PRESENTATION TO THE VINYL CHLORIDE SAFETY ASSOCIATION

BY ROBERT R. OUBRE - DOW CHEMICAL

TAMPA, FLORIDA

SEPTEMBER 13, 1985

VCM QUESTIONNAIRE

SENT COPIES TO 37 COMPANIES

US - 17 13 REPLIED

NON US - 19 16 REPLIED

RECEIVED 67 COMPLETED QUESTIONNAIRES

B. F. GOODRICH	12
ICI	10
ENICHEM POLIMERI	7
LIMBURQSE VINYL	5

CTL020682

SLIDE 1

QUESTIONNAIRE TOPICS

STORAGE VESSELS	-	SIZE
		DISTANCE FROM POPULATED AREAS
		SAFETY FEATURES
PROCEDURES	-	EMERGENCY PLAN
		INVOLVEMENT OF COMMUNITY
PUMPS, LINES	-	SAFETY FEATURES
LOCATION	-	U. S. COMPANY
		NON U.S. COMPANY

SLIDE 2

CTL020683

3. WHAT IS THE DISTANCE FROM TANK TO NEAREST RESIDENCE?

WHAT IS THE DISTANCE TO NEAREST COMMUNITY?

METERS	<100	101 200	201 500	501 1000	1001 2000	2001 5000	>5000
RESIDENCE	2	15	14	10	17	6	0
COMMUNITY	0	3	14	12	21	12	3

SLIDE 3

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4. DOES THE PREVAILING WIND BLOW TOWARD A RESIDENTIAL AREA?

YES - 26 NO - 39

OF THE 26 YESES - CLOSEST RESIDENCE = 150 M

CLOSEST COMMUNITY = 150 M

OF THE 26 YESES - AVER. DIST.TO RESIDENCE = 900 M

AVER. DIST.TO COMMUNITY = 1300 M

5. HAVE YOU DONE ANY VAPOR CLOUD DISPERSION MODELING?

YES - 23
NO - 42
} 35 % have done modeling

OF THE 26 YESES IN "4" - 46 % HAVE DONE MODELING

6. DOES YOUR PLANT HAVE AN EMERGENCY PLAN WHICH INCLUDES NOTIFICATION OR WARNING OF THE LOCAL COMMUNITY?

YES - 54

NO - 11

83% INCLUDE COMMUNITY IN THEIR PLAN

OF THE 26 PLANTS WITH PREVAILING WIND TOWARD COMMUNITY

88% INCLUDE COMMUNITY IN PLANS

7. HAVE YOU MADE ANY CHANGES IN YOUR OPERATION OR PROCEDURES SINCE THE BHOPAL INCIDENT?

YES - 14

NO - 63

ONLY 22% HAVE MADE CHANGES

8. TANK SAFETY FEATURES:

A. IS TANK DIKED?

YES - 54

NO - 11

83% DIKED

B. IF SPILL OCCURS DOES VCM COLLECT UNDER TANK OR DOES IT DRAIN AWAY TO BASIN?

UNDER - 40

AWAY - 23

C. WHAT SPECIAL FEATURES DOES DIKED AREA OR BASIN HAVE?

HARD SURFACE	- 32%
COVERED PIT	- 8%
FOAM SYSTEM	- 15%
WATER SPRINKLER	- 44%
PUMP OUT PUMP	- 6%
STEAM CURTAINS 4 SIDES	- 1 PLANT

D. ARE YOUR TANKS SPRINKLED?

YES - 60

NO - 5

92% SPRINKLED

E. ARE FLAMMABLE VAPOR DETECTORS DETECTORS LOCATED WHERE SPILL COULD OCCUR? YES-39 NO-26 — 60% HAVE DETECTORS

F. ARE VCM AREA MONITORS LOCATED AT TANKS (FOR MEASURING PPM)? YES-42 NO-23 — 65% HAVE PPM DETECTORS

86% HAVE EITHER FLAMMABLE VAPOR DETECTORS OR PPM DETECTORS OR BOTH

14% HAVE NEITHER

G. DO LEVEL INSTRUMENTS HAVE REDUNDANCY (BACKUP)? YES-40 NO-25 — 62% ARE REDUNDANT

H. DO LEVELS ALARM AT A CONTROL BUILDING WHICH IS MANNED AROUND THE CLOCK? YES-52 NO-13 — 79% ARE AROUND THE CLOCK

I. DOES TANK(S) HAVE DUAL RELIEF VALVE? YES-51 NO-14 — 78% HAVE DUALS

J. IS THERE A RUPTURE DISC UNDER THE RELIEF VALVE? YES-41 NO-24 — 63% HAVE RUPTURE DISCS

OUTSIDE US PLANTS YES-22 NO-22 — 50%

SLIDE 7

CTL020688

K. HOW IS SPACE MONITORED BETWEEN THE RELIEF VALVE AND THE RUPTURE DISC?

PRESSURE GAUGES	-	61%
PRESSURE SWITCH	-	29%
OPEN VALVES	-	10%
OTHERS	-	12%

L. HAVE YOU ESTABLISHED A MAXIMUM FILL LEVEL FOR YOUR TANK?

YES	-	100%
RANGE	-	65% TO 98%
AVERAGE	-	84.5%

M. HAS TANK(S) BEEN INTERNALLY INSPECTED SINCE ORIGINAL INSTALLATION DATE?

YES - 57

NO - 8 (1 NEW, 2 DUE SOON)] 88%

TANK AGE	<10 YRS	10-20	20-30	>30	34
	11	27	11	2	1

ONE PLANT REPORTED EXTERNAL CORROSION

TWO REPORTED INTERNAL PITTING (RECOVERED MONOMER)

TWO REPORTED NEGLIGIBLE TO LIGHT CORROSION

REMAINDER FAIR TO GOOD TO EXCELLENT CONDITION

SLIDE 8

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N. ANY OTHER TANK SAFETY FEATURES?

MANY REPORTED REMOTE OPERATED VALVES.

TOTALIZING METER BACKS UP LEVEL.

EXCESS FLOW CHECKS IN LIQUID LINES.

2 HLA'S SET AT 72% -85% - 95% (2 INST).

HLS TRIPS PUMP, CLOSES VALVE. SAME FOR VAPOR ALARM.

HLS OR HPS CLOSES FEED. LPS CLOSES PUMP SUCTION.

INTERNAL BILLET VALVE. ALL VALVES CLOSE ON ABNORMAL CONDITION.

AUTO CLOSE INLET WITH HLS.

OVERPRESSURE OF TANK VENTED TO INCINERATOR.

AUTO VALVE CLOSE WITH XS FLOW OR DELUGE TRIP OR HL.

BOTTOM HALF OF SPHERE IN CONCRETE CUP.

STEAM CURTAIN ON 4 SIDES.

WATER INJECTION CAPABILITY FOR LEAK.

VAPOR DETECTOR TRIPS SPRINKLER.

REPEATERS ON LEVEL TRANSMITTER MAKE Dp CELL MORE RELIABLE BY ELIMINATING VCM FILLED LEG.

9. PUMPS AND AND LINES:

A. ARE BOTTOM TANK VALVES EQUIPPED WITH REMOTE OPERATED VALVES?

YES -54
NO -11

83% HAVE REMOTE VALVES

B. DO PUMPS HAVE DOUBLE SEALS?

YES -44
NO -10

81% HAVE DOUBLE SEALS

NON-U.S.

YES -23
NO -11

68% HAVE DOUBLE SEALS

C. ARE PUMPS SEALLESS?

YES - 11

NON U.S. -10

U.S. - 1

D. ARE PUMPS STEEL OR WROUGHT IRON CONSTRUCTION?

YES -60
NO - 5

92% HAVE STEEL OR WROUGHT IRON.

E. ARE PUMPS PROTECTED FROM DEAD-HEADED CONDITION (RUNNING WITH DISCHARGE BLOCKED)?

YES - 38
NO - 27
58% PROTECTED

PSV- 14
TS, FS, PS- 11
RECYCLE- 7
ELECT OVERLOAD- 1

OTHER - COMPUTER CONTROL PUMP START W/FLOW AND RECYCLE

F. ARE PUMPS PROTECTED FROM BLOCKED IN CONDITION?

YES - 27
NO - 38
41% PROTECTED

PSV -17
S - 3

G. ARE PIPELINES PROTECTED FROM LIQUID BLOCKED IN CONDITION?

YES - 49
NO - 16
75% ARE PROTECTED

PSV -48
BY-PASS - 1

SLIDE 11

CTL020692

H. ARE PIPELINES PROTECTED FROM HYDRAULIC SHOCK OF SUDDEN VALVE CLOSURE?

YES - 21
NO - 44
32% ARE PROTECTED

I. WHAT TYPE GASKETS ARE USED IN PIPING?

FLAT RING ASBESTOS - 56

RETAINED TYPE (FLEXITALLIC) - 9

ONE PLANT USES- FLAT ASBESTOS ON 150 LB
RETAINED ON 300 LB

10. TANK CAR LOADING/UNLOADING : 50 PLANTS

A. IS THE T/C AREA PROTECTED BY SPRINKLER?

YES -22
NO - 28
44% PROTECTED

B. ARE MONITOR NOZZLES INSTALLED?

YES - 34
NO - 16
70% HAD MONITORS

90% HAD EITHER SPRINKLERS OR MONITORS OR BOTH.

SLIDE 12

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C. ARE FLEXIBLE HOSES USED IN THE OPERATION?

YES - 39
NO - 11

78% USE HOSES

TEST PROGRAM USED? YES - 24

FREQUENCY - VARIES FROM EACH USE INITIALLY
QUARTERLY
YEARLY

OTHER COMMENTS - ONE REQUIRED BY LAW TO TEST YEARLY AND WHENEVER DISCONNECTED TO 1.5 X MWP FOR 15 MIN. HOSE HAS TEST DATE TAG AND NUMBER.

ONE HAS DOUBLE WALL HOSE WITH GAUGE ON OUTSIDE HOSE.

ONE DOES ELONGATION TEST DURING PRESSURE TEST AND ELECTRICAL CONDUCTIVITY TEST. EVERY 6 MONTHS OR 1600 HOURS USE.

MOST USE WATER PRESSURE TEST.

D. HAVE YOU HAD A HOSE FAIL UNDER VCM PRESSURE?

YES- 9
NO- 41

18% HAD FAILURES

SLIDE 13

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E. HOW IS OVERFILLING OF T/C PREVENTED?

THERE WERE 41 WHO LOAD T/C'S

MAGNETIC FLOAT GAUGES	- 15
TOTALIZING METER AUTO STOP (3 REPORTED TWIN METERS)	- 10
COMBINATION OF LEVEL SWITCH AND DP CELL	- 9
LOAD SCALE	- 7
OUTAGE GAUGES	- 4

NON - U.S. PLANTS MAGNETIC GAUGE - 6 OF 26

F. IS T/C AREA DIKED FOR SPILL CONTAINMENT?

YES - 7 ┐ 14% HAVE
NO - 41 ┘

11. DO YOU RECEIVE OR SHIP VCM BY T/T?

YES - 18 NON U.S. - 16

U.S. - 2

12. TOTAL RETURNS 65 NON U.S. - 44

U.S. - 21

SLIDE 14

CTL020695

DOW CHEMICAL U.S.A.

TEXAS OPERATIONS
FREEPORT TEXAS 77541

September 19, 1985

TO ALL VINYL CHLORIDE SAFETY ASSOCIATION MEMBERS

VCM DISPERSION MODELING
CHEMICAL EXPOSURE RISK FORMULA

Attached is the additional information I presented at the Vinyl Chloride Safety Association Meeting in Tampa.

1. The VCM dispersion modeling was an attempt to show the effect of various releases of VCM with respect to the community. The line represents the centerline of the vapor cloud with the circular dot as the source. Concentration, distance and time are shown along the line. The circled number represents the downwind location of communities as reported in Question 3 of the VCM Questionnaire. The wind stability factor used was "B" and the model is one developed by Dow using the newest technology.

2. The Chemical Risk Potential Index Formula slides shown during the presentation are attached along with a letter from our company to EPA which gives additional information.

Robert R. Oubre

Robert R. Oubre
Technical Manager
Dow Chemical Company
(409) 238-9455

wcb

attachment

CTL020696

CONTINUOUS LIQUID SPILL
- PUMP SEAL LEAKING-

AMOUNT SPILLED: 38 KGS/MIN
WIND VELOCITY: 4.5 MPS
AREA OF SPILL: 45 M^2

CENTERLINE GROUND LEVEL CONCENTRATION DURING RELEASE EQUILIBRIUM PERIOD (1-10 MINS)

CONCENTRATION, PPM	DISTANCE, METERS	TIME, MIN
1030		
	100	
50		
	200	0.75
15		
	300	
7		
	400	1.5
	500	
	600	
	700	
	800	3.0

(3)

(14)

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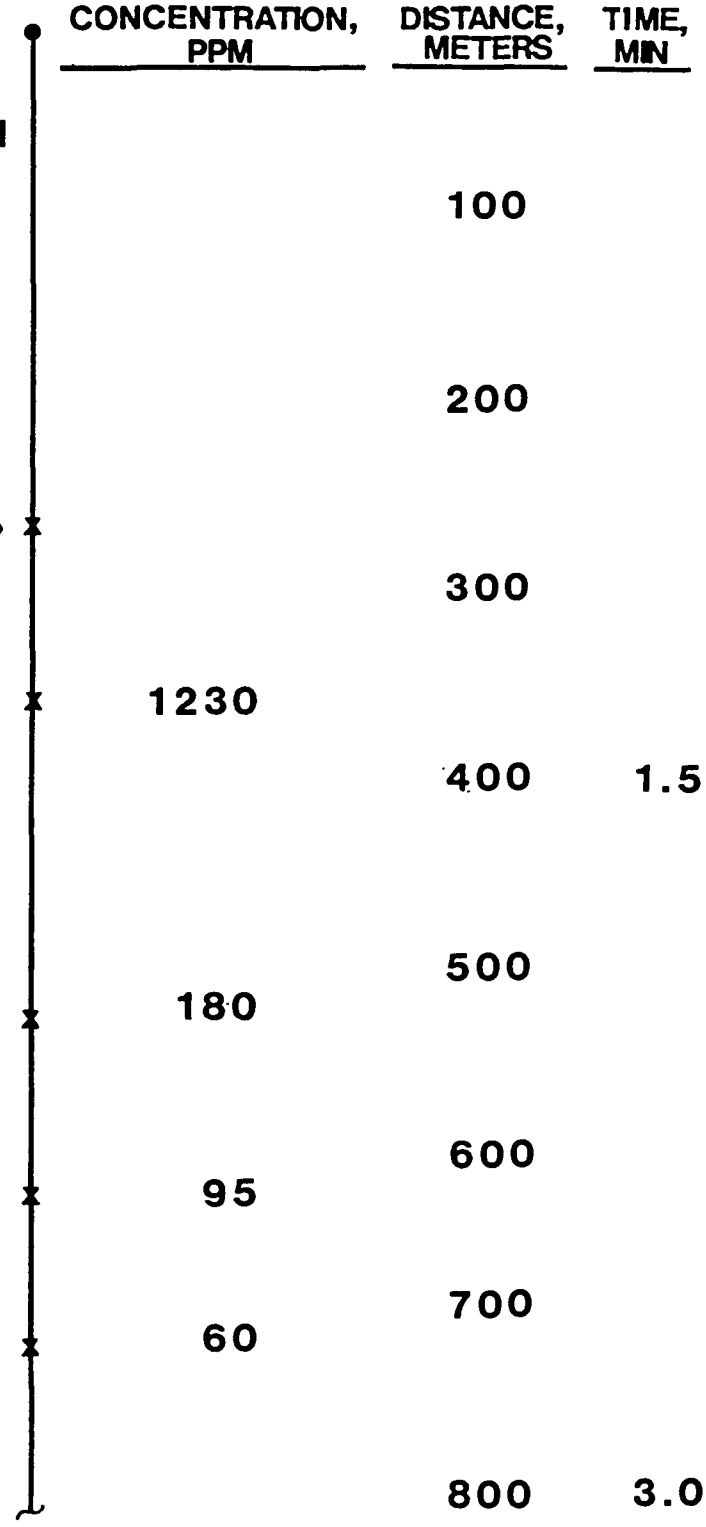
CONTINUOUS PSV RELEASE

AMOUNT RELEASED: 454 KGS/MIN
HEIGHT: 24M
WIND VELOCITY: 4.5 MPS

GROUND LEVEL CENTERLINE CONCENTRATIONS DURING (3) RELEASE EQUILIBRIUM PERIOD



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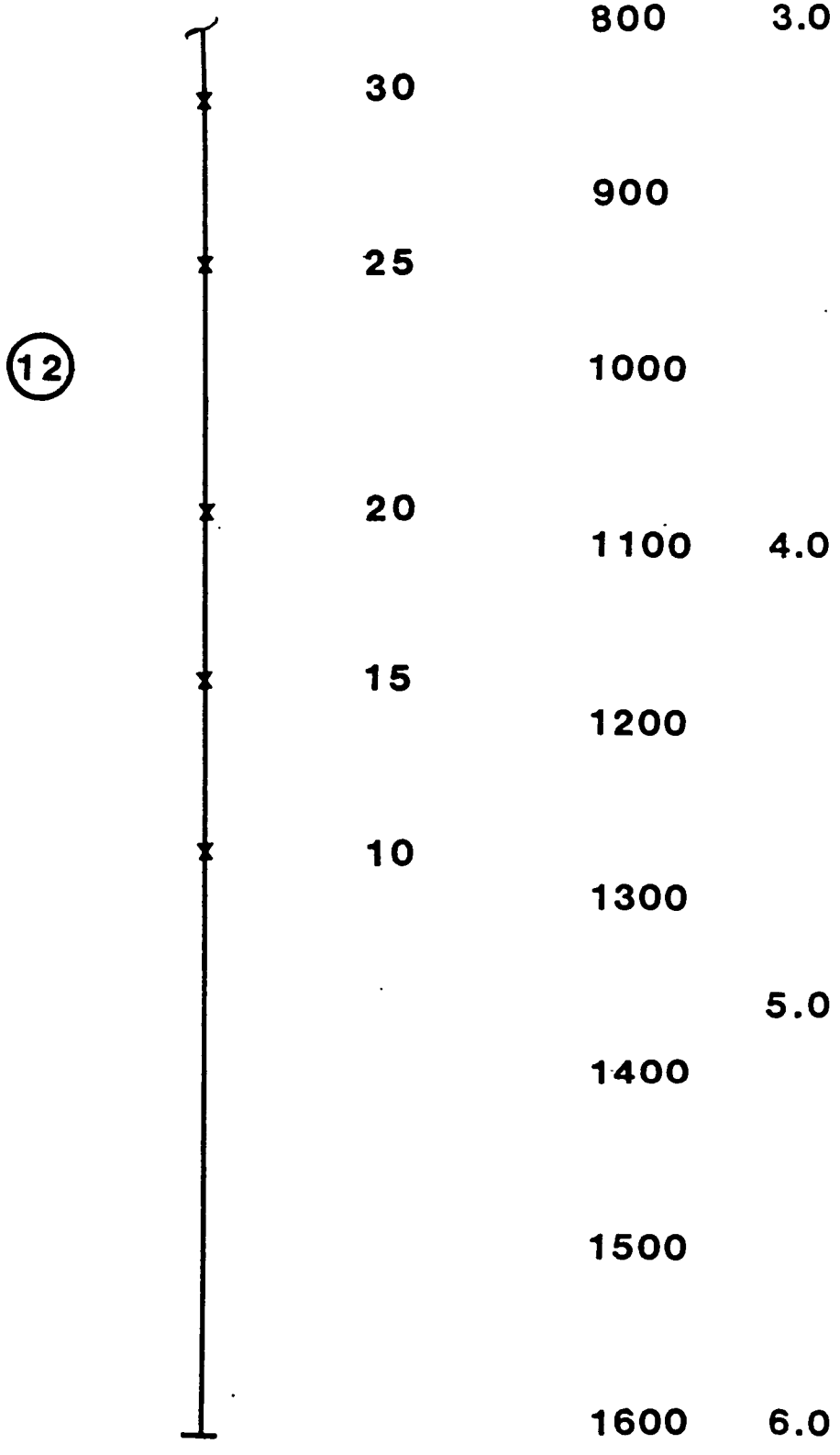
CONTINUOUS PSV RELEASE



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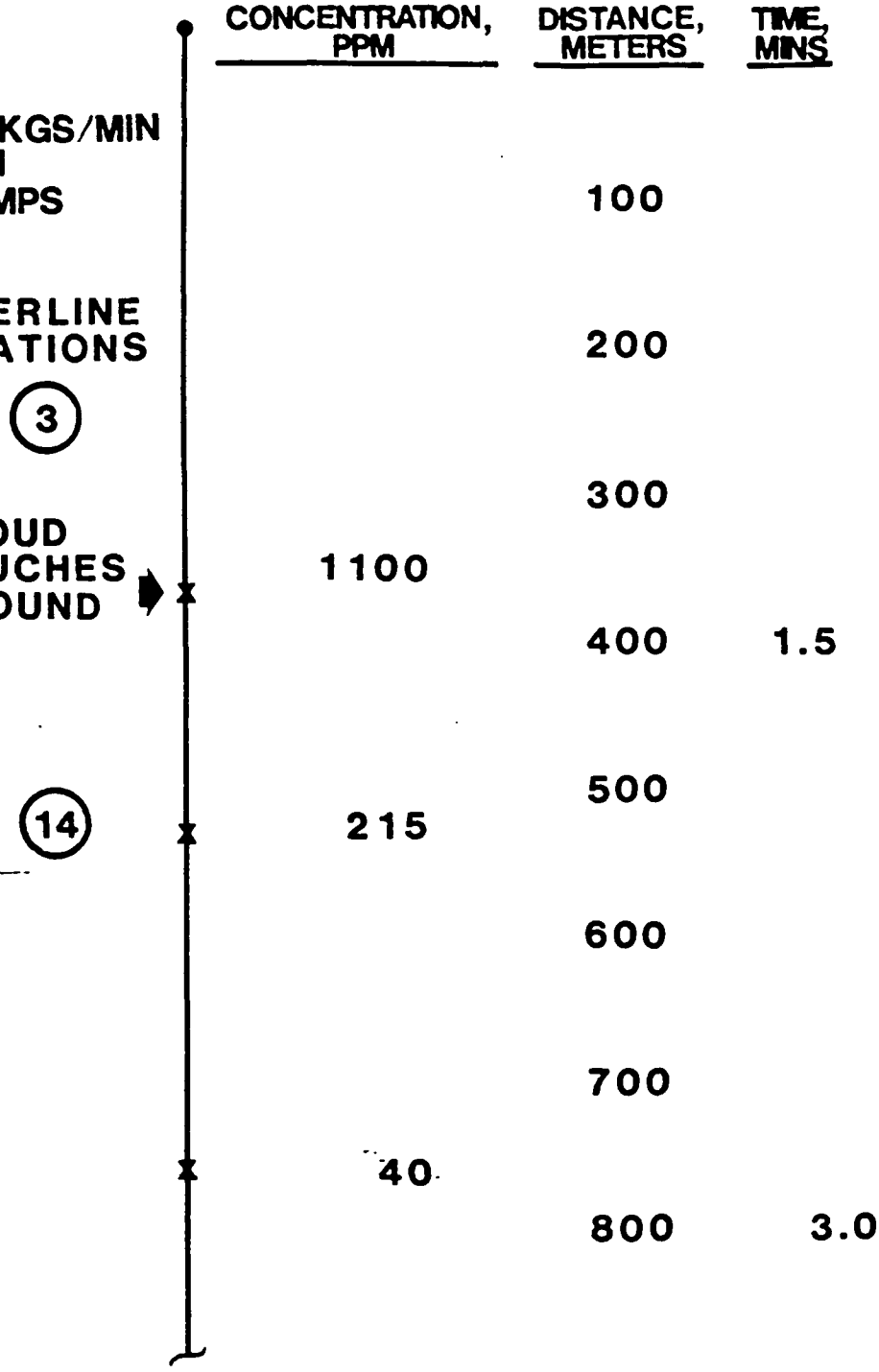
INSTANTANEOUS PSV RELEASE

AMOUNT RELEASED: 454 KGS/MIN
HEIGHT: 24 M
WIND VELOCITY: 4.5 MPS

GROUND LEVEL CENTERLINE MAXIMUM CONCENTRATIONS OF MOVING CLOUD.



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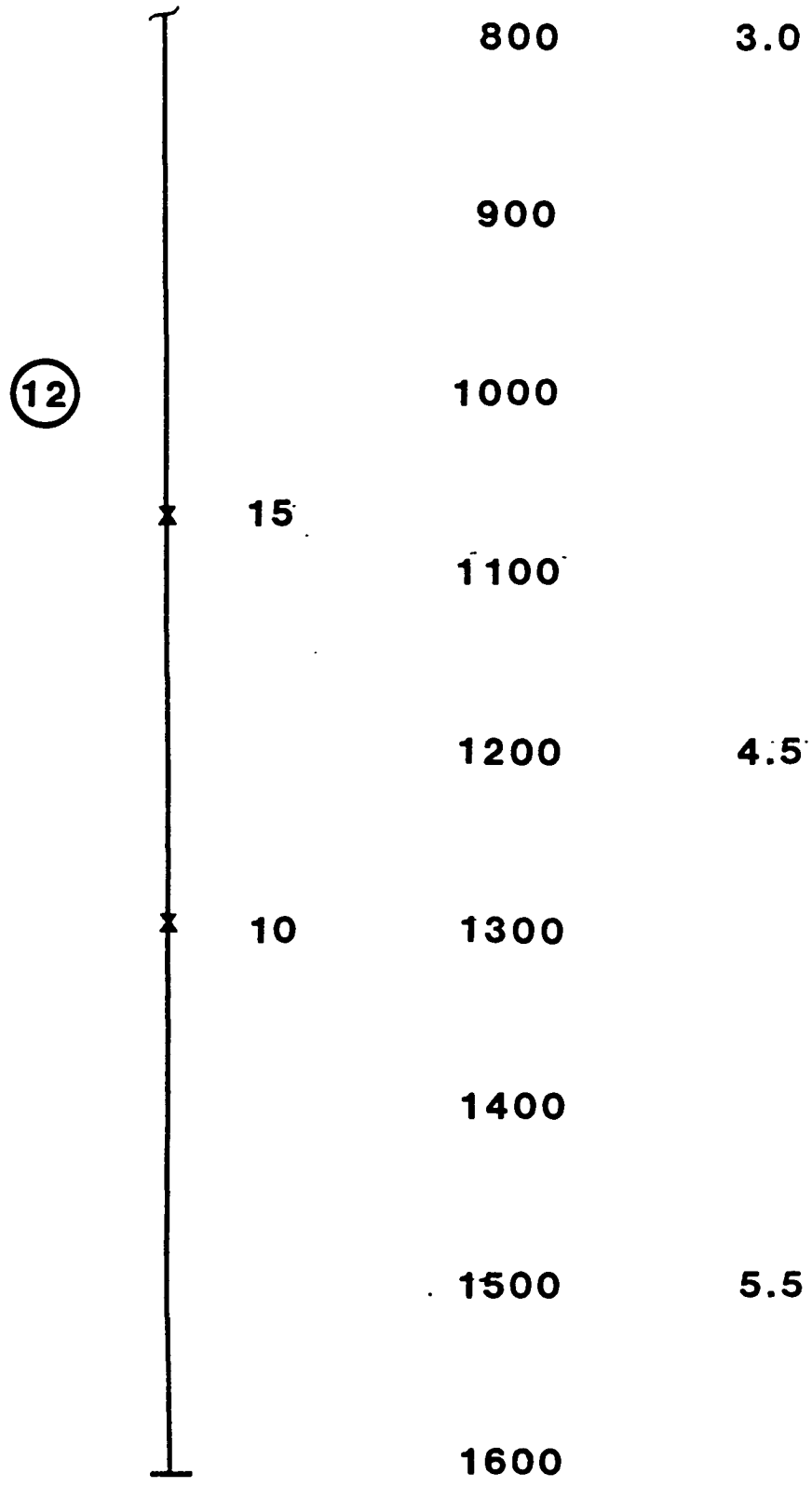
INSTANTANEOUS PSV RELEASE



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CONTINUOUS LIQUID SPILL
- MASSIVE LEAK -

AMOUNT SPILLED: 11,338 KGS
RELEASE TIME: 8 MINS
WIND VELOCITY: 2.5 MPS
AREA OF SPILL: 232 M^2

(3)

CENTERLINE GROUND LEVEL CONCENTRATION DURING RELEASE EQUILIBRIUM PERIOD (1-6 MINS)

(14)

CONCENTRATION, PPM	DISTANCE, METERS	TIME, MINS
48,200		
	100	
2600		
	200	
1050		
	300	
410	400	1.5
250	500	
180	600	
	700	
120		
	800	3.0

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CONTINUOUS LIQUID SPILL
- MASSIVE LEAK-

AMOUNT SPILLED: 11,338 KGS
TIME OF RELEASE: 8 MINS
WIND VELOCITY: 4.5 MPS
AREA OF SPILL: 232 M^2

CENTERLINE GROUND LEVEL CONCENTRATIONS DURING RELEASE EQUILIBRIUM PERIOD (1-6 MINS)

CONCENTRATION, PPM	DISTANCE, METERS	TIME, MINS
2700		
	100	
1450		
	200	
470		
	300	
230	400	1.5
	500	
140		
	600	
75	700	
	800	3.0

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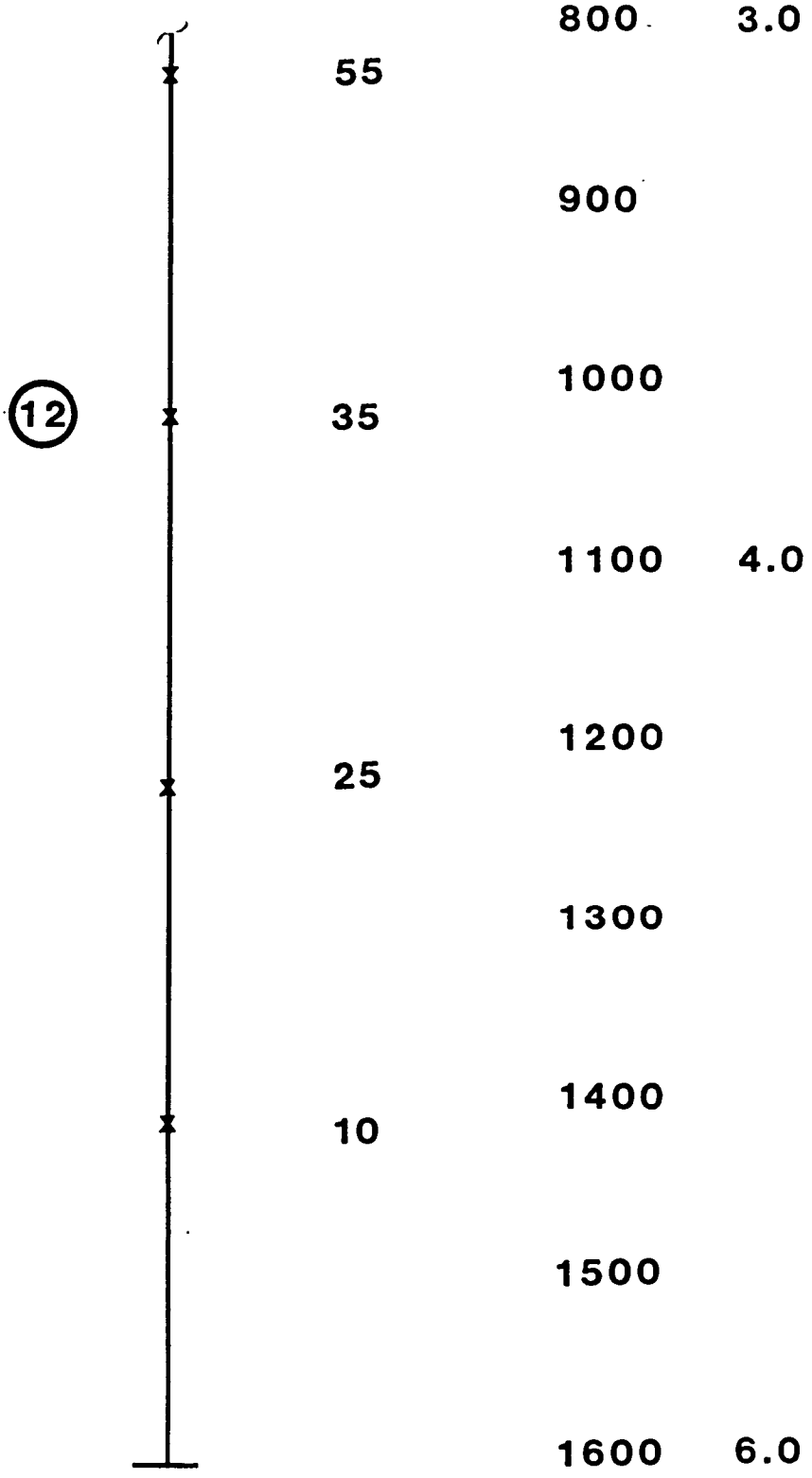
CONTINUOUS LIQUID SPILL - MASSIVE LEAK



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CHEMICAL EXPOSURE RISK FORMULA

$$\text{RISK POTENTIAL INDEX} = \frac{\text{R.V. X Q.F. X V.D.F. X P.P.F.}}{\text{D.F. X T.O.X.}}$$

R.V. = RELATIVE VOLATILITY, > 760 MM, USE 1.0

Q.F. = QUANTITY FACTOR, $\frac{\text{POUNDS}}{1000}$

V.D.F.= VAPOR DISPERSION FACTOR, RATIO OF VAPOR DENSITY OF CHEMICAL TO AIR.

P.P.F = PROCESS PENALTY FACTOR, MULTIPLY BY 2 FOR EACH

(1) STORED ABOVE 10 PSIG

(2) THERMALLY ACTIVE WITH ITSELF, WATER OR AIR.

D.F. = DISTANCE FACTOR, $\frac{\text{FEET}}{1000}$

T.O.X.= ACUTE TOXICITY FACTOR, DEFINED BY O.S.H.A. AS I.D.H.L., IMMEDIATELY DANGEROUS TO HEALTH OR LIFE.

HCL = 100 PPM

CHLORINE = 25 PPM

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EXAMPLE

A LIQUID CHLORINE SPHERE OF 5.0 MM LB CAPACITY OPERATING AT 20 PSIG AND 4250 FEET FROM POINT OF PUBLIC CONCERN.

R.V.	=	RELATIVE VOLATILITY	= 1
Q.F.	=	QUANTITY FACTOR	= 5000
V.D.F.	=	VAPOR DISPERSION FACTOR	= 2.5
P.P.F.	=	PROCESS PENALTY FACTOR	= 1 X 2 = 2
D.F.	=	DISTANCE FACTOR	= 4
TOX.	=	TOXICITY FACTOR	= 25

$$\text{RISK POTENTIAL INDEX} = \frac{\text{R.V. X Q.F. X V.D.F. X P.P.F.}}{\text{D.F. X TOX.}}$$

$$\text{R.P.I.} = \frac{1 \times 5000 \times 2.5 \times 2}{4 \times 25} = 250$$

DEVELOP RELATIVE R.P.I'S FOR PREPAREDNESS LEVEL NEEDED:

FOR EXAMPLE:
- DISPERSION MODELING AND MAPPING
- PLAN FOR COMMUNITY NOTIFICATION
- DETERMINATION OF WORST CASE AND PURPOSED RESPONSES
- REVIEW OPERATING PROCEDURES
- CONDUCT PRACTICE DRILLS

DOW CHEMICAL U.S.A.

August 1, 1985

TEXAS OPERATIONS
FREEPORT, TEXAS 77541

Mr. George Wirth
Environmental Protection Agency
401 M St. S.W.
Washington, D.C. 20460

RE: AIR TOXIC-SITE GUIDANCE MEETING, JULY 23, 1985

Dear Mr. Wirth:

Attached is the proposed formula for determining the Relative Exposure Risk Potential Index for chemical containment systems I promised last week.

As I understand, EPA is committed to providing community guidance in case of a large, acutely toxic chemical release by listing chemicals of concern. The dedication by you and the other EPA people to establish a very sound scientific basis for this guidance while insisting on simplicity is admirable. Toxicity alone is obviously not definitive enough. This proposed formula incorporates every factor you and the other EPA people brought up and discussed as being important considerations, and yet, is the simplest type formula mathematically possible.

I would propose the EPA work with several chemical companies to determine an index on many of the chemicals proposed to be placed on the Site Review Guidance List. These indexes could be bracketed into Emergency Response Guidance catagories (i.e. 1 through 5) with a different level of response for each. A "1" might call for nothing more than general information on the chemical such as making available Material Safety Data Sheets, while a "5" might recommend good communications, evacuation procedures, annual drills, vapor detectors with warning horns, etc. Certainly these different levels would be a positive basis for good rapport between industry and the community. After you formalize any proposal, it would be important to provide a response period for both public and industry to give you their comments.

Hopefully, this type of index can identify those chemicals which can be of great concern to a community and also eliminate those which offer no threat. Probably 95% of chemicals handled in the industry would thus be eliminated from the list.

Once again, I would like to thank you for this opportunity to input during your strategy forming stage. The safety record of the Chemical Industry in the United States is one of the best of all industries and we certainly want to see this record continue.

Sincerely,

Gordon R. Miller

Gordon R. Miller
Loss Prevention Engineering
APB

CTL020707

bj
attachment

CHEMICAL EXPOSURE RISK POTENTIAL INDEX

Scope

Provide a comparable index to measure the relative degree of risk to the public from loss of containment of any chemical.

Introduction

The impact on the public from loss of containment of any chemical is based on: (1) The acute toxicity of the compound, (2) The concentration that reaches the people, and (3) The length of time of exposure.

Even though it is impossible to predict all of the factors that will control concentration and time of exposure (i.e. temperature, humidity, wind speed and direction), these two factors are equally as important as toxicity. The best one can do in determining the degree of risk from any chemical containment is to develop a simple, relative formula of those important parameters that can be measured and hold all other parameters constant. This will allow a Relative Risk Potential number to be generated which can be catagorized to determine a level of Emergency Response Preparedness needed. These catagories and proper responses will be developed later. Non-linear and logarithimic functions of gas dispersions have been ignored to maintain simplicity.

Formula

$$\frac{R.V. \times Q.F. \times V.D.F. \times P.P.F.}{TOX. \times D.F.} = \text{RISK POTENTIAL INDEX}$$

Factor Identification

1. Tox = Toxicity - Select acute toxicity in ppm by preferred method. Suggest:
   IDLH = Immediately Dangerous to Life or Health in ppm; See NIOSH/OSHA Pocket Guide, or LC50 at 4 hour value.

2. R.V. = Relative Volatility - Vapor pressure of substance in mm of Hg at 25°C divided by 760 mm. If above 760 mm, use 1.0.

3. Q.F. = Quantity Factor - Amount of release in thousand lbs., i.e. 500 lbs. = 0.5, 1000 lbs. = 1.0, 10,000 lbs. = 10, etc. Do not use more than one decimal place. Use only amount that will become airborne in 15 minutes of a "worst" case release.

4. D. F. = Distance Factors - Determine distance from point of containment to point of public exposure concern in thousand foot increments; i.e. 500 ft. = 0.5, 1000 ft. = 1.0, 10,000 ft. = 10.0, etc. Do not use more than one decimal and round off to one significant number.

5. V.D.F. = Vapor Dispersion Factor - The vapor density relative to air is proportional to dispersion, i.e. light density = rapid dispersion, heavy = slow. Divide the molecular weight of the substance by 28.8 (molecular weight of air) and round to one decimal place, i.e. Ammonia = 17/28.8 = 0.6. Chlorine = 71/28.8 = 2.5, etc.

6. P.P.F. = Process Penalty Factors - Multiply by 2 for each factor: (1) contained above 10 psig; (2) thermally reactive with itself, water, air, or other common on site materials below 100°C. (Includes loss of inhibitors).

SKETCH PAD INFORMATION - FOR PLANNING ONLY

Examples:

* For a 2,000 lb. chlorine cylinder rupture at 1000 ft. distance:

$$\frac{1 \times 2 \times 2.5 \times 2}{25 \times 1} = \frac{10}{25} = 0.4$$

* For 50,000 lb. methyl isocyanate at 500 ft.:

$$\frac{0.5 \times 50 \times 2.3 \times 2}{20 \times 0.5} = \frac{115}{10} = 11.5$$

* For 5,000 lb. ammonia spill at 5000 ft.:

$$\frac{1 \times 5 \times 0.6 \times 2}{500 \times 5} = \frac{6}{2500} = 0.0024$$

GRM
8/01/85

CTL020709