragments, zeolites present		10
		23.2	NS	15	Subangular to subrounded cinder (tuff) chips, very hard, tan, reddish brown color w/ some zeolites present		15
		8.7	NS	20	Basalt, gray, medium to coarse, subrounded to subangular fragments, trace silt/ powdered material	GM	20
		15.9	NS	25	Same		25
					To be continued on the next page...		

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.006** BORING/WELL **W-2**
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)**

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
				25		GM	25	
	26.0		NS	30	Same w/ small to coarse fragments, blackish, wet		30	
					Boring terminated at 30 feet. Groundwater encountered at approximately 26 feet during drilling.			
				35			35	
				40			40	
				45			45	
				50			50	
				55			55	

Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

F:/FILES/PORTLAND/08716

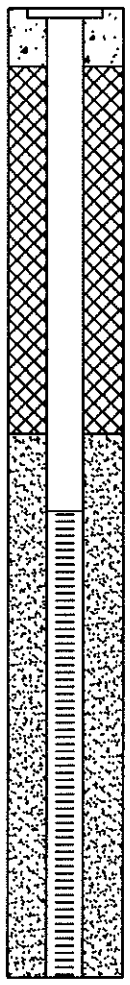
DWG: 15-8716-6L

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.006** 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 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)**

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
				5			5
				0	Asphalt surface		0
		1.1	NS	5	Clayey SILT w/ gravel, brown, gravels are small, subrounded, moist, soft	GM	5
		1.1	NS	10	Same, graels are very small		10
		1.0	NS	15	Sandy SiLT, brown, sand is very fine grained, moist, soft, trace small subrounded gravels (Lens of black medium grained, well sorted sand 16–17' bgs)	SM	15
		1.4	NS	20	SILT, brown, some small subrounded gravels, soft, moist	ML	20
		4.3	NS	25	Basalt fragments, gray, subrounded to subangular, small to coarse pieces, some powdered material (silt), dry	GM	25
					To be continued on the next page...		

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

Groundwater Level at Time of Drilling
Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

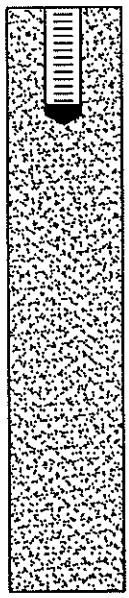
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08716.006** 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 RAE 2000 w/ 100 ppm isobutylene**
SUBCONTRACTOR AND EQUIPMENT **Environmental West Explorations Air Rotary Rig 6 3/4" casing,**
COMMENTS **6" bit (w/ casing), 4 3/4" open hole bit, cuttings observed as they come up (no sampling)**

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
				25			25
		3.0	NS	30	Same w/ more powdered material present (silt)	GM	30
		2.3	NS	▽35	Same.		35
		2.3	NS	40	Same but saturated, higher percentage (~70%) of small fragments, subrounded to subangular, silt present		40
					Boring terminated at 40 feet. Groundwater encountered at approximately 35 feet during drilling.		
				45			45
				50			50
				55			55

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

▽ Groundwater Level at Time of Drilling
▼ Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite

10/20 Colorado Silica Sand

2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

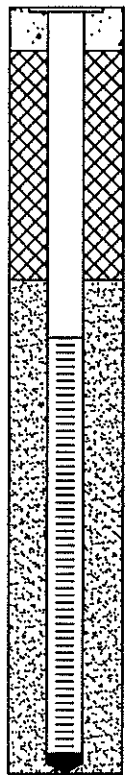
DWG: 15-8716-6L

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08860.003** BORING/WELL **W-4**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **1125 11/09/00** FINISH **1305 11/09/00** CASING TOP ELEVATION **NA**
LOGGED BY **DEC** MONITORING DEVICE **OVM 580B w/ 100 ppm isobutylene**
SUBCONTRACTOR AND EQUIPMENT **Environmental West Air Rotary Rig w/ 4 1/2" open hole bit**
COMMENTS **(6" bit w/ casing 0-10' bgs) lithology described from cuttings - no sampling**

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
				0	Asphalt surface		0
	0-5	3.8	NS	5	SILT, brown; trace small gravel; moist	ML	5
	5-10	2.6	NS	10	GRAVEL w/silt, gray; gravels are fine to coarse, mostly subrounded; damp		10
	10-15	2.1	NS	15 ▽	GRAVEL/fragments, gray; fine to coarse, mostly subrounded; trace silt; damp	GM	15
	15-20	0.0	NS	20	Same as above, but wet		20
	20-25	0.0	NS	25	Same as above, wet		25
					Boring terminated at 25 feet. Groundwater encountered at approximately 15 feet during drilling.		
				30			30
				35			35

Well Construction Schematic



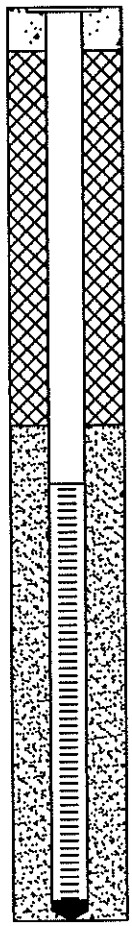
Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis
▽ Groundwater Level at Time of Drilling
▼ Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts
Gradational Contact
Contact Located Approximately
Contact
Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

SECOR
International Incorporated
015

FACILITY **FORT JAMES SPECIALTY CHEMICAL** JOB # **015.08860.003** BORING/WELL **W-5**
LOCATION **CAMAS, WASHINGTON** SURFACE ELEVATION **NA**
START **0815 11/09/00** FINISH **1120 11/09/00** CASING TOP ELEVATION **NA**
LOGGED BY **DEC** MONITORING DEVICE **OVM 580B w/ 100 ppm Isobutylene**
SUBCONTRACTOR AND EQUIPMENT **Environmental West Air Rotary Rig w/ 4 1/2" open hole bit**
COMMENTS **(6" bit w/ casing 0-10' bgs) lithology described from cuttings - no sampling**

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
				5			5
				0	Asphalt surface		0
		4.1	NS	5	SILT, reddish brown; trace very fine-grained sand; damp	ML	5
		4.6	NS	10	GRAVEL and SILT, reddish brown; fine to medium gravels, subangular to subrounded; trace coarse gravel; dry (color changes to gray at 12' bgs)	GM	10
		4.3	NS	15	SILT /powder material, gray; dry (some material is comprised of small chips – fragments that can be broken by hand)	ML	15
		4.1	NS	20 ▽	Same w/trace medium to large gravels		20
		0.0	NS	25	Basalt fragments, black; wet	GM	25
		0.0	NS	30	Same as above		30
					Boring terminated at 30 feet. Groundwater encountered at approximately 20 feet during drilling.		
				35			35

Well Construction Schematic



Field Screen/Lithologic Description Sample
Preserved Sample
No Recovery
* Sample Submitted for Laboratory Analysis

▽ Groundwater Level at Time of Drilling
▼ Static Groundwater Level
SD Sheen Detected
NS No Sheen Detected
NT Not Tested
(2.5Y 4/2) Munsell (1990) Soil Color Charts

Gradational Contact
Contact Located Approximately
Contact

Concrete
Bentonite
10/20 Colorado Silica Sand
2" PVC Blank Casing
2" PVC Screen Casing (0.010 slots)
End Cap

F:/FILES/PORTLAND/FORT JAMES

DWG: 15-8860-003L

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

www.ncalabs.com

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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

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW1	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

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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

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 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	0.630	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*102 %*	*50-150*							
MW2 (P008562-02) Water					Sampled: 08/25/00 Received: 08/29/00				
Gasoline Range Hydrocarbons	**DET**	0.250	mg/l	1	NWTPH HCID	09/01/00	09/05/00	0090013	D-15
Diesel Range Hydrocarbons	ND	0.630	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	0.630	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*100 %*	*50-150*							
MW3 (P008562-03) Water					Sampled: 08/25/00 Received: 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	"	"	"	"	"	"	
Heavy Oil Range Hydrocarbons	ND	0.630	"	"	"	"	"	"	
Surr: 1-Chlorooctadecane	*99.6 %*	*50-150*							

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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

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						Sampled: 08/25/00	Received: 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*							

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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

Polychlorinated Biphenyls per EPA Method 8082

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Dilution	Method	Prepared	Analyzed	Batch	Notes
MW1 (P008562-01) Water					Sampled: 08/25/00 Received: 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	"	"	"	"	"	"	
Aroclor 1232	ND	0.500	"	"	"	"	"	"	
Aroclor 1242	ND	0.500	"	"	"	"	"	"	
Aroclor 1248	ND	0.500	"	"	"	"	"	"	
Aroclor 1254	ND	0.500	"	"	"	"	"	"	
Aroclor 1260	ND	0.500	"	"	"	"	"	"	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*70.0 %*	*44-119*							
Surr: Decachlorobiphenyl	*21.0 %*	*54-128*							*S-07*
MW2 (P008562-02) Water					Sampled: 08/25/00 Received: 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	"	"	"	"	"	"	
Aroclor 1232	ND	0.500	"	"	"	"	"	"	
...clor 1242	ND	0.500	"	"	"	"	"	"	
...clor 1248	ND	0.500	"	"	"	"	"	"	
Aroclor 1254	ND	0.500	"	"	"	"	"	"	
Aroclor 1260	ND	0.500	"	"	"	"	"	"	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*78.2 %*	*44-119*							
Surr: Decachlorobiphenyl	*49.3 %*	*54-128*							*S-07*
MW3 (P008562-03) Water					Sampled: 08/25/00 Received: 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	"	"	"	"	"	"	
Aroclor 1232	ND	0.500	"	"	"	"	"	"	
Aroclor 1242	ND	0.500	"	"	"	"	"	"	
Aroclor 1248	ND	0.500	"	"	"	"	"	"	
Aroclor 1254	ND	0.500	"	"	"	"	"	"	
Aroclor 1260	ND	0.500	"	"	"	"	"	"	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*76.0 %*	*44-119*							
Surr: Decachlorobiphenyl	*25.6 %*	*54-128*							*S-07*

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Lisa Domenighini, Project Manager

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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

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					Sampled: 08/25/00 Received: 08/29/00				
Acetone	ND	10.0	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
Benzene	ND	1.00	"	"	"	"	"	"	
Bromobenzene	ND	1.00	"	"	"	"	"	"	
Bromochloromethane	ND	1.00	"	"	"	"	"	"	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Bromoform	ND	1.00	"	"	"	"	"	"	
Bromomethane	ND	5.00	"	"	"	"	"	"	
2-Butanone	ND	10.0	"	"	"	"	"	"	
n-Butylbenzene	ND	5.00	"	"	"	"	"	"	
sec-Butylbenzene	ND	1.00	"	"	"	"	"	"	
tert-Butylbenzene	ND	1.00	"	"	"	"	"	"	
Carbon disulfide	ND	10.0	"	"	"	"	"	"	
Carbon tetrachloride	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	**11.1**	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloroform	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
2-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
4-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	"	
Dibromochloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dibromoethane	ND	1.00	"	"	"	"	"	"	
Dibromomethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	**76.6**	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	**2.51**	1.00	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	**2.39**	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	"	
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	

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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

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					Sampled: 08/25/00 Received: 08/29/00				
Hexachlorobutadiene	ND	2.00	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
2-Hexanone	ND	10.0	"	"	"	"	"	"	
Isopropylbenzene	ND	2.00	"	"	"	"	"	"	
p-Isopropyltoluene	ND	2.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
Tetrachloroethene	**23.6**	1.00	"	"	"	"	"	"	
Toluene	**1.94**	1.00	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichloropropane	ND	1.00	"	"	"	"	"	"	
1,2,4-Trimethylbenzene	**1.22**	1.00	"	"	"	"	"	"	
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
o-Xylene	**1.10**	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	2.00	"	"	"	"	"	"	
Surr: 4-BFB	*94.0 %*	*75-125*							
Surr: 1,2-DCA-d4	*104 %*	*75-125*							
Surr: Dibromofluoromethane	*101 %*	*75-125*							
Surr: Toluene-d8	*97.5 %*	*75-125*							

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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

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					Sampled: 08/25/00 Received: 08/29/00				
Acetone	ND	10.0	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
Benzene	ND	1.00	"	"	"	"	"	"	
Bromobenzene	ND	1.00	"	"	"	"	"	"	
Bromochloromethane	ND	1.00	"	"	"	"	"	"	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Bromoform	ND	1.00	"	"	"	"	"	"	
Bromomethane	ND	5.00	"	"	"	"	"	"	
2-Butanone	ND	10.0	"	"	"	"	"	"	
n-Butylbenzene	ND	5.00	"	"	"	"	"	"	
sec-Butylbenzene	ND	1.00	"	"	"	"	"	"	
tert-Butylbenzene	ND	1.00	"	"	"	"	"	"	
Carbon disulfide	ND	10.0	"	"	"	"	"	"	
Carbon tetrachloride	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloroform	**1.15**	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
2-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
4-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	"	
Dibromochloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dibromoethane	ND	1.00	"	"	"	"	"	"	
Dibromomethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	"	
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	

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cor	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

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					Sampled: 08/25/00 Received: 08/29/00				
Hexachlorobutadiene	ND	2.00	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
2-Hexanone	ND	10.0	"	"	"	"	"	"	
Isopropylbenzene	ND	2.00	"	"	"	"	"	"	
p-Isopropyltoluene	ND	2.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
Tetrachloroethene	**2.32**	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	**2.71**	1.00	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichloropropane	ND	1.00	"	"	"	"	"	"	
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	2.00	"	"	"	"	"	"	
Surr: 4-BFB	*108 %*	*75-125*							
Surr: 1,2-DCA-d4	*99.0 %*	*75-125*							
Surr: Dibromofluoromethane	*96.0 %*	*75-125*							
Surr: Toluene-d8	*97.0 %*	*75-125*							

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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

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: 08/25/00 Received: 08/29/00				
Acetone	ND	10.0	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
Benzene	ND	1.00	"	"	"	"	"	"	
Bromobenzene	ND	1.00	"	"	"	"	"	"	
Bromochloromethane	ND	1.00	"	"	"	"	"	"	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Bromoform	ND	1.00	"	"	"	"	"	"	
Bromomethane	ND	5.00	"	"	"	"	"	"	
2-Butanone	ND	10.0	"	"	"	"	"	"	
n-Butylbenzene	ND	5.00	"	"	"	"	"	"	
sec-Butylbenzene	ND	1.00	"	"	"	"	"	"	
tert-Butylbenzene	ND	1.00	"	"	"	"	"	"	
Carbon disulfide	ND	10.0	"	"	"	"	"	"	
Carbon tetrachloride	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloroform	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
2-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
4-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	"	
Dibromochloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dibromoethane	ND	1.00	"	"	"	"	"	"	
Dibromomethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	"	
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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Decor 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: 08/25/00 Received: 08/29/00				
Hexachlorobutadiene	ND	2.00	ug/l	1	EPA 8260B	09/08/00	09/08/00	0090152	
2-Hexanone	ND	10.0	"	"	"	"	"	"	
Isopropylbenzene	ND	2.00	"	"	"	"	"	"	
p-Isopropyltoluene	ND	2.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	**17.5**	1.00	"	"	"	"	"	"	
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichloropropane	ND	1.00	"	"	"	"	"	"	
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	2.00	"	"	"	"	"	"	
Surr: 4-BFB	*108 %*	*75-125*							
Surr: 1,2-DCA-d4	*103 %*	*75-125*							
Surr: Dibromofluoromethane	*99.0 %*	*75-125*							
Surr: Toluene-d8	*96.5 %*	*75-125*							

Lisa Domenighini, Project Manager

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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

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: 08/25/00 Received: 08/29/00				
Acenaphthene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Acenaphthylene	ND	5.00	"	"	"	"	"	"	
Anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) pyrene	ND	5.00	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	5.00	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzoic Acid	ND	50.0	"	"	"	"	"	"	
Benzyl alcohol	ND	10.0	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	5.00	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	5.00	"	"	"	"	"	"	
4-Chloroaniline	ND	20.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	10.0	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	5.00	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	10.0	"	"	"	"	"	"	
2-Chloronaphthalene	ND	5.00	"	"	"	"	"	"	
2-Chlorophenol	ND	5.00	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Chrysene	ND	5.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	5.00	"	"	"	"	"	"	
Diethyl phthalate	ND	5.00	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	10.0	"	"	"	"	"	"	
Dimethyl phthalate	ND	5.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	25.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	10.0	"	"	"	"	"	"	
Fluoranthene	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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ecor	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

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: 08/25/00 Received: 08/29/00				
Fluorene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Hexachlorobenzene	ND	5.00	"	"	"	"	"	"	
Hexachlorobutadiene	ND	10.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	10.0	"	"	"	"	"	"	
Hexachloroethane	ND	10.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	5.00	"	"	"	"	"	"	
Isophorone	ND	5.00	"	"	"	"	"	"	
2-Methylnaphthalene	ND	5.00	"	"	"	"	"	"	
2-Methylphenol	ND	10.0	"	"	"	"	"	"	
3-,4-Methylphenol	ND	5.00	"	"	"	"	"	"	
Naphthalene	ND	5.00	"	"	"	"	"	"	
2-Nitroaniline	ND	5.00	"	"	"	"	"	"	
3-Nitroaniline	ND	10.0	"	"	"	"	"	"	
4-Nitroaniline	ND	10.0	"	"	"	"	"	"	
Nitrobenzene	ND	5.00	"	"	"	"	"	"	
itrophenol	ND	5.00	"	"	"	"	"	"	
-Nitrophenol	ND	25.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	10.0	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	5.00	"	"	"	"	"	"	
Pentachlorophenol	ND	10.0	"	"	"	"	"	"	
Phenanthrene	ND	5.00	"	"	"	"	"	"	
Phenol	ND	5.00	"	"	"	"	"	"	
Pyrene	ND	5.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
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 %*	*38-149*							
Surr: 2,4,6-Tribromophenol	*112 %*	*19-126*							

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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

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					Sampled: 08/25/00 Received: 08/29/00				
Acenaphthene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Acenaphthylene	ND	5.00	"	"	"	"	"	"	
Anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) pyrene	ND	5.00	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	5.00	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzoic Acid	ND	50.0	"	"	"	"	"	"	
Benzyl alcohol	ND	10.0	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	5.00	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	5.00	"	"	"	"	"	"	
4-Chloroaniline	ND	20.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	10.0	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	5.00	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	10.0	"	"	"	"	"	"	
2-Chloronaphthalene	ND	5.00	"	"	"	"	"	"	
2-Chlorophenol	**11.0**	5.00	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Chrysene	ND	5.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,2-Dichlorobenzene	**74.4**	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	5.00	"	"	"	"	"	"	
Diethyl phthalate	ND	5.00	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	10.0	"	"	"	"	"	"	
Dimethyl phthalate	ND	5.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	25.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	**10.1**	10.0	"	"	"	"	"	"	
Fluoranthene	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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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

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					Sampled: 08/25/00 Received: 08/29/00				
Fluorene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Hexachlorobenzene	ND	5.00	"	"	"	"	"	"	
Hexachlorobutadiene	ND	10.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	10.0	"	"	"	"	"	"	
Hexachloroethane	ND	10.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	5.00	"	"	"	"	"	"	
Isophorone	ND	5.00	"	"	"	"	"	"	
2-Methylnaphthalene	ND	5.00	"	"	"	"	"	"	
2-Methylphenol	ND	10.0	"	"	"	"	"	"	
3-,4-Methylphenol	ND	5.00	"	"	"	"	"	"	
Naphthalene	ND	5.00	"	"	"	"	"	"	
2-Nitroaniline	ND	5.00	"	"	"	"	"	"	
3-Nitroaniline	ND	10.0	"	"	"	"	"	"	
4-Nitroaniline	ND	10.0	"	"	"	"	"	"	
Nitrobenzene	ND	5.00	"	"	"	"	"	"	
itrophenol	ND	5.00	"	"	"	"	"	"	
4-Nitrophenol	ND	25.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	10.0	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	5.00	"	"	"	"	"	"	
Pentachlorophenol	ND	10.0	"	"	"	"	"	"	
Phenanthrene	ND	5.00	"	"	"	"	"	"	
Phenol	ND	5.00	"	"	"	"	"	"	
Pyrene	ND	5.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
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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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

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: 08/25/00 Received: 08/29/00				
Acenaphthene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Acenaphthylene	ND	5.00	"	"	"	"	"	"	
Anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) pyrene	ND	5.00	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	5.00	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzoic Acid	ND	50.0	"	"	"	"	"	"	
Benzyl alcohol	ND	10.0	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	5.00	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	5.00	"	"	"	"	"	"	
4-Chloroaniline	ND	20.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	10.0	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	5.00	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	10.0	"	"	"	"	"	"	
2-Chloronaphthalene	ND	5.00	"	"	"	"	"	"	
2-Chlorophenol	ND	5.00	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Chrysene	ND	5.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	5.00	"	"	"	"	"	"	
Diethyl phthalate	ND	5.00	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	10.0	"	"	"	"	"	"	
Dimethyl phthalate	ND	5.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	25.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	**22.0**	10.0	"	"	"	"	"	"	
Fluoranthene	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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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

Gasoline Hydrocarbons per NWTPH-Gx Method - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090110 - EPA 5030B										
Blank (0090110-BLK1)				Prepared & Analyzed: 09/07/00						
Gasoline Range Hydrocarbons	ND	80.0	ug/l							
Surr: 4-BFB	*45.3*		"	*50.0*		*90.6*	*50-150*			
LCS (0090110-BS1)				Prepared & Analyzed: 09/07/00						
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)		**Source: P008562-02**		Prepared & Analyzed: 09/07/00						
Gasoline Range Hydrocarbons	ND	4000	ug/l		ND				50	
Surr: 4-BFB	*44.0*		"	*50.0*		*88.0*	*50-150*			
Batch 0090138 - EPA 5030B										
Blank (0090138-BLK1)				Prepared & Analyzed: 09/08/00						
line Range Hydrocarbons	ND	80.0	ug/l							
Surr: 4-BFB	*52.4*		"	*50.0*		*105*	*50-150*			
LCS (0090138-BS1)				Prepared & Analyzed: 09/08/00						
Gasoline Range Hydrocarbons	1220	80.0	ug/l	1250		97.6	50-150			
Surr: 4-BFB	*68.8*		"	*50.0*		*138*	*50-150*			
Duplicate (0090138-DUP1)		**Source: P009036-02**		Prepared: 09/08/00 Analyzed: 09/09/00						
Gasoline Range Hydrocarbons	160	80.0	ug/l		146			9.15	50	
Surr: 4-BFB	*55.3*		"	*50.0*		*111*	*50-150*			

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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

Polychlorinated Biphenyls per EPA Method 8082 - Quality Control

North Creek Analytical - Portland

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	"							
Aroclor 1232	ND	0.500	"							
Aroclor 1242	ND	0.500	"							
Aroclor 1248	ND	0.500	"							
Aroclor 1254	ND	0.500	"							
Aroclor 1260	ND	0.500	"							
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)				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*		"	*0.500*		*73.6*	*54-128*			
LCS Dup (0080774-BSD1)				Prepared: 08/31/00 Analyzed: 09/14/00						
Aroclor 1016	5.10	0.500	ug/l	5.00		102	45-145	17.5	50	
Aroclor 1260	5.15	0.500	"	5.00		103	47-155	14.6	50	
Surr: 2,4,5,6-Tetrachloro-m-xylene	*0.456*		"	*0.500*		*91.2*	*44-119*			
Surr: Decachlorobiphenyl	*0.422*		"	*0.500*		*84.4*	*54-128*			

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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 Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090152 - EPA 5030										
Blank (0090152-BLK1)				Prepared: 09/08/00 Analyzed: 09/09/00						
Acetone	ND	10.0	ug/l							
Benzene	ND	1.00	"							
Bromobenzene	ND	1.00	"							
Bromochloromethane	ND	1.00	"							
Bromodichloromethane	ND	1.00	"							
Bromoform	ND	1.00	"							
Bromomethane	ND	5.00	"							
2-Butanone	ND	10.0	"							
n-Butylbenzene	ND	5.00	"							
sec-Butylbenzene	ND	1.00	"							
tert-Butylbenzene	ND	1.00	"							
Carbon disulfide	ND	10.0	"							
Carbon tetrachloride	ND	1.00	"							
robenzene	ND	1.00	"							
Chloroethane	ND	1.00	"							
Chloroform	ND	1.00	"							
Chloromethane	ND	5.00	"							
2-Chlorotoluene	ND	1.00	"							
4-Chlorotoluene	ND	1.00	"							
1,2-Dibromo-3-chloropropane	ND	5.00	"							
Dibromochloromethane	ND	1.00	"							
1,2-Dibromoethane	ND	1.00	"							
Dibromomethane	ND	1.00	"							
1,2-Dichlorobenzene	ND	1.00	"							
1,3-Dichlorobenzene	ND	1.00	"							
1,4-Dichlorobenzene	ND	1.00	"							
Dichlorodifluoromethane	ND	5.00	"							
1,1-Dichloroethane	ND	1.00	"							
1,2-Dichloroethane	ND	1.00	"							
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	"							
1,3-Dichloropropane	ND	1.00	"							
2,2-Dichloropropane	ND	1.00	"							
1,1-Dichloropropene	ND	1.00	"							

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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

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090152 - EPA 5030										
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	"							
Ethylbenzene	ND	1.00	"							
Hexachlorobutadiene	ND	2.00	"							
2-Hexanone	ND	10.0	"							
Isopropylbenzene	ND	2.00	"							
p-Isopropyltoluene	ND	2.00	"							
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	"							
1,1,1,2-Tetrachloroethane	ND	1.00	"							
1,1,2,2-Tetrachloroethane	ND	1.00	"							
Tetrachloroethene	ND	1.00	"							
Toluene	ND	1.00	"							
1,2,3-Trichlorobenzene	ND	1.00	"							
1,2,4-Trichlorobenzene	ND	1.00	"							
1,1,1-Trichloroethane	ND	1.00	"							
1,1,2-Trichloroethane	ND	1.00	"							
Trichloroethene	ND	1.00	"							
Trichlorofluoromethane	ND	1.00	"							
1,2,3-Trichloropropane	ND	1.00	"							
1,2,4-Trimethylbenzene	ND	1.00	"							
1,3,5-Trimethylbenzene	ND	1.00	"							
Vinyl chloride	ND	1.00	"							
o-Xylene	ND	1.00	"							
m,p-Xylene	ND	2.00	"							
Surr: 4-BFB	*21.5*		"	*20.0*		*108*	*75-125*			
Surr: 1,2-DCA-d4	*20.2*		"	*20.0*		*101*	*75-125*			
Surr: Dibromofluoromethane	*20.2*		"	*20.0*		*101*	*75-125*			
Surr: Toluene-d8	*20.1*		"	*20.0*		*101*	*75-125*			

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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 Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090152 - EPA 5030										
LCS (0090152-BS1)				Prepared: 09/08/00 Analyzed: 09/09/00						
Benzene	17.0	1.00	ug/l	20.0		85.0	80-125			
Chlorobenzene	18.4	1.00	"	20.0		92.0	80-125			
1,1-Dichloroethene	18.6	1.00	"	20.0		93.0	70-135			
Toluene	17.6	1.00	"	20.0		88.0	80-125			
Trichloroethene	15.6	1.00	"	20.0		78.0	70-130			
Surr: 4-BFB	*21.3*		"	*20.0*		*106*	*75-125*			
Surr: 1,2-DCA-d4	*20.3*		"	*20.0*		*101*	*75-125*			
Surr: Dibromofluoromethane	*20.1*		"	*20.0*		*101*	*75-125*			
Surr: Toluene-d8	*20.1*		"	*20.0*		*101*	*75-125*			
LCS Dup (0090152-BSD1)				Prepared: 09/08/00 Analyzed: 09/09/00						
Benzene	16.5	1.00	ug/l	20.0		82.5	80-125	2.99	25	
Chlorobenzene	17.9	1.00	"	20.0		89.5	80-125	2.75	25	
Dichloroethene	17.5	1.00	"	20.0		87.5	70-135	6.09	25	
luene	16.8	1.00	"	20.0		84.0	80-125	4.65	25	
Trichloroethene	14.3	1.00	"	20.0		71.5	70-130	8.70	25	
Surr: 4-BFB	*20.2*		"	*20.0*		*101*	*75-125*			
Surr: 1,2-DCA-d4	*21.1*		"	*20.0*		*106*	*75-125*			
Surr: Dibromofluoromethane	*20.6*		"	*20.0*		*103*	*75-125*			
Surr: Toluene-d8	*20.1*		"	*20.0*		*101*	*75-125*			

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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

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090018 - EPA 3510/600 Series										
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	"							
Benzo (a) anthracene	ND	5.00	"							
Benzo (a) pyrene	ND	5.00	"							
Benzo (b) fluoranthene	ND	5.00	"							
Benzo (ghi) perylene	ND	5.00	"							
Benzo (k) fluoranthene	ND	5.00	"							
Benzoic Acid	ND	50.0	"							
Benzyl alcohol	ND	10.0	"							
4-Bromophenyl phenyl ether	ND	5.00	"							
Butyl benzyl phthalate	ND	5.00	"							
4-Chloro-3-methylphenol	ND	5.00	"							
4-Chloroaniline	ND	20.0	"							
Bis(2-chloroethoxy)methane	ND	10.0	"							
Bis(2-chloroethyl)ether	ND	5.00	"							
Bis(2-chloroisopropyl)ether	ND	10.0	"							
2-Chloronaphthalene	ND	5.00	"							
2-Chlorophenol	ND	5.00	"							
4-Chlorophenyl phenyl ether	ND	5.00	"							
Chrysene	ND	5.00	"							
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	"							
1,2-Dichlorobenzene	ND	5.00	"							
1,3-Dichlorobenzene	ND	5.00	"							
1,4-Dichlorobenzene	ND	5.00	"							
3,3'-Dichlorobenzidine	ND	5.00	"							
2,4-Dichlorophenol	ND	5.00	"							
Diethyl phthalate	ND	5.00	"							
2,4-Dimethylphenol	ND	10.0	"							
Dimethyl phthalate	ND	5.00	"							
4,6-Dinitro-2-methylphenol	ND	10.0	"							
2,4-Dinitrophenol	ND	25.0	"							
2,4-Dinitrotoluene	ND	5.00	"							

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ecor	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

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090018 - EPA 3510/600 Series										
Blank (0090018-BLK1)				Prepared: 09/01/00 Analyzed: 09/05/00						
2,6-Dinitrotoluene	ND	5.00	ug/l							
Bis(2-ethylhexyl)phthalate	ND	10.0	"							
Fluoranthene	ND	5.00	"							
Fluorene	ND	5.00	"							
Hexachlorobenzene	ND	5.00	"							
Hexachlorobutadiene	ND	10.0	"							
Hexachlorocyclopentadiene	ND	10.0	"							
Hexachloroethane	ND	10.0	"							
Indeno (1,2,3-cd) pyrene	ND	5.00	"							
Isophorone	ND	5.00	"							
2-Methylnaphthalene	ND	5.00	"							
2-Methylphenol	ND	10.0	"							
3-,4-Methylphenol	ND	5.00	"							
hthalene	ND	5.00	"							
2-Nitroaniline	ND	5.00	"							
3-Nitroaniline	ND	10.0	"							
4-Nitroaniline	ND	10.0	"							
Nitrobenzene	ND	5.00	"							
2-Nitrophenol	ND	5.00	"							
4-Nitrophenol	ND	25.0	"							
N-Nitrosodi-n-propylamine	ND	10.0	"							
N-Nitrosodiphenylamine	ND	5.00	"							
Pentachlorophenol	ND	10.0	"							
Phenanthrene	ND	5.00	"							
Phenol	ND	5.00	"							
Pyrene	ND	5.00	"							
1,2,4-Trichlorobenzene	ND	5.00	"							
2,4,5-Trichlorophenol	ND	5.00	"							
2,4,6-Trichlorophenol	ND	5.00	"							
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*		"	*75.0*		*104*	*23-147*			
Surr: Phenol-d6	*60.8*		"	*150*		*40.5*	*11-130*			
Surr: p-Terphenyl-d14	*79.0*		"	*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	Project Number: 015.08716	**Reported:**
Tualatin, OR 97062	Project Manager: Joe Hunt	09/19/00 12:39

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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	"	150		81.3	40-110			
2-Chlorophenol	122	5.00	"	150		81.3	40-110			
1,4-Dichlorobenzene	55.7	5.00	"	75.0		74.3	20-90			
2,4-Dinitrotoluene	62.7	5.00	"	75.0		83.6	50-110			
4-Nitrophenol	48.5	25.0	"	150		32.3	15-100			
N-Nitrosodi-n-propylamine	59.6	10.0	"	75.0		79.5	40-110			
Pentachlorophenol	118	10.0	"	150		78.7	30-120			
Phenol	56.2	5.00	"	150		37.5	15-110			
Pyrene	56.3	5.00	"	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*		"	*75.0*		*103*	*26-135*			
Surr: 2-Fluorophenol	*91.2*		"	*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*		"	*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/l	75.0		89.2	40-110	2.73	25	
4-Chloro-3-methylphenol	128	5.00	"	150		85.3	40-110	4.80	25	
2-Chlorophenol	126	5.00	"	150		84.0	40-110	3.23	25	
1,4-Dichlorobenzene	57.0	5.00	"	75.0		76.0	20-90	2.31	35	
2,4-Dinitrotoluene	68.3	5.00	"	75.0		91.1	50-110	8.55	25	
4-Nitrophenol	54.9	25.0	"	150		36.6	15-100	12.4	35	
N-Nitrosodi-n-propylamine	63.1	10.0	"	75.0		84.1	40-110	5.70	30	
Pentachlorophenol	133	10.0	"	150		88.7	30-120	12.0	30	
Phenol	58.2	5.00	"	150		38.8	15-110	3.50	30	
Pyrene	55.5	5.00	"	75.0		74.0	40-110	1.43	25	
1,2,4-Trichlorobenzene	55.2	5.00	"	75.0		73.6	25-100	1.28	30	
Surr: 2-Fluorobiphenyl	*76.9*		"	*75.0*		*103*	*26-135*			
Surr: 2-Fluorophenol	*93.8*		"	*150*		*62.5*	*6-124*			
Surr: Nitrobenzene-d5	*74.4*		"	*75.0*		*99.2*	*23-147*			
Surr: Phenol-d6	*64.3*		"	*150*		*42.9*	*11-130*			
Surr: p-Terphenyl-d14	*69.6*		"	*75.0*		*92.8*	*38-149*			
Surr: 2,4,6-Tribromophenol	*169*		"	*150*		*113*	*19-126*			

North Creek Analytical - Portland

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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

Semivolatile Organic Compounds per EPA Method 8270C - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Batch 0090018 - EPA 3510/600 Series

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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

Conventional Chemistry Parameters per APHA/EPA Methods - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0090296 - Wet Chem										
Blank (0090296-BLK1)				Prepared & Analyzed: 09/08/00						
Total Alkalinity	ND	10.0	mg/l							
LCS (0090296-BS1)				Prepared & Analyzed: 09/08/00						
Total Alkalinity	191	10.0	mg/l	200		95.5	85-115			
Duplicate (0090296-DUP1)		**Source: P008562-01**		Prepared & Analyzed: 09/08/00						
Total Alkalinity	52.1	10.0	mg/l		52.8			1.33	20	
Batch 0090361 - Wet Chem										
Blank (0090361-BLK1)				Prepared & Analyzed: 09/14/00						
Acidity	ND	10.0	mg/l							
Duplicate (0090361-DUP1)		**Source: P008562-01**		Prepared & Analyzed: 09/14/00						
Acidity	14.4	10.0	mg/l		17.1			17.1	20	

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ɔcor 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 - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0I11019 - EPA 3005A										
Blank (0I11019-BLK1)				Prepared: 09/11/00 Analyzed: 09/12/00						
Arsenic	ND	0.00100	mg/l							
Barium	ND	0.00100	"							
Cadmium	ND	0.00100	"							
Chromium	ND	0.00100	"							
Lead	ND	0.00100	"							
Selenium	ND	0.00100	"							
Silver	ND	0.00100	"							
LCS (0I11019-BS1)				Prepared: 09/11/00 Analyzed: 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	"	0.200		99.0	80-120			
Chromium	0.196	0.00100	"	0.200		98.0	80-120			
·d	0.190	0.00100	"	0.200		95.0	80-120			
ɔnium	0.203	0.00100	"	0.200		101	80-120			
Silver	0.203	0.00100	"	0.200		101	60-140			
Matrix Spike (0I11019-MS1)		**Source: P008562-01**		Prepared: 09/11/00 Analyzed: 09/12/00						
Arsenic	0.183	0.00100	mg/l	0.200	ND	91.3	75-125			
Barium	0.209	0.00100	"	0.200	0.00362	103	75-125			
Cadmium	0.191	0.00100	"	0.200	ND	95.4	75-125			
Chromium	0.191	0.00100	"	0.200	ND	95.2	75-125			
Lead	0.198	0.00100	"	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			
Matrix Spike Dup (0I11019-MSD1)		**Source: P008562-01**		Prepared: 09/11/00 Analyzed: 09/12/00						
Arsenic	0.185	0.00100	mg/l	0.200	ND	92.3	75-125	1.09	20	
Barium	0.209	0.00100	"	0.200	0.00362	103	75-125	0	20	
Cadmium	0.195	0.00100	"	0.200	ND	97.4	75-125	2.07	20	
Chromium	0.190	0.00100	"	0.200	ND	94.7	75-125	0.525	20	
Lead	0.197	0.00100	"	0.200	ND	98.4	75-125	0.506	20	
Selenium	0.168	0.00100	"	0.200	ND	83.7	75-125	1.77	20	
Silver	0.165	0.00100	"	0.200	ND	82.0	60-140	3.57	40	

North Creek Analytical - Portland

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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

Dissolved Metals by EPA 6000/7000 Series Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0I15024 - EPA 7470A										
Blank (0I15024-BLK1)				Prepared: 09/15/00 Analyzed: 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)		Source: B0I0128-02		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)		Source: B0I0128-02		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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...ecor	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

Notes and Definitions

D-15	Detected hydrocarbons have non-petroleum peaks or elution pattern that suggests the presence of biogenic interference.
I-02	This sample was analyzed outside of the EPA recommended holding time.
Q-13	Multiple analyses indicate the percent recovery is outside the control limits due to a matrix effect.
S-07	Surrogate recovery is out of control limits. QA criteria are met when one surrogate is within control limits.
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
wet	Sample results reported on a wet weight basis
RPD	Relative Percent Difference

North Creek Analytical - Portland

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NORTH CREEK ANALYTICAL
Environmental Laboratory Services

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9.3°

CHAIN OF CUSTODY REPORT

Work Order # P008562

REPORT TO: SECOR
ATTENTION: Joe Hunt
ADDRESS: 7730 SW. Mohawk St.
Tualatin, Oregon 97062
PHONE: 503-691-2030 FAX: 503-692-7074
PROJECT NAME: Fort James Specialty Chemicals
PROJECT NUMBER: 015.08716
SAMPLED BY: DEC

INVOICE TO: same
ATTENTION:
ADDRESS:
P.O. NUMBER: NCA QUOTE #:

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: (10) Standard | 7 | 5 | 4 | 3 | 2 | 1 | Same Day
Fuels & Hydrocarbon Analyses: 5 Standard | 3-4 | 2 | 1 | Same Day
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	Analysis Request: 8260B	8270SIM	NWTPH-HCID	6010/7000	305.1/310.1	EPA 8082	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1. MW1-082500	8/25/00 1315		X	X	X	X	X	X	W	8	see below
2. MW2-082500	1237		X	X	X	X	X	X		8	
3. MW3-082500	1400		X	X	X	X	X	X		8	
4.											
5.											
6.											
7.											
8.											
9.											
10.											

RELINQUISHED BY: D. Edward Cafferty DATE: 8-29-00
PRINT NAME: D. Edward Cafferty FIRM: SECOR TIME: 1045
RELINQUISHED BY: DATE: 8-29-00
PRINT NAME: Lanny Stanley FIRM: NCA TIME:

RECEIVED BY: DATE: 8-29-
PRINT NAME: Lanny Stanley FIRM: NCA TIME: 1045
RECEIVED BY: DATE: 8-
PRINT NAME: E. Moore FIRM: NCA TIME: 1:3

ADDITIONAL REMARKS: 8270 SIM - acid/base neutral extractable SVOC's
NWTPH-HCID - quantify as gas/diesel/oil
305.1/310.1 - acidity/alkalinity
6010/7000 - field filtered

PAGE 1 OF

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

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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

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

North Creek Analytical - Portland

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;or	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

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: 11/10/00 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	"	"	"	"	"	"	
Bromobenzene	ND	1.00	"	"	"	"	"	"	
Bromochloromethane	ND	1.00	"	"	"	"	"	"	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Bromoform	ND	1.00	"	"	"	"	"	"	
Bromomethane	ND	5.00	"	"	"	"	"	"	
2-Butanone	ND	10.0	"	"	"	"	"	"	
n-Butylbenzene	ND	5.00	"	"	"	"	"	"	
sec-Butylbenzene	ND	1.00	"	"	"	"	"	"	
tert-Butylbenzene	ND	1.00	"	"	"	"	"	"	
Carbon disulfide	ND	10.0	"	"	"	"	"	"	
Carbon tetrachloride	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	**3.36**	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
;roform	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
2-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
4-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	"	
Dibromochloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dibromoethane	ND	1.00	"	"	"	"	"	"	
Dibromomethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	**8.46**	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	"	
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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

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: 11/10/00 Received: 11/13/00				
Ethylbenzene	ND	1.00	ug/l	1	EPA 8260B	11/14/00	11/14/00	0110489	
Hexachlorobutadiene	ND	2.00	"	"	"	"	"	"	
2-Hexanone	ND	10.0	"	"	"	"	"	"	
Isopropylbenzene	ND	2.00	"	"	"	"	"	"	
p-Isopropyltoluene	ND	2.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichloropropane	ND	1.00	"	"	"	"	"	"	
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	2.00	"	"	"	"	"	"	
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 %*	*75-125*							

Lisa Domenighini, Project Manager

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:or	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

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Dilution	Method	Prepared	Analyzed	Batch	Notes
W5-111000 (P0K0303-02) Water					Sampled: 11/10/00 Received: 11/13/00				
Acetone	ND	10.0	ug/l	1	EPA 8260B	11/14/00	11/14/00	0110489	
Benzene	ND	1.00	"	"	"	"	"	"	
Bromobenzene	ND	1.00	"	"	"	"	"	"	
Bromochloromethane	ND	1.00	"	"	"	"	"	"	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Bromoform	ND	1.00	"	"	"	"	"	"	
Bromomethane	ND	5.00	"	"	"	"	"	"	
2-Butanone	ND	10.0	"	"	"	"	"	"	
n-Butylbenzene	ND	5.00	"	"	"	"	"	"	
sec-Butylbenzene	ND	1.00	"	"	"	"	"	"	
tert-Butylbenzene	ND	1.00	"	"	"	"	"	"	
Carbon disulfide	ND	10.0	"	"	"	"	"	"	
Carbon tetrachloride	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
›roform	ND	1.00	"	"	"	"	"	"	
..oromethane	ND	5.00	"	"	"	"	"	"	
2-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
4-Chlorotoluene	ND	1.00	"	"	"	"	"	"	
1,2-Dibromo-3-chloropropane	ND	5.00	"	"	"	"	"	"	
Dibromochloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dibromoethane	ND	1.00	"	"	"	"	"	"	
Dibromomethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
Dichlorodifluoromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,3-Dichloropropane	ND	1.00	"	"	"	"	"	"	
2,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloropropene	ND	1.00	"	"	"	"	"	"	
cis-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
trans-1,3-Dichloropropene	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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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

Volatile Organic Compounds per EPA Method 8260B

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Dilution	Method	Prepared	Analyzed	Batch	Notes
W5-111000 (P0K0303-02) Water					Sampled: 11/10/00 Received: 11/13/00				
Hexachlorobutadiene	ND	2.00	ug/l	1	EPA 8260B	11/14/00	11/14/00	0110489	
2-Hexanone	ND	10.0	"	"	"	"	"	"	
Isopropylbenzene	ND	2.00	"	"	"	"	"	"	
p-Isopropyltoluene	ND	2.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,1,1,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2,2-Tetrachloroethane	ND	1.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,2-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Trichlorofluoromethane	ND	1.00	"	"	"	"	"	"	
1,2,3-Trichloropropane	ND	1.00	"	"	"	"	"	"	
1,2,4-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
1,3,5-Trimethylbenzene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	2.00	"	"	"	"	"	"	
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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cor	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					Sampled: 11/10/00 Received: 11/13/00				
Acenaphthene	ND	5.00	ug/l	1	EPA 8270C	11/16/00	11/20/00	0110577	
Acenaphthylene	ND	5.00	"	"	"	"	"	"	
Anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) pyrene	ND	5.00	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	5.00	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzoic Acid	ND	50.0	"	"	"	"	"	"	
Benzyl alcohol	ND	10.0	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	5.00	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	5.00	"	"	"	"	"	"	
4-Chloroaniline	ND	20.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	10.0	"	"	"	"	"	"	
(2-chloroethyl)ether	ND	5.00	"	"	"	"	"	"	
(2-chloroisopropyl)ether	ND	10.0	"	"	"	"	"	"	
2-Chloronaphthalene	ND	5.00	"	"	"	"	"	"	
2-Chlorophenol	ND	5.00	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Chrysene	ND	5.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	5.00	"	"	"	"	"	"	
Diethyl phthalate	ND	5.00	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	10.0	"	"	"	"	"	"	
Dimethyl phthalate	ND	5.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	25.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	10.0	"	"	"	"	"	"	
Fluoranthene	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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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					Sampled: 11/10/00 Received: 11/13/00				
Fluorene	ND	5.00	ug/l	1	EPA 8270C	11/16/00	11/20/00	0110577	
Hexachlorobenzene	ND	5.00	"	"	"	"	"	"	
Hexachlorobutadiene	ND	10.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	10.0	"	"	"	"	"	"	
Hexachloroethane	ND	10.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	5.00	"	"	"	"	"	"	
Isophorone	ND	5.00	"	"	"	"	"	"	
2-Methylnaphthalene	ND	5.00	"	"	"	"	"	"	
2-Methylphenol	ND	10.0	"	"	"	"	"	"	
3-,4-Methylphenol	ND	5.00	"	"	"	"	"	"	
Naphthalene	ND	5.00	"	"	"	"	"	"	
2-Nitroaniline	ND	5.00	"	"	"	"	"	"	
3-Nitroaniline	ND	10.0	"	"	"	"	"	"	
4-Nitroaniline	ND	10.0	"	"	"	"	"	"	
Nitrobenzene	ND	5.00	"	"	"	"	"	"	
2-Nitrophenol	ND	5.00	"	"	"	"	"	"	
4-Nitrophenol	ND	25.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	10.0	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	5.00	"	"	"	"	"	"	
Pentachlorophenol	ND	10.0	"	"	"	"	"	"	
Phenanthrene	ND	5.00	"	"	"	"	"	"	
Phenol	ND	5.00	"	"	"	"	"	"	
Pyrene	ND	5.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
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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:cor	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
W5-111000 (P0K0303-02) Water					Sampled: 11/10/00 Received: 11/13/00				
Acenaphthene	ND	5.00	ug/l	1	EPA 8270C	11/16/00	11/20/00	0110577	
Acenaphthylene	ND	5.00	"	"	"	"	"	"	
Anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) anthracene	ND	5.00	"	"	"	"	"	"	
Benzo (a) pyrene	ND	5.00	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	5.00	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	5.00	"	"	"	"	"	"	
Benzoic Acid	ND	50.0	"	"	"	"	"	"	
Benzyl alcohol	ND	10.0	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	5.00	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	5.00	"	"	"	"	"	"	
4-Chloroaniline	ND	20.0	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	10.0	"	"	"	"	"	"	
(2-chloroethyl)ether	ND	5.00	"	"	"	"	"	"	
(2-chloroisopropyl)ether	ND	10.0	"	"	"	"	"	"	
2-Chloronaphthalene	ND	5.00	"	"	"	"	"	"	
2-Chlorophenol	ND	5.00	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	5.00	"	"	"	"	"	"	
Chrysene	ND	5.00	"	"	"	"	"	"	
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	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	5.00	"	"	"	"	"	"	
3,3'-Dichlorobenzidine	ND	5.00	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	5.00	"	"	"	"	"	"	
Diethyl phthalate	ND	5.00	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	10.0	"	"	"	"	"	"	
Dimethyl phthalate	ND	5.00	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	10.0	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	25.0	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	5.00	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	10.0	"	"	"	"	"	"	
Fluoranthene	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Portland

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Lisa Domenighini, Project Manager

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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
W5-111000 (P0K0303-02) Water					Sampled: 11/10/00 Received: 11/13/00				
Fluorene	ND	5.00	ug/l	1	EPA 8270C	11/16/00	11/20/00	0110577	
Hexachlorobenzene	ND	5.00	"	"	"	"	"	"	
Hexachlorobutadiene	ND	10.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	10.0	"	"	"	"	"	"	
Hexachloroethane	ND	10.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	5.00	"	"	"	"	"	"	
Isophorone	ND	5.00	"	"	"	"	"	"	
2-Methylnaphthalene	ND	5.00	"	"	"	"	"	"	
2-Methylphenol	ND	10.0	"	"	"	"	"	"	
3-,4-Methylphenol	ND	5.00	"	"	"	"	"	"	
Naphthalene	ND	5.00	"	"	"	"	"	"	
2-Nitroaniline	ND	5.00	"	"	"	"	"	"	
3-Nitroaniline	ND	10.0	"	"	"	"	"	"	
4-Nitroaniline	ND	10.0	"	"	"	"	"	"	
Nitrobenzene	ND	5.00	"	"	"	"	"	"	
2-Nitrophenol	ND	5.00	"	"	"	"	"	"	
4-Nitrophenol	ND	25.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	10.0	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	5.00	"	"	"	"	"	"	
Pentachlorophenol	ND	10.0	"	"	"	"	"	"	
Phenanthrene	ND	5.00	"	"	"	"	"	"	
Phenol	ND	5.00	"	"	"	"	"	"	
Pyrene	ND	5.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
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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[illegible]or 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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0110489 - EPA 5030										
Blank (0110489-BLK1)				Prepared & Analyzed: 11/14/00						
Acetone	ND	10.0	ug/l							
Benzene	ND	1.00	"							
Bromobenzene	ND	1.00	"							
Bromochloromethane	ND	1.00	"							
Bromodichloromethane	ND	1.00	"							
Bromoform	ND	1.00	"							
Bromomethane	ND	5.00	"							
2-Butanone	ND	10.0	"							
n-Butylbenzene	ND	5.00	"							
sec-Butylbenzene	ND	1.00	"							
tert-Butylbenzene	ND	1.00	"							
Carbon disulfide	ND	10.0	"							
C[illegible]bon tetrachloride	ND	1.00	"							
[illegible]obenzene	ND	1.00	"							
Chloroethane	ND	1.00	"							
Chloroform	ND	1.00	"							
Chloromethane	ND	5.00	"							
2-Chlorotoluene	ND	1.00	"							
4-Chlorotoluene	ND	1.00	"							
1,2-Dibromo-3-chloropropane	ND	5.00	"							
Dibromochloromethane	ND	1.00	"							
1,2-Dibromoethane	ND	1.00	"							
Dibromomethane	ND	1.00	"							
1,2-Dichlorobenzene	ND	1.00	"							
1,3-Dichlorobenzene	ND	1.00	"							
1,4-Dichlorobenzene	ND	1.00	"							
Dichlorodifluoromethane	ND	5.00	"							
1,1-Dichloroethane	ND	1.00	"							
1,2-Dichloroethane	ND	1.00	"							
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	"							
1,3-Dichloropropane	ND	1.00	"							
2,2-Dichloropropane	ND	1.00	"							

North Creek Analytical - Portland

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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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0110577 - EPA 3510/600 Series										
LCS (0110577-BS1)				Prepared: 11/16/00 Analyzed: 11/20/00						
Acenaphthene	35.3	5.00	ug/l	75.0		47.1	40-110			
4-Chloro-3-methylphenol	97.5	5.00	"	150		65.0	40-110			
2-Chlorophenol	78.1	5.00	"	150		52.1	40-110			
1,4-Dichlorobenzene	12.8	5.00	"	75.0		17.1	20-90			Q-01
2,4-Dinitrotoluene	53.2	5.00	"	75.0		70.9	50-110			
4-Nitrophenol	46.8	25.0	"	150		31.2	15-100			
N-Nitrosodi-n-propylamine	39.4	10.0	"	75.0		52.5	40-110			
Pentachlorophenol	120	10.0	"	150		80.0	30-120			
Phenol	36.7	5.00	"	150		24.5	15-110			
Pyrene	53.7	5.00	"	75.0		71.6	40-110			
1,2,4-Trichlorobenzene	15.0	5.00	"	75.0		20.0	25-100			Q-01
Surr: 2-Fluorobiphenyl	*37.4*		"	*75.0*		*49.9*	*26-135*			
Surr: 2-Fluorophenol	*56.9*		"	*150*		*37.9*	*6-124*			
Surr: Nitrobenzene-d5	*37.7*		"	*75.0*		*50.3*	*23-147*			
Surr: Phenol-d6	*37.7*		"	*150*		*25.1*	*11-130*			
Surr: p-Terphenyl-d14	*64.8*		"	*75.0*		*86.4*	*38-149*			
Surr: 2,4,6-Tribromophenol	*123*		"	*150*		*82.0*	*19-126*			
LCS Dup (0110577-BSD1)				Prepared: 11/16/00 Analyzed: 11/20/00						
Acenaphthene	34.2	5.00	ug/l	75.0		45.6	40-110	3.17	25	
4-Chloro-3-methylphenol	92.6	5.00	"	150		61.7	40-110	5.16	25	
2-Chlorophenol	69.4	5.00	"	150		46.3	40-110	11.8	25	
1,4-Dichlorobenzene	9.33	5.00	"	75.0		12.4	20-90	31.4	35	Q-01
2,4-Dinitrotoluene	49.4	5.00	"	75.0		65.9	50-110	7.41	25	
4-Nitrophenol	44.3	25.0	"	150		29.5	15-100	5.49	35	
N-Nitrosodi-n-propylamine	37.1	10.0	"	75.0		49.5	40-110	6.01	30	
Pentachlorophenol	115	10.0	"	150		76.7	30-120	4.26	30	
Phenol	34.1	5.00	"	150		22.7	15-110	7.34	30	
Pyrene	51.1	5.00	"	75.0		68.1	40-110	4.96	25	
1,2,4-Trichlorobenzene	11.3	5.00	"	75.0		15.1	25-100	28.1	30	Q-01
Surr: 2-Fluorobiphenyl	*37.6*		"	*75.0*		*50.1*	*26-135*			
Surr: 2-Fluorophenol	*52.6*		"	*150*		*35.1*	*6-124*			
Surr: Nitrobenzene-d5	*33.2*		"	*75.0*		*44.3*	*23-147*			
Surr: Phenol-d6	*34.7*		"	*150*		*23.1*	*11-130*			
Surr: p-Terphenyl-d14	*60.9*		"	*75.0*		*81.2*	*38-149*			
Surr: 2,4,6-Tribromophenol	*115*		"	*150*		*76.7*	*19-126*			

North Creek Analytical - Portland

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...cor	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

Volatile Organic Compounds per EPA Method 8260B - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0110489 - EPA 5030										
LCS (0110489-BS1)				Prepared & Analyzed: 11/14/00						
Benzene	20.0	1.00	ug/l	20.0		100	80-125			
Chlorobenzene	20.0	1.00	"	20.0		100	80-125			
1,1-Dichloroethene	21.5	1.00	"	20.0		108	70-135			
Toluene	20.3	1.00	"	20.0		101	80-125			
Trichloroethene	19.5	1.00	"	20.0		97.5	70-130			
Surr: 4-BFB	*20.0*		"	*20.0*		*100*	*75-125*			
Surr: 1,2-DCA-d4	*19.6*		"	*20.0*		*98.0*	*75-125*			
Surr: Dibromofluoromethane	*18.8*		"	*20.0*		*94.0*	*75-125*			
Surr: Toluene-d8	*19.2*		"	*20.0*		*96.0*	*75-125*			
LCS Dup (0110489-BSD1)				Prepared & Analyzed: 11/14/00						
Benzene	19.0	1.00	ug/l	20.0		95.0	80-125	5.13	25	
Chlorobenzene	18.8	1.00	"	20.0		94.0	80-125	6.19	25	
...ichloroethene	20.1	1.00	"	20.0		101	70-135	6.73	25	
...uene	19.2	1.00	"	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*		"	*20.0*		*100*	*75-125*			
Surr: 1,2-DCA-d4	*19.9*		"	*20.0*		*99.5*	*75-125*			
Surr: Dibromofluoromethane	*18.5*		"	*20.0*		*92.5*	*75-125*			
Surr: Toluene-d8	*19.0*		"	*20.0*		*95.0*	*75-125*			

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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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0110577 - EPA 3510/600 Series										
Blank (0110577-BLK1)				Prepared: 11/16/00 Analyzed: 11/20/00						
Acenaphthene	ND	5.00	ug/l							
Acenaphthylene	ND	5.00	"							
Anthracene	ND	5.00	"							
Benzo (a) anthracene	ND	5.00	"							
Benzo (a) pyrene	ND	5.00	"							
Benzo (b) fluoranthene	ND	5.00	"							
Benzo (ghi) perylene	ND	5.00	"							
Benzo (k) fluoranthene	ND	5.00	"							
Benzoic Acid	ND	50.0	"							
Benzyl alcohol	ND	10.0	"							
4-Bromophenyl phenyl ether	ND	5.00	"							
Butyl benzyl phthalate	ND	5.00	"							
4-Chloro-3-methylphenol	ND	5.00	"							
4-Chloroaniline	ND	20.0	"							
Bis(2-chloroethoxy)methane	ND	10.0	"							
Bis(2-chloroethyl)ether	ND	5.00	"							
Bis(2-chloroisopropyl)ether	ND	10.0	"							
2-Chloronaphthalene	ND	5.00	"							
2-Chlorophenol	ND	5.00	"							
4-Chlorophenyl phenyl ether	ND	5.00	"							
Chrysene	ND	5.00	"							
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	"							
1,2-Dichlorobenzene	ND	5.00	"							
1,3-Dichlorobenzene	ND	5.00	"							
1,4-Dichlorobenzene	ND	5.00	"							
3,3'-Dichlorobenzidine	ND	5.00	"							
2,4-Dichlorophenol	ND	5.00	"							
Diethyl phthalate	ND	5.00	"							
2,4-Dimethylphenol	ND	10.0	"							
Dimethyl phthalate	ND	5.00	"							
4,6-Dinitro-2-methylphenol	ND	10.0	"							
2,4-Dinitrophenol	ND	25.0	"							
2,4-Dinitrotoluene	ND	5.00	"							

Lisa Domenighini, Project Manager

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..cor	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

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: 08/25/00 Received: 08/29/00				
Fluorene	ND	5.00	ug/l	1	EPA 8270C	09/01/00	09/06/00	0090018	
Hexachlorobenzene	ND	5.00	"	"	"	"	"	"	
Hexachlorobutadiene	ND	10.0	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	10.0	"	"	"	"	"	"	
Hexachloroethane	ND	10.0	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	5.00	"	"	"	"	"	"	
Isophorone	ND	5.00	"	"	"	"	"	"	
2-Methylnaphthalene	ND	5.00	"	"	"	"	"	"	
2-Methylphenol	ND	10.0	"	"	"	"	"	"	
3-,4-Methylphenol	ND	5.00	"	"	"	"	"	"	
Naphthalene	ND	5.00	"	"	"	"	"	"	
2-Nitroaniline	ND	5.00	"	"	"	"	"	"	
3-Nitroaniline	ND	10.0	"	"	"	"	"	"	
4-Nitroaniline	ND	10.0	"	"	"	"	"	"	
Nitrobenzene	ND	5.00	"	"	"	"	"	"	
trophenol	ND	5.00	"	"	"	"	"	"	
4-Nitrophenol	ND	25.0	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	10.0	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	5.00	"	"	"	"	"	"	
Pentachlorophenol	ND	10.0	"	"	"	"	"	"	
Phenanthrene	ND	5.00	"	"	"	"	"	"	
Phenol	ND	5.00	"	"	"	"	"	"	
Pyrene	ND	5.00	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	5.00	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	5.00	"	"	"	"	"	"	
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*							

North Creek Analytical - Portland

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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

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					Sampled: 08/25/00 Received: 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: 08/25/00 Received: 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	"	"	EPA 310.1	09/08/00	09/08/00	0090296	
MW3 (P008562-03) Water					Sampled: 08/25/00 Received: 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	"	"	EPA 310.1	09/08/00	09/08/00	0090296	

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

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;or	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

Dissolved Metals by EPA 6000/7000 Series Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Method	Prepared	Analyzed	Batch	Notes
MW1 (P008562-01) Water					Sampled: 08/25/00 Received: 08/29/00				
Arsenic	ND	0.00100	mg/l	1	EPA 6020	09/11/00	09/12/00	0I11019	
Barium	**0.00362**	0.00100	"	"	"	"	"	"	
Cadmium	ND	0.00100	"	"	"	"	"	"	
Chromium	ND	0.00100	"	"	"	"	"	"	
Lead	ND	0.00100	"	"	"	"	"	"	
Mercury	ND	0.00125	"	"	EPA 7470A	09/15/00	09/18/00	0I15024	
Selenium	ND	0.00100	"	"	EPA 6020	09/11/00	09/12/00	0I11019	
Silver	ND	0.00100	"	"	"	"	"	"	
MW2 (P008562-02) Water					Sampled: 08/25/00 Received: 08/29/00				
Arsenic	**0.00268**	0.00100	mg/l	1	EPA 6020	09/11/00	09/12/00	0I11019	
Barium	**0.0625**	0.00100	"	"	"	"	"	"	
Cadmium	ND	0.00100	"	"	"	"	"	"	
Chromium	**0.00344**	0.00100	"	"	"	"	"	"	
Lead	**0.00367**	0.00100	"	"	"	"	"	"	
;ury	ND	0.00125	"	"	EPA 7470A	09/15/00	09/18/00	0I15024	
Selenium	ND	0.00100	"	"	EPA 6020	09/11/00	09/12/00	0I11019	
Silver	**0.00133**	0.00100	"	"	"	"	"	"	
MW3 (P008562-03) Water					Sampled: 08/25/00 Received: 08/29/00				
Arsenic	ND	0.00100	mg/l	1	EPA 6020	09/11/00	09/12/00	0I11019	
Barium	**0.00777**	0.00100	"	"	"	"	"	"	
Cadmium	ND	0.00100	"	"	"	"	"	"	
Chromium	ND	0.00100	"	"	"	"	"	"	
Lead	ND	0.00100	"	"	"	"	"	"	
Mercury	ND	0.00100	"	"	EPA 7470A	09/15/00	09/18/00	0I15024	
Selenium	ND	0.00100	"	"	EPA 6020	09/11/00	09/12/00	0I11019	
Silver	ND	0.00100	"	"	"	"	"	"	

North Creek Analytical - Portland

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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

Hydrocarbon Identification per NW TPH Methodology - Quality Control

North Creek Analytical - Portland

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	"							
Heavy Oil Range Hydrocarbons	ND	0.315	"							
Surr: 1-Chlorooctadecane	*DET*		"	*0.100*		*97.0*	*50-150*			

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cor	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 - Quality Control

North Creek Analytical - Portland

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Batch 0110577 - EPA 3510/600 Series

Lisa Domenighini, Project Manager

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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

Notes and Definitions

Q-01	The spike recovery, and/or RPD, for this QC sample is outside of established control limits. Review of associated batch QC indicates the recovery for this analyte does not represent an out-of-control condition for the batch.
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
wet	Sample results reported on a wet weight basis
RPD	Relative Percent Difference

NORTH CREEK ANALYTICAL
Environmental Laboratory Services

18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508 (425) 420-9200 FAX 420-9210
East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 (509) 924-9200 FAX 924-9290
9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 906-9200 FAX 906-9210

1.4°

CHAIN OF CUSTODY REPORT

Work Order # POK0303

REPORT TO: SECOR	INVOICE TO:
ATTENTION: Joe Hunt	ATTENTION:
ADDRESS: 7730 SW. Mohawk St. Tualatin, Oregon 97062	ADDRESS:
PHONE: 503-691-2030 FAX: 503-692-7074	P.O. NUMBER: NCA QUOTE #:
PROJECT NAME: Fort James Specialty Chemicals	
PROJECT NUMBER: 015-08716	
SAMPLED BY: DEC	

TURNAROUND REQUEST in Business Days *

Organic & Inorganic Analyses: (10) Standard | 7 | 5 | 4 | 3 | 2 | 1 | Same Day

Fuels & Hydrocarbon Analyses: (5) Standard | 3-4 | 2 | 1 | Same Day

OTHER Specify:

* Turnaround Requests less than standard may incur Rush Charges.

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	Analysis Request: EPA 8260B	EPA 8270C	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1.	W4 - 111000	11/10/00 1310		X	X	W	4	See remarks
2.	W5 - 111000	11/10/00 1245		X	X	W	4	See remarks
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

RELINQUISHED BY: D. Edward Caffery DATE: 11-13-00
PRINT NAME: D. Edward Caffery FIRM: SECOR TIME: 1100

RECEIVED BY: DATE:
PRINT NAME: Gary Spangler FIRM: NCA TIME: 1100

RELINQUISHED BY: DATE: 11-13-00
PRINT NAME: Gary Spangler FIRM: NCA TIME:

RECEIVED BY: DATE: 11-13-00
PRINT NAME: Sarah Passarge FIRM: NCA TIME: 1310

ADDITIONAL REMARKS: VOC's and acid/base neutral extractable SVOC's