AP42 Section:	4.12, draft 1997
Related:	5
Title:	RMA Emissions Testing Program Presentation September 1996

RMA EMISSIONS TESTING PROGRAM

RMA EMISSIONS TESTING PROGRAM

- TIRE AND ENGINEERED PRODUCTS
- TRC CONSULTANT
- RUBBER PROCESSING EQUIPMENT
- GENERIC COMPOUNDS & COMPANY SPECIFIC
- PILOT SCALE & LAB SCALE TESTING
- EPA & STATE SUPPORT

RMA EMISSION TESTING PROGRAM

- EPA SUPPORT
  - MET WITH EPA TESTING GROUP - JUNE 8,1995
    - ACCEPTED PROGRAM WITH MINOR MODIFICATIONS
    - WILL SUPPORT IN GETTING STATE BUY-IN
  - MET WITH EPA EMISSION FACTOR DEVELOPMENT GROUP - JUNE 22,1995
  - EXPECT TO PUBLISH ON BULLETIN BOARD -12/
  - EXPECT PUBLISHED ON AP-42 -1996

RMA EMISSIONS TESTING PROGRAM

- STATE SUPPORT
  - RMA PACKAGED PROGRAM FOR PRESENTATION TO STATES AND MET WITH ALL STATES OF CONCERN
  - PRESENTED LIST OF INSIGNIFICANT SOURCES

PROGRAM GOALS

- IDENTIFICATION OF SPECIFIC AIR TOXICS
- DATA BASED ON CURRENT PRACTICES
- SHARED IDEAS, RESOURCES AND COSTS
- MORE COMPLETE TESTING PROGRAM DUE TO MORE RESOURCES

PROGRAM GOALS

- CONSISTENCY IN REPORTING BETWEEN RUBBER MANUFACTURERS
- FEDERAL AND STATE BUY-IN DUE TO GROUP INVOLVEMENT
- EMISSION FACTOR DEVELOPMENT

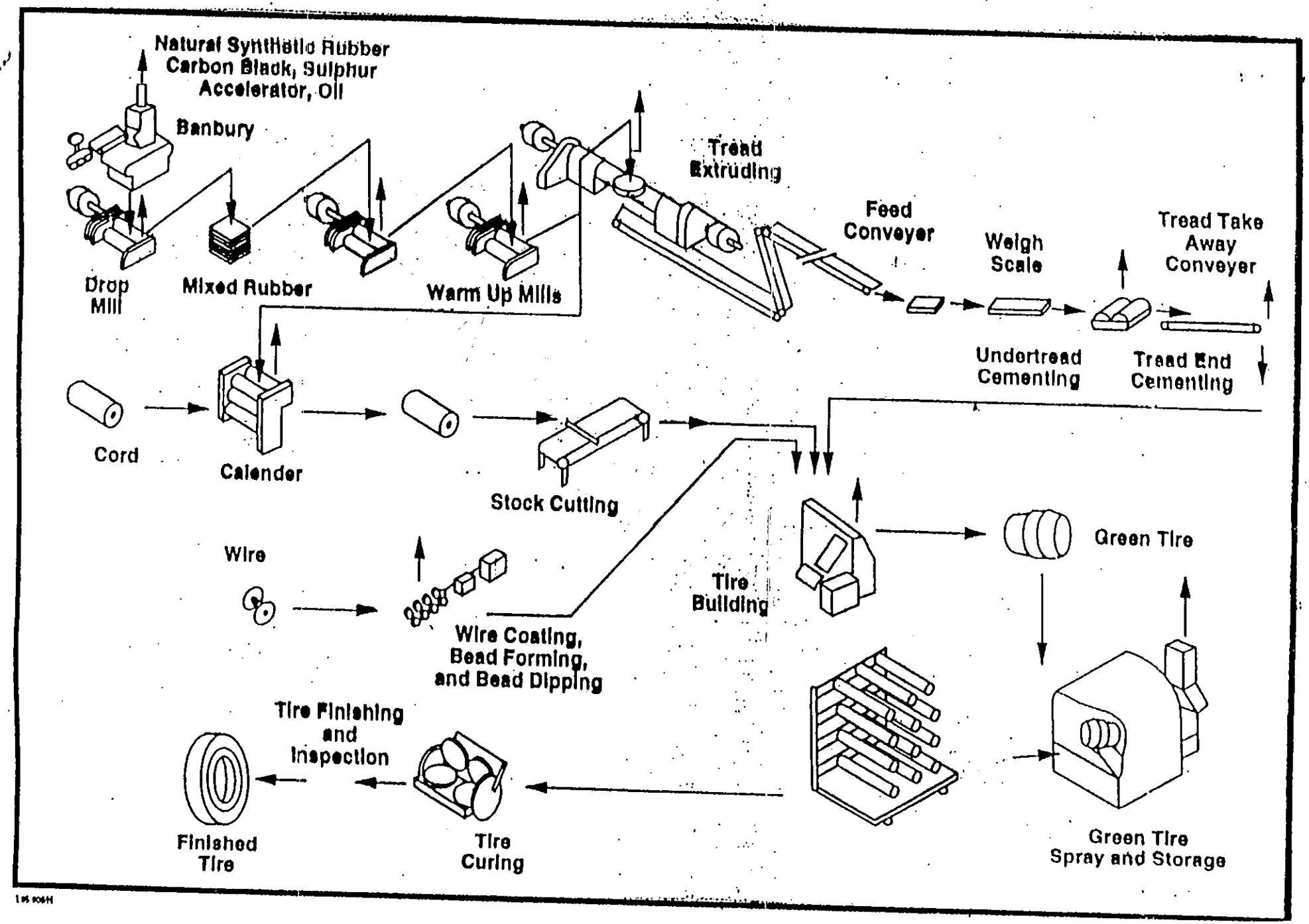

Natural Synthetic Rubber
Carbon Black, Sulphur
Accelerator, Oil
Banbury
Drop Mill
Mixed Rubber
Warm Up Mills
Tread Extruding
Feed Conveyer
Weigh Scale
Tread Take Away Conveyer
Undertread Cementing
Tread End Cementing
Cord
Calender
Stock Cutting
Wire
Wire Coating, Bead Forming, and Bead Dipping
Tire Building
Green Tire
Green Tire Spray and Storage
Tire Curing
Tire Finishing and Inspection
Finished Tire

Table 4. Sampling and Analytical Methods Summary			
	Parameters	Sampling Method	Analytical Methods
1	Total Volatile Organic Compounds	M25A	M25A/FID
2	Speciated Volatiles	TO-14 (a) Grab Sample	TO-14/GC-MS M 8240
3	Volatile Ozone Precursors	TO-14	TO-14/GC-FID
4	Sulfur Compounds	TO-14	GC/FPD
5	Semivolatiles	M 0010 (b) Grab Sample (b)	M 8270 M 8270
6	Particulate Organic Matter	M202	Extr./Gravimetric
7	Particulate Matter	M5	Gravimetric
8	Metals	M0012	M 6010, 7000
9	Amines	Midget Impinger Sampling Train	GC
10	FTIR	Extractive	FTIR

(a) Grab sample for autoclave water trap.
(b) Grab/composite sample for autoclave water trap.

Table 3. Test Matrix of Processes and Chemical Analyses									
	Tire Press	Oven Cure	Autoclave	Extruder	Banbury Mixers	Grinding	Platen Press	Calendar	Warming Mill
Total Volatile Organic Compounds	X		X	X	X	X	X	X	X
Speciated Volatiles	X		X	X	X	X	X	X	X
Volatile Ozone Precursors	X		X	X	X	X	X	X	X
Sulfur Compounds	X		X	X	X	X	X	X	X
Semivolatiles	X		X	X	X	X	X	X	X
Polycyclic Organic Matter	X		X	X	X	X	X	X	X
Amines	X		X						
FTIR	X	X		X		(a)			
Particulate Matter				X	X	X			
Metals				X	X	X			

(a) FTIR at one grinding facility.

Table 4-1. Generic Rubber Formulations/Products		
Compound	Category	Description
1	Tire Inner Liner	Brominated IIR/Natural Rubber
2	Tire Ply Coat	Natural Rubber/Synthetic Rubber
3	Tire Belt Coat	Natural Rubber
4	Tire Base/Sidewall	Natural Rubber/Polybutadiene Rubber
5	Tire Apex	Natural Rubber
6	Tire Tread	Styrene Butadiene Rubber/Polybutadiene Rubber
7	Tire Bladder	Butyl Rubber/Neoprene Rubber
8	EPDM 1	EPDM Sulfur Cure
9	EPDM 2	Peroxide Cure
10	EPDM 3	Non-black EPDM Sulfur Cure
11	CRW	Polychloroprene W Type
12	CRG	Polychloroprene G Type
13	Paracryl OZO	Nitrile Rubber/PVC
14	Paracryl BLT	Nitrile Rubber
15	Hypalon	CSM
16	Fluoroelastomer	FKM
17	AEM	Vamac
18	Hydrogenated Nitrile	HNBR
19	Silicone	VMQ
20	Acrylate Rubber	ACM
21	Chlorinated Polyethylene	CPE
22	Emulsion SBR	SBR.1502
23	Epichlorohydrin	ECO
24	Oil-Extended SBR*	SBR 1712
25	Emulsion SBR*	SBR 1500
26	Solution SBR*	Duradene 707

*Compounds 24, 25, and 26. Were mixes of polymer only, without fillers or cure system.

GENERIC COMPOUNDS

- MIXING
  - 23 COMPOUNDS
  - 3 SYNTHETIC RUBBERS
- MILLING, EXTRUDING
  - 4 BASE GENERIC COMPOUNDS
- AUTOCLAVE
  - 11 COMPOUNDS
- PLATEN PRESS
  - 17 COMPOUNDS
- HOT AIR CURE
  - 3 COMPOUNDS
- TIRE CURE/GRINDING
  - COMPANY SPECIFIC

RMA EMISSION TESTING PROGRAM

- MIXING
  - PRELIMINARY TEST CONDUCTED AT FARREL
    - MIXING - 130 # AND 3 #
    - GENERIC TREAD, SIDEWALL, EPDM-P, SBR1502
    - MIXING -3# FOR REMAINING COMPOUNDS
  - OPERATING PARAMETERS
    - NON-PRODUCTIVE - 335^{O} F
    - PRODUCTIVE - 220^{O} F
    - SAMPLING ZONES - EXHAUST LEADING TO BAGHOUSE
    - EXHAUST FROM DROP MILL/ROLLER DIE

RMA EMISSION TESTING PROGRAM

- MILLING
  - MILLS FEEDING TO HOT FEED EXTRUDERS OR CALENDERS
    - MILLS - 60"X12"
      - NEOPRENE
    - MILLS 18"X 6"
      - PLY COAT, BELT COAT,BASE/ SIDEWALL
  - OPERATING PARAMETERS
    - SAMPLE SIZE - 2.5 POUNDS
    - MILL ROLL - 90° F
    - RUBBER TEMPERATURE - 175° F
    - THICKNESS - 0.3 INCHES

RMA EMISSION TESTING PROGRAM

- EXTRUDER
  - TESTING CONDUCTED AT DAVIS STANDARD
  - EXTRUDER - 3.5 "
  - GENERIC TREAD, SIDEWALL, EPDM-P, SBR1502
  - APPLIES TO HOT AND COLD FEED EXTRUDERS

RMA EMISSIONS TESTING PROGRAM

- EXTRUDER OPERATING PARAMETERS
  - TREAD - 225-275^{O} F
  - SIDEWALL - 230-260^{O} F
  - SBR 1502 - 255-275^{O} F
  - EPDM 2 - 250-280^{O} F
  - SAMPLING ZONES
    - OUTLET(HEAD) - 1 POINT
    - COOL DOWN ZONE - 2 POINTS

RMA EMISSION TESTING PROGRAM

- CALENDERING
  - CALENDER - TIRE PLY COAT
  - BATCH CALENDER - NEOPRENE

RMA EMISSIONS TESTING PROGRAM

- AUTOCLAVE
  - TESTING CONDUCTED AT RODGERS INDUSTRY
  - FULL SIZE AUTOCLAVE
  - TEST INCLUDED CURING TRAP, BLOWDOWN AND COOL DOWN
  - RAN 11 GENERIC COMPOUNDS
- OPERATING PARAMETERS
  - TEMPERATURES - 340° F
  - PRESSURES - 110 PSIG
  - SAMPLE SIZE - 50 POUNDS

RMA EMISSIONS TESTING PROGRAM

- HOT AIR CURE
  - TESTING DONE ON LAB SCALE EQUIPMENT
  - TEST INCLUDED CURING AND COOL DOWN
  - RAN 3 GENERIC COMPOUNDS
- OPERATING PARAMETERS
  - TEMPERATURES - 400° F
  - TIME - 5-8 MINUTES
  - SAMPLE SIZE - 50 GRAMS

RMA EMISSIONS TESTING PROGRAM

- PLATEN PRESS
  - TESTING DONE ON LAB SCALE EQUIPMENT
  - TEST INCLUDED COOL DOWN AFTER CURE
  - RAN 17 COMPOUNDS THROUGH TEST
- OPERATING PARAMETERS
  - TEMPERATURES - 340-350^{O} F
  - PRESSURES - 30 TONS/3 MINUTES AND 20 TONS/3 MINUTES
  - SAMPLE SIZE - 50 GRAMS
  - COOL DOWN - 6 MINUTES

RMA EMISSION TESTING PROGRAM

- TIRE PRESS
  - PRELIMINARY TEST CONDUCTED AT RODGERS INDUSTRY
  - TEST INCLUDES 2 CURE CYCLES AFTER REMOVAL
  - EACH COMPANY RUNS 3 SETS OF 3 TYPES OF PASSENGER TIRES

RMA EMISSIONS TESTING PROGRAM

- TIRE PRESS OPERATING PARAMETERS
  - 42" PRESS
    - TEMPERATURES - 330 - 355° F
    - PRESSURES - 200-300 PSIG
    - CURE TIME - 10-15 MINUTES
  - OVEN
    - CROSS SECTION OF TIRE
    - TEMPERATURE - OVEN - 360° F
    - TEMPERATURE - CORE - 340° F

RMA EMISSIONS TESTING PROGRAM

- GRINDING
  - DUNLOP
    - WHITE SIDEWALL
  - BANDAG
    - BUFFING
  - MICHELIN
    - CARCASS
  - GATES
    - V-BELT

RMA EMISSIONS TESTING PROGRAM

- WSW
  - GRINDING TIME - 20 SECONDS
- FORCE GRINDING
  - EMISSIONS NOT CONCENTRATED ENOUGH TO ANALYZE

RMA EMISSIONS TESTING PROGRAM

- RETREAD BUFFING
  - EDGER
  - 4 IN-LINE BUFFING WHEELS
  - 37 FOOT LONG TREAD
  - 40 SECOND RUN WITH 5 SECONDS BETWEEN RUNS
- CARCASS GRINDING
  - 10-12 TIRES/HOUR
  - COARSE GRIND - 1-2 MINUTES
  - FINE GRIND - 4 MINUTES

RMA EMISSIONS TESTING PROGRAM

- V-BELT GRINDING
  - 8 GRINDERS EACH ENCLOSED IN A CLOSE FITTING HOOD
  - WATER COOLING BY LOCALIZED SPRAY AT EACH GRINDER
  - CRG NEOPRENE TYPE COMPOUND

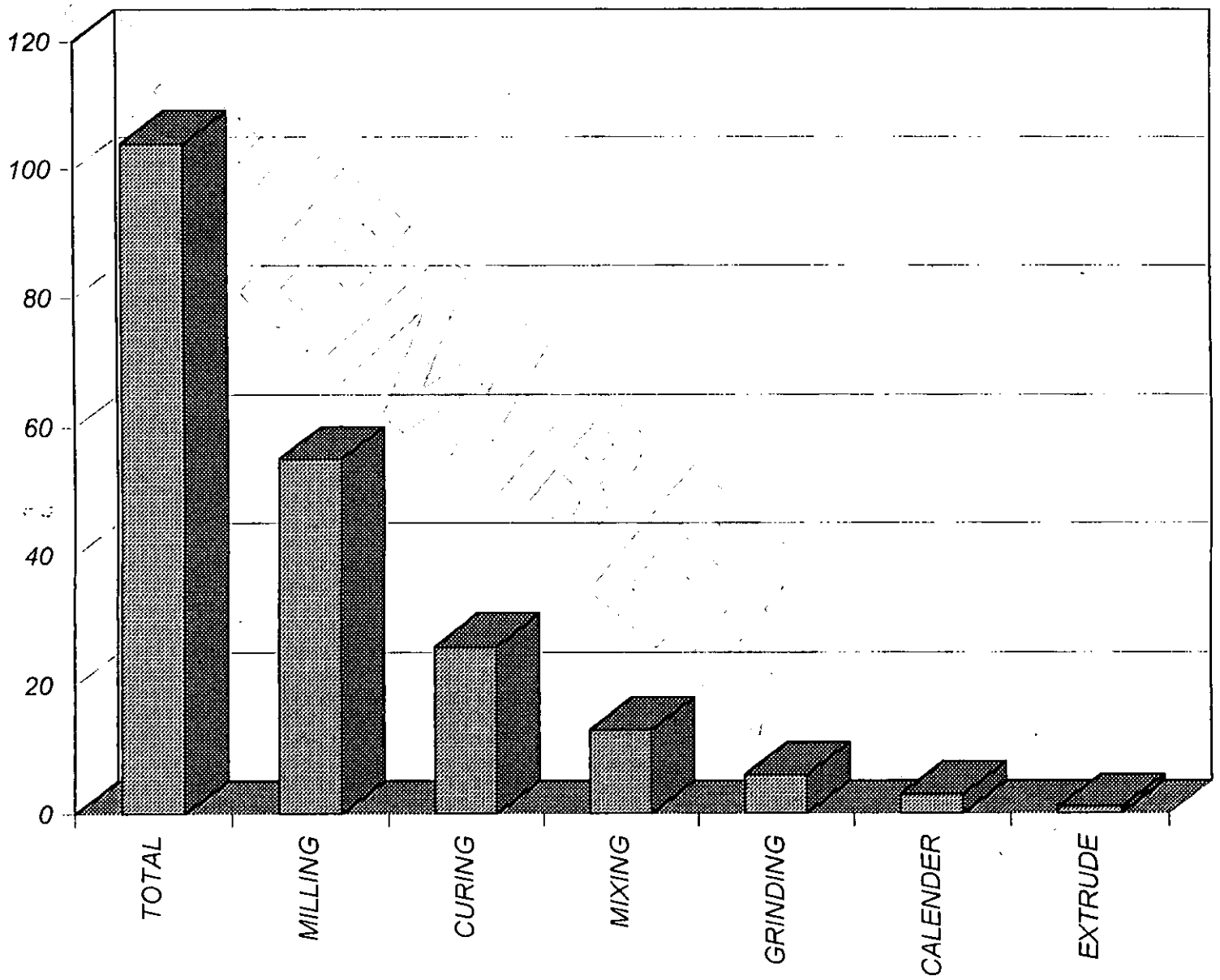
TIRE PLANT EMISSIONS
35,000 TIRES/DAY

- BASIS
  - 60% OF MATERIAL EXTRUDED(TREAD)
  - 40% OF MATERIAL CALENDERED(PLY)
  - 25 LBS/TIRE ==>21.4 LBS RUBBER/TIRE
  - MIXING/MILLING/CURING (AVG 1-7)
  - 50% WSW
- PARTICULATE
  - UNCONTROLLED - 934 TPY
  - CONTROLLED - 9.34 TPY (99% EFF)

TIRE PLANT EMISSIONS
35,000 TIRES/DAY

- VOC RUBBER PROCESSING
  - TOTAL 104 TPY
  - MILLING 55 TPY
  - CURING 26 TPY
  - MIXING 13 TPY
  - GRINDING 6 TPY
  - CALENDER 3 TPY
  - EXTRUDE 1 TPY

TIRE PLANT EMISSIONS



8/30/96

HAZARDOUS AIR POLLUTANTS

- COMMONLY FOUND HAPS
  - MIXED XYLENES
  - TOLUENE
  - CARBON DISULFIDE
  - ETHYLBENZENE
  - 4-METHYL-2-PENTANONE
  - HEXANE
  - ANILINE
  - STYRENE
  - HYDROQUINONE
- MIXING/TIRE CURE - 1%-15% OF TOTAL VOC

RMA APPLICATION OF EMISSION FACTORS

SEPTEMBER 1996

MANUALS

- VOLUME 1 - DELETE ORIGINAL AND SUBSTITUTE TRAINING MANUAL
- VOLUME 2 - USE FEBRUARY 1996 VERSION WITH THE TITLE "PROGRAM DATABASE SUMMARY REPORT - DEVELOPMENT OF EMISSION FACTORS FOR THE RUBBER INDUSTRY"
  - LETTER OF EXPLANATION OF CHANGES
  - METHYLENE CHLORIDE LETTER

MANUALS

- VOLUME 3 - VERSION DATED FEBRUARY 1995 (NO CHANGE)
- VOLUME 4 - SUBSTITUTE AP-42 VERBIAGE AND EXCEL SPREADSHEETS - SEPTEMBER 1996

RMA GENERAL ASSUMPTIONS

- TOTAL VOC(METHOD 25A) - TO BE USED IN ALL CASES UNLESS TOTAL HAPS EXCEED TOTAL VOC; DISCUSS DIFFERENCES WITH STATE AS NECESSARY. NOTE DIFFERENCES IN PERMIT APPLICATION.

RMA GENERAL ASSUMPTIONS

- AVERAGING OF EMISSIONS FOR MULTIPLE RUNS - IF ONE OR MORE RUN WAS GREATER THAN DETECTION, THEN ANY VALUE BELOW DETECTION WAS ADDED AT ONE-HALF DETECTION AND THEN AVERAGED. FOR EXAMPLE:
- 3; <1; <1 = 3 +1/2+1/2 = 4/3
- EMISSIONS WHERE ALL VALUES FOR ONE OR MORE RUNS IS BELOW DETECTION A VALUE OF ZERO WAS REPORTED

RMA GENERAL ASSUMPTIONS

- RMA EMISSION FACTORS INDICATE THE TOTAL UNCONTROLLED EMISSIONS. ANY REDUCTION IN EMISSIONS FROM A CONTROL DEVICES MUST BE ADDED TO THE CALCULATION.
- CONTROL DEVICE EFFICIENCY WAS TESTED ON MIXING AND GRINDING. IF NO OTHER DATA IS AVAILABLE THIS CAN BE USED.

RMA GENERAL ASSUMPTIONS

- METALS AND PARTICULATE TESTED IN MIXING, GRINDING AND EXTRUDING.
- EXTRUDING VALUES SO LOW THAT IT CONCLUDED TO NOT BE USEFUL TO TEST IN CALENDERING, MILLING OR CURING

RMA GENERAL ASSUMPTIONS

- TESTING ONLY INCLUDES RUBBER PROCESSING. TRANSFER OPERATIONS, WEIGH STATIONS, CEMENTING, MOLD RELEASE AND OTHER PROCESSES ANCILLARY TO RUBBER PROCESSING ARE NOT INCLUDED.

RMA MIXING ASSUMPTIONS

- INCLUDES EMISSIONS FROM INTERNAL MIXER AND DROP MILL OR ROLLER DIE. ASSUMING PELLITIZER IS THE SAME AS ROLLER DIE.
- FACTORS INCLUDE EMISSIONS FROM PRODUCTIVE AND NON PRODUCTIVE RUNS.
- PRODUCTIVE/NON-PRODUCTIVE MIXERS ASSUME 90% OF EMISSIONS ARE NON-PRODUCTIVE MIXING AND 10% ARE FROM PRODUCTIVE MIXING

RMA MIXING ASSUMPTIONS

- PARTICULATE REDUCTION SHOULD BE BASED ON THE EFFICIENCY OF THE SPECIFIC CONTROL DEVICE BEING USED IN THE PLANT
- THERE WAS NO VOC REDUCTION FOUND THROUGH THE DUST COLLECTOR
- METAL COMPOUNDS ASSUMED TO BE PARTICULATE MATTER AND WOULD BE REDUCED BASED ON THE EFFICIENCY OF THE PARTICULATE CONTROL DEVICE

SAMPLE CALCULATION

- MIXING EXAMPLE (PARTICULATE)
- UNCONTROLLED: (LBS OF RUBBER PROCESSED) x (EMISSION FACTOR)
- CONTROLLED: (UNCONTROLLED EMISSIONS) x (1- CONTROL EFFICIENCY)

SAMPLE CALCULATION BASIS

- 480,000,000 LBS OF COMPOUND #9
- MIXING
- CONTROL DEVICE EFFICIENCY IS 99.2%
- FIND: TPY OF TSP CONTROLLED AND UNCONTROLLED

RMA WARM-UP MILL ASSUMPTIONS

- FACTOR INCLUDES ONE PASS FROM A WARM UP MILL
- WHERE MULTIPLE MILLS ARE USED EACH MILL MUST BE COUNTED SEPARATELY.

RMA EXTRUDING ASSUMPTIONS

- FACTOR INCLUDES EMISSIONS FROM A COLD FEED EXTRUDER INCLUDING THE DIE HEAD AND COOLING CONVEYOR
- THE SAME FACTOR IS TO BE USED FOR A HOT FEED EXTRUDER;WITH ADDITIONAL EMISSIONS FROM MILLING ADDED

RMA CALENDERING ASSUMPTIONS

- FACTOR EXCLUDES FEED MILLS

RMA TIRE PRESS CURING ASSUMPTIONS

- FACTORS INCLUDE EMISSIONS DURING VULCANIZING, PRESS OPENING, AND TIRE COOL-DOWN.
- FACTORS DO NOT INCLUDE MOLD RELEASE AGENTS
- FACTORS BASED ON POUNDS OF RUBBER COMPOUND IN A TIRE, WE WILL ASSUME 90% OF TIRE WEIGHT IS RUBBER COMPOUNDS

RMA TIRE PRESS CURING ASSUMPTIONS

- 1,1,1 TRICHLOROETHANE - FOR TIRE F IS AVERAGED FROM THE OTHER TIRES TESTED DUE TO SUSPECTED MOLD RELEASE PRESENCE NOT NORMALLY USED.

RMA AUTOCLAVE CURING ASSUMPTIONS

- FACTOR CORRECTED FOR NON-CONTACT CURING TO INCLUDE EMISSIONS FROM THE WATER PHASE THAT HAD BEEN CONDENSED OUT. IF CONTACT STEAM CURING MULTIPLY THE FACTOR BY 83% SINCE SOME OF THE EMISSIONS WOULD BE CONDENSED OUT.
- EMISSIONS FROM MOLD RELEASES WERE NOT INCLUDED

RMA PLATEN PRESS CURING ASSUMPTIONS

- FACTOR INCLUDES EMISSIONS FROM THE CURING AND THE COOLDOWN
- MOLD RELEASES WERE NOT INCLUDED IN THE FACTOR
- ELEVATED METHYLENE CHLORIDE CONCENTRATIONS ARE IN QUESTION. SUBSEQUENT TESTING AT THE LAB AND AT RMA MEMBER FACILITIES SUPPORTS REPORTING CONCENTRATIONS AT THE DETECTION LEVEL DUE TO HIGH BACKGROUND LEVELS FOUND IN THE LAB DURING TESTING

RMA HOT AIR CURE ASSUMPTIONS

- EMISSIONS FROM MOLD RELEASES WERE NOT INCLUDED IN THE FACTOR
- ELEVATED METHYLENE CHLORIDE CONCENTRATIONS ARE IN QUESTION. SUBSEQUENT TESTING AT THE LAB AND AT RMA MEMBER FACILITIES SUPPORTS REPORTING CONCENTRATIONS AT THE DETECTION LEVEL DUE TO HIGH BACKGROUND LEVELS FOUND IN THE LAB DURING TESTING

RMA GRINDING ASSUMPTIONS

- CARCASS GRINDING AND V- BELT GRINDING - FACTOR BASED ON LBS OF RUBBER GROUND OFF
- RETREAD BUFFING - FACTOR BASED ON LBS OF TREAD RUBBER PROCESSED (BUFFED)

RMA GRINDING ASSUMPTIONS

- FORCE GRINDING, COSMETIC BUFFING OR REPAIR GRINDING SHOULD USE THE SAME FACTOR AS WSW GRINDING (NOT ENOUGH SAMPLE IN FORCE GRINDING TEST)
- V-BELT GRINDING BASED ON NEOPRENE COMPOUND

INTERPOLATION

- FACTORS WERE INTERPOLATED FOR MATERIALS THAT HAVE NOT BEEN TESTED FOR IN A PROCESS; INTERPOLATION IS BASED OFF OF THE MIXING DATA
- CALCULATION - DETERMINE RATIO BY COMPOUND BY PROCESS/MIXING, DETERMINE AVERAGE, USE AVERAGE RATIO TO MULTIPLY BY THE MIXING FACTOR BY COMPOUND TYPE FOR THE CONTAMINANT OF INTEREST

PRODUCTION DATA

- PRODUCTION DATA MUST BE GATHERED IN LBS OF RUBBER PROCESSED BY COMPOUND FOR THE FOLLOWING PROCESSES:
  - MIXING, MILLING, EXTRUDING, CALENDERING, AUTOCLAVE CURE, PRESS CURE, AND HOT AIR CURE
- STOCK IMPORTED OR EXPORTED MUST BE ACCOUNTED FOR IN THE CALCULATION

PRODUCTION DATA

- PRODUCTION DATA FOR TIRE PRESS CURING MUST BE GATHERED BASED ON THE LBS OF RUBBER IN A TIRE. THIS VARIES BY TIRE TYPE(A BALLPARK FIGURE IS 90%)
- SCRAPED MATERIAL MUST BE ACCOUNTED FOR IN THE THROUGHPUT
- RETREAD BUFFING DATA MUST BE GATHERED IN POUNDS OF TREAD PROCESSED THROUGH THE BUFFER

PRODUCTION DATA

- WSW GRINDING DATA CAN BE TRACKED BY EITHER THE NUMBER TIRES THROUGH THE PROCESS TIMES 0.061 LBS OF RUBBER REMOVED/TIRE OR WEIGHING THE POUNDS OF RUBBER REMOVED (MUST BE CORRECTED FOR POLLUTION CONTROL EFFICIENCY)
- SIMILAR CALCULATION CAN BE USED FOR OTHER GRINDING BASED ON COMPANY DATA

PRODUCTION DATA

- CARCASS, FORCE, COSMETIC, REPAIR AND V-BELT GRINDING PRODUCTION DATA MUST BE GATHERED IN POUNDS OF RUBBER REMOVED(CORRECTED FOR POLLUTION CONTROL EFFICIENCY)

TIER 1

- ALL CRITERIA POLLUTANTS MUST BE REVIEWED TO DETERMINE IF ANY THRESHOLDS HAVE BEEN EXCEEDED
- THRESHOLDS FOR CRITERIA POLLUTANTS MUST BE DETERMINED BASED ON THE CLASSIFICATION OF THE AREA
- EMISSIONS FROM ALL SOURCES IN THE PLANT MUST BE ADDED TOGETHER TO DETERMINE IF A THRESHOLD HAS BEEN EXCEEDED
- PTE INCLUDES INSIGNIFICANT AND FUGITIVE EMISSIONS

Tier 1

ASSESSMENT STEP	PTE THRESHOLD	ACTION
Total VOC emissions	100 tpy(less non attainment areas)	No further action if threshold is not exceeded
Total HAPs	25 TPY total HAPs	No further action if threshold is not exceeded
TSP	100 tpy(less non attainment areas	No further action if threshold is not exceeded

BASIS TIER CALCULATIONS

- TOTAL MIXED RUBBER = 480,000,000 LBS/YR
- APEX = 168,000,000 LBS/YR
- CRW = 104,000,000 LBS/YR
- CRG = 30,000,000 LBS/YR
- SIDEWALL = 74,000,000 LBS/YR
- TREAD = 58,000,000 LBS/YR
- CPE = 46,000,000 LBS/YR

TIER 2

- DETAILED CALCULATIONS BASED ON THE ACTUAL COMPOUNDS USED IN EACH PROCESS
- EMISSIONS FROM SPECIFIC HAPS, VOC OR TSP MUST BE ADDED WITH SAME EMISSIONS TYPES FROM OTHER PROCESSES IN THE PLANT TO DETERMINE IF A THRESHOLD IS EXCEEDED

TIER 2

- ASSESSMENT IS BASED ON WORST CASE OR AVERAGE FACTORS FOR ALL COMPOUNDS THROUGH A SPECIFIC PROCESS
- EMISSIONS FROM SPECIFIC HAPS MUST BE ADDED TO EMISSIONS FROM THE SAME HAP FROM OTHER PROCESSES IN THE PLANT TO DETERMINE IF A THRESHOLD IS EXCEEDED

TIER 2

ANALYTE	PTE THRESHOLD	ACTION
Total VOC	100 TPY (less non-attainment)	No further action required if not exceeded
TSP	100 TPY (less non-attainment)	No further action required if not exceeded
HAPS, maximum concentration values	25 TPY Total HAPS 10 TPY Individual HAPS	No further action if threshold is not exceeded If exceeded, evaluate each compound based on throughput
HAPS, average concentration values	25 TPY Total HAPS 10 TPY Individual HAPS	No further action if threshold is not exceeded (less conservative) If exceeded, evaluate each compound based on throughput

TIER 2

ANALYTE	PTE THRESHOLD	ACTION
HAPs	10 TPY of individual HAPs	No further action required if not exceeded
HAPs	112(g) limits for major source	

TIER SUMMARY

- TIER 1
  - TOTAL VOC MAX - 107 TPY
  - TOTAL VOC AVG - 25 TPY
- TIER 2
  - APEX - 18 TPY
  - CRW - 1.7 TPY
  - CRG - 0.2 TPY
  - SIDEWALL - 1.4 TPY
  - TREAD - 1 TPY
  - CPE - 3.6 TPY
    - TOTAL 25.7 TPY

TIRE ASSUMPTIONS TO CONSIDER

- COMPOUND TYPES CLOSEST TO THOSE TESTED
- POT HEATER CURE, RETREAD CURE, PRECURE TREADS - DETERMINE FACTORS TO BE USED
- SLURRY DIP ASSUMPTIONS
- EXTRUDERS COLD FEED/HOT FEED

GP ASSUMPTIONS TO CONSIDER

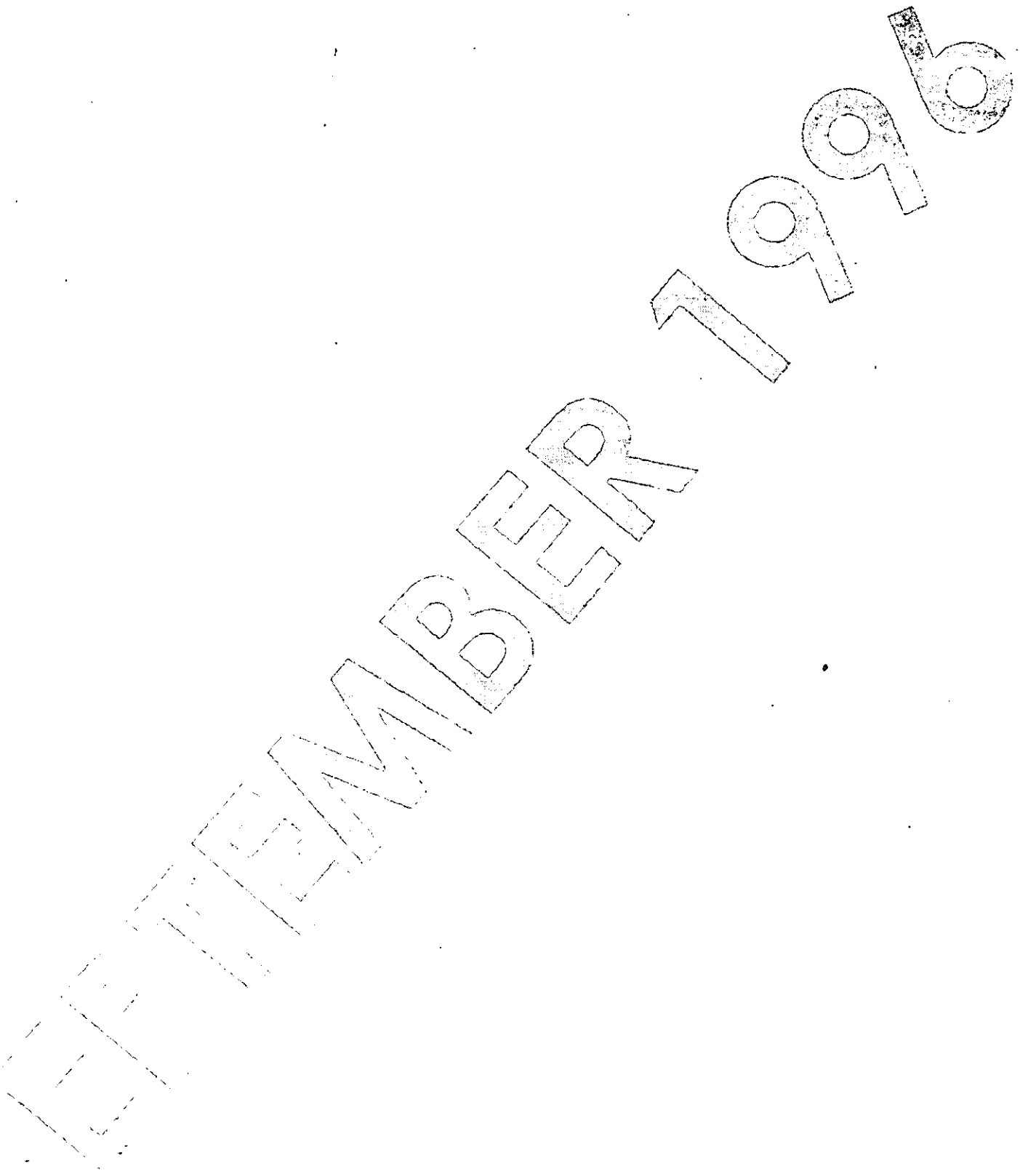
- EMISSIONS FROM FABRIC DIPS INTEGRATED INTO A PRODUCT
- EMISSIONS FROM COMPOSITE PRODUCTS
- APPLICABILITY OF DIFFERENT CURE TYPES (DIAPHRAGM CURE, RING CURE, ETC.)
- NON-BLACK COMPOUND EMISSIONS
- PRODUCT DUSTING EMISSIONS

SEPTEMBER 1996

Tire Cure			Platen Press			Mixing			Milling			
1	m-Xylene + p-Xylene	15.35%	1	4-Methyl-2-penta	134.67%	1	4-Methyl-2-P	14.24%	1	4-Methyl-2-pentanone	5.06%	
2	1,1,1-Trichloroethane	12.57%	2	Carbon Disulfide	45.20%	2	Hydroquinon	12.20%	2	Hydroquinone	4.34%	
3	Toluene	7.67%	3	Styrene	18.69%	3	m-Xylene +	6.70%	3	Isophorone	3.57%	
4	Carbon Disulfide	7.59%	4	2-Butanone	12.02%	4	Hexane	5.01%	4	m-Xylene + p-Xylene	2.38%	
5	Ethylbenzene	6.28%	5	Propylene Oxide	8.77%	5	o-Xylene	3.59%	5	Hexane	1.78%	
6	4-Methyl-2-Pentanone	5.74%	6	Carbonyl Sulfide	7.00%	6	2-Butanone	2.75%	6	Aniline	1.70%	
7	o-Xylene	3.35%	7	Hexane	6.87%	7	Ethylbenzen	2.01%	7	o-Xylene	1.28%	
8	Hexane	2.37%	8	o-Xylene	4.18%	8	Styrene	1.98%	8	2-Butanone	0.98%	
9	Aniline	2.22%	9	Hydroquinone	3.56%	9	Tetrachloroe	1.91%	9	Ethylbenzene	0.71%	
10	Styrene	1.19%	10	m-Xylene + p-Xyl	2.74%	10	Carbon Disul	1.78%	10	Styrene	0.70%	

Grinding			Extrude			Calender			Autoclave			
1	Toluene	60.33%	1	Hydroquinone	27.29%	1	4-Methyl-2-pentanone	11.95%	1	m-Xylene + p-Xylene	62.06%	
2	Aniline	2.55%	2	Toluene	17.96%	2	Hydroquinone	10.24%	2	4-Methyl-2-Pentanone	54.04%	
3	Carbon Disulfide	1.91%	3	m-Xylene + p-Xylene	14.99%	3	m-Xylene + p-Xylene	5.62%	3	Hexane	46.43%	
4	Tetrachloroethene	0.88%	4	4-Methyl-2-Pentanone	13.05%	4	Hexane	4.20%	4	o-Xylene	33.28%	
5	Hexane	0.78%	5	Hexane	11.21%	5	o-Xylene	3.01%	5	2-Butanone	25.45%	
6	Isooctane	0.72%	6	o-Xylene	8.04%	6	2-Butanone	2.31%	6	Ethylbenzene	18.62%	
7	2-Chloro-1,3 Butadiene	0.51%	7	Acetophenone	6.44%	7	Toluene	2.11%	7	Tetrachloroethene	17.65%	
8	Ethylbenzene	0.36%	8	2-Butanone	6.15%	8	Ethylbenzene	1.69%	8	Acetophenone	9.98%	
9	bis(2-Ethylhexyl)phthalate	0.33%	9	Ethylbenzene	4.50%	9	Styrene	1.66%	9	Toluene	9.10%	
10	m-Xylene + p-Xylene	0.20%	10	Tetrachloroethene	4.26%	10	Carbon Disulfide	1.49%	10	Isooctane	3.31%	

Hot Air		
1	Zinc (Zn)	44.40%
2	4-Methyl-2-pentanone	10.57%
3	m-Xylene + p-Xylene	4.97%
4	Acetone	4.58%
5	Ethanol	3.96%
6	Methenamine	3.92%
7	Hexane	3.72%
8	C10H20 Alkyl Substituted Cyclohexane	3.30%
9	C8H16 Alkene	3.28%
10	Cyclohexane	2.68%


SEPTEMBER 1996

MEMO FOR FILE

Subject: Clean Air Act - Health information for Selected Chemicals

Date: December 29, 1995

Carbon Disulfide CAS: 75-15-0

Skin TLV-TWA, 10 ppm (31 mg/m3)

CS[sub 2] vapor is absorbed largely through the lungs, although toxic quantities can also be absorbed through the skin. Its effects are mostly on the nervous, cardiovascular, and reproductive systems; 100 to 150 ppm resulted in chronic poisoning, usually after a year or more; concentrations between 50 and 100 ppm caused only sporadic cases of mild intoxication; levels below 45 ppm never caused intoxication; and 30 ppm could be considered safe.

Carbonyl Sulfide - CAS: 463-58-1

Poison by intraperitoneal rout. Mildly toxic by inhalation. Narcotic in high concentration. An irritant. May liberate highly toxic hydrogen sulfide upon decomposition. Most carbonyls are highly toxic. The toxicity of carbonyls depends in part, but not always on their ready decomposition which releases carbon monoxide.

DOT classification: Poison A

Aniline CAS: 62-53-3

Skin TLV-TWA, 2 ppm (7.6 mg/m3)

Human Studies

Occupational aniline poisoning was at one time relatively common. Acute intoxication, due to the formation of methemoglobin, resulting in cyanosis and possible death from asphyxiation, has been the most frequent consequence of overexposure.

Based on the increase in methemoglobin in blood observed at 5 ppm in animals and the skin absorption in humans, a TLV-TWA close to the structurally similar chemical, nitrobenzene, is in order. Accordingly, a TLV-TWA of 2 ppm is recommended, provided absorption through the skin by contact with liquid aniline is prevented. A skin notation is also recommended.

Isophorone CAS: 78-59-1

Isoacetophorone; Isoforon; 3,5,5-Trimethyl-2-cyclohexen-1-one

TLV-CEILING, 5 ppm (28 mg/m3)

Based on the report that workplace air TWA concentrations of 5 to 8 ppm were associated with fatigue and malaise and that reduction of ambient concentrations of Isophorone to 1 to 4 ppm eliminated the complaints of irritation, (14) a TLV-Ceiling of 5 ppm is recommended for Isophorone. The TLV Committee is reviewing the strength of evidence for potential carcinogenicity of this substance based on the interpretation of the relevance of the rat kidney and mouse liver tumor data to human health risk assessment.

Mercaptobenzothiazole CAS: 149-30-4

Causes allergic dermatitis.

Propylene Oxide CAS: 75-56-9

1,2-Epoxypropane; Methyloxidrane; Propene oxide; 1,2-Propylene oxide

TLV-TWA, 20 ppm (48 mg/m3)

The National Toxicology Program (NTP) (28) completed a chronic inhalation bioassay of propylene oxide in rats and mice. The animals were exposed at concentrations of 0, 200, or 400 ppm, 6 hours/day, 5 days/week for 103 weeks. There was some evidence of carcinogenicity in rats exposed at 400 ppm, based on an increased incidence of papillary adenomas of the nasal turbinates.

The International Agency for Research on Cancer (IARC) (31,32) considered the results of the above studies as consistent with sufficient evidence for carcinogenicity of propylene oxide in animals.

Carcinogenic Classification

IARC: Group 2A, probably carcinogenic in humans.
NIOSH: Carcinogen, with no further categorization.
NTP: Group 2, reasonably anticipated to be a carcinogen.

d-Limonene CAS: 5989-27-5

Mildly toxic by ingestion.

Styrene CAS: 100-42-5

Cinnamene; Ethenylbenzene; Phenylethylene; Vinylbenzene

Skin

TLV-TWA, 50 ppm (213 mg/m3)
TLV-STEL, 100 ppm (426 mg/m3)

There are no rigorous data showing an association between peripheral neuropathy, encephalopathy, or other toxicologically significant effects associated with either worker exposure or controlled studies in humans other than central nervous system (CNS) depression at concentrations greater than 50 ppm. Headache, fatigue, nausea, and dizziness are reported consistently after exposure at concentrations of 100 ppm or more.

Benzyl Chloride CAS: 100-44-7

[alpha]-Chlorotoluene TLV-TWA, 1 ppm (5.2 mg/m3)

Based on the available data up to 1980, the TLV Committee recommends a TLV-TWA of 1 ppm (5.2 mg/m3) for occupational exposure to benzyl chloride. This value should prevent lung injury and irritation of the eye, nose, and throat.

Carcinogenic Classification
IARC: Group 2B, possibly carcinogenic in humans

1,4 dioxane CAS: 123-91-1

Diethylene dioxide; Diethylene ether; p-Dioxane; 1,4-Dioxane

Skin TLV-TWA, 25 ppm (90 mg/m3)

OSHA PEL: OSHA established a PEL-TWA of 25 ppm, with a skin designation, for dioxane. OSHA concluded that the PEL for dioxane would protect exposed workers against the significant risks of kidney and liver damage and cancer, all material health impairments associated with exposures at levels above the PEL. (25) The PEL is consistent with the recommended ACGIH TLV.

2-Butanone(MEK) CAS: 78-93-3

2-Butanone; Butan-2-one; MEK

TLV-TWA, 200 ppm (590 mg/m3) TLV-STEL, 300 ppm (885 mg/m3)

Based on the review of the available scientific data, a TLV-TWA of 200 ppm and a STEL of 300 ppm are recommended for MEK to prevent injurious systemic effects and minimize objections to odor and irritation.
Interactions with other solvents cannot be excluded but are best handled by application of the ACGIH formula for determining Threshold Limit Values for mixtures. Where synergism or potentiation may occur, stringent control of the primary toxin, e.g., n-hexane or methyl butyl ketone, is recommended with additional consideration of lowering the exposure to MEK.

OSHA PEL: OSHA established a PEL-TWA of 200 ppm and a 15-minute STEL of 300 ppm for MEK. OSHA concluded these limits were necessary to protect employees from the irritant and narcotic effects associated with higher exposures to MEK. (31) The OSHA PEL is consistent with the recommended
ACGIH TLV.

Mercaptans

The response of animals to single exposures of n-butyl mercaptan by various routes showed the substance to be only slightly toxic.

There were no studies with n-butyl mercaptan upon which to base a threshold for the CNS toxicity. A TLV-TWA of 0.5 ppm for n-butyl mercaptan is recommended, based on analogy with its homologue, ethyl mercaptan, which has a similar odor threshold and a no effect level of 0.4 ppm to less than 4 ppm for CNS toxicity and minor irritation.

Cumene CAS: 98-82-8

Cumol; Isopropylbenzene; 2-Phenylpropane

Skin TLV-TWA, 50 ppm (246 mg/m3)

In the absence of industrial human experience and on the basis of the animal studies (1,2) cited above, a TLV-TWA of 50 ppm for cumene is recommended to prevent induction of narcosis from exposure to cumene. Based on the reported skin absorption, (6) a skin notation is also recommended.

Carbon Tetrachloride CAS: 56-23-5

Tetrachloromethane

Skin TLV-TWA, 5 ppm (31 mg/m3)

On the basis of the animal experiments that demonstrate fatty infiltration of the liver at 10 ppm (8-10) and the potentiation of carbon tetrachloride toxicity by alcohol and other common substances, (11-13) a TLV-TWA of 5 ppm is recommended. This should provide significant protection for the 70%-80% of the population who consume alcoholic beverages, have compromised liver function, and are exposed to carbon tetrachloride. Furthermore, it is expected that the 5 ppm TLV will also protect against the development of liver cancer and prevent fetal toxicity and teratogenesis where pregnant workers are exposed. The skin absorption data of Stewart and Dodd (50) support the inclusion of a skin notation.

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Trichlorofluoromethane CAS: 75-69-4

CFC-11; F-11; Fluorocarbon 11; Fluorochloroform; Fluorotrichloromethane;
Freon[Registered] 11; Monofluorotrichloromethane; Refrigerant 11

TLV-CEILING, 1000 ppm (5620 mg/m3)

Following inhalation of extremely high concentrations, CFC-11 causes acute narcosis and death from respiratory depression. Instantaneous deaths have occurred following sensitization of the heart to the arrythmogenic actions of adrenaline. Following inhalation of CFC-11, the compound is promptly absorbed and rapidly eliminated. No acute or chronic toxicities have been reported in either animals or humans exposed to concentrations of CFC-11 normally encountered in household or industrial use of the compound.

Benzaldehyde **No information**

Methylene chloride CAS: 75-09-2

Dichloromethane

TLV-TWA, 50 ppm (174 mg/m3)

In order to provide a wider margin of safety for minimizing the potential for liver injury, a lowering of the recommended TLV-TWA from 100 ppm to 50 ppm was recommended for methylene chloride in the absence of occupational exposure to carbon monoxide. This level should also provide protection against the possible weak carcinogenic effects of methylene chloride which have been demonstrated in laboratory rats and mice.

bis(1,1 dimethylene) peroxide

Organic peroxides are often highly toxic and irritating to the skin, eyes, and mucous membranes.

1,1,1 Trichloroethane CAS: 71-55-6

TCA; 1,1,1-Trichloroethane
TLV-TWA, 350 ppm (1910 mg/m3) TLV-STEL, 450 ppm (2460 mg/m3)

Methyl chloroform has a low acute and chronic toxicity by the oral and inhalation routes. In exposed workers and animals, it is a CNS depressant and has caused liver and kidney damage. Myocardial arrhythmia and fatalities associated with gross inhalation have also been reported. Methyl chloroform was not carcinogenic in rodents, and repeated exposure of human volunteers at 500 ppm caused anesthesia. At 500 ppm, its odor is objectionable. Accordingly, a TLV-TWA for methyl chloroform of 350 ppm is recommended to prevent beginning anesthetic effects, and a STEL of 450 ppm is recommended for protection against anesthesia and objections to odor.

Acrolein CAS: 107-02-8

Acrylaldehyde; Allyl aldehyde; Ethylene aldehyde; 2-Propenal

TLV-TWA, 0.1 ppm (0.23 mg/m3)TLV-STEL, 0.3 ppm (0.69 mg/m3)

The TLV-TWA of 0.1 ppm is sufficiently low to minimize, but not entirely prevent, irritation to all exposed individuals. A STEL of 0.3 ppm is also recommended.

OSHA PEL: The OSHA PEL-TWA for acrolein is 0.1 ppm and a 15-minute STEL of 0.3 ppm. These limits are the same as the TLVs by ACGIH. OSHA concluded that these limits would protect employees from airborne concentrations found to cause eye and nose irritation and more severe signs and symptoms of respiratory tract pathology.

Acrylonitrile CAS: 107-13-1

Propenenitrile; Vinyl cyanide

Skin TLV-TWA, 2 ppm (4.3 mg/m3)

Carcinogenic Classification:

IARC: Group 2A, probably carcinogenic in humans.
A2 - Suspected Human Carcinogen
NIOSH: Carcinogen, with no further categorization.
NTP: Group 2, reasonably anticipated to be a carcinogen.
TLV: A2, suspected human carcinogen.

Prolonged skin contact with liquid acrylonitrile can result in systemic toxicity and the formation of large dermal vesicles after a latent period of several hours. The affected skin area may resemble a second degree, thermal burn.

Acrylonitrile is readily absorbed from the respiratory and gastrointestinal tracts and through the intact skin. It is highly toxic, showing many of the toxic characteristics of the cyanide ion.

1,3 Butadiene CAS: 106-99-0

Biethylene; Butadiene; Divinyl; Erythrene; Pyrrolylene; Vinylethylene

TLV-TWA, 10 ppm (22mg/m3)

1,3-Butadiene has previously been associated with a low degree of toxicity in experimental animals, mild irritant properties, and the absence of reported serious industrial illness. Skin contact with liquid 1,3-butadiene will cause irritation. Cooling due to its evaporation from the skin surface may cause frostbite. The recent identification of multiple organ cancer in various tissues in rats and mice exposed to 1,3-butadiene at concentrations as low

as 6.25 ppm and the reported mutagenicity warrant an A2, suspected human carcinogen, classification.

Carcinogenic Classification
IARC: Group 2B, possibly carcinogenic in humans.
NIOSH: Carcinogen, with no further categorization.
NTP: Group 2, reasonably anticipated to be a carcinogen.
TLV: A2, suspected human carcinogen.

Chloroform CAS: 67-66-3

Formyl trichloride; Methenyl trichloride; Trichloroform; Trichloromethane

TLV-TWA, 10 ppm (49 mg/m3)

Chloroform is a central nervous system (CNS) depressant and is toxic to the liver and kidneys. Liquid chloroform in the eye causes burning pain, tearing, and reddening of the conjunctiva.

In the view of reports on carcinogenicity (8) and embryotoxicity (6) of chloroform, the TLV Committee's recommendation for a TLV-TWA is 10 ppm and classification as an A2 suspected human carcinogen. A concentration of 10 ppm is one-fifth the concentration at which organ injury was observed and is one-half the concentration which would be derived comparing the toxicity of other organic solvents.

Carcinogenic Classification

IARC: Group 2B, possibly carcinogenic in humans.
NIOSH: Carcinogen, with no further classification.
NTP: Group 2, reasonably anticipated to be a carcinogen.
OSHA: Carcinogen with no further classification.
TLV: A2, suspected human carcinogen.

Chlorodifluoromethane CAS: 75-45-6

Difluoromonochloromethane; FC-22; Freon 22[Registered]; Genetron-22[Registered]; Monochlorodifluoromethane

TLV-TWA, 1000 ppm 3540 mg/m3)

Acute: High atmospheric concentrations of FC-22 produce stimulation and then depression of the central nervous system (CNS), and finally asphyxiation.

A TLV-TWA of 1000 ppm FC-22 is recommended as a guide for good industrial hygiene practice for vapors of low toxicity.

Chlorinated Paraffins (aliphatic)

Suspected carcinogen with experimental tumors of the liver, lung, skin, and blood forming tissues.

Acetaldehyde CAS: 75-07-0

Acetic aldehyde; Acetylaldehyde; Ethanal; Ethyl aldehyde

TLV-TWA, 100 ppm (180 mg/m3) TLV-STEL, 150 ppm (270 mg/m3)

The TLV-TWA of 100 ppm and the STEL of 150 ppm were recommended to prevent excessive eye irritation and potential injury to the respiratory tract. Sensitive individuals are reported to suffer eye irritation at concentrations of acetaldehyde as low as 25 ppm. Data from recent studies with rats suggest that acetaldehyde is teratogenic. The recent identification of nasal and laryngeal carcinomas in rats and hamsters exposed to vapors of acetaldehyde at concentrations as low as 750 ppm and its reported mutagenicity indicate that classification of acetaldehyde as an experimental animal carcinogen should be considered.

Carcinogenic Classification
IARC: Group 2B, possibly carcinogenic-inadequate evidence in humans; sufficient evidence in animals.
NIOSH: Carcinogenic, without further classification.
EPA: Group B2, probable human carcinogen.

Formaldehyde CAS: 50-00-0

Formic aldehyde; Methanal; Oxymethylene

TLV-CEILING, 0.3 ppm (0.37 mg/m3)

The major noncancer effects posed by animal exposure to formaldehyde are a result of the irritating characteristics of this chemical. Sensory irritation has been well documented with respect to acute inhalation exposures and has been found to be concentration-dependent. Irritation of the eyes, nose, throat, and lungs, as well as cellular changes in the upper respiratory tract, have been observed in animals exposed to formaldehyde.

Carcinogenic Classification
EPA: Group B1, probable human carcinogen.
IARC: Group A2, probably carcinogenic in humans.
NIOSH: Carcinogen, with no further classification.
NTP: Group 2, reasonably anticipated to be a carcinogen.
TLV: A2, suspected human carcinogen.

SEPTEMBER 1996

TRC Project No. 18775

May 1995

DEVELOPMENT OF EMISSION FACTORS FOR THE RUBBER MANUFACTURING INDUSTRY

SUPPLEMENTAL REPORT

FORMALDEHYDE EMISSIONS RESULTS

Prepared for

Rubber Manufacturers Association (RMA)
Suite 900
1400 K Street, N.W.
Washington, District of Columbia 20005

Prepared by

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FORMALDEHYDE EMISSIONS TEST PROGRAM

Background

Formaldehyde emissions were measured during the platen press curing of two generic rubber compounds, Compound No. 1 (Tire Inner Liner) and Compound No. 7 (Tire Bladder). The platen press was used to simulate processing of the compounds at a temperature of 340° F, typical of non-productive mixing and curing operations. The rubber compounds were uncured formulations mixed on a small Banbury in late 1994 and stored at TRC's Lowell facility since that time.

The platen press curing process is a general approach to pressure-curing engineered rubber products in molds. The platen press was used in this testing to simulate higher temperature conditions for maximum formaldehyde off-gassing. Emissions from the platen presses were controlled using an exhaust hood and duct.

The platen press used in this program was manufactured by Pasadena Hydraulics, Inc. of Pasadena, CA and provided for the test program by the Goodyear Tire and Rubber Company. Testing was conducted at TRC's Lowell, MA facility. Emission rates were developed based on: pounds of pollutant emitted per hour (lbs/hr) and pounds emitted per pound of rubber (lbs/lb rubber) cured.

Sampling Approach

During this program, the platen press was operated at a temperature of 340° F and pressures of 30 tons for the first 3 minutes and 20 tons for the second 3 minutes. Nine samples of approximately 50 grams each were cured for each rubber type. Each 50-gram tab of rubber was placed directly onto the lower plate and pressed into a "pancake" approximately 185 mm in diameter and 1 mm thickness. The cooldown period lasted for 6 minutes when the cured samples were removed from the press and left inside the enclosure. Emissions were contained by an exhaust hood and flexible Tyvek sheeting, and exhausted by a single 5-inch duct and blower.

Sampling was conducted in accordance with Method TO-11 using dinitrophenyl-hydrazine (DNPH)-impregnated silica gel in sampling cartridges. Exhaust gas from the platen press ductwork was drawn through the cartridge at a known rate (200 mL/min.) for a 2-hour period. During this sampling period, nine tabs of the desired rubber compound were pressed. One integrated sampling event was conducted for each rubber compound. A total of 1.04 lbs of rubber was pressed for each integrated sample.

Analytical Summary

Analyses of two field samples and one field blank were conducted in accordance with Method TO-11. Analysis was by HPLC using a Hewlett Packard ODS Hyersil column. The

laboratory also prepared and analyzed sets of Laboratory Spikes and Spike Duplicates and Method Blanks. Lab Spike and Spike Duplicate recoveries were 86 and 82 percent, respectively.

Emissions Results

The results of the emissions testing are shown in Table 1. The formaldehyde concentrations were very low, but detectable. All results were less than the lowest calibrator, so the reported concentrations are estimated based on extrapolation of the standard curve. A comparison of formaldehyde emissions from the two rubber compounds yields very similar results, although Compound No. 1 emissions were slightly higher. Table 2 presents the recipes for these two rubber formulations.

An emission factor for formaldehyde emissions from Compounds 1 and 7 was developed and is reported in Table 1. This factor represents the pounds of formaldehyde emitted for every pound of rubber compound processed in this temperature range. Please note that for any given process, the emission factor user should be aware that there will be differences in formaldehyde release rates depending on the amount of exposed rubber surface area, the process type, and the rubber temperature.

Table 1
Formaldehyde Emission Factors

Compounds 1 and 7

Measurement Parameters	Compound No. 1 Tire Inner Liner	Compound No. 7 Tire Bladder
Platen Press Temperature (°F)	340	340
Run Time (min.)	120	120
Total Rubber (lbs/hour)	0.52	0.52
Volume of Gas collected (L)	23.830	23.984
Flowrate (dscfm)	60.1	60.3
Formaldehyde Sample Value (ug)*	0.103	0..068
Formaldehyde Concentration (ug/m^3)	4.322	2.835
Formaldehyde Emission Rate (lbs/hour)	9.73×10^{-7}	6.40×10^{-7}
Formaldehyde Emission Factor		
Formaldehyde Emission Factor (lbs/lb rubber)	1.88×10^{-6}	1.23×10^{-6}

* Blank Corrected Value.
Formaldehyde values were above the detection limit, but below the lowest calibrator value.

Table 2
Rubber Formulation Recipes

Compounds 1 and 7

Compound #1: Tire Inner Liner (BRIIR/NR)

Recipe:

Brominate IIR X-2	85.00
SMR 20 Natural Rubber	15.00
GPF Black	60.00
Stearic Acid	1.00
Paraffinic Medium Process Oil	15.00
Unreactive Phenol Formaldehyde-type Resin (Arofene 8318, SP1068)	5.00
Zinc Oxide	3.00
Sulfur	.50
MBTS	1.50
	186.00

Number of Passes/Temperatures
1 (NP) Temperature: 320°F Chlorobutyl or 290°F Bromobutyl
2 (P) Temperature: 220°F

Compound #7: Tire Bladder

Recipe:

Butyl 268	100.00
N330	55.00
Castor Oil	5.00
SP 1045 Resin	10.00
Zinc Oxide	5.00
Neoprene W	5.00
	180.00

Number of Passes/Temperatures
NP1 All Butyl, Castor Oil, Zinc Oxide, 45 phr N330, discharge approx. 330°/340°F.
+ Resin, 10 phr N330, discharge approx. 270°/280°F. Do not exceed 290°F.
PROD NP2 = neoprene, discharge approx. 250°/260°F.

→ omit

DISCLAIMER

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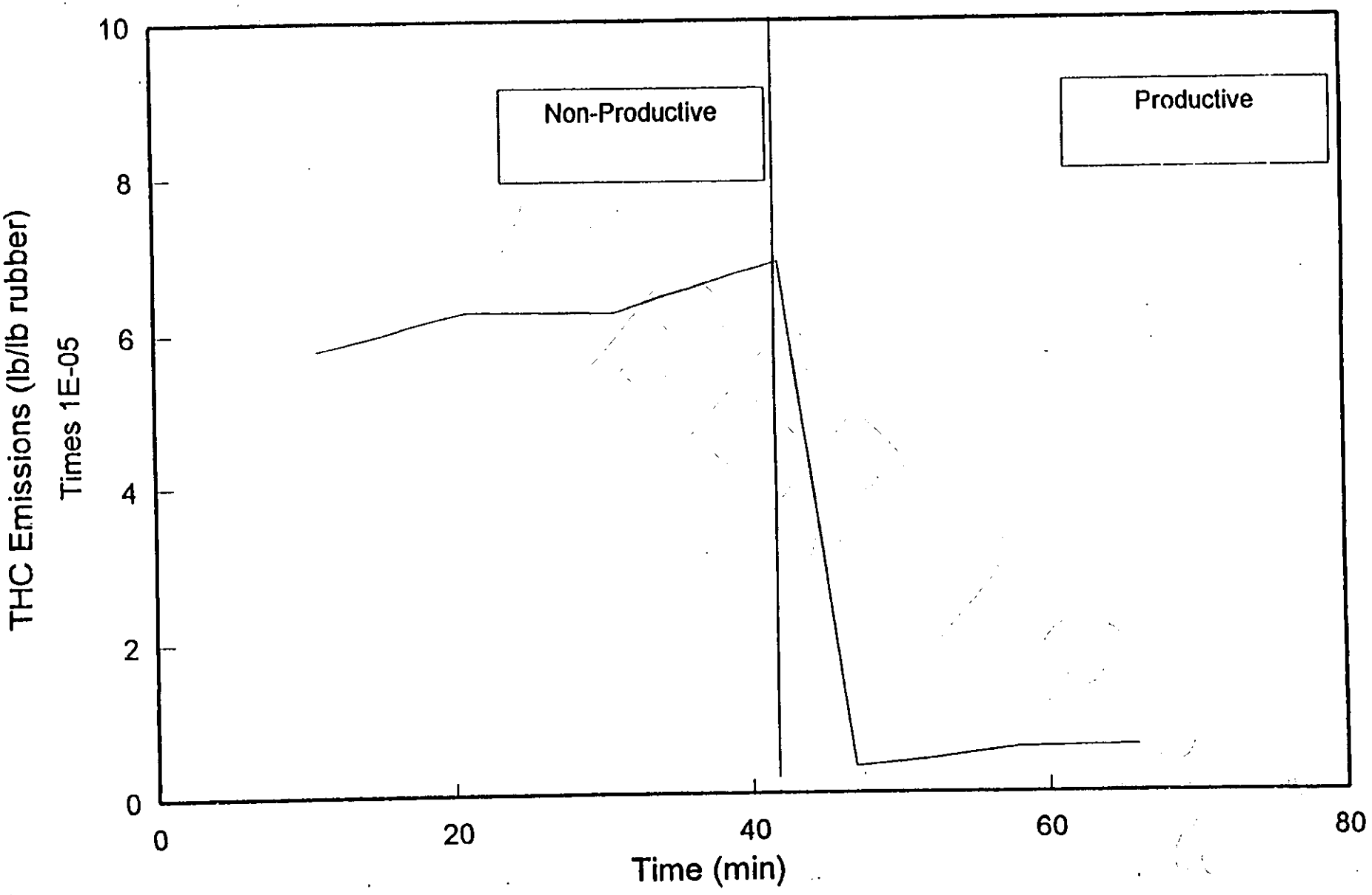
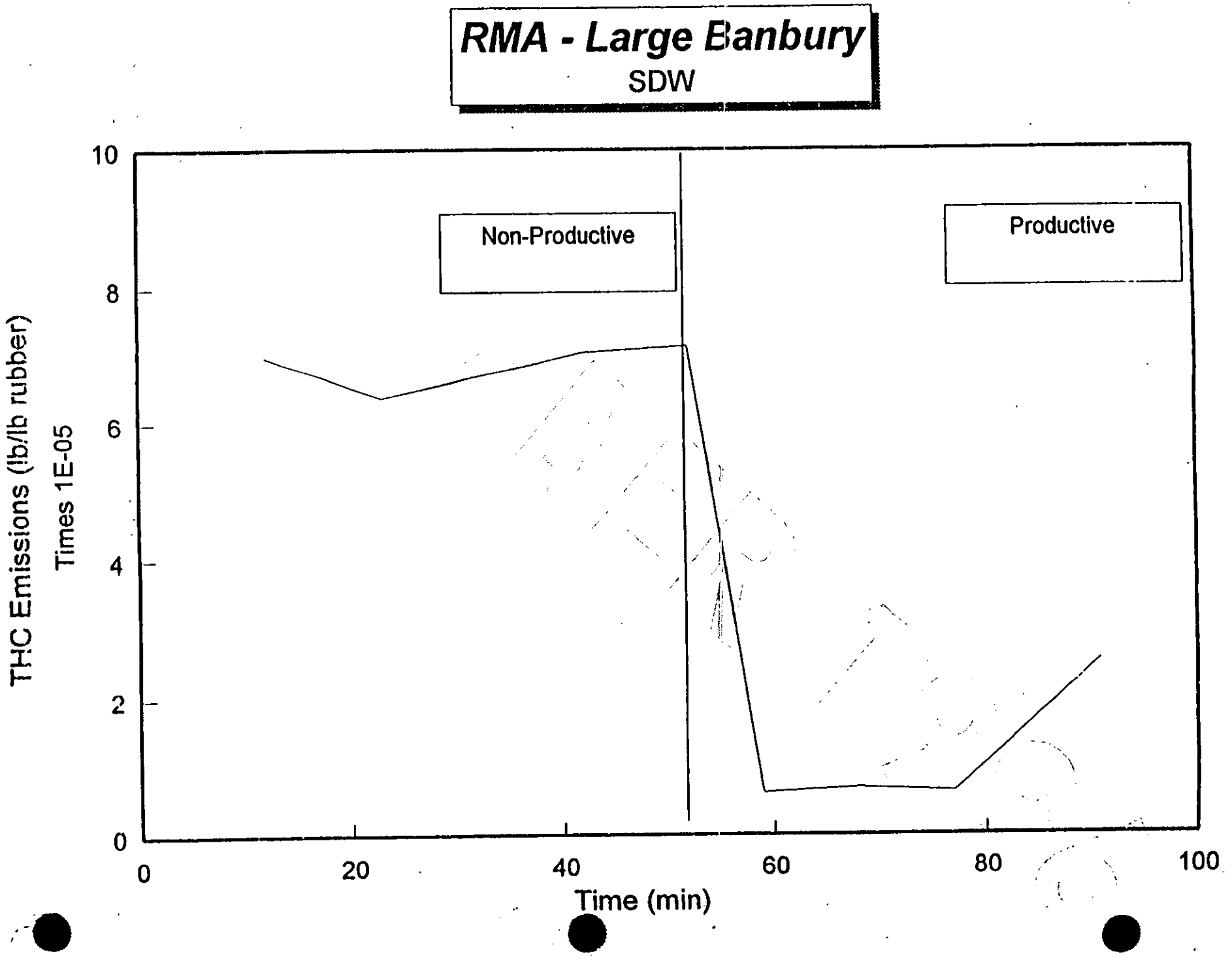
omit

RMA - Large Banbury

SBR

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Productive
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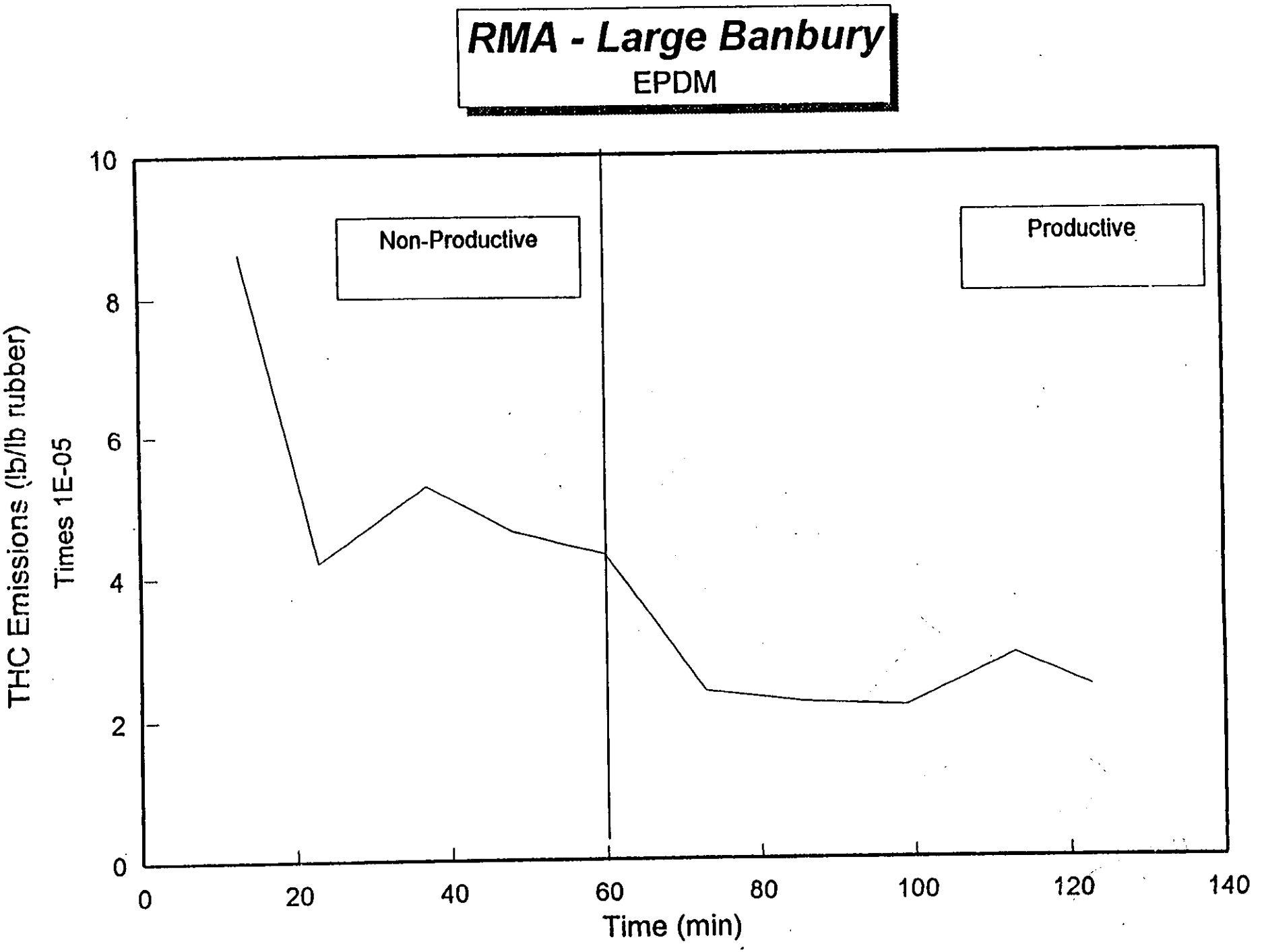
Time (min)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Productive
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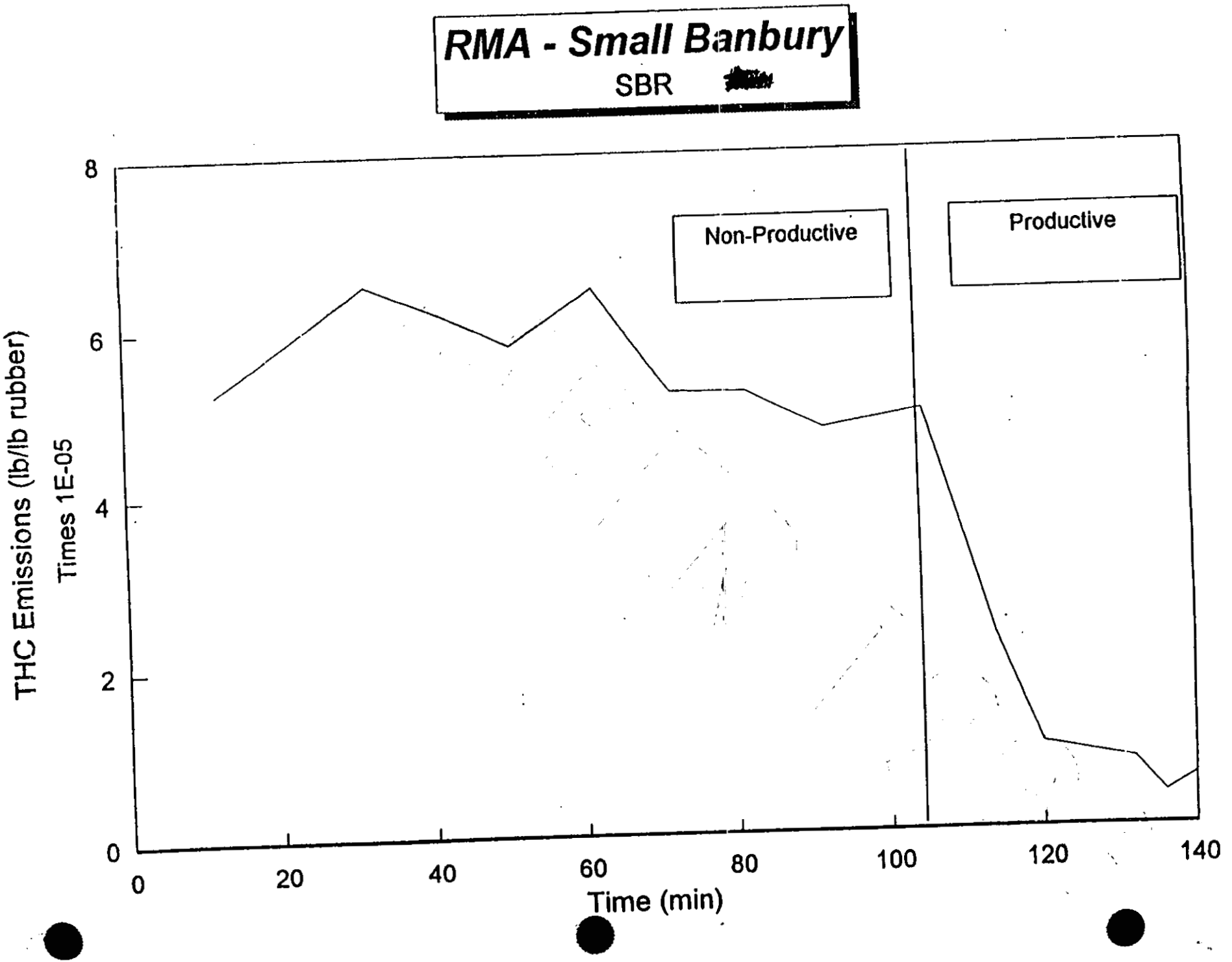
Time (min)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SBR [redacted]
Non-Productive
Productive
THC Emissions (lb/lb rubber)
Times 1E-05
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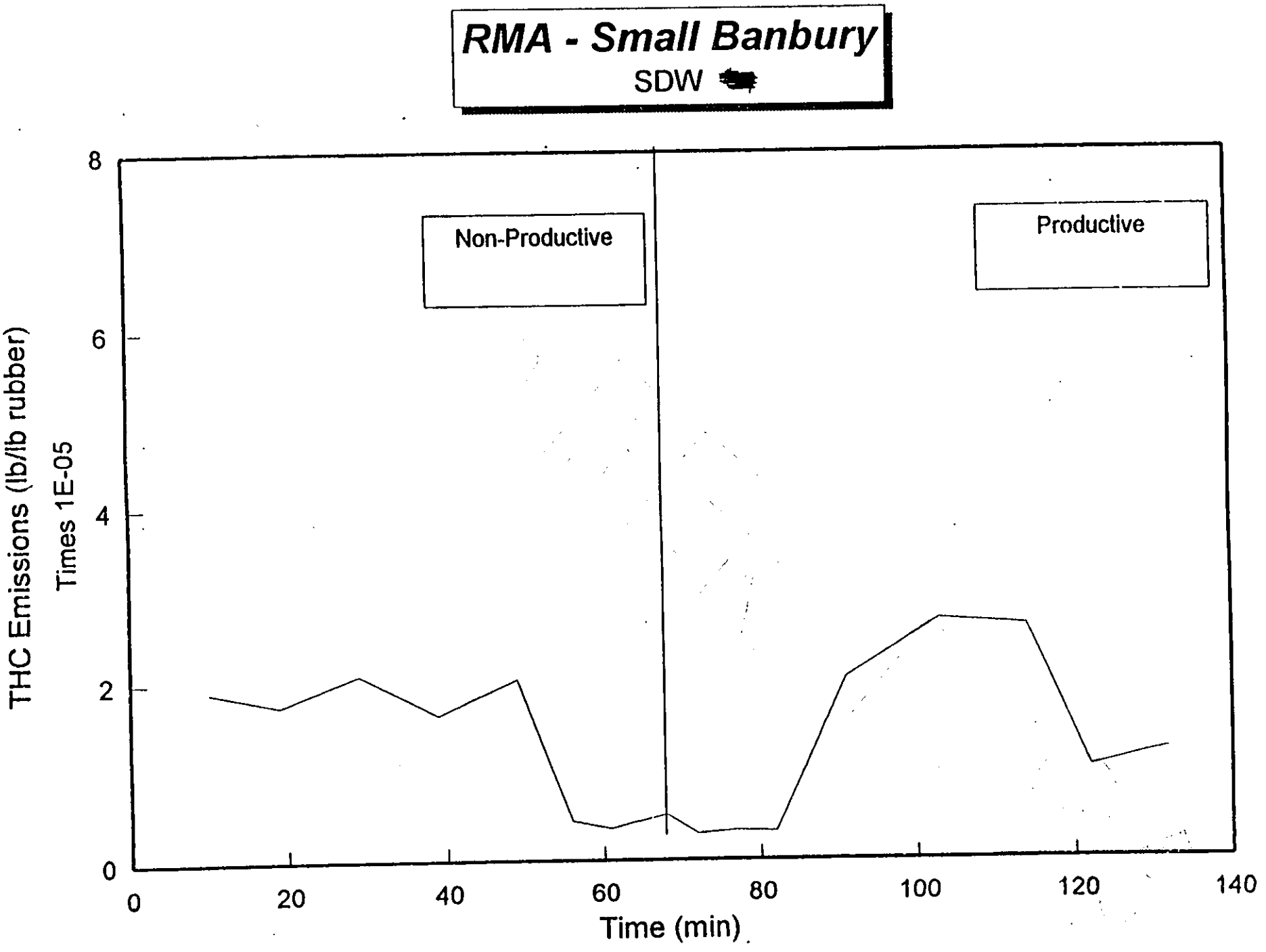
Time (min)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SDW [redacted]
Non-Productive
Productive
THC Emissions (lb/lb rubber)
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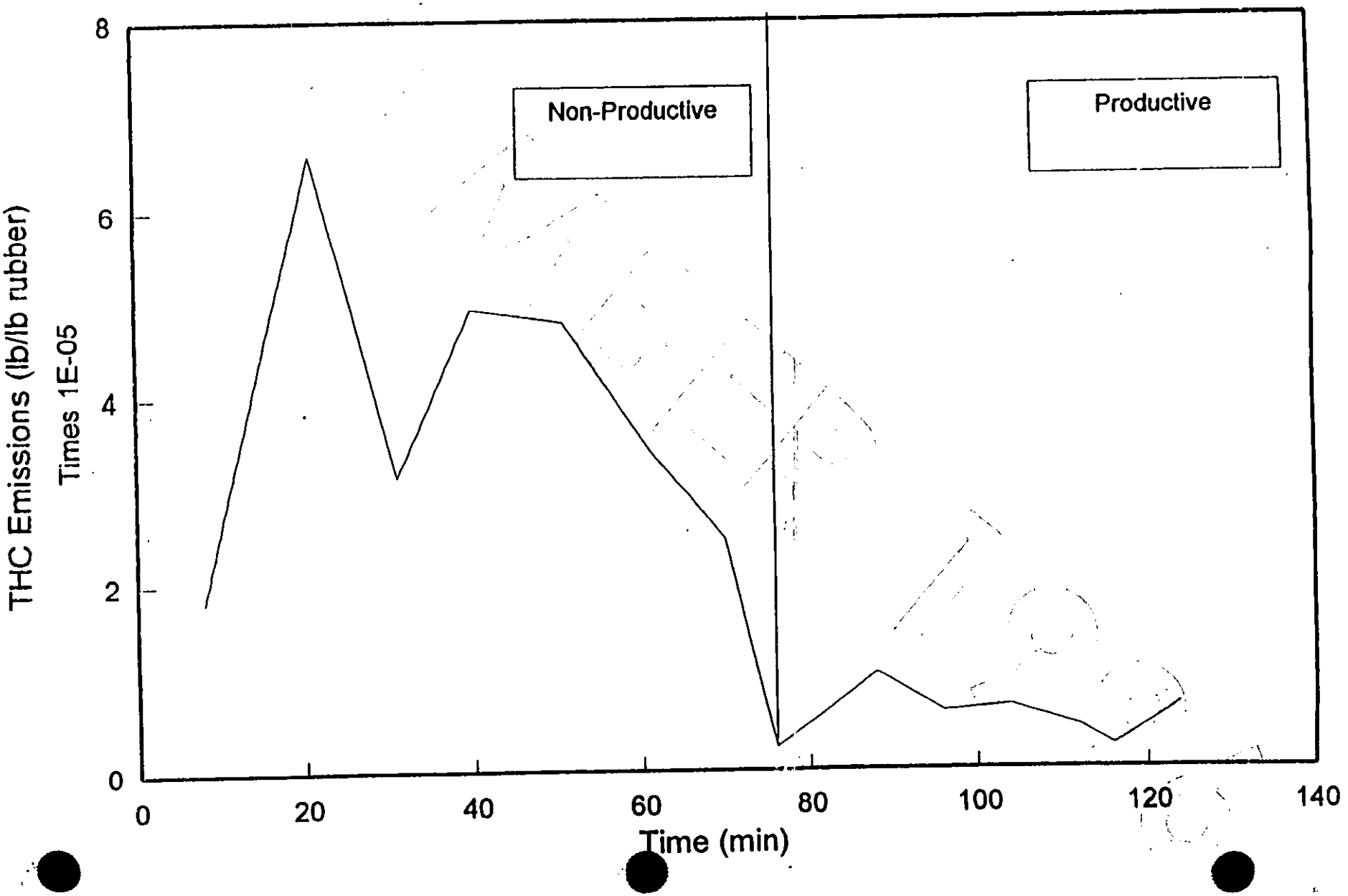
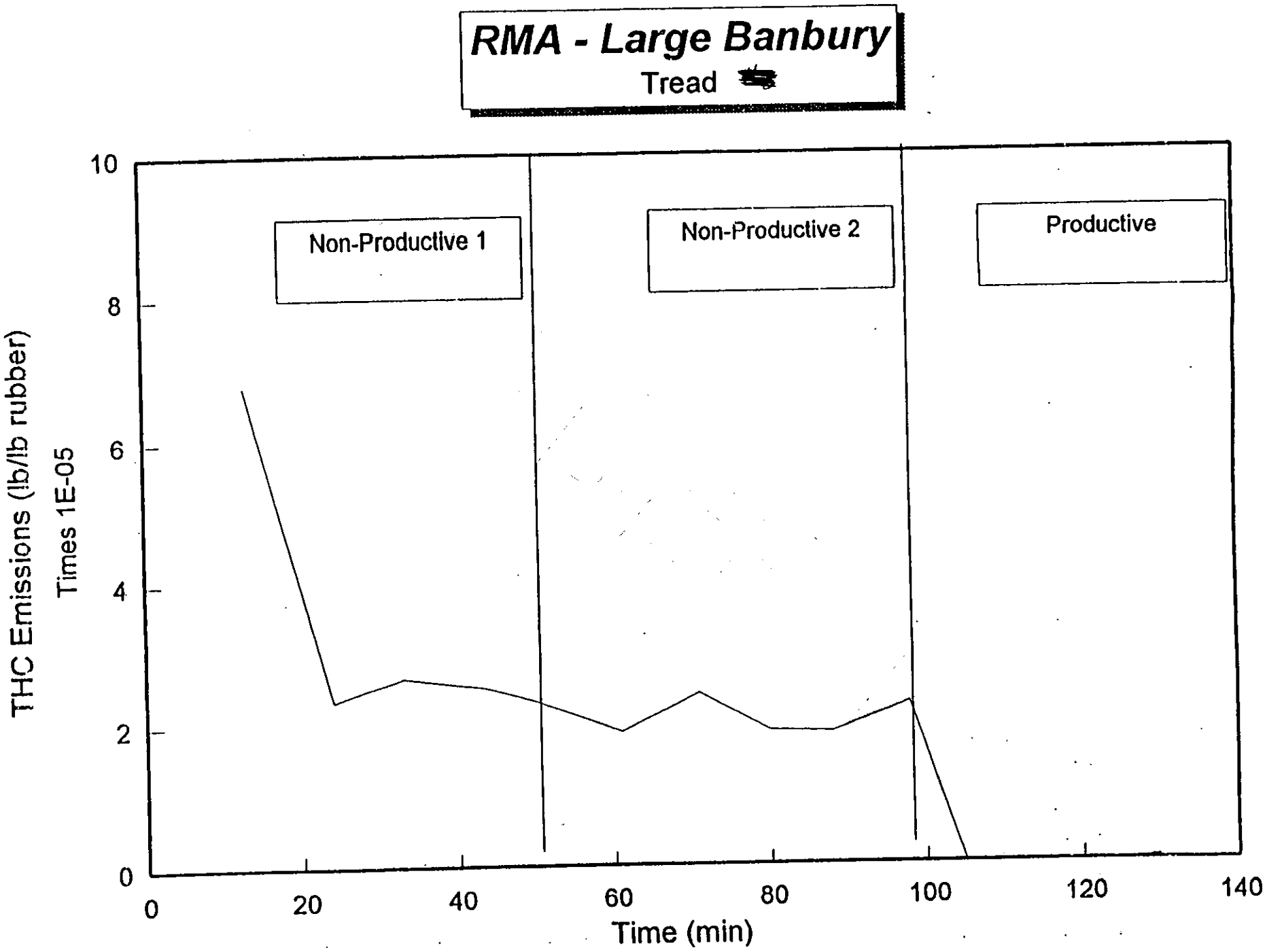
Time (min)

RMA - Small Banbury

EPDM




RMA - Large Banbury
Tread
Non-Productive 1
Non-Productive 2
Productive
THC Emissions (lb/lb rubber)
Times 1E-05
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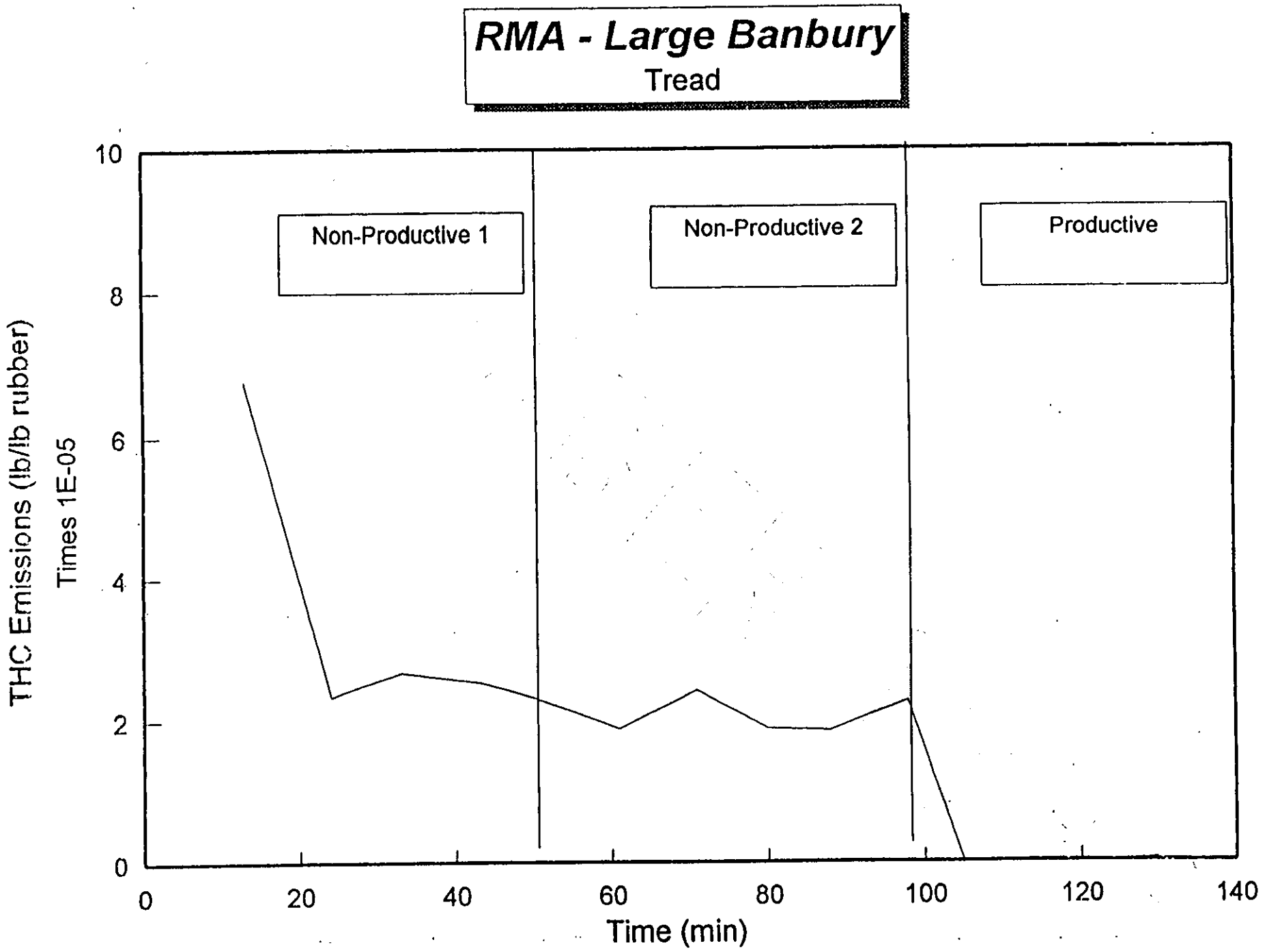
SEPTEMBER 1996

SEPTEMBER 1996


RMA - Large Banbury
Tread
Non-Productive 1
Non-Productive 2
Productive
THC Emissions (lb/lb rubber)
Times 1E-05
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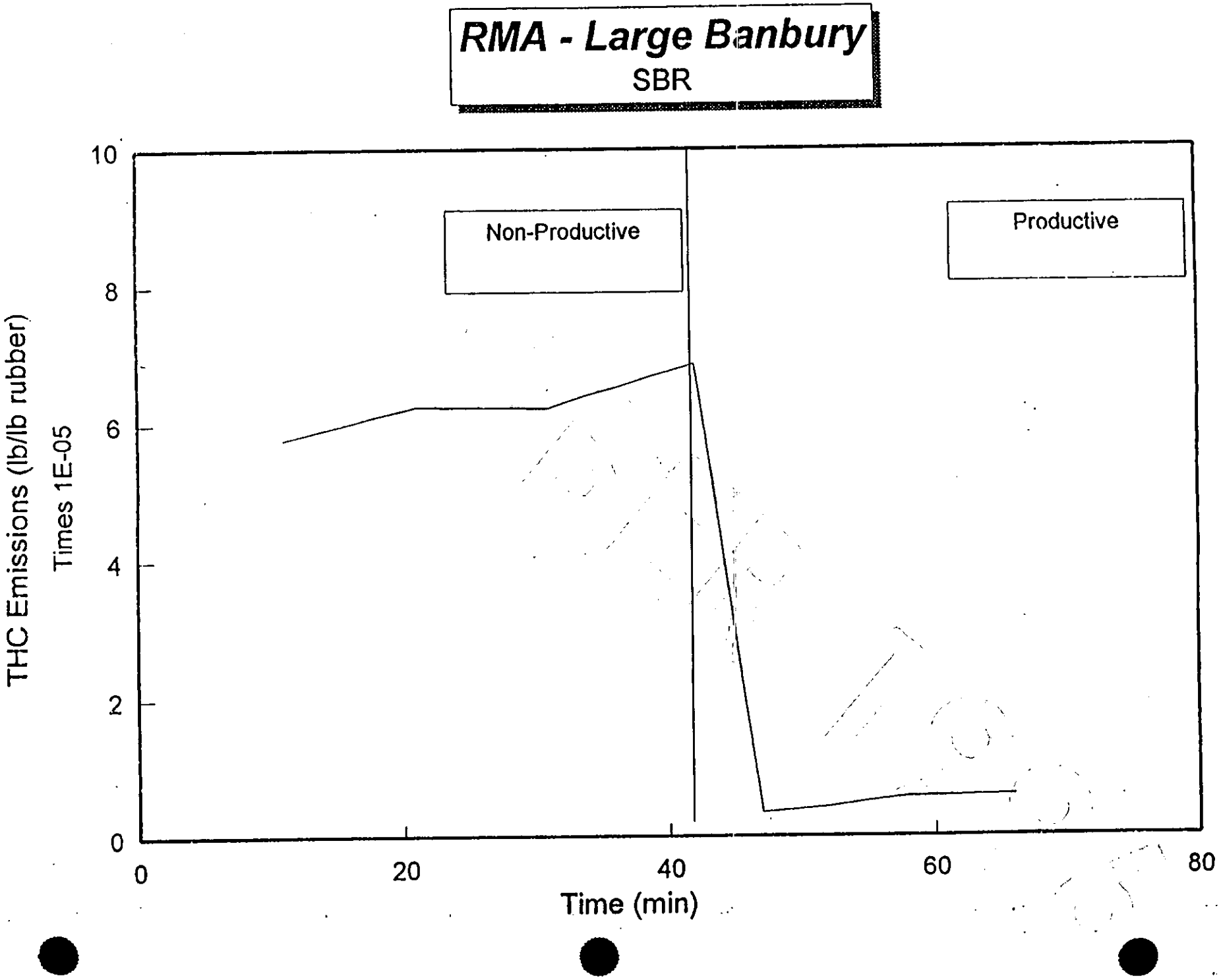
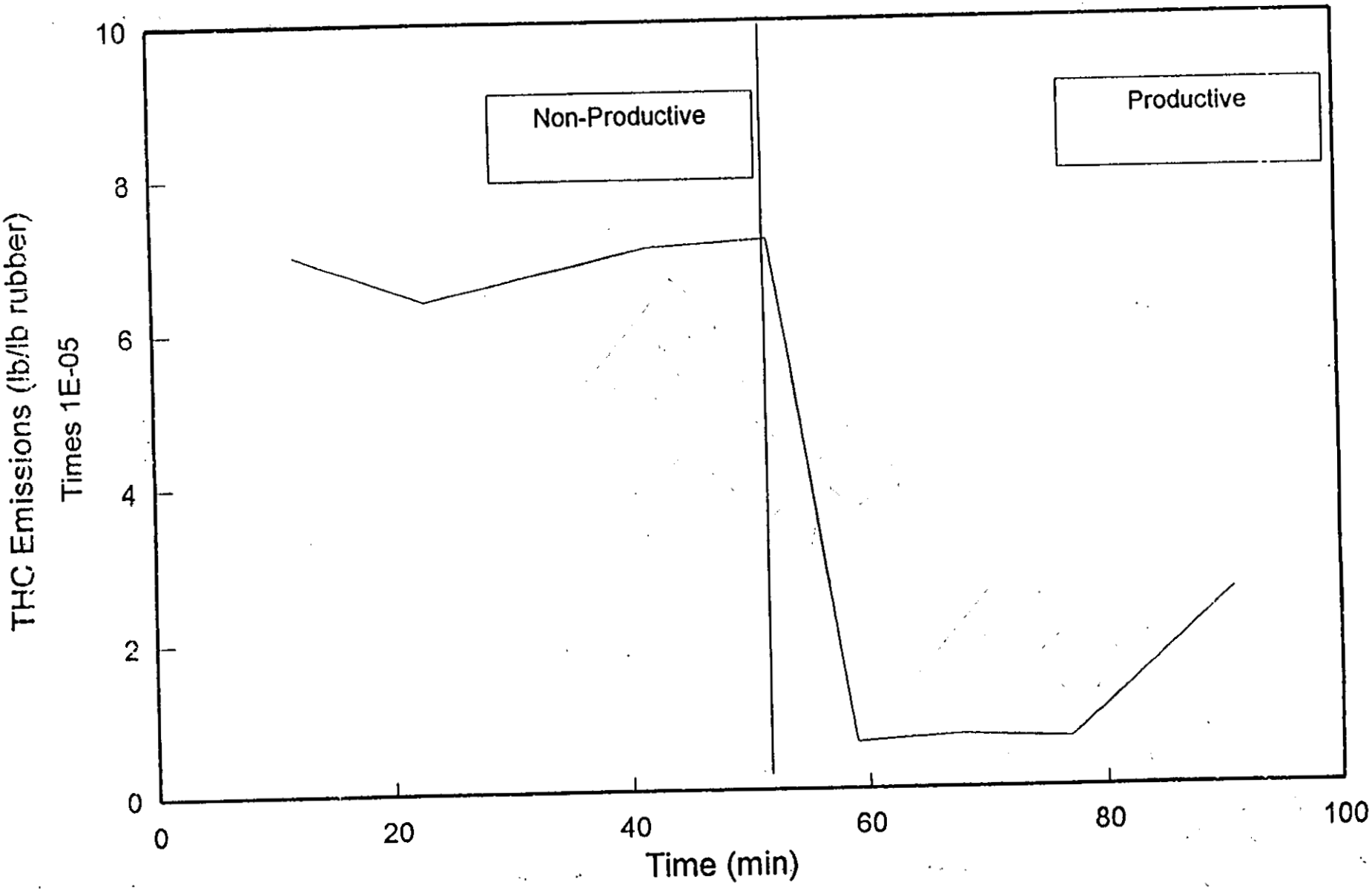
140
Time (min)


RMA - Large Banbury
SBR
Non-Productive
Productive
THC Emissions (lb/lb rubber)
Times 1E-05
10
8
6
4
2
0
0
20
40
60
80
Time (min)

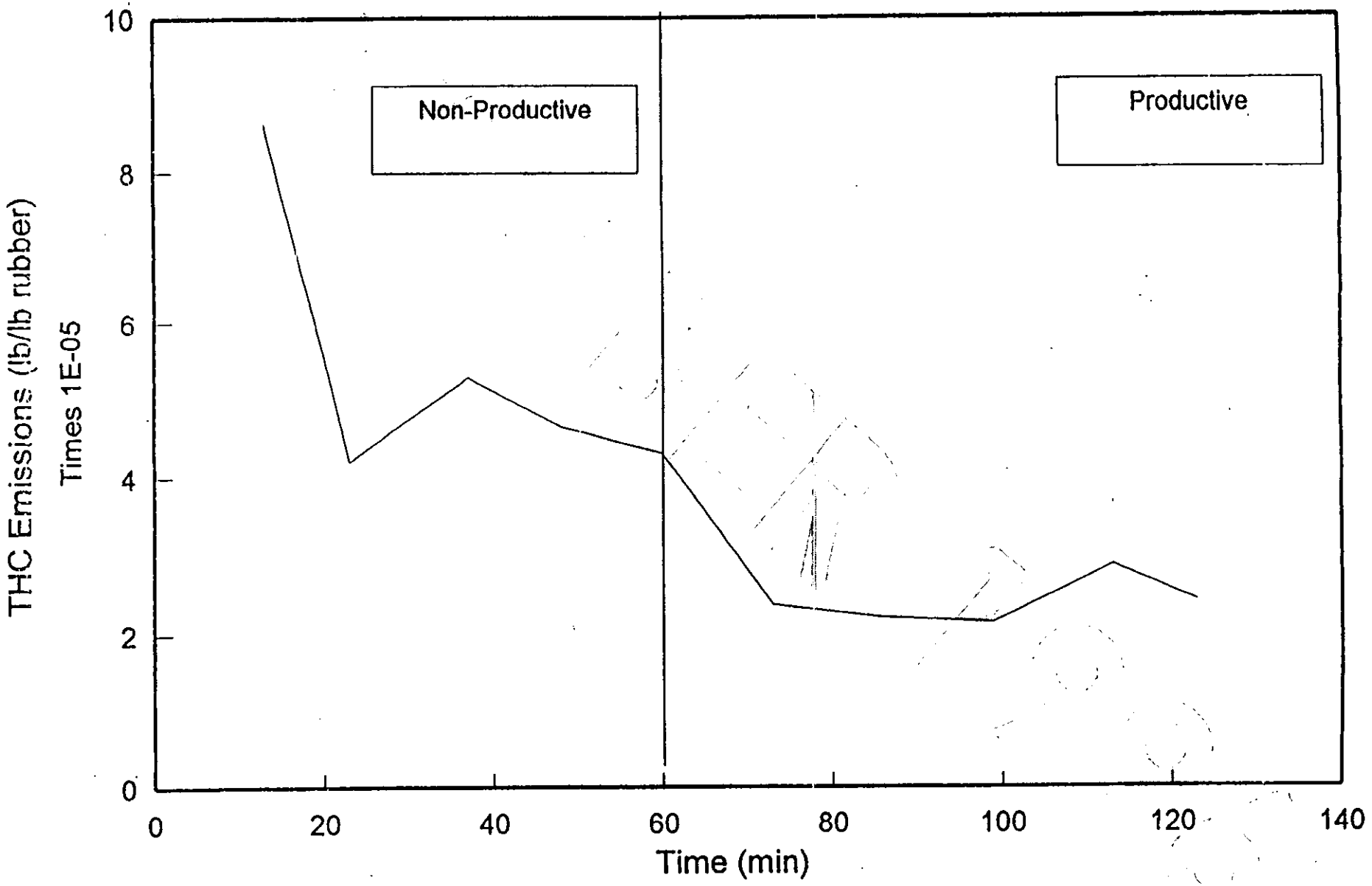
RMA - Large Banbury

SDW



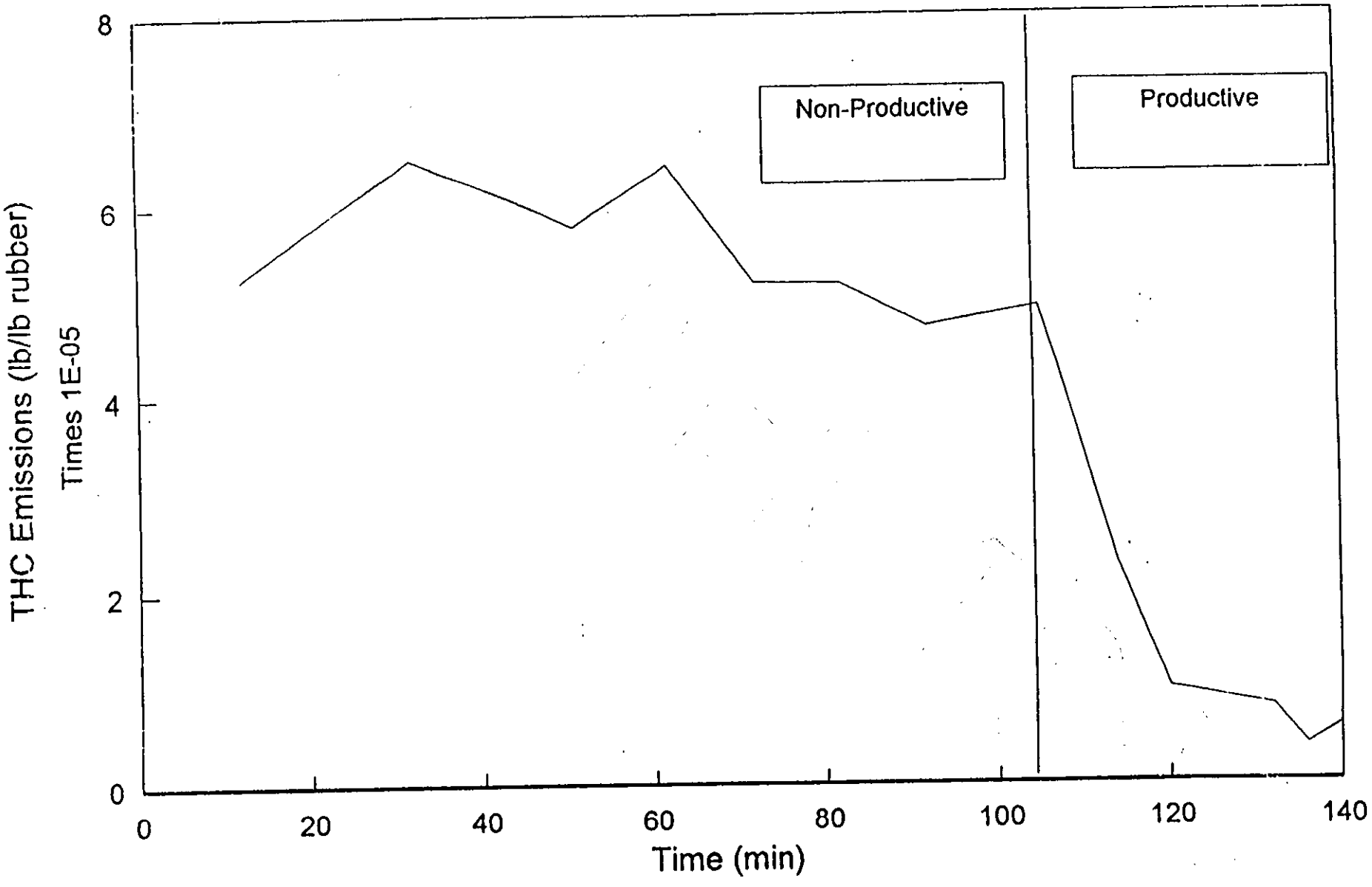
RMA - Large Banbury

EPDM



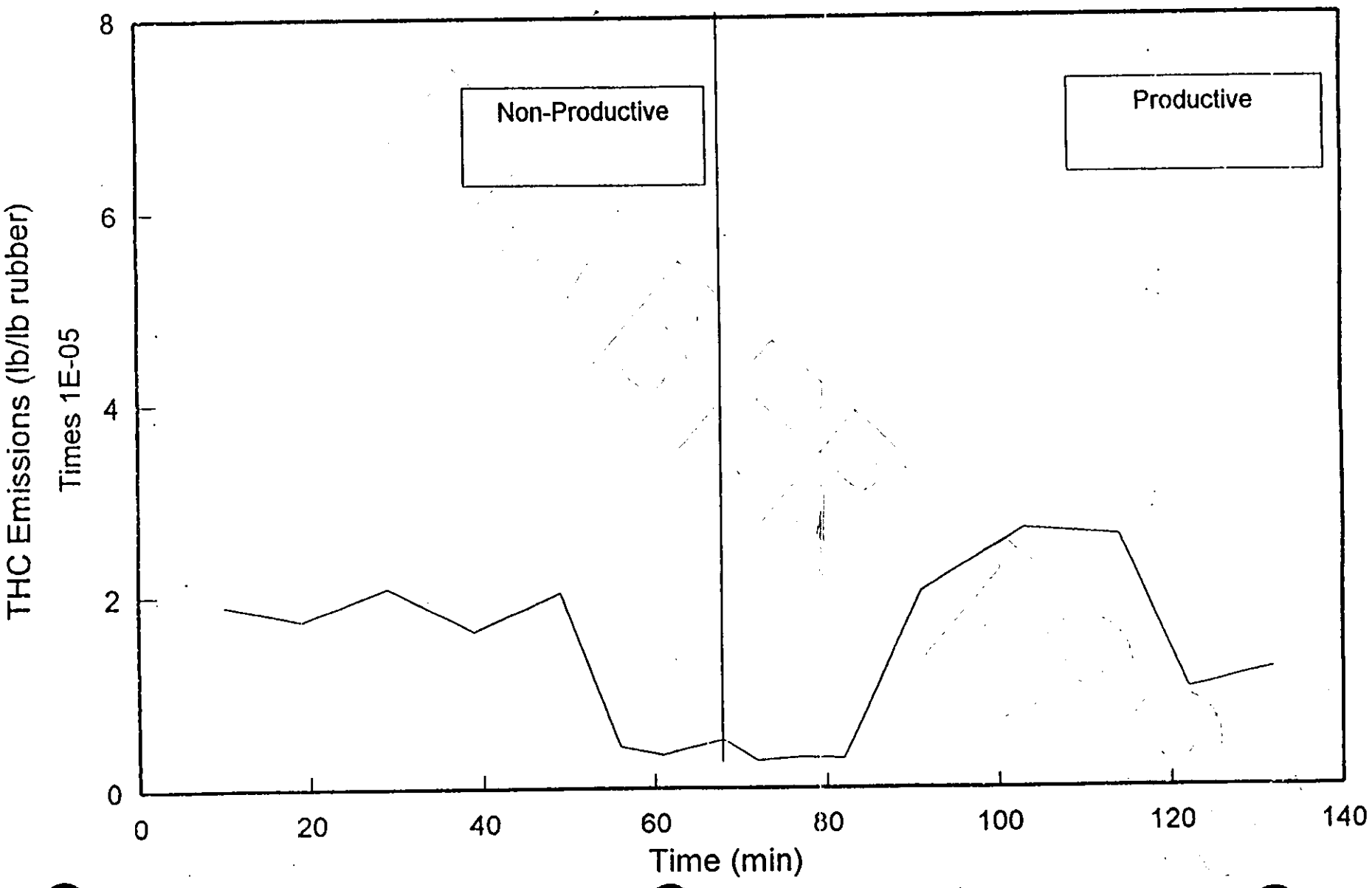
RMA - Small Banbury

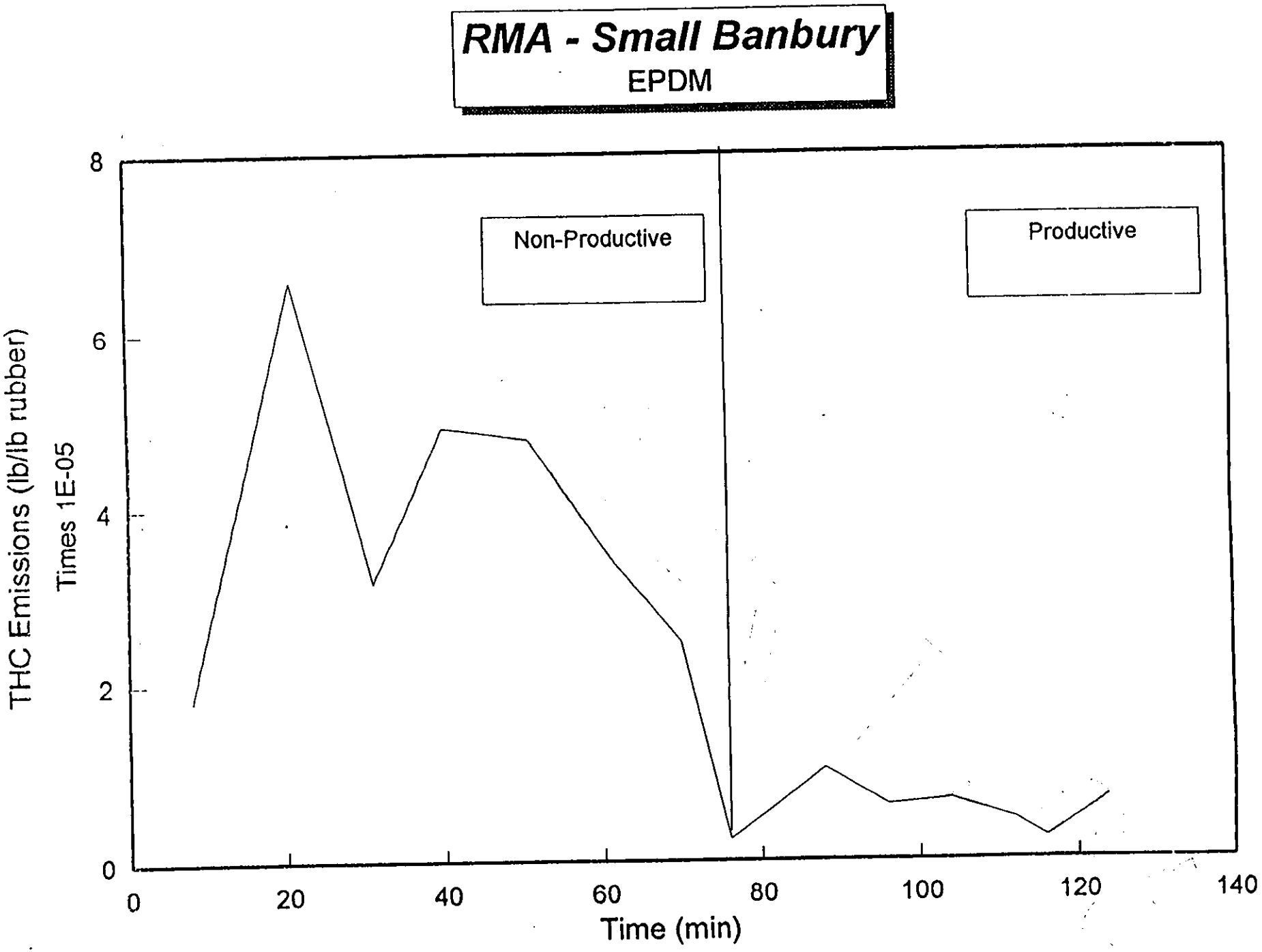
SBR

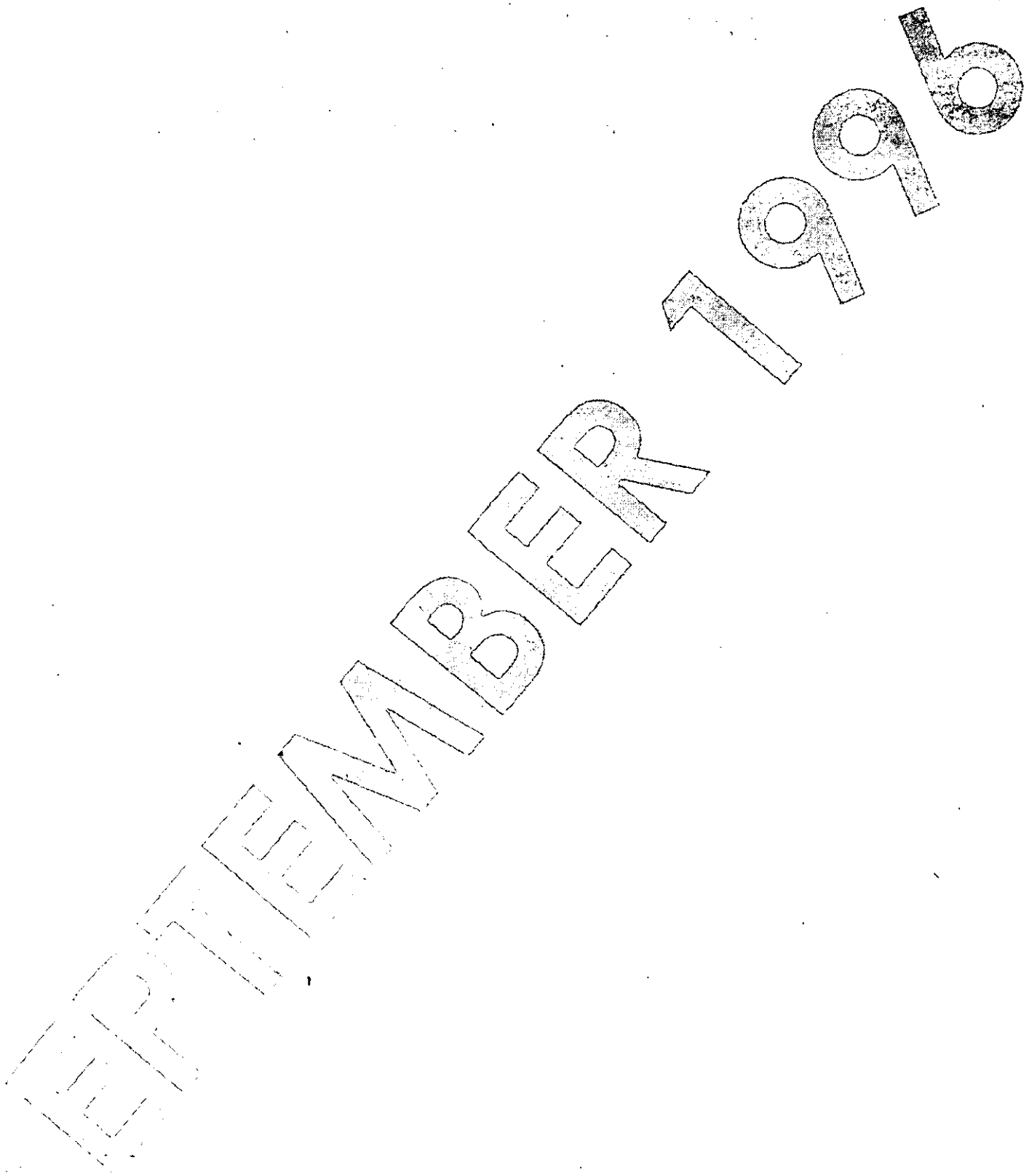


RMA - Small Banbury

SDW




RMA - Small Banbury
EPDM
Non-Productive
Productive
THC Emissions (lb/lb rubber)
Times 1E-05
0
2
4
6
8
0
20
40
60
80
100
120
140
Time (min)


SEPTEMBER 1996

SEPTEMBER 1996

TRC Environmental Corporation

Booth Mills South, Foot of John Street
Lowell, Massachusetts 01852
Telephone 508-970-5600
Facsimile 508-453-1995

Memorandum

April 8, 1996

To: Dale Louda, Manager of Regulatory Affairs, RMA

From: Mark Gollands, TRC

Enclosed is my response to the review comments from Dave Clark of Michelin. These comments were faxed to me on 4 April after having been discussed earlier at the RMA meeting in Baltimore on 2 April. Dave selected some representative processes for conducting his review, the Extruder (Cmpds 4, 6, 9, and 22) and Grinding (Carcass and Sidewall). There were some general comments, as well as some specific comments. The general comments included chemicals that were not on the EPA HAP list or RMA test list and shouldn't show up in the new database, and chemicals that were not on the previous spread sheets submitted in 1995 (assumed to mean Volumes 2 and 4), but appear in the new data.

Responses

1) The chemicals (or analytes) indicated by a hyphen (-) in the table are:

Extruder
- 2-Methylphenol
- Di-n-butylphthalate
- 1,1-Dichloroethene
- 2-Butanone
- 4-Methyl-2-Pentanone
- Chloroethane
- Chloromethane
- Isooctane

Grinding (Carcass)
- 2-Butanone
- 4-Methyl-2-Pentanone
- Chloromethane
- Isooctane

Grinding (Sidewall)
- 2-Butanone
- Isooctane

All of these analytes are HAPs or were on the original RMA list and were targeted during this program. In the preparation of the new database, we took the opportunity to standardize the nomenclature for the list of analytes and corresponding CAS numbers. The revised nomenclature is in accordance with IUPAC with the exception of cumene (Isopropyl benzene, or 1-Methylethyl benzene). The above list may have been reported under a different name in earlier volumes.

Examples:	IUPAC	Synonym
	2-Methylphenol	o-Cresol
	Di-n-butylphthalate	Di-n-butylphthalate
	1,1-Dichloroethene	Vinylidene Chloride
	2-Butanone	Methyl Ethyl Ketone (MEK)

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4-Methyl-2-Pentanone	Methyl Isobutyl Ketone (MIBK)
Chloroethane	Ethyl Chloride
Chloromethane	Methyl Chloride
Isooctane	2,2,4-Trimethyl Pentane

2) Analytes indicated by an asterisk (*) were noted to have been omitted from the 1995 volumes - why were they included in the new database?

The compounds in question are:

Extruder

- Biphenyl
- Dimethylphthalate
- N,N-Dimethylaniline
- 1,4-Dioxane
- Ethylbenzene
- Trichloroethene

Grinding (Carcass)

- 2-Chloroacetophenone
- Di-n-butylphthalate
- Carbonyl Sulfide
- Benzene
- Hexane
- Trichloroethene

Grinding (Sidewall)

- Cumene
- 1,3-Butadiene
- m+p-Xylenes
- o-Xylenes
- Di-n-butylphthalate
- Carbon Disulfide
- Methylene Chloride
- Toluene

In all but four cases, the reported analytes are consistent with the earlier volumes. All of the above *were* presented in Volume 2. However, trichlorocthene should have been presented as a HAP in the Volume 4 Extruder data. Similarly, carbonyl sulfide and trichloroethene should have been presented in the Volume 4 Carcass Grinding, and cumene should have been presented in the Volume 4 Sidewall Grinding data. All other analytes were presented correctly. The new database contains the correct analytes.

3) The numbers indicated by an arrow (→) were noted as data that did not match the 1995 data volumes.

All new data is consistent with the 1995 version, with one exception. The value reported for bis(2-Ethylhexyl)phthalate (9.28×10^{-8}) in the 1995 data did not have the Location A factor added. The correct factor is 1.94×10^{-7}, as presented in the new database. Note that the individual Location A and B factors were correct in the 1995 volume, but not the combined factors. Other analytes were correctly combined.

The cumene data presented for the Extruder in the new data report are correct but not necessarily traceable back to the 1995 volumes. This is because of the new data reporting method where the highest analyte value is taken from the semivol. or vol. results and all non-detects are excluded. The data shown in the Extruder tables is derived from Locations A and B, Runs 1 through 3, semivol. or vol. results. Therefore, it is easy to see that, although the algorithms remain the same, the semivol. and vol. data shown are presented separately,

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making it difficult to compare some of the new data with the 1995 volumes.

In summary, a review of the Extruder and Grinding data was conducted. The algorithms used in the new database are correct and the data presented in the new volumes are traceable back to the old volumes. Once the semivol. and vol. data are combined, the factors should be more "recognizable".

Summary

An in-depth investigation into the comments received last week yielded no global errors or misrepresentation of data except as noted in Response 3, above. All algorithms were in control for the new database. Any differences in analytes from one volume to another were the result of standardizing the analyte list to IUPAC nomenclature (eg.- the use of common synonyms). The Tire Press data has been reviewed and the algorithm revised. These were sent to you last week. Further review of other processes is ongoing.

cc: Ed Peduto

RMA.
RUBBER MANUFACTURERS ASSOCIATION

March 17, 1995

Lydia N. Wegman
Deputy Director
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

Dear Ms. Wegman:

This letter is to confirm that the US EPA only intends to regulate certain POM's related to thermal combustion sources.

The Rubber Manufacturers Association (RMA) represents the interests of the North American tire and general products rubber companies. The RMA membership accounts for over 95 percent of the tire plants in the United States and over 80 percent of the general products facilities.

Recently, the RMA completed a study to determine the emission factors from the rubber manufacturing process. This proactive endevour will greatly enhance EPA's ability to obtain vital emission data that is uniform, verified, and current. This project, which has been reviewed by James Southerland of the AP-42 group as well as Tom Helms of the Air Quality Management Division, has caused us to request this POM clarification.

As you know, POM is a general term referring to a complex mixture of thousands of polysyclic aromatic compounds, including many diverse classes of hydrocarbons, substituted aromatic hydrocarbons, and heterocyclic aromatic compounds. The conclusion regarding POM's is based on a review of "Documentation for Developing the Source Category List" for the development of NESHAP. In discussions with Dr. Pate, she indicated that there were specific POM's which EPA was looking at, generated from thermal processes. The definition and the source materials show that POM regulation is mainly for combustion and related processes.

To establish EPA's intent on the regulation of POM's, D.G. Berkebile of The Goodyear Tire and Rubber Company spoke with Nancy Pate, Environmental Health Scientist with the Pollution Assesment Branch of OAQPS. Also, Howard Schiff of TRC Environmental spoke with Dr. JoEllen Lewtas, Tom Lehre, Larry Johnson, and Bruce Harris of EPA along with Ray Merrill of Radian, an EPA contractor, concerning this matter. Based on all of these discussions, the conclusion is that US EPA only intends to regulate certain POM's related to thermal combustion sources.

Thank-you for the opportunity to clarify this position. If you have any further comments, please call me at 202.682.4839.

Sincerely,

Dale A. Louda, Jr.,
Manager of Regulatory Affairs

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1400 K STREET, N.W., WASHINGTON, D.C. 20005 • TELEPHONE (202) 682-4800 • FAX (202) 682-4854

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 27 1995

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Dale A. Louda, Jr.
Manager of Regulatory Affairs
Rubber Manufacturers Association
1400 K Street, NW
Washington, DC 20005

Dear Mr. Louda:

This is in response to your March 17, 1995 letter to Lydia Wegman in which you state your understanding that the Environmental Protection Agency only intends to regulate polycyclic organic matter (POM) from combustion processes. All of the source categories currently listed on the basis of POM emissions are combustion sources. Historically, the working definition of POM has been that complex mixture of compounds which is formed during organic combustion and pyrolysis processes. Therefore, our regulatory focus on POM will continue to be on emissions from combustion and pyrolysis activities.

We are currently evaluating the need for clarification of the definitions in the Clean Air Act Amendments of 1990 for some of the hazardous air pollutants listed in section 112(b), including POM. Any such information would be proposed in the Federal Register to provide opportunity for public notice and comment.

I appreciate this opportunity to be of service and trust this information will be helpful.

Sincerely,

William Hunt

for Sally L. Shaver
Director
Air Quality Strategies
and Standards Division

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