

B.F. GOODRICH COMPANY ANNOUNCED THAT THE PLANT PHYSICIAN
AT THE KY PVC PLANT HAD IDENTIFIED THREE CASES OF LIVER CANCER
AMONG PLANT EMPLOYEES. THE COMPANY SAID IT SUSPECTED THAT VINYL
CHLORIDE MIGHT BE IMPLICATED IN THE THREE DEATHS.

THE BFG TRIGGERED ONE OF THE MOST INTENSIVE
IN THE HISTORY OF OCCUPATIONAL HEALTH. IT BECAME THE TOPIC
OF MAGAZINE AND NEWSPAPER ARTICLES, TELEVISION SPECIALS, AND
CONFERENCES. VCM HAS BECOME ONE OF THE MOST STUDIED
SUBSTANCES FROM A TOXICOLOGY STANDPOINT.

LET'S DISCUSS WITH YOU SOME CONCEPTS OF TOXICOLOGY IN GENERAL,
AND THEN WE'LL GO INTO MORE SPECIFICS REGARDING VINYL CHLORIDE AND POLYVINYL CHLORIDE.
I'LL TRY TO ANSWER ANY QUESTIONS YOU MIGHT HAVE.

ASKED QUESTIONS LIKE "WILL THIS STUFF HURT YOU" AND I
FEEL UNCOMFORTABLE BECAUSE I KNOW THE PERSON ASKING THE QUESTION IS
WANTING A STRAIGHT ANSWER: YES OR NO. BUT THAT'S A QUESTION WITHOUT
A STRAIGHT ANSWER. YOU CAN SAY NO, IF ..., OR YOU CAN SAY YES, BUT ..., AND
THE NEXT 20 MINUTES QUALIFYING YOUR ANSWER. BUT THERE ARE GOOD
REASONS FOR SOUNDING EVASIVE WHEN YOU TRY TO ANSWER SUCH A QUESTION. SO ...
BEFORE WE START TALKING SPECIFICALLY ABOUT VCM & PVC I'D LIKE TO GIVE YOU A
SHORT COURSE IN TOXICOLOGY SO THAT YOU'LL UNDERSTAND WHY ANSWERS MUST BE
COMPLEX.

TOXICOLOGY

TOXICOLOGY BEGAN, AS YOU MIGHT SUSPECT, AS THE STUDY OF POISONS. AS A
MATTER OF FACT, THE ROOT WORD TOXON - REFERS TO BOWS & ARROWS.

A

THEOPHASTUS VON HOHENHEIM (ALIAS PARACELSUS). HE IS

... (AT LEAST) FOR HIS RECOGNITION THAT ... "ALL SUBSTANCES

IS NONE WHICH IS NOT A POISON. THE RIGHT DOSE

PRISON AND A REMEDY."

WANTING TO SAY THAT, AS EXPLAINED BY PROFESSOR EMIL MRAK

U.S. CONGRESS CONCERNING THE SAFETY OF PESTICIDE

ARE NO HARMLESS SUBSTANCES; THERE ARE ONLY HARMLESS

"CIRCUMSTANCES". ALL OF THIS LEADS US TO A BASIC PREMISE OF

THE CONCEPT OF THRESHOLD.

PRODUCE A RESPONSE (E.G. TOXICITY, IRRITATION,

(ARROWS) AT SOME LEVEL. BUT, A LEVEL EXISTS FOR ALL

FOR WHICH NO RESPONSE MAY BE EXPECTED.

EXTRA STORY ON WATER

WHAT I'M WORKING TOWARD HERE IS THE CONCEPT OF DOSE - PROBABLY THE
LEAST UNDERSTOOD CONCEPT IN TOXICOLOGY BY THOSE NOT TRAINED IN THE FIELD.

DOSE IS THE AMOUNT OF MATERIAL REQUIRED TO PRODUCE THE DESIRED AFFECT.

WHEN YOUR DR. TELLS YOU TO TAKE TWO ASPIRIN & GO TO BED, HE HAS A REASON. IF HE TOLD YOU TO CRUMBLE ONE ASPIRIN & TAKE JUST A PINCH OF THE POWDER, IT WOULDN'T CURE YOUR HEADACHE. IF HE TOLD YOU TO TAKE THREE BOTTLES OF ASPIRIN, IT MIGHT HAVE DRASTIC EFFECTS.

VEV-202080

SO IT MAKES SENSE THAT AS YOU INCREASE THE DOSE YOU INCREASE THE
RESPONSE ...

THIS ALL LEADS US TO THE DOSE/RESPONSE CURVE.

ADS US TO THE DOSE/RESPONSE CURVE.

VC Isolation	6 hrs	Depletion
100 ppm	100	100
50 ppm	50	50
25 ppm	25	25
12.5 ppm	12.5	12.5
6.25 ppm	6.25	6.25
3.125 ppm	3.125	3.125
1.5625 ppm	1.5625	1.5625
0.78125 ppm	0.78125	0.78125
0.390625 ppm	0.390625	0.390625
0.1953125 ppm	0.1953125	0.1953125
0.09765625 ppm	0.09765625	0.09765625
0.048828125 ppm	0.048828125	0.048828125
0.0244140625 ppm	0.0244140625	0.0244140625
0.01220703125 ppm	0.01220703125	0.01220703125
0.006103515625 ppm	0.006103515625	0.006103515625
0.0030517578125 ppm	0.0030517578125	0.0030517578125
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EXAMPLE ON BOARD)

EXAMPLE

50

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USED FOR OTHER RESPONSES

DERMAL/ORAL

EFFECTS --H₂O LEAD CHROMATE

TOXIC EFFECTS

DESCRIBE: EXAMPLE OF ALCOHOL

EFFECTS: DRUNKEN STUPOR

UPSET STOMACH

BLURRED VISION

NAUSEA

GIDDYNESS

LACK OF BALANCE

EUPHORIA

CNS DEPRESSANT

HEADACHE

CHRONIC EFFECTS:

LIVER

INCREASED AGING

ADDICTION

TOXICITY & HAZARD

TOXICITY INHERENT PROPERTY OF THE COMPOUND LD 50, CATALOG OF ADVERSE EFFECTS

HAZARD LIKELIHOOD OF EXPOSURE IS CONSIDERED (EXAMPLE: BLOCK OF LEAD, N₂)

LIKE MANY SUBSTANCES, VCM HAS BEEN KNOWN FOR YEARS TO HAVE SOME TOXIC PROPERTIES. BUT PRIOR TO 1974 IT WAS CONSIDERED TO BE A RATHER INNOCUOUS CHEMICAL. IT WAS KNOWN AT EXTREMELY HIGH CONCENTRATIONS TO BE AN ANESTHETIC, IN FACT IT WAS ACTUALLY USED AS AN ANESTHETIC FOR A WHILE.

THE FIRST INKLING OF A POTENTIAL CHRONIC PROBLEM WAS A 1949 STUDY OF WORKERS IN A RUSSIAN PLANT. HEPATITIS WAS SEEN. BUT IT WAS CONCLUDED THAT A PCB PLASTICIZER WAS PROBABLY THE CULPRIT.

another chemical

NOTE: Toxicology is not an exact science; calculations have variability: LD₅₀ ± 50% =

STUDY BY THE DOW CHEMICAL COMPANY ON LABORATORY ANIMALS
 LIVER DAMAGE AT 100 PPM BUT A SIMILAR STUDY AT YALE FOUND
 NO CONCERN.

BY 1970 THERE WAS A RECOMMENDED STANDARD DEVELOPED BY A
 OF 500 PPM FOR WORKER EXPOSURE. WHEN THE OSHACT WAS
 THIS CONSENSUS STANDARD WAS ADOPTED INTO LAW.
 (PARTS PER MILLION.)

REVERSIBLE DISEASE OF THE BONES OF THE FINGERS CALLED
 WAS DISCOVERED AMONG SOME HEAVILY EXPOSED REACTOR CLEANERS.
 TRIGGERED RESEARCH PROJECTS IN BOTH THE UNITED STATES
 TO DISCOVER THE EXACT CAUSE OF THE DISEASE.
 A PVC PRODUCER, REPORTED AT THE 10TH INTERNATIONAL
 IN HOUSTON IN MAY 1970 THAT HE HAD BEEN ABLE TO PRODUCE
 (ANGIOSARCOMA) IN TEST ANIMALS AT EXTREMELY HIGH LEVELS
 (100 PPM) OF VCM EXPOSURE. DR. VIOLA'S FINDINGS WERE
 PUBLISHED IN THE JOURNAL OF CANCER RESEARCH IN 1971.

THE INDUSTRY BEGAN PLANS FOR MORE EXTENSIVE ANIMAL STUDIES AT
 EXPOSURE MORE LIKELY TO BE ENCOUNTERED IN ACTUAL PLANT SITUATIONS.
 EPIDEMIOLOGICAL STUDIES OF PLANT WORKERS WERE ALSO PLANNED.

AN ANIMAL INHALATION STUDY WAS CONDUCTED UNDER THE DIRECTION OF DR.
 CESARE MALTONI OF ITALY.

IN THE UNITED STATES THE CHEMICALS MANUFACTURERS ASSOCIATION IN JUNE
 1973 ANNOUNCED THAT 17 PVC PRODUCERS HAD AGREED TO SPONSOR A STUDY OF ALL
 CAUSES OF DEATHS IN VINYL CHLORIDE WORKERS. IN FEBRUARY 1973 THE INDUSTRY
 ALSO CONTRACTED FOR LIFETIME CHRONIC INHALATION STUDIES USING TEST ANIMALS.

SOME PRELIMINARY RESULTS OF DR. MALTONI'S STUDY BECAME AVAILABLE IN
 EARLY 1973. DR. MALTONI HAD DETECTED A VARIETY OF TUMORS IN TEST ANIMALS
 AT CONCENTRATIONS AS LOW AS 250 PPM.

IN JANUARY 1974, B.F. GOODRICH NOTIFIED GOVERNMENT OFFICIALS OF THE THREE ANGIOSARCOMA DEATHS.

A SPECIAL "FACT-FINDING" HEARING HELD IN FEBRUARY 1974, OSHA ISSUED AN EMERGENCY TEMPORARY STANDARD WHICH LOWERED THE MAXIMUM VCM WORKER EXPOSURE FROM 500 PPM TO 50 PPM.

THEFORE, OSHA PROPOSED A PERMANENT WORKER STANDARD WHICH LIMITED PLANT EXPOSURE TO THE "NO DETECTABLE LEVEL" AND REQUIRE THE USE OF OVERSUIT SUITS AND SELF-CONTAINED BREATHING EQUIPMENT.

THE HEARINGS, UP TILL THEN THE LARGEST EVER HELD BY OSHA, BEGAN ON JUNE 25.

THE HEARING, OSHA HEARD EVIDENCE PRESENTED BY REPRESENTATIVES OF THE INDUSTRY, PUBLIC INTEREST GROUPS, SCIENTISTS AND ENGINEERS.

AFTER REVIEWING THE EVIDENCE, OSHA PUBLISHED A PERMANENT STANDARD OF 100 PPM ALLOWABLE WORKER EXPOSURE WHICH WENT INTO EFFECT ON APRIL 1, 1975. THE WIDE COST OF COMPLIANCE RAN BETWEEN \$300 AND \$400 MILLION IN CAPITAL EXPENDITURES PLUS YEARLY OPERATING EXPENSES. THE CONOCO PVC

PLANT IN OKC HAS SPENT APPROXIMATELY \$300 MILLION TO REACH COMPLIANCE WITH THE NEW STANDARD.

EPA INVESTIGATIONS

AT THE SAME TIME THE OSHA STANDARDS WERE BEING HAMMERED OUT, THE ENVIRONMENTAL PROTECTION AGENCY (EPA) BEGAN INVESTIGATIONS INTO WHETHER VCM CONSTITUTED A HAZARD TO THE HEALTH OF PERSONS LIVING IN THE VICINITY OF PVC PLANTS.

AN EPA TASK FORCE, ESTABLISHED IN FEBRUARY 1974, DETERMINED THAT THERE WAS "NO SCIENTIFIC EVIDENCE TO INDICATE THAT THESE EMISSIONS POSE AN IMMINENT HAZARD TO PEOPLE LIVING NEAR THESE PLANTS ..."

NONETHELESS, THE EPA SAID IT WOULD PROPOSE REGULATIONS TO REDUCE VCM EMISSIONS DRASTICALLY FROM 1974 LEVELS.

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INVESTIGATIONS INTO VINYL CHLORIDE RESULTED IN THE PUBLICATION
OF DOCUMENTS ON THE SUBJECT: (1) A 67-PAGE PRELIMINARY
REPORT ON THE ENVIRONMENTAL PROBLEMS ASSOCIATED WITH VINYL CHLORIDE --
MAY 1975, (2) A SCIENTIFIC AND TECHNICAL ASSESSMENT REPORT ON VINYL
CHLORIDE -- JUNE 1975, (3) A QUANTITATIVE RISK-
ASSESSMENT REPORT ON ENVIRONMENTAL EXPOSURE TO VINYL CHLORIDE -- DECEMBER 1975, AND
(4) A VOLUME STANDARD SUPPORT AND ENVIRONMENTAL IMPACT
REPORT -- SEPTEMBER 1976.

THE AGENCY ALSO OFFERED INTERESTED PARTIES THE OPPORTUNITY TO MEET
WITH AGENCY REPRESENTATIVES TO DISCUSS PROPOSED METHODS OF CONTROLLING VCM EMISSIONS.
FOLLOWING A PERIOD OF EXTENSIVE STUDY AND DISCUSSIONS, THE AGENCY
ON DECEMBER 16, 1975, A STANDARD REGULATING EMISSIONS
OF VINYL CHLORIDE INTO THE AMBIENT AIR. ^{define} A PUBLIC HEARING WAS HELD IN
JANUARY 1976, THE OFFICIAL RECORD OF THE AGENCY'S INVESTIGATION OF VINYL
CHLORIDE CONSISTS OF 999 DOCUMENTS TOTALING SOME 9,000 PAGES.
IN MARCH 1976, AFTER MORE THAN TWO AND A HALF YEARS OF INTENSIVE
INVESTIGATION EPA PROMULGATED NATIONAL EMISSION STANDARDS FOR VINYL CHLORIDE
AND PVC RESIN PLANTS.

THE EPA STANDARDS REDUCED EMISSIONS BY APPROXIMATELY 95 PERCENT FROM
1974 LEVELS. THE STANDARDS WOULD THEORETICALLY REDUCE THESE EXPOSURE LEVELS
FROM APPROXIMATELY 17 PPB (STOP AND DISCUSS PARTS PER BILLION) TO LESS THAN
ONE PPB AS A YEARLY AVERAGE. BASED ON EPA'S OWN CALCULATIONS, THIS COULD
RESULT AT A MAXIMUM IN APPROXIMATELY ONE CASE OF ANGIOSARCOMA EVERY TWO
YEARS AMONG THE FIVE MILLION PEOPLE LIVING IN THE VICINITY OF THESE PLANTS.
CONSIDERING THAT MORE THAN 80,000 OF THESE PEOPLE COULD BE-EXPECTED TO DIE
FROM OTHER CAUSES DURING THAT SAME TWO-YEAR PERIOD, THE THEORETICAL ONE
ANGIOSARCOMA CASE WAS CONSIDERED AN ACCEPTABLE RISK BY EPA.

ADDRESS FOR A MOMENT AND DISCUSS THAT TERM "ACCEPTABLE RISK".
 THAT WE UNDERSTAND THAT THERE IS NO SUCH THING AS ZERO
 HUMAN ACTIVITIES FROM GETTING OUT OF BED, TO TAKING A SHOWER,
 CAN INVOLVE SOME AMOUNT OF RISK. EVEN NOT GETTING OUT OF BED

WE ARE CONSCIOUSLY OR NOT, WE ARE CHOOSING TO
 ACTIVITIES BECAUSE WE JUDGE THE RISKS TO BE ACCEPTABLE. LET ME
 EXAMPLES OF SOME EVERYDAY RISKS THAT HAVE BEEN QUANTIFIED:

INDIVIDUAL RISK OF FATALITY

MOTOR VEHICLE	300 CHANCES/MILLION
SLIPS	90 CHANCES/MILLION
FALLS	40 CHANCES/MILLION
TRAVEL	9 CHANCES/MILLION
EATING	1/2 CHANCE /MILLION
CANCER	3000 CHANCES/MILLION
VINYL CHLORIDE	1/10 CHANCE /MILLION
70 VS 55 MPH	50 CHANCES/MILLION

Many numerical
also 1/10
or p.8

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IF WE CAN ASSIGN MATHEMATICAL VALUES TO RISK, IT FOLLOWS THAT WE CAN
 COMPARE RISKS WHICH ARE ROUGHLY EQUIVALENT. GETTING BACK TO THE SUBJECT
 AT HAND, PROFESSOR RICHARD WILSON OF HARVARD UNIVERSITY HAS CALCULATED THAT
 THE RISK OF LIVING WITHIN FIVE MILES OF A PVC PLANT FOR ONE YEAR IS
 EQUIVALENT TO THE RISK OF CONTRACTING CANCER FROM EATING 1/2 TABLESPOON OF
 PEANUT BUTTER, OR TO THE RISK OF CONTRACTING CANCER FROM THE INCREASED
 COSMIC RADIATION DURING A THREE-DAY VISIT TO DENVER, COLORADO, OR TO THE
 HAZARD FROM SMOKING 1/15TH OF A CIGARETTE.

GETTING BACK ON TRACK ... IN NOVEMBER 1976

THE ENVIRONMENTAL DEFENSE FUND FILED SUIT IN THE COURT OF APPEALS IN
 WASHINGTON CHALLENGING THE EFFECTIVENESS OF THE STANDARD.

EPA NEGOTIATED IN PRIVATE MEETINGS FROM WHICH THE
 [REDACTED] ALTHOUGH AN EVENTUAL RULING BY THE COURT THAT
 [REDACTED] HAD A LEGITIMATE RIGHT TO INTERVENE IN THE

THOSE SECRET NEGOTIATIONS WAS A FORMAL AGREEMENT ON
 BETWEEN EPA AND EDF TO PROPOSE AMENDMENTS TO THE EXISTING
 STANDARD WHICH HAD BEEN PROMULGATED [REDACTED] MONTHS
 [REDACTED] AMENDMENTS WERE PUBLISHED IN THE FEDERAL
REGISTER, 1977.

[REDACTED] HAD RECEIVED OR OBTAINED NO NEW MEDICAL OR TECHNICAL
 [REDACTED] WOULD JUSTIFY ANY CHANGES IN THE STANDARD.

[REDACTED] TECHNICAL READINGS PLUS SOPHISTICATED COMPUTER PROGRAMS,
 [REDACTED] THAT THE ORIGINAL EPA ESTIMATE OF 17 PPB OF VINYL
 [REDACTED] AVERAGE EXPOSURE WITHIN FIVE MILES (NEAR) OF
 [REDACTED] VINYL CHLORIDE INSTALLATIONS WAS FAR TOO HIGH.

[REDACTED] IT WAS DETERMINED THAT MEAN VINYL CHLORIDE CONCENTRATIONS ON
 [REDACTED] OF 2.5-4.5 PPB FOR EACH UNREGULATED PLANT ARE REDUCED TO
 [REDACTED] ON THE ORDER OF 0.15-0.25 PPB WHEN IN COMPLIANCE WITH
 [REDACTED] STANDARDS.

SEVERAL EXPERTS HAVE VOICED OPINIONS REGARDING ACCEPTABLE AMBIENT
 CONCENTRATIONS OF VINYL CHLORIDE. DR. CARLO TUMBURRO, DIRECTOR OF A
 VC RESEARCH PROGRAM AT THE UNIVERSITY OF LOUISVILLE MEDICAL SCHOOL, DR.
 CHARLES SHAW, CHIEF OF THE MEDICAL GENETICS SECTION OF MD ANDERSON AND
 DR. MITCHELL ZAVON, PROFESSOR OF INDUSTRIAL MEDICINE AT THE UNIVERSITY
 OF CINCINNATI HAVE ALL STATED THAT CONCENTRATIONS OF VC ON THE ORDER OF
 10 PPB SHOULD BE SAFE FOR HUMAN EXPOSURE.

ONE LAST POINT: I MENTIONED THAT THE EPA ESTIMATED THAT AN AMBIENT
 LEVEL COMPLIANCE WITH ITS STANDARD COULD RESULT AT A MAXIMUM OF ONE CASE

EVERY TWO YEARS IN AN EXPOSED POPULATION OF 5 MILLION.
IS CONSIDERED A VERY RARE FORM OF CANCER. THE NATIONAL
PER 78,000 DEATHS. OUT OF A POPULATION OF 5 MILLION
DEATHS FROM ALL CAUSES IN TWO YEARS SO AN
ANGIOSARCOMA EVERY 2 YEARS IS NO MORE THAN WOULD
NATURALLY.