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Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-01	NW-MW-01	NW-MW-01I	NW-MW-01S	NW-MW-02	NW-MW-02	NW-MW-03
	Sample ID	09011060992	09012060992	09012111991	09011111991	09021111991	09021060992	09031111991
	Sample Date	06/10/1992	06/10/1992	11/19/1991	11/19/1991	11/19/1991	06/10/1992	11/19/1991
	Sample Time							
	Sample Depth	0.0'	0.0'	20.50' - 30.5	8.10' - 18.10	7.20' - 17.20	7.20' - 17.20	7.50' - 17.50
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM
	Lab. Number	920297-14	920297-13	910646-11	910646-12	910646-13	920297-15	910646-14
Constituent	Units							
Depth to Water	FT							
Water Elevation	FT							
Date Organics Analyzed	-							
Vinyl Acetate	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
Carbon Disulfide	µg/l							
Carbon Tetrachloride	µg/l							
1,1,1,2-Tetrachloroethane	µg/l							
1,1,2,2-Tetrachloroethane	µg/l							
1,2-Dichloroethane	µg/l							
1,1-Dichloroethylene	µg/l	<5 U	<5 U	<5 U	<5 U	5	18	<5 U
Vinyl Chloride	µg/l			<10 U	<10 U	<10 U		<10 U
Tetrachloroethylene	µg/l							
Trichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l							
Dichlorodifluoromethane	µg/l							
Bromoform	µg/l							
Chloroform	µg/l							
Propylene Dichloride	µg/l							
Xylenes	µg/l							

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-03	NW-MW-04	NW-MW-04	NW-MW-05	NW-MW-05	NW-MW-05	NW-MW-06
	Sample ID	09031060992	09041111991	09041060992	09051111991	09051060992	1009545	1004998
	Sample Date	06/10/1992	11/19/1991	06/10/1992	11/19/1991	06/10/1992	12/21/1995	12/23/1994
	Sample Time						16:30	10:10
	Sample Depth	7.50' - 17.50	8.10' - 18.10	8.10' - 18.10	14.40' - 24.4	14.40' - 24.4	14.40' - 24.4	0.0'
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	AEL	AEL
	Lab. Number	920297-16	910646-15	920297-17	910646-16	920297-18	AEL95014161	AEL94011703
Constituent	Units							
Depth to Water	FT						15.85	12.00
Water Elevation	FT						22.88	-12.00
Date Organics Analyzed	-						12/26/1995	01/04/1995
Vinyl Acetate	µg/L							<400
Acrylonitrile	µg/L							<1000
Benzene	µg/l							<400 N1
Carbon Disulfide	µg/l							<400
Carbon Tetrachloride	µg/l							<400
1,1,1,2-Tetrachloroethane	µg/l							<400
1,1,2,2-Tetrachloroethane	µg/l							<400
1,2-Dichloroethane	µg/l							<400
1,1-Dichloroethylene	µg/l	<5 U	<5 U	<5 U	5	<5 U	1.3	<400
Vinyl Chloride	µg/l		<10 U		<10 U			<400
Tetrachloroethylene	µg/l							
Trichloroethylene	µg/l							<400
Bromomethane	µg/l							<400
Bromodichloromethane	µg/l							<400
Dichlorodifluoromethane	µg/l							<400
Bromoform	µg/l							
Chloroform	µg/l							<400
Propylene Dichloride	µg/l							<400
Xylenes	µg/l							

Notes: 1. Only Exceedances Shown
2. P[illegible] on 09/05/01

Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-06	NW-MW-06	NW-MW-07	NW-MW-08	SW-MW-01	SW-MW-01	SW-MW-01
	Sample ID	1009547	1009548	1009546	NW-MW-08	31390112650	31391022648	30291053015
	Sample Date	12/21/1995	12/21/1995	12/21/1995	05/31/1995	11/26/1990	02/26/1991	05/30/1991
	Sample Time	16:50	16:55	16:25	:	12:25	14:25	09:41
	Sample Depth	0.0'	0.0'	0.0'	9.0'	3.0' - 18.0'	3.0' - 18.0'	3.0' - 18.0'
	Laboratory	AEL	AEL	AEL	AEL	M&E?	M&E?	AEL
	Lab. Number	AEL95014163	AEL95014164	AEL95014162	AEL95005896	31390112650	28928508	289-28-1366
Constituent	Units							
Depth to Water	FT	11.02	11.02	7.5		1.29	1.00	1.80
Water Elevation	FT	-11.02	-11.02	-7.50		17.17	17.46	16.66
Date Organics Analyzed	-	12/29/1995	12/28/1995	12/26/1995	06/13/1995			
Vinyl Acetate	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l				530	<1000 U		<250 U
Carbon Disulfide	µg/l					<5000 U		
Carbon Tetrachloride	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
1,1,1,2-Tetrachloroethane	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
1,1,2,2-Tetrachloroethane	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
1,2-Dichloroethane	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
1,1-Dichloroethylene	µg/l	<50	<50	50		<1000 U	<50 U	<250 U
Vinyl Chloride	µg/l	<50	<50	130		<1000 U	<100 U	<500 U
Tetrachloroethylene	µg/l							
Trichloroethylene	µg/l			600		<1000 U		<250 U
Bromomethane	µg/l					<1000 U	<500 U	<250 U
Bromodichloromethane	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
Dichlorodifluoromethane	µg/l	<50	<50			<1000 U	<50 U	<500 U
Bromoform	µg/l					<1000 U		
Chloroform	µg/l					<1000 U		
Propylene Dichloride	µg/l	<50	<50	<25		<1000 U	<50 U	<250 U
Xylenes	µg/l					22000		

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-02	SW-MW-02	SW-MW-03	SW-MW-10	SW-MW-10	SW-MW-9	SW-MW-A2
	Sample ID	31391022647	30291053018	31391022645	08101111991	08101060992	08091111991	31390083142
	Sample Date	02/26/1991	05/30/1991	02/26/1991	11/19/1991	06/10/1992	11/19/1991	08/31/1990
	Sample Time	14:12	09:32	13:50				13:28
	Sample Depth	3.00' - 18.00	3.00' - 18.00	3.00' - 18.00	4.50' - 14.50	4.50' - 14.50	5.00' - 15.00	0.7' - 10.6'
	Laboratory	M&E?	AEL	M&E?	CEIM	CEIM	CEIM	M&E?
	Lab. Number	28928505	289-28-1370	28928503	910646-20	920297-27	910646-19	31390083142
Constituent	Units							
Depth to Water	FT	13.35	15.09	15.83				5.60
Water Elevation	FT	3.72	1.98	5.75				25.57
Date Organics Analyzed	-							
Vinyl Acetate	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							269.0
Carbon Disulfide	µg/l							
Carbon Tetrachloride	µg/l			<100 U				
1,1,1,2-Tetrachloroethane	µg/l			<100 U				
1,1,2,2-Tetrachloroethane	µg/l			<100 U				
1,2-Dichloroethane	µg/l			<100 U				
1,1-Dichloroethylene	µg/l	<2.5 U	<5 U	<100 U	<5 U	<5 U	<5 U	
Vinyl Chloride	µg/l	<5 U	<5 U	<200 U	<10 U		<10 U	
Tetrachloroethylene	µg/l							
Trichloroethylene	µg/l							
Bromomethane	µg/l			<1000 U				
Bromodichloromethane	µg/l			<100 U				
Dichlorodifluoromethane	µg/l			<100 U				
Bromoform	µg/l							
Chloroform	µg/l							
Propylene Dichloride	µg/l			<100 U				
Xylenes	µg/l							

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-A2	SW-MW-B2	SW-MW-B2	SW-MW-C4	SW-MW-D2	SW-MW-D2	SW-MW-E08
	Sample ID	31390112651	31390112759	30291053021	31390112652	31390112653	30291053020	31390112654
	Sample Date	11/26/1990	11/27/1990	05/30/1991	11/26/1990	11/26/1990	05/30/1991	11/26/1990
	Sample Time	13:58	10:40	10:14	13:40	14:15	11:27	14:15
	Sample Depth	0.7' - 10.6'	2.50' - 12.50	2.50' - 12.50	-0.5' - 9.5'	1.0' - 10.0'	1.0' - 10.0'	-0.5' - 9.50'
	Laboratory	M&E?	M&E?	AEL	M&E?	M&E?	AEL	M&E?
	Lab. Number	31390112651	31390112759	289-28-1371	31390112652	31390112653	289-28-1369	31390112654
Constituent	Units							
Depth to Water	FT	6.01	8.93	9.30	6.04	8.05	8.15	6.40
Water Elevation	FT	25.16	22.79	22.42	24.84	22.75	22.65	-6.40
Date Organics Analyzed	-							
Vinyl Acetate	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
Carbon Disulfide	µg/l	<250 U	<1000 U					
Carbon Tetrachloride	µg/l	<50 U	<100 U					
1,1,1,2-Tetrachloroethane	µg/l	<50 U	<100 U					
1,1,2,2-Tetrachloroethane	µg/l	<50 U	3136					
1,2-Dichloroethane	µg/l	<50 U	<100 U					
1,1-Dichloroethylene	µg/l	<50 U	<100 U	<5 U	<10 U	<10 U	<5 U	<5 U
Vinyl Chloride	µg/l	<50 U	<100 U	<10 U	<10 U	<10 U	<5 U	<5 U
Tetrachloroethylene	µg/l		3136					
Trichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l	<50 U	<100 U					
Dichlorodifluoromethane	µg/l	<50 U	<100 U					
Bromoform	µg/l							
Chloroform	µg/l							
Propylene Dichloride	µg/l	<50 U	<100 U					
Xylenes	µg/l							

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2. Printed on 09/05/01

Table E14
EXCEEDANCES OF P & W VCAP RISK-BASED LIMITS BASED ON RESIDENTIAL AIR INHALATION
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-F3	SW-MW-F3	SW-MW-G2	SW-MW-H4			
	Sample ID	31390112655	31391022759	31390112656	31390112657			
	Sample Date	11/26/1990	02/27/1991	11/26/1990	11/26/1990			
	Sample Time	15:15	13:00	13:05	13:07			
	Sample Depth	6.00' - 16.00	6.00' - 16.00	2.00' - 12.00	-1.0' - 9.00'			
	Laboratory	M&E?	M&E?	M&E?	M&E?			
	Lab. Number	31390112655	28928518	31390112656	31390112657			
Constituent	Units							
Depth to Water	FT	10.67	10.80	6.64	4.79			
Water Elevation	FT	21.48	21.35	26.32	26.48			
Date Organics Analyzed	-							
Vinyl Acetate	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
Carbon Disulfide	µg/l			<250 U				
Carbon Tetrachloride	µg/l		<50 U	<50 U	<20 U			
1,1,1,2-Tetrachloroethane	µg/l		<50 U	<50 U	<20 U			
1,1,2,2-Tetrachloroethane	µg/l		<50 U	<50 U				
1,2-Dichloroethane	µg/l		<50 U	<50 U				
1,1-Dichloroethylene	µg/l	<10 U	<50 U	<50 U	<20 U			
Vinyl Chloride	µg/l	<10 U	<100 U	<50 U	<20 U			
Tetrachloroethylene	µg/l							
Trichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l		<50 U	<50 U				
Dichlorodifluoromethane	µg/l		<100 U	<50 U				
Bromoform	µg/l							
Chloroform	µg/l							
Propylene Dichloride	µg/l		<50 U	<50 U	<20 U			
Xylenes	µg/l							

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-01	NW-MW-01	NW-MW-01I	NW-MW-01S	NW-MW-02	NW-MW-02	NW-MW-03
	Sample ID	09011060992	09012060992	09012111991	09011111991	09021111991	09021060992	09031111991
	Sample Date	06/10/1992	06/10/1992	11/19/1991	11/19/1991	11/19/1991	06/10/1992	11/19/1991
	Sample Time							
	Sample Depth	0.0'	0.0'	20.50' - 30.5	8.10' - 18.10	7.20' - 17.20	7.20' - 17.20	7.50' - 17.50
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM
	Lab. Number	920297-14	920297-13	910646-11	910646-12	910646-13	920297-15	910646-14
Constituent	Units							
Depth to Water	FT							
Water Elevation	FT							
Date Organics Analyzed	-							
Arsenic	mg/l	<.005 U	<.005 U	<.005 U	<.005 U	<.005 U	<.005 U	<.005 U
Cadmium	mg/l	<.01 U	<.01 U				<.01 U	
Mercury	mg/l	<.0008 U	<.0008 U	<.0008 U	<.0008 U	<.0008 U	<.0008 U	<.0008 U
Silver	mg/l			<.02 U	<.02 U	<.02 U		<.02 U
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l							
Carbon Tetrachloride	µg/l							
1,1,1,2-Tetrachloroethane	µg/l							
1,1,2,2-Tetrachloroethane	µg/l							
1,1-Dichloroethane	µg/l							
Chloroethane	µg/l							
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l							
cis-1,2-Dichloroethylene	µg/L							
Tetrachloroethylene	µg/l							
trans-1,2-Dichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l							
Dichlorodifluoromethane	µg/l							
Fluorotrichloromethane	µg/l							

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-01	NW-MW-01	NW-MW-01I	NW-MW-01S	NW-MW-02	NW-MW-02	NW-MW-03
	Sample ID	09011060992	09012060992	09012111991	09011111991	09021111991	09021060992	09031111991
	Sample Date	06/10/1992	06/10/1992	11/19/1991	11/19/1991	11/19/1991	06/10/1992	11/19/1991
	Sample Time							
	Sample Depth	0.0'	0.0'	20.50' - 30.5	8.10' - 18.10	7.20' - 17.20	7.20' - 17.20	7.50' - 17.50
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM	CEIM
	Lab. Number	920297-14	920297-13	910646-11	910646-12	910646-13	920297-15	910646-14
Constituent	Units							
Methyl Isobutyl Ketone	µg/l							
1,2,3-Trichloropropane	µg/l							
Propylene Dichloride	µg/l							
Styrene	µg/L							
m-Xylene	µg/l							
Xylene-o	µg/l							
p-Xylene	µg/l							
Xylenes	µg/l							

Notes: 1. Only Exceedances Shown
2. Print[illegible] on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-03	NW-MW-04	NW-MW-04	NW-MW-05	NW-MW-05	NW-MW-06	NW-MW-06
	Sample ID	09031060992	09041111991	09041060992	09051111991	09051060992	1004998	1009547
	Sample Date	06/10/1992	11/19/1991	06/10/1992	11/19/1991	06/10/1992	12/23/1994	12/21/1995
	Sample Time						10:10	16:50
	Sample Depth	7.50' - 17.50	8.10' - 18.10	8.10' - 18.10	14.40' - 24.4	14.40' - 24.4	0.0'	0.0'
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	AEL	AEL
	Lab. Number	920297-16	910646-15	920297-17	910646-16	920297-18	AEL94011703	AEL95014163
Constituent	Units							
Depth to Water	FT						12.00	11.02
Water Elevation	FT						-12.00	-11.02
Date Organics Analyzed	-						01/04/1995	12/29/1995
Arsenic	mg/l	<.005 U	<.005 U	<.005 U	<.005 U	<.005 U		
Cadmium	mg/l	<.01 U		<.01 U		<.01 U		
Mercury	mg/l	<.0008 U	<.0008 U	<.0008 U	<.0008 U	<.0008 U		
Silver	mg/l		<.02 U		<.02 U			
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L						<400	
Acetone	µg/L						<2000	
Acrylonitrile	µg/L						<1000	
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l						<400	
Carbon Tetrachloride	µg/l						<400	
1,1,1,2-Tetrachloroethane	µg/l						<400	<50
1,1,2,2-Tetrachloroethane	µg/l						<400	
1,1-Dichloroethane	µg/l						<400	
Chloroethane	µg/l						<400	
Methyl-tert-butyl Ether	µg/L						<400 N1	
1,1-Dichloroethylene	µg/l						<400	
cis-1,2-Dichloroethylene	µg/L						<400	
Tetrachloroethylene	µg/l						<400	
trans-1,2-Dichloroethylene	µg/l				54		<400	
Bromomethane	µg/l						<400	
Bromodichloromethane	µg/l						<400	
Dichlorodifluoromethane	µg/l						<400	
Fluorotrichloromethane	µg/l						<400	

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-03	NW-MW-04	NW-MW-04	NW-MW-05	NW-MW-05	NW-MW-06	NW-MW-06
	Sample ID	09031060992	09041111991	09041060992	09051111991	09051060992	1004998	1009547
	Sample Date	06/10/1992	11/19/1991	06/10/1992	11/19/1991	06/10/1992	12/23/1994	12/21/1995
	Sample Time						10:10	16:50
	Sample Depth	7.50' - 17.50	8.10' - 18.10	8.10' - 18.10	14.40' - 24.4	14.40' - 24.4	0.0'	0.0'
	Laboratory	CEIM	CEIM	CEIM	CEIM	CEIM	AEL	AEL
	Lab. Number	920297-16	910646-15	920297-17	910646-16	920297-18	AEL94011703	AEL95014163
Constituent	Units							
Methyl Isobutyl Ketone	µg/l						<1000	
1,2,3-Trichloropropane	µg/l						<400	
Propylene Dichloride	µg/l						<400	
Styrene	µg/L						<400	
m-Xylene	µg/l							
Xylene-o	µg/l							
p-Xylene	µg/l							
Xylenes	µg/l						7100	360

Notes: 1. Only Exceedances Shown
2. Prin' ' on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-06	NW-MW-07	NW-MW-09	NW-MW-10	SW-MW-01	SW-MW-01	SW-MW-01
	Sample ID	1009548	1009546	NW-MW-09	NW-MW-10	31390083139	31390112650	31391022648
	Sample Date	12/21/1995	12/21/1995	05/31/1995	05/31/1995	08/31/1990	11/26/1990	02/26/1991
	Sample Time	16:55	16:25	:	:	11:05	12:25	14:25
	Sample Depth	0.0'	0.0'	12.0' - 22.0'	12.0' - 22.0'	3.0' - 18.0'	3.0' - 18.0'	3.0' - 18.0'
	Laboratory	AEL	AEL	AEL	AEL	M&E?	M&E?	M&E?
	Lab. Number	AEL95014164	AEL95014162	AEL95005897	AEL95005898	31390083139	31390112650	28928508
Constituent	Units							
Depth to Water	FT	11.02	7.5			1.67	1.29	1.00
Water Elevation	FT	-11.02	-7.50			16.79	17.17	17.46
Date Organics Analyzed	-	12/28/1995	12/26/1995	06/12/1995	06/12/1995			
Arsenic	mg/l							
Cadmium	mg/l							
Mercury	mg/l							
Silver	mg/l							
bis(2-Chloroethoxy)methane	µg/l						<1000 U	
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l						<1000 U	
2-Butanone	µg/l						<5000 U	
Carbon Disulfide	µg/l						<5000 U	
Carbon Tetrachloride	µg/l						<1000 U	
1,1,1,2-Tetrachloroethane	µg/l	<50	<25				<1000 U	<50 U
1,1,2,2-Tetrachloroethane	µg/l						<1000 U	
1,1-Dichloroethane	µg/l						<1000 U	
Chloroethane	µg/l						<1000 U	
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l						<1000 U	
cis-1,2-Dichloroethylene	µg/L		700					
Tetrachloroethylene	µg/l						<1000 U	
trans-1,2-Dichloroethylene	µg/l						<1000 U	
Bromomethane	µg/l						<1000 U	<500 U
Bromodichloromethane	µg/l						<1000 U	
Dichlorodifluoromethane	µg/l						<1000 U	
Fluorotrichloromethane	µg/l						<1000 U	

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	NW-MW-06	NW-MW-07	NW-MW-09	NW-MW-10	SW-MW-01	SW-MW-01	SW-MW-01
	Sample ID	1009548	1009546	NW-MW-09	NW-MW-10	31390083139	31390112650	31391022648
	Sample Date	12/21/1995	12/21/1995	05/31/1995	05/31/1995	08/31/1990	11/26/1990	02/26/1991
	Sample Time	16:55	16:25	:	:	11:05	12:25	14:25
	Sample Depth	0.0'	0.0'	12.0' - 22.0'	12.0' - 22.0'	3.0' - 18.0'	3.0' - 18.0'	3.0' - 18.0'
	Laboratory	AEL	AEL	AEL	AEL	M&E?	M&E?	M&E?
	Lab. Number	AEL95014164	AEL95014162	AEL95005897	AEL95005898	31390083139	31390112650	28928508
Constituent	Units							
Methyl Isobutyl Ketone	µg/l						<5000 U	
1,2,3-Trichloropropane	µg/l						<1000 U	
Propylene Dichloride	µg/l						<1000 U	
Styrene	µg/L							
m-Xylene	µg/l							
Xylene-o	µg/l					97.0		
p-Xylene	µg/l							
Xylenes	µg/l	550		310	91		22000	

Notes: 1. Only Exceedances Shown
2. Pri[illegible] 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-01	SW-MW-03	SW-MW-10	SW-MW-10	SW-MW-9	SW-MW-9	SW-MW-A2
	Sample ID	30291053015	31391022645	08101111991	08101060992	08091111991	08091060992	31390083142
	Sample Date	05/30/1991	02/26/1991	11/19/1991	06/10/1992	11/19/1991	06/10/1992	08/31/1990
	Sample Time	09:41	13:50					13:28
	Sample Depth	3.0' - 18.0'	3.00' - 18.00	4.50' - 14.50	4.50' - 14.50	5.00' - 15.00	5.00' - 15.00	0.7' - 10.6'
	Laboratory	AEL	M&E?	CEIM	CEIM	CEIM	CEIM	M&E?
	Lab. Number	289-28-1366	28928503	910646-20	920297-27	910646-19	920297-26	31390083142
Constituent	Units							
Depth to Water	FT	1.80	15.83					5.60
Water Elevation	FT	16.66	5.75					25.57
Date Organics Analyzed	-							
Arsenic	mg/l			<.005 U	<.005 U	<.005 U	<.005 U	
Cadmium	mg/l				<.01 U		<.01 U	
Mercury	mg/l			<.0008 U	<.0008 U	<.0008 U	<.0008 U	
Silver	mg/l			<.02 U		<.02 U		
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l							
Carbon Tetrachloride	µg/l	<250 U						
1,1,1,2-Tetrachloroethane	µg/l	<250 U	<100 U					
1,1,2,2-Tetrachloroethane	µg/l	<250 U						
1,1-Dichloroethane	µg/l	<250 U	<100 U					
Chloroethane	µg/l	<250 U						
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l	<250 U	<100 U					
cis-1,2-Dichloroethylene	µg/L							
Tetrachloroethylene	µg/l	<250 U	<100 U					
trans-1,2-Dichloroethylene	µg/l	<250 U	<100 U					
Bromomethane	µg/l	<250 U	<1000 U					
Bromodichloromethane	µg/l	<250 U	<100 U					
Dichlorodifluoromethane	µg/l	<500 U	<100 U					
Fluorotrichloromethane	µg/l	<250 U	<100 U					

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-01	SW-MW-03	SW-MW-10	SW-MW-10	SW-MW-9	SW-MW-9	SW-MW-A2
	Sample ID	30291053015	31391022645	08101111991	08101060992	08091111991	08091060992	31390083142
	Sample Date	05/30/1991	02/26/1991	11/19/1991	06/10/1992	11/19/1991	06/10/1992	08/31/1990
	Sample Time	09:41	13:50					13:28
	Sample Depth	3.0' - 18.0'	3.00' - 18.00	4.50' - 14.50	4.50' - 14.50	5.00' - 15.00	5.00' - 15.00	0.7' - 10.6'
	Laboratory	AEL	M&E?	CEIM	CEIM	CEIM	CEIM	M&E?
	Lab. Number	289-28-1366	28928503	910646-20	920297-27	910646-19	920297-26	31390083142
Constituent	Units							
Methyl Isobutyl Ketone	µg/l	<250 U	<100 U					
1,2,3-Trichloropropane	µg/l	<250 U	<100 U					
Propylene Dichloride	µg/l	<250 U	<100 U					
Styrene	µg/L							
m-Xylene	µg/l							1076.0
Xylene-o	µg/l							897.0
p-Xylene	µg/l							1076.0
Xylenes	µg/l	<250 U	<100 U					

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-A2	SW-MW-A2	SW-MW-B2	SW-MW-C4	SW-MW-C4	SW-MW-D2	SW-MW-D2
	Sample ID	31390112651	31391022757	31390112759	31390112652	31391022752	31390112653	30291053020
	Sample Date	11/26/1990	02/27/1991	11/27/1990	11/26/1990	02/27/1991	11/26/1990	05/30/1991
	Sample Time	13:58	12:25	10:40	13:40	11:05	14:15	11:27
	Sample Depth	0.7' - 10.6'	0.7' - 10.6'	2.50' - 12.50	-0.5' - 9.5'	-0.5' - 9.5'	1.0' - 10.0'	1.0' - 10.0'
	Laboratory	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?	AEL
	Lab. Number	31390112651	28928516	31390112759	31390112652	28928511	31390112653	289-28-1369
Constituent	Units							
Depth to Water	FT	6.01	6.05	8.93	6.04	6.09	8.05	8.15
Water Elevation	FT	25.16	25.12	22.79	24.84	24.79	22.75	22.65
Date Organics Analyzed	-							
Arsenic	mg/l							
Cadmium	mg/l							
Mercury	mg/l							
Silver	mg/l							
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l	<250 U		<1000 U				
Carbon Tetrachloride	µg/l							
1,1,1,2-Tetrachloroethane	µg/l	<50 U		<100 U				
1,1,2,2-Tetrachloroethane	µg/l			3136				
1,1-Dichloroethane	µg/l			<100 U				
Chloroethane	µg/l							
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l			<100 U				
cis-1,2-Dichloroethylene	µg/L							
Tetrachloroethylene	µg/l			3136				
trans-1,2-Dichloroethylene	µg/l			<100 U				
Bromomethane	µg/l							
Bromodichloromethane	µg/l			<100 U				
Dichlorodifluoromethane	µg/l			<100 U				
Fluorotrichloromethane	µg/l			<100 U				

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-A2	SW-MW-A2	SW-MW-B2	SW-MW-C4	SW-MW-C4	SW-MW-D2	SW-MW-D2
	Sample ID	31390112651	31391022757	31390112759	31390112652	31391022752	31390112653	30291053020
	Sample Date	11/26/1990	02/27/1991	11/27/1990	11/26/1990	02/27/1991	11/26/1990	05/30/1991
	Sample Time	13:58	12:25	10:40	13:40	11:05	14:15	11:27
	Sample Depth	0.7' - 10.6'	0.7' - 10.6'	2.50' - 12.50	-0.5' - 9.5'	-0.5' - 9.5'	1.0' - 10.0'	1.0' - 10.0'
	Laboratory	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?	AEL
	Lab. Number	31390112651	28928516	31390112759	31390112652	28928511	31390112653	289-28-1369
Constituent	Units							
Methyl Isobutyl Ketone	µg/l	<250 U	340	<1000 U				
1,2,3-Trichloropropane	µg/l			<100 U				
Propylene Dichloride	µg/l			<100 U				
Styrene	µg/L							
m-Xylene	µg/l							
Xylene-o	µg/l							
p-Xylene	µg/l							
Xylenes	µg/l	3754	2700	<200 U	448	420	130	72

Notes: 1. Only Exceedances Shown
2. Prir[illegible]n 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-E05	SW-MW-F3	SW-MW-G2	SW-MW-G2	SW-MW-G2	SW-MW-H4	SW-MW-H4
	Sample ID	31390090563	31391022759	31390083140	31390112656	31391022758	31390083141	31390112657
	Sample Date	09/05/1990	02/27/1991	08/31/1990	11/26/1990	02/27/1991	08/31/1990	11/26/1990
	Sample Time	15:33	13:00	12:50	13:05	12:30	12:50	13:07
	Sample Depth	2.00' - 12.00	6.00' - 16.00	2.00' - 12.00	2.00' - 12.00	2.00' - 12.00	-1.0' - 9.00'	-1.0' - 9.00'
	Laboratory	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?
	Lab. Number	31390090563	28928518	31390083140	31390112656	28928517	31390083141	31390112657
Constituent	Units							
Depth to Water	FT	7.39	10.80	6.15	6.64	6.64	4.42	4.79
Water Elevation	FT	-7.39	21.35	26.81	26.32	26.32	26.85	26.48
Date Organics Analyzed	-							
Arsenic	mg/l							
Cadmium	mg/l							
Mercury	mg/l							
Silver	mg/l							
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l				<250 U			<100 U
Carbon Tetrachloride	µg/l							
1,1,1,2-Tetrachloroethane	µg/l		<50 U		<50 U			<20 U
1,1,2,2-Tetrachloroethane	µg/l							
1,1-Dichloroethane	µg/l							
Chloroethane	µg/l							
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l							
cis-1,2-Dichloroethylene	µg/L							
Tetrachloroethylene	µg/l							
trans-1,2-Dichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l							
Dichlorodifluoromethane	µg/l		<100 U					
Fluorotrichloromethane	µg/l							

Notes: 1. Only Exceedances Shown
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Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-E05	SW-MW-F3	SW-MW-G2	SW-MW-G2	SW-MW-G2	SW-MW-H4	SW-MW-H4
	Sample ID	31390090563	31391022759	31390083140	31390112656	31391022758	31390083141	31390112657
	Sample Date	09/05/1990	02/27/1991	08/31/1990	11/26/1990	02/27/1991	08/31/1990	11/26/1990
	Sample Time	15:33	13:00	12:50	13:05	12:30	12:50	13:07
	Sample Depth	2.00' - 12.00	6.00' - 16.00	2.00' - 12.00	2.00' - 12.00	2.00' - 12.00	-1.0' - 9.00'	-1.0' - 9.00'
	Laboratory	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?	M&E?
	Lab. Number	31390090563	28928518	31390083140	31390112656	28928517	31390083141	31390112657
Constituent	Units							
Methyl Isobutyl Ketone	µg/l		<100 U		<250 U			<100 U
1,2,3-Trichloropropane	µg/l							
Propylene Dichloride	µg/l							
Styrene	µg/L							
m-Xylene	µg/l	417.0		1082.0			1419.0	
Xylene-o	µg/l	299.0		606.0			467.0	
p-Xylene	µg/l	417.0		1082.0			1419.0	
Xylenes	µg/l				4908	3200		6073

Notes: 1. Only Exceedances Shown
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Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-H4						
	Sample ID	31391022756						
	Sample Date	02/27/1991						
	Sample Time	12:10						
	Sample Depth	-1.0' - 9.00'						
	Laboratory	M&E?						
	Lab. Number	28928515						
Constituent	Units							
Depth to Water	FT	4.65						
Water Elevation	FT	26.62						
Date Organics Analyzed	-							
Arsenic	mg/l							
Cadmium	mg/l							
Mercury	mg/l							
Silver	mg/l							
bis(2-Chloroethoxy)methane	µg/l							
Vinyl Acetate	µg/L							
Acetone	µg/L							
Acrylonitrile	µg/L							
Benzene	µg/l							
2-Butanone	µg/l							
Carbon Disulfide	µg/l							
Carbon Tetrachloride	µg/l							
1,1,1,2-Tetrachloroethane	µg/l							
1,1,2,2-Tetrachloroethane	µg/l							
1,1-Dichloroethane	µg/l							
Chloroethane	µg/l							
Methyl-tert-butyl Ether	µg/L							
1,1-Dichloroethylene	µg/l							
cis-1,2-Dichloroethylene	µg/L							
Tetrachloroethylene	µg/l							
trans-1,2-Dichloroethylene	µg/l							
Bromomethane	µg/l							
Bromodichloromethane	µg/l							
Dichlorodifluoromethane	µg/l							
Fluorotrichloromethane	µg/l							

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

Table E15
EXCEEDANCES OF P & W VCAP RISK-BASED GW LIMITS BASED ON CT SURFACE WATER
Pratt & Whitney, Pent Road, East Hartford, CT (Willgoos) - historic groundwater sampling

	Location ID	SW-MW-H4						
	Sample ID	31391022756						
	Sample Date	02/27/1991						
	Sample Time	12:10						
	Sample Depth	-1.0' - 9.00'						
	Laboratory	M&E?						
	Lab. Number	28928515						
Constituent	Units							
Methyl Isobutyl Ketone	µg/l	86						
1,2,3-Trichloropropane	µg/l							
Propylene Dichloride	µg/l							
Styrene	µg/L							
m-Xylene	µg/l							
Xylene-o	µg/l							
p-Xylene	µg/l							
Xylenes	µg/l	2400						

Notes: 1. Only Exceedances Shown
2. Printed on 09/05/01

LIST OF QUALIFIERS

Organic Qualifiers

A	Tentatively Identified Compound (TIC) is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentation exceeds the calibration range of the instrument
J	Estimated value
N	Presumptive evidence of a compound (TOCs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is < contract required detection limit CRDL, but > instrument detection limit II
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

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Facility Name: Pratt & Whitney (Pent Road)

Phase Classification: R-13

Document Title: Environmental Indicator (EI) Determination, Migration of Contaminated Groundwater Under Control (CA750YE) - Pratt & Whitney (Pent Road) [Part 2 of 2]

Date of Document: 01-06-2003

Document Type: EI Determination

Purpose of Target Sheet:

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Comments: Drawing E1, Sheet 1 of 1: Areas of Observed LNAPL

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Memorandum

Gradient CORPORATION

To: David Fiereck, Loureiro **Date:** September 4, 2002

From: Richard Blanchet

Subject: Surface Water Levels for the Protection of Human Health and the Environment for cis-1,2-dichloroethylene, isobutyl alcohol, proprionitrile, and methacrylonitrile

This memorandum presents the rationale for the derivation of surface water levels for the protection of human health and the environment for the following four chemicals: cis-1,2-dichloroethylene (CAS # 156-59-2), isobutyl alcohol (CAS # 78-83-1), proprionitrile (CAS # 107-12-0), and methacrylonitrile (CAS # 126-98-7).

Because National Ambient Water Quality Criteria (NAWQC) for the protection of human health are not available for these chemicals, USEPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA, 2000) was used to derive surface water levels for the protection of human health for two potential exposure pathways: fish ingestion only and combined fish and water ingestion.

For the protection of aquatic receptors, *Proposed Water Quality Guidance for the Great Lakes System* (USEPA, 1993), as described in Suter and Tsao (1996), was used to derive Tier II surface water levels for the protection of the environment. The Tier II method was established so that aquatic benchmarks could be derived with fewer data than are required for NAWQC. Tier II values are concentrations that would be expected to be higher than the NAWQC in no more than 20% of cases. The Tier II values equivalent to the NAWQC Final Acute Values (FAV) and Final Chronic Values (FCV) are the Secondary Acute Values (SAV) and Secondary Chronic Values (SCV), respectively.

Surface Water Levels for the Protection of Human Health

The *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA, 2000) was used to develop surface water levels for the protection of human health.

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USEPA intends to use this guidance both to develop new AWQC for additional pollutants and to revise existing AWQC. In the absence of established standards, the guidance document provides scientifically valid options for developing criteria in the absence of established standards. This guidance was used to derive surface water levels for the protection of human health for cis-1,2-dichloroethylene, isobutyl alcohol, proprionitrile, and methacrylonitrile using the following equation based on noncancer effects (potential exposures to these chemicals can elicit a noncarcinogenic effect; these chemical are not classifiable as to their carcinogenicity based on a lack of data for humans or equivocal data in animals):

$$SWL = RfD \times RSC \times \left(\frac{BW}{DI + \sum FI \times BAF} \right),$$

where:

SWL	=	Surface water level (mg/L) for the protection of human health
RfD	=	Reference dose for noncancer effects (mg/kg-d)
RSC	=	Relative source contribution factor to account for non-water sources of exposure
BW	=	Human body weight (default = 70 kg for adults)
DI	=	Drinking water intake (default 2L/day for adults)
FI	=	Fish intake (default for total intake = 0.0175 kg/day for general adult population)
BAF	=	Bioaccumulation factor, lipid normalized (L/kg)

Based on the AWQC guidance, surface water levels for the protection of human health are designed to minimize the risk of adverse effects from a lifetime of exposure through ingestion of drinking water and the consumption of fish obtained from surface waters. Each of the parameters shown above in the equation is briefly described below.

Currently available toxicity criteria were obtained from USEPA's Integrated Risk Information System (IRIS) for isobutyl alcohol and methacrylonitrile (USEPA, 2002). Because no toxicity criteria were available on IRIS for cis-1,2-dichloroethelyne, a reference dose (RfD) was obtained from USEPA's Health Effects Assessment Summary Tables (HEAST), a precursor to IRIS (USEPA, 1997). No toxicity criteria are available for proprionitrile in both IRIS and HEAST. Based on information contained in the Hazardous Substance Data Base (HSDB, 2002) and in Cohrsseen (2001), the relative toxicity of proprionitrile is similar to acetonitrile, a related compound in the nitrile class of compounds. A toxicity criteria is available on IRIS for acetonitrile, and this information was used to derive an AWQC. As mentioned above, potential exposures to these chemicals are associated with noncarcinogenic health effect; however, these chemicals are not classifiable as to their carcinogenicity in humans based on a lack

of data for human or equivocal data in animals (USEPA, 2002). Table 1 presents the reference doses (RfD) used to derive surface water levels for the protection of human health.

The purpose of the relative source contribution (RSC) is to ensure that the level of a chemical allowed by a criterion when combined with other identified sources of exposure common to the population of concern, will not result in exposures that exceed the RfD. Because there is a paucity of information to characterize exposure, a conservative default assumption of 20% of the RfD is used here to derive the surface water levels for the protection of human health (USEPA, 2000).

USEPA recommends maintaining the default body weight at 70 kg for deriving AWQC as a representative value for both male and female adults (USEPA, 2000). Exposure factors specific to adults are recommended to protect against effects from long-term exposures since the four chemicals of interest here are not generally associated with reproductive and/or development effects (USEPA, 2002, HSDB, 2002); thus, no adjustment of fish intake rates for children 1-14 years of age or pregnant women is recommended in the development of the surface water levels for the protection of human health (USEPA, 2000).

USEPA recommends maintaining the default drinking water intake rate of 2 L/day to protect most consumers from chemicals in water (USEPA, 2000). USEPA believes this assumption is representative of the majority of the population over the course of a lifetime.

USEPA recommends a fish intake rate of 0.0175 kg/day to adequately protect the general population of fish consumers (USEPA, 2000). This value represents the 90th percentile for the general adult population and sport fishers from the 1994-1996 Continuing Survey of Food Intake by Individuals (CSFII) conducted by the US Department of Agriculture. This value also represents the uncooked weight intake of fish. As mentioned above, the four chemicals of interest here are not generally associated with reproductive and/or development effects (USEPA, 2002, HSDB, 2002); thus, no adjustment of fish intake rates for children 1-14 years of age or pregnant women is recommended (USEPA, 2000).

Bioaccumulation is defined as the accumulation of certain chemicals in aquatic organism tissues when exposed to these chemicals through water, diet, and other sources. The magnitude of bioaccumulation varies widely depending on the chemical's physical and chemicals characteristics. To account for the bioaccumulation of chemicals in fish, USEPA recommends the use of a bioaccumulation

factor (BAF) when deriving AWQC (USEPA, 2000). A BAF is the ratio (in L/kg) that relates the concentration of a chemical in the environment to levels in fish tissue. Of the four different BAFs methods recommended by USEPA to derive AWQC (*i.e.*, measured BAF from a field study, BAF predicted from BSAF, BAF predicted from laboratory measured bioconcentration factor (BCF), or BAF predicted from a chemical's octanol-water partition coefficient (K_{ow})), the K_{ow} method was used to predict the BAF used in the derivation of surface water levels for the protection of human health based on the following (USEPA, 2000):

- Kow has been extensively correlated with BCF for organic chemicals that are poorly metabolized by aquatic organisms;
- Chemicals of interest exhibiting low hydrophobicity, *i.e.*, not a likely to partition into lipids or organic carbon (Log K_{ow} < 4; Table 1); thus non-aqueous exposure to these chemicals is not likely to be important in determining chemical residues in aquatic organisms;

The general equation for deriving the BAF is as follows:

$$BAF = FCM \times K_{ow}$$

where:

BAF	=	Bioaccumulation factor (L/kg)
FCM	=	Food chain multiplier
Kow	=	Octanol-water partition coefficient (L/kg)

Because biomagnification is not an overriding concern for these organic chemicals with low hydrophobicity (*i.e.*, log Kow < 4.0), food chain multipliers are not used in the above equation for deriving the BAF (USEPA, 2000). Thus the above equation can be reduced to the following:

$$BAF = K_{ow}$$

Table 1
Physical and Toxicological Properties for the Chemicals of Interest

Chemical	Log Kow (L/kg)	RfD (mg/kg-d)
cis-1,2-Dichloroethylene	1.86	0.01
Isobutyl alcohol	0.76	0.3
Proprionitrile	0.16	0.017*
Methacrylonitrile	0.68	0.0001

** Based on inhalation RfD for acetonitrile.*

Table 7 below presents the surface water levels for the protection of human health based on ingestion of fish only and fish and water ingestion.

Tier II Secondary Acute and Chronic Surface Water Levels for the Protection of the Environment

Data used to derive the Tier II Secondary Acute (SAV) and Chronic (SCV) Surface Water Levels for the Protection of the Environment for isobutyl alcohol and proprionitrile were obtained from the most recent update (March 20, 2002) of the Aquatic Toxicity Information Retrieval (AQUIRE) data base maintained by USEPA (AQUIRE, 2002). Because there was no toxicity information available for methacrylonitrile in the AQUIRE data base, a surrogate benchmark was derived using information for acrylonitrile. Acrylonitrile was selected because of the general similarity in toxicological properties (although acrylonitrile is more toxic than methacrylonitrile) and physical and chemical parameters between the two chemicals. Finally, Tier II SAV and SCV for the Protection of the Environment for cis-1,2-dichloroethylene were obtained from Suter and Tsao (1996) based on the values derived for 1,2-dichloroethylene using the methodology to derive Tier II water quality criteria. Tables 2 to 5 present the data used to derive the Tier II SAV and SCV for the Protection of the Environment for 1,2-dichloroethylene, isobutyl alcohol, proprionitrile, and acrylonitrile.

Methodology

Acute data obtained from the AQUIRE data base for isobutyl alcohol, proprionitrile, and acrylonitrile were screened against the following USEPA-recommended criteria to select the most appropriate and acceptable data for the derivation of SAVs and SCVs (Stephan *et al.*, 1985):

1. Single cell organisms and brine shrimp (Artemia sp.) were not used.
2. Fish were limited to species with wild North American populations.
3. Exposure periods were 96 hours in duration, except daphnids and midges, where 48 hours is the standard exposure period.
4. Endpoint for daphnids and midges is the effective concentration for 50% of the test population (EC50) for immobilization. If EC50 not available, the lethal concentration to 50% of the test population (LC50) is used.
5. Endpoint for fish is the EC50 for loss of equilibrium, immobilization, and/or mortality. If not available, the LC50 is used.
6. High acute values were excluded if the acute values within a species or among species in a genus differed by a factor of 10 or more.

Tier II surface water levels are derived if fewer than eight of the acute data requirements or three chronic data requirements presented in USEPA (1993) are met. The eight acute data requirements are:

1. The family *Salmonidae* in the class *Osteichthyes*.
2. One other family(preferably a commercial or recreational important species) in the class *Osteichthyes* (*i.e.*, bluegill).
3. A third family in the phylum *Chordata* (*e.g.*, fish, amphibian).
4. A planktonic crustacean (*e.g.*, cladocceran, copepod).
5. A benthic crustacean (*e.g.*, ostracod, isopod, amphipod).
6. An insect (*e.g.*, mayfly, dragonfly, damselfly,stonefly, caddisfly).
7. A family in a phylum other than *Arthropoda* or *Chordata* (*e.g.*, *Rotifera*, *Annelida*, *Mollusca*, *Gastropoda*)
8. A family in any order of insect or any phylum not already represented.

The first calculation of the Tier II surface water levels is the SAV. The SAV is estimated by taking the lowest genus mean acute value (GMAV) for any of the genera present and dividing it by the Final Acute Value Factor (FAVF). The FAVF is selected from Table 6 below based on the number of the eight acute data requirements that are satisfied. The FAVFs are selected depending whether an acute value for a daphnid is included in the data set.

Table 6
Factors for Deriving the FAVF

# of Acute Requirements Met	Factor for data sets that include an acute value for a daphnid	Factor for data sets that do not include an acute value for a daphnid
1	20.5	242
2	13.2	64.8
3	8.6	36.2
4	6.5	20.1
5	5	12.9
6	4	9.2
7	3.6	7.2

Once the SAV is calculated, the Secondary Acute-Chronic Ratio (SACR) is derived. The SACR is the geometric mean of three or more Acute-Chronic Ratios (ACRs). There must be at least three ACRs. An ACR is the ratio of the GMAV over the geometric mean chronic value for a particular species. If chronic values (*i.e.*, chronic animal tests) are not available in the literature, then a default value of 17.9 is used until the total number of ACRs is three. If no ACRs are given in the data base for a

specific compound, then the SACR is by default 17.9. The final calculation for Tier II surface water levels is the derivation of an SCV. The SCV is estimated by dividing the SAV by the SACR.

The toxicological information obtained from the AQUIRE data base for isobutyl alcohol, proprionitrile, acrylonitrile, and 1,2-dichloroethylene (reprinted from Suter and Tsao, 1996) was compared to the six acute screening criteria listed earlier. The resulting information used to derive the SAVs and SCVs are presented in Tables 2 to 5.

Table 7 below presents the Surface Water Levels for the Protection of Human Health and the Environment.

Table 7
Summary of Surface Water Levels for the Protection of Human Health and the Environment

	Human Health Criteria			Ecological Criteria	
Chemical	Ingestion of Fish Only (μg/L)	Ingestion of Fish and Water (ug/L)	Chemical	Secondary Acute Value SAV (ug/L)	Secondary Chronic Value SCV (ug/L)
cis-1,2-dichloroethene	110	42.8	cis-1,2-dichloroethene (b)	1100	590
isobutyl alcohol	42850	2000	isobutyl alcohol	305600	1700
proprionitrile (a)	9714	117	proprionitrile	6280	350
methacrylonitrile	16.7	0.67	methacrylonitrile (c)	1440	300

(a) Based on RfD for acetonitrile
(b) Based on 1,2-dichloroethylene
(c) Based on acrylonitrile

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Table 2
Data and Calculated Results for the Derivation of Tier II Surface Water Levels for the Protection of the Environment for 1,2-Dichloroethylene

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio
Lepomis macrochirus	Bluegill	2	LC50	140	140	
Daphnia magna	Water flea	4	LC50	220	220	
				Lowest GMAV	**140**	

Source: Suter and Tsao, 1996

Tier II Parameters	Tier II Values	
FAVF	13.2	Obtained from Table 1based on # of acute requirements met
SAV (mg/L)	**10.61**	Lowest GMAV/FAVF
SACR	17.9	Geomean of the ACR; use 17.9 as default
SCV (mg/L)	**0.59**	SAV/SACR

Table 3
Data and Calculated Results for the Derivation of Tier II Surface Water Levels for the Protection of the Environment for Isobutyl Alcohol

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio
Carassius auratus	goldfish	3	LC50	2032		
Carassius auratus	goldfish	3	LC50	2030	2031	
Ceriodaphnia reticulata	water flea	4	EC50	1200	1200	
Daphnia magna	water flea	4	EC50	1112		
Daphnia magna	water flea	4	EC50	1300		
Daphnia magna	water flea	4	EC50	1439		
Daphnia magna	water flea	4	LC50	1190		
Daphnia magna	water flea	4	LC50	1030	1214.2	
Daphnia pulex	water flea	4	EC50	1100	1100	
Gambusia affinitis	mosquitofish	3	LC50	1800	1800	
Ictalurus punctatus	channel catfish	2	LC50	1460	1460	
Lepomis macrochirus	bluegill	2	LC50	1600	1600	
Oncorhynchus mykiss	rainbow trout	1	LC50	1326	1326	
Orconectes immunis	crayfish	5	LC50	2137		
Orconectes immunis	crayfish	5	LC50	949	1543	
Rana catesbeiana	bullfrog	7	LC50	3020		
Rana catesbeiana	bullfrog	7	LC50	3010		
Rana catesbeiana	bullfrog	7	LC50	3030	3020	
Tanytarsus dissimilis	midge	6	LC50	2137		
Tanytarsus dissimilis	midge	6	LC50	2190		
Tanytarsus dissimilis	midge	6	LC50	2090	2139	
Pimephales promelas	fathead minnow	3	LC50	1430		
Pimephales promelas	fathead minnow	3	LC50	1510	1470	
				Lowest GMAV	**1100**	

Source: AQUIRE, 2002

Tier II Parameters	Tier II Values	
FAVF	3.6	Obtained from Table 1based on # of acute requirements met
SAV (mg/L)	**305.56**	Lowest GMAV/FAVF
SACR	17.9	Geomean of the ACR; use 17.9 as default
SCV (mg/L)	**17.070**	SAV/SACR

Table 4
Data and Calculated Results for the Derivation of Tier II Surface Water Levels for the Protection of the Environment for Proprionitrile

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio
Pimephales promelas	Fathead minnow	3	LC50	1520	1520	
				Lowest GMAV	**1520**	

Source: AQUIRE, 2002

Tier II Parameters	Tier II Values	
FAVF	242	Obtained from Table 1based on # of acute requirements met
SAV (mg/L)	**6.28**	Lowest GMAV/FAVF
SACR	17.9	Geomean of the ACR; use 17.9 as default
SCV (mg/L)	**0.35**	SAV/SACR

Table 5
Data and Calculated Results for the Derivation of Tier II Surface Water Levels for the Protection of the Environment for Acrylonitrile

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio	
Americamysis bahia	Opossum shrimp	5	LC50	5.8	5.8		
Bufo bufo gargarizans	Toad	8	LC50	11.94			
Bufo bufo gargarizans	Toad	8	LC50	11.26	11.6		
Bufo bufo gargarizans	Toad		CV	3.2		3.6	
Chironomus	Midge	6	EC50	9.45			
Chironomus	Midge	6	EC50	21.36	15.4		
Ctenopharyngodon idella	Carp	3	LC50	4.96			
Ctenopharyngodon idella	Carp	3	LC50	5.38	5.2		4
							1
Cyprinus carpio	Carp	3	LC50	18.1			
Cyprinus carpio	Carp	3	LC50	21.36	19.7		
Danio rerio	Zebra danio	7	LC50	25	25.0		2.8
							0.71
Daphnia magna	Water flea	4	EC50	10.95			0.7
Daphnia magna	Water flea	4	EC50	10.25			
Daphnia magna	Water flea	4	EC50	7.38			2
Daphnia magna	Water flea	4	LC50	7.6			
Daphnia magna	Water flea	4	LC50	10	9.2	7.9	
Daphnia magna	Water flea		CV	4			
Daphnia magna	Water flea		CV	1			
Daphnia magna	Water flea		CV	1			
Daphnia magna	Water flea		CV	1			
Daphnia magna	Water flea		CV	2.8			
Daphnia magna	Water flea		CV	2.8			
Daphnia magna	Water flea		CV	0.7			
Daphnia magna	Water flea		CV	0.7			
Daphnia magna	Water flea		CV	0.7			
Daphnia magna	Water flea		CV	2			
Daphnia magna	Water flea		CV	2			
Daphnia magna	Water flea		CV	2			
Daphnia magna	Water flea		CV	0.5			
Daphnia magna	Water flea		CV	0.5			
Daphnia magna	Water flea		CV	0.5			
							2
Lepomis macrochirus	Bluegill	2	LC50	10			0.5
Lepomis macrochirus	Bluegill	2	LC50	23.6			

Table 5
Data and Calculated Results for the Derivation of Tier II Surface Water Levels for the Protection of the Environment for Acrylonitrile

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio	
Lepomis macrochirus	Bluegill	2	LC50	9.3			0.5
Lepomis macrochirus	Bluegill	2	LC50	11.8	13.7		1.2
Limnodrilus hoffmeisteri	Tubificid worm, Oligochaete	7	EC50	18.87			
Limnodrilus hoffmeisteri	Tubificid worm, Oligochaete	7	EC50	17.88	18.4		
Pimephales promelas	Fathead minnow	3	LC50	34			
Pimephales promelas	Fathead minnow	3	LC50	8.4			
Pimephales promelas	Fathead minnow	3	LC50	6.9			
Pimephales promelas	Fathead minnow	3	LC50	5.2			
Pimephales promelas	Fathead minnow	3	LC50	4.2			
Pimephales promelas	Fathead minnow	3	LC50	8.1			
Pimephales promelas	Fathead minnow	3	LC50	10.1			
Pimephales promelas	Fathead minnow	3	LC50	18.1			
Pimephales promelas	Fathead minnow	3	LC50	14.3	12.1	2.9	
Pimephales promelas	Fathead minnow		CV	6.9			
Pimephales promelas	Fathead minnow		CV	6.9			
Pimephales promelas	Fathead minnow		CV	6.9			
Pimephales promelas	Fathead minnow		CV	6.9			
Pimephales promelas	Fathead minnow		CV	6.9			
Poecilia reticulata	Guppy	3	LC50	33.5	33.5		
Radix plicatula	Mollusk	7	EC50	25.7	25.7		
				Lowest GMAV	**5.2**		

Source: AQUIRE, 2002

Tier II Parameters	Tier II Values	
FAVF	3.6	Obtained from Table 1based on # of acute requirements met
SAV (mg/L)	**1.44**	Lowest GMAV/FAVF
SACR	4.4	Geomean of the ACR; use 17.9 as default
SCV (mg/L)	**0.326**	SAV/SACR

Memorandum

Gradient CORPORATION

To: David Fiereck, Loureiro **Date:** September 17, 2002

From: Richard Blanchet

Subject: Surface Water Levels for the Protection of Human Health and the Environment for Dichlorodifluoromethane (CAS# 75-71-8)

This memorandum briefly presents the derivation of surface water levels for the protection of human health and the environment for dichlorodifluoromethane (CAS# 75-71-8). A more detailed description of these two approaches can be found in the Gradient memorandum dated September 4, 2002.

Because national AWQC for the protection of human health are not available for dichlorodifluoromethane, USEPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA, 2000) was used to derive surface water levels for the protection of human health for two potential exposure pathways: fish ingestion only and combined fish and water ingestion. For the protection of aquatic receptors, *Proposed Water Quality Guidance for the Great Lakes System* (USEPA, 1993), as described in Suter and Tsao (1996), was used to derive Tier II surface water levels for the protection of the environment.

Surface Water Levels for the Protection of Human Health

The *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA, 2000) was used to develop surface water levels for the protection of human health for dichlorodifluoromethane using the following equation based on noncancer effects:

$$SWL = RfD \times RSC \times \left(\frac{BW}{DI + \sum FI \times BAF} \right),$$

where:

SWL	=	Surface water level (mg/L) for the protection of human health
RfD	=	Reference dose for noncancer effects (0.2 mg/kg-day; USEPA, 2002)
RSC	=	Relative source contribution factor to account for non-water sources of exposure (20%; USEPA, 2000)
BW	=	Human body weight (default = 70 kg for adults; USEPA, 2000)

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DI	=	Drinking water intake (default 2L/day for adults; USEPA, 2000)
FI	=	Fish intake (default for total intake = 0.0175 kg/day for general adult population; USEPA, 2000)
BAF	=	Bioaccumulation factor, lipid normalized (145 L/kg)

The K_{ow} method was used to predict the BAF used in the derivation of surface water levels for the protection of human health based on the following (USEPA, 2000):

- K_{ow} has been extensively correlated with BCF for organic chemicals that are poorly metabolized by aquatic organisms;
- Dichlorodifluoromethane exhibits low hydrophobicity (log K_{ow} < 4), *i.e.*, not likely to partition into lipids or organic carbon (log K_{ow} for dichlorodifluoromethane is equal to 2.16); thus non-aqueous exposure to this chemical is not likely to be important in determining chemical residues in aquatic organisms;

The general equation for deriving the BAF is as follows:

$$BAF = FCM \times K_{ow}$$

where:

BAF	=	Bioaccumulation factor (L/kg)
FCM	=	Food chain multiplier
Kow	=	Octanol-water partition coefficient (L/kg)

Because biomagnification is not an overriding concern for dichlorodifluoromethane with low hydrophobicity (*i.e.*, log Kow < 4.0), food chain multipliers are not used in the above equation for deriving the BAF (USEPA, 2000). Thus, the above equation can be reduced to the following:

$$BAF = K_{ow}$$

Table 1 below presents the surface water levels for the protection of human health.

Table 1
Surface Water Levels for the Protection of Human Health

Chemical	Ingestion of Fish Only (µg/L)	Ingestion of Fish and Water (µg/L)
Dichlorodifluoromethane	1,100	616

Tier II Secondary Acute and Chronic Surface Water Levels for the Protection of the Environment

Data used to derive the Tier II Secondary Acute (SAV) and Chronic (SCV) Surface Water Levels for the Protection of the Environment for dichlorodifluoromethane were obtained from a material safety data sheet from Dupont (Dupont, 1996). There was no toxicity information available for this chemical on the Aquatic Toxicity Information Retrieval (AQUIRE) data base maintained by USEPA (AQUIRE, 2002). Table 2 presents the data used to derive the Tier II Secondary Acute and Chronic Surface Water Levels for the Protection of the Environment for dichlorodifluoromethane.

The first calculation of the Tier II values is the SAV. The SAV is estimated by taking the lowest genus mean acute value (GMAV) for any of the genera present and dividing it by the Final Acute Value Factor (FAVF). The FAVF is selected from Table 3 below based on the number of acute data requirements that are satisfied. The FAVF is selected depending whether an acute value for a daphnid is included in the data set.

Table 3
Factors for Deriving the FAVF

# of Acute Requirements Met	Factor for data sets that include an acute value for a daphnid	Factor for data sets that do not include an acute value for a daphnid
1	20.5	242
2	13.2	64.8
3	8.6	36.2
4	6.5	20.1
5	5	12.9
6	4	9.2
7	3.6	7.2

Once the SAV is calculated, the Secondary Acute-Chronic Ratio (SACR) is derived. The SACR is the geometric mean of three or more Acute-Chronic Ratios (ACRs). If no ACRs are given in the data base for a specific compound, then the SACR is by default 17.9. The final calculation for Tier II values is the derivation of an SCV. The SCV is estimated by dividing the SAV by the SACR.

Table 4 below presents the Tier II Secondary Acute and Chronic Surface Water Levels for the Protection of the Environment.

Table 4
Tier II Secondary Acute and Chronic
Surface Water Levels for the Protection of the Environment

Chemical	Secondary Acute Value SAV (ug/L)	Secondary Chronic Value SCV (ug/L)
Dichlorodifluoromethane	4,630	260

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Table 2

Data and Calculated Results for the Derivation of Tier II Secondary Acute and Chronic Surface Water Levels for the Protection of the Environment for Dichlorodifluoromethane

Scientific Name (genus/species)	Common Name	Requirement	Endpoint	Concentration (mg/L)	GMAV	A-C Ratio
Daphnia magna	Water flea	4	EC50	95	95	
				Lowest GMAV	**95**	

Source: AQUIRE, 2002

Tier II Parameters	Tier II Values	
FAVF	20.5	Obtained from Table 3 based on # of acute requirements met
SAV (mg/L)	**4.63**	Lowest GMAV/FAVF
SACR	17.9	Geomean of the ACR; use 17.9 as default
SCV (mg/L)	**0.26**	SAV/SACR