

CEI2 : THE CHEMICAL EXPOSURE INDEX CALCULATION SYSTEM

Reference: "Chemical Exposure Index Guide" - Second Edition, September-1993
Corporate Safety and Loss Prevention, The Dow Chemical Company

Plant or Project Name: CA2

Prepared By: STEVE TEDESCHI

Location: PLAQUEMINE

Date Prepared: 10/26/94

Plant Superintendent or Manager: GRETCHEN LEBLANC

Reviewed By: BUCK BAILEY

Site Review Representative: STEVE TEDESCHI

Date Reviewed: 10/31/94

I. CASE DATA

Case Number

Release Scenario

Chemical Name

Release Scenario Description

**EMERGENCY RESPONSE PLANNING
GUIDELINES (ERPG) VALUES**

Dow IHG (ppm)

ACGIH TLV-TWA (ppm)

STEL (ppm)

ERPG-1 (ppm)

ERPG-2 (ppm)

ERPG-3 (ppm)

PLANT DATA

Total Quantity in Plant, (lb)

Largest Single Containment, (lb)

Pressure of Containment, (psig)

DISTANCES TO (feet):

1. Public

2. Other in-company facility

3. Non-company plant or business

PHYSICAL PROPERTIES

Operating Temperature of Liquid, Ts (°F)

Molecular Weight, MW

Normal Boiling Point of Liquid, Tb (°F)

Vapor Pressure at Ts, P_{vap} (psia)

Liquid Density at Ts, Rho (lb/ft³)

Heat Capacity, Cp (Btu/lb/°F)

Heat of Vaporization, Hv (Btu/lb)

II. AIRBORNE QUANTITY ESTIMATION

Liquid System Inventory, (gal)

1	2
Liquid Release - Pipe/Vessel/Hose	Liquid Release - Pipe/Vessel/Hose
Chlorine	Chlorine
T-35 DEVELOPES 2" HOLE IN BOTTOM OF TANK; 10'	4" TRANSFER LINE (XS PIPESIZE) DEVELOPES 2" DIA. HOLE; NO
-	-
-	-
-	-
1	1
3	3
20	20
300000	300000
250000	55000
6	170
675	675
375	375
1310	1310
-10.0	-10.0
70.9	70.9
-29.3	-29.3
20.892	20.892
95.89	95.89
0.216	0.216
120.96	120.96
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1. FROM A RELIEF DEVICE or OTHER
Input Release Rate (lb/min)
2. FROM A GAS RELEASE
Gauge Pressure, Pg (psig)
Diameter of Hole, D (in)
3. FROM A LIQUID RELEASE (PIPE/VESSEL, HOSE)
Process Pipe/Vessel? or Hose?
Diameter of Hole, D (in)
Gauge Pressure, Pg (psig)
Height of Liquid Above Release Point, ³h (ft)
Diked area (ft²)
4. FROM A LIQUID OVERFLOW/SPILL
Filling or Unloading Rate (gpm)
Diked area (ft²)

CHEMICAL EXPOSURE INDEX

Release Scenario

Airborne Quantity, AQ (lb/min)

C E I

Hazard Distance, HD-1 (feet)

Hazard Distance, HD-2 (feet)

Hazard Distance, HD-3 (feet)

Pipe/Vessel	Pipe/Vessel
2.00	2.00
6.2	160.0
9.5	30.0
1150	0
Liquid Release - Pipe/Vessel/Hose	Liquid Release - Pipe/Vessel/Hose
943.5	1471.5
593	741
32800	32800
19466	24310
7539	9415

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CEI2 - INTERMEDIATE SUPPORTING CALCULATIONS			
Plant or Project Name: CA2			
Location: PLAQUEMINE			
Prepared By: STEVE TEDESCHI			
Date Prepared: 10/26/94			
Case Number		1	2
Release Scenario		Liquid Release - Pipe/Vessel/Hose	Liquid Release - Pipe/Vessel/Hose
1. RELIEF DEVICE or OTHER CALCS.			
Input Release Rate (lb/min)		-	-
Time to Deplete System Inventory, (min)		-	-
Airborne Quantity for CEI, AQr (lb/min)		-	-
2. GAS RELEASE CALCS.			
Calculated Release Rate, (lb/min)		-	-
Time to Deplete System Inventory, (min)		-	-
Airborne Quantity for CEI, AQg (lb/min)		-	-
3. LIQUID RELEASE CALCS. (PIPE/VESSEL, HOSE)			
Step 1: Liquid Flow Rate Released			
Calculated Diameter to Use, Dcalc (in)		2.00	2.00
Calculated Liquid Release Rate, Lcalc (lb/min)		3716.4	14087.1
Time to Deplete System Inventory, (min)		67.3	0.5
Liquid Release Rate to Use, L (lb/min)		3716.4	1471.5
Step 2: Total Liquid Released			
Calculated Total Liquid Release, WTcalc (lb)		55746.1	211307.1
System Inventory, Wlnvt (lb)		249950.5	7357.5
Total Liquid Release, WT (lb)		55746.1	7357.5
Step 3: Fraction Flashed			
Fraction Flashed, Fv		0.035	0.035
Calculated Flash Rate, AQfcalc (lb/min)		641.5	1471.5
Time to Deplete System Inventory, (min)		389.6	5.0
Airborne Quantity by Flash to Use, AQf (lb/min)		641.5	1471.5
Step 4: Liquid Pool Size			
Mass of Liquid Entering Pool, Wp (lb)		46123.6	6087.5
Calculated Liquid Pool Area, Ap calc (ft2)		14670	1936
Liquid Pool Area, Ap (ft2)		1150	1936
Step 5: Evaporation from Pool Surface			
Molecular Weight, MW		70.9	70.9
Characteristic Pool Temperature, T (°F)		-29.3	-29.3
Vapor Pressure at Ts, Pvp (psia)		20.892	20.892
Vapor Pressure at T, Pvp (psia)		14.700	14.700
Evaporation from Pool Surface, AQp (lb/min)		302.0	495.4
Step 6: Total Airborne Quantity			
Calculated Airborne Rate, AQlcalc (lb/min)		943.5	1471.5

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Time to Deplete System Inventory, (min)	264.9	5.0
Airborne Quantity for CEI, AQI (lb/min)	943.5	1471.5
4. LIQUID OVERFLOW/SPILL CALCS.		
Step 1: Liquid Flow Rate Released		
Calculated Liquid Release Rate, Lcalc (lb/min)	-	-
Time to Deplete System Inventory, (min)	-	-
Liquid Release Rate to Use, L (lb/min)	-	-
Step 2: Total Liquid Released		
Calculated Total Liquid Release, WTcalc (lb)	-	-
System Inventory, WInv (lb)	-	-
Total Liquid Release, WT (lb)	-	-
Step 3: Fraction Flash		
Fraction Flash, Fv	-	-
Calculated Flash Rate, AQfcalc (lb/min)	-	-
Time to Deplete System Inventory, (min)	-	-
Airborne Quantity by Flash to Use, AQf (lb/min)	-	-
Step 4: Liquid Pool Size		
Mass of Liquid Entering Pool, Wp (lb)	-	-
Calculated Liquid Pool Area, Ap calc (ft2)	-	-
Liquid Pool Area, Ap (ft2)	-	-
Step 5: Evaporation from Pool Surface		
Molecular Weight, MW	-	-
Characteristic Pool Temperature, T (°F)	-	-
Vapor Pressure at Ts, Pvp (psia)	-	-
Vapor Pressure at T, Pvp (psia)	-	-
Evaporation from Pool Surface, AQp (lb/min)	-	-
Step 6: Total Airborne Quantity		
Calculated Airborne Rate, AQoscalc (lb/min)	-	-
Time to Deplete System Inventory, (min)	-	-
Airborne Quantity for CEI, AQos (lb/min)	-	-

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CEI2 : THE CHEMICAL EXPOSURE INDEX CALCULATION		Work File Name
Reference: "Chemical Exposure Index Guide" - Second Edition Corporate Safety and Loss Prevention, The Dow Chemical Company		CA294.XLS
Plant or Project Name: <u>CA2</u>		
Location: <u>PLAQUEMINE</u>		
Plant Superintendent or Manager: <u>GRETCHEN LEBLAN</u>		
Site Review Representative: <u>STEVE TEDESCHI</u>		

I. CASE DATA	
Case Number	3
Release Scenario	Relief Device
Chemical Name	Chlorine
Release Scenario Description	C-201A DEVELOPES A DISCHARGE LINE (10") LEAK (5"
EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG) VALUES	
Dow IHG (ppm)	-
ACGIH TLV-TWA (ppm)	-
STEL (ppm)	-
ERPG-1 (ppm)	1
ERPG-2 (ppm)	3
ERPG-3 (ppm)	20
PLANT DATA	
Total Quantity in Plant, (lb)	300000
Largest Single Containment, (lb)	8500
Pressure of Containment, (psig)	67
DISTANCES TO (feet):	
1. Public	675
2. Other in-company facility	375
3. Non-company plant or business	1310
PHYSICAL PROPERTIES	
Operating Temperature of Liquid, Ts (°F)	170.0
Molecular Weight, MW	70.9
Normal Boiling Point of Liquid, Tb (°F)	-29.3
Vapor Pressure at Ts, P _{vap} (psia)	358.263
Liquid Density at Ts, Rho (lb/ft ³)	76.47
Heat Capacity, Cp (Btu/lb/°F)	0.256
Heat of Vaporization, Hv (Btu/lb)	85.51
II. AIRBORNE QUANTITY ESTIMATION	
Liquid System Inventory, (gal)	1000

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1. FROM A RELIEF DEVICE or OTHER	
Input Release Rate (lb/min)	1700.0
2. FROM A GAS RELEASE	
Gauge Pressure, Pg (psig)	
Diameter of Hole, D (in)	
3. FROM A LIQUID RELEASE (PIPE/VESSEL, HOSE)	
Process Pipe/Vessel? or Hose?	
Diameter of Hole, D (in)	
Gauge Pressure, Pg (psig)	
Height of Liquid Above Release Point, ² h (ft)	
Diked area (ft ²)	
4. FROM A LIQUID OVERFLOW/SPILL	
Filling or Unloading Rate (gpm)	
Diked area (ft ²)	
CHEMICAL EXPOSURE INDEX	
Release Scenario	Relief Device
Airborne Quantity, AQ (lb/min)	1700.0
C E I	797
Hazard Distance, HD-1 (feet)	32800
Hazard Distance, HD-2 (feet)	26129
Hazard Distance, HD-3 (feet)	10120

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CEI2 - INTERMEDIATE SUPPORTING CALCULATIONS	
Plant or Project Name: CA2	
Location: PLAQUEMINE	
Prepared By: STEVE TEDESCHI	
Date Prepared: 10/26/94	
Case Number	3
Release Scenario	Relief Device
1. RELIEF DEVICE or OTHER CALCS.	
Input Release Rate (lb/min)	1700.0
Time to Deplete System Inventory, (min)	6.0
Airborne Quantity for CEI, AQr (lb/min)	1700.0
2. GAS RELEASE CALCS.	
Calculated Release Rate, (lb/min)	-
Time to Deplete System Inventory, (min)	-
Airborne Quantity for CEI, AQg (lb/min)	-
3. LIQUID RELEASE CALCS. (PIPE/VESSEL, HOSE)	
Step 1: Liquid Flow Rate Released	
Calculated Diameter to Use, Dcalc (in)	-
Calculated Liquid Release Rate, Lcalc (lb/min)	-
Time to Deplete System Inventory, (min)	-
Liquid Release Rate to Use, L (lb/min)	-
Step 2: Total Liquid Released	
Calculated Total Liquid Release, WTcalc (lb)	-
System Inventory, WInvt (lb)	-
Total Liquid Release, WT (lb)	-
Step 3: Fraction Flashed	
Fraction Flashed, Fv	-
Calculated Flash Rate, AQfcalc (lb/min)	-
Time to Deplete System Inventory, (min)	-
Airborne Quantity by Flash to Use, AQf (lb/min)	-
Step 4: Liquid Pool Size	
Mass of Liquid Entering Pool, Wp (lb)	-
Calculated Liquid Pool Area, Ap calc (ft2)	-
Liquid Pool Area, Ap (ft2)	-
Step 5: Evaporation from Pool Surface	
Molecular Weight, MW	-
Characteristic Pool Temperature, T (°F)	-
Vapor Pressure at Ts, Pvp (psia)	-
Vapor Pressure at T, Pvp (psia)	-
Evaporation from Pool Surface, AQp (lb/min)	-
Step 6: Total Airborne Quantity	
Calculated Airborne Rate, AOIcalc (lb/min)	-

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Time to Deplete System Inventory, (min)	-
Airborne Quantity for CEI, AQI (lb/min)	-
4. LIQUID OVERFLOW/SPILL CALCS.	
Step 1: Liquid Flow Rate Released	
Calculated Liquid Release Rate, Lcalc (lb/min)	-
Time to Deplete System Inventory, (min)	-
Liquid Release Rate to Use, L (lb/min)	-
Step 2: Total Liquid Released	
Calculated Total Liquid Release, WTcalc (lb)	-
System Inventory, WInvt (lb)	-
Total Liquid Release, WT (lb)	-
Step 3: Fraction Flash	
Fraction Flash, Fv	-
Calculated Flash Rate, AQfcalc (lb/min)	-
Time to Deplete System Inventory, (min)	-
Airborne Quantity by Flash to Use, AQf (lb/min)	-
Step 4: Liquid Pool Size	
Mass of Liquid Entering Pool, Wp (lb)	-
Calculated Liquid Pool Area, Ap calc (ft2)	-
Liquid Pool Area, Ap (ft2)	-
Step 5: Evaporation from Pool Surface	
Molecular Weight, MW	-
Characteristic Pool Temperature, T (°F)	-
Vapor Pressure at Ts, Pvp (psia)	-
Vapor Pressure at T, Pvp (psia)	-
Evaporation from Pool Surface, AQp (lb/min)	-
Step 6: Total Airborne Quantity	
Calculated Airborne Rate, AQoscalc (lb/min)	-
Time to Deplete System Inventory, (min)	-
Airborne Quantity for CEI, AQos (lb/min)	-

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