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AIR POLLUTION CONTROL IN THE SÃO PAULO METROPOLITAN REGION

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AIR POLLUTION CONTROL IN THE SÃO PAULO METROPOLITAN REGION

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THE STATE OF SÃO PAULO, BRAZIL, IS WITHOUT A DOUBT, THE HUB OF THE BRAZILIAN ECONOMY. THE STATE CAPITAL - THE CITY OF SÃO PAULO - AND THE 36 ADJACENT MUNICIPALITIES COMPRISE A METROPOLITAN REGION OF 8.051 SQ.KM WHICH, OVER THE YEARS, HAS BEEN TRANSFORMED INTO THE CHIEF COMMERCIAL AND INDUSTRIAL CENTER IN LATIN AMERICA.

AS IS THE CASE IN THE MAJORITY OF DEVELOPING COUNTRIES, ENVIRONMENTAL CONDITIONS IN THE SÃO PAULO METROPOLITAN REGION (SPMR) ARE NOT ADEQUATE. RAPID POPULATION GROWTH, LACK OF URBAN INFRASTRUCTURE AND UNPLANNED INDUSTRIALIZATION HAVE LED TO THE DEVELOPMENT OF LARGE CONURBATIONS HAVING EVERY KIND OF SOCIAL AND ENVIRONMENTAL PROBLEMS.

THE AIR POLLUTION PROBLEMS IN THE SPMR ARE BASICALLY CAUSED BY MOTOR VEHICLES AND INDUSTRIAL ACTIVITIES. IN ADDITION, COMMERCIAL ACTIVITIES AND SERVICES CONTRIBUTE TO THE GENERATION OF POLLUTION LEVELS WHICH, AS A GENERAL RULE, EXCEED THE STANDARDS FOR AIR QUALITY.

CETESB, THE SÃO PAULO STATE ENVIRONMENTAL PROTECTION AGENCY AND THE LARGEST AND MOST IMPORTANT AGENCY OF ITS KIND IN LATIN AMERICA, HAS BEEN ACTIVELY REGULATING AND ENFORCING EMISSION SOURCES OVER ALMOST TWO DECADES. ALTHOUGH AIR QUALITY IN THE SPMR IS STILL FAR FROM THE DESIRED LEVELS, IT HAS TO BE RECOGNIZED THAT CETESB'S EFFORTS HAVE CONTRIBUTED TO HALT THE RAPIDLY GROWING AIR POLLUTION EMISSIONS, WHICH WERE SEEN IN BRAZIL AS A SIGN OF INDUSTRIAL PROGRESS AND DEVELOPMENT IN THE PAST YEARS. FURTHERMORE, IT WAS POSSIBLE TO ACHIEVE SIGNIFICANT AIR QUALITY IMPROVEMENTS FOR SPECIFIC POLLUTANTS, AS IS THE CASE OF SULFUR DIOXIDE AND LEAD, WHICH ARE PRESENTLY BELOW THE CORRESPONDING AIR QUALITY STANDARDS.

THE LATEST EMISSION INVENTORY FIGURES FOR THE SPMR (1990) SHOW THAT MOTOR VEHICLES ARE THE MOST IMPORTANT SOURCE OF CARBON MONOXIDE (CO), HYDROCARBONS, (HC), NITROGEN OXIDES (NO_x) AND SULFUR OXIDES (SO_x) EMISSIONS AND THIS CONTRIBUTION RANGES FROM ABOUT 70% FOR SO_x TO APPROXIMATELY 95% FOR CO.

ON THE OTHER HAND, STATIONARY SOURCES ARE RESPONSIBLE FOR MOST OF THE PARTICULATE EMISSIONS (PM, APPROXIMATELY 70%) AND HAVE BEEN RESPONSIBLE FOR ALMOST THE TOTALITY OF AIR POLLUTION RELATED PUBLIC COMPLAINTS.

AT THE HEART OF THE CONTROL PROGRAM FOR STATIONARY SOURCES IS THE PERMIT SYSTEM, WHICH EVALUATES FOR COMPLIANCE WITH LEGAL REQUIREMENTS AND EMISSION STANDARDS NEW INSTALLATIONS OR MODIFICATIONS OF EXISTING ONES, PRIOR TO ISSUANCE OF A PERMIT TO CONSTRUCT AND OPERATE.

CETESB'S REGIONAL OFFICES ARE RESPONSIBLE FOR ALL ENFORCEMENT WITHIN ASSIGNED AREAS WHERE THEY ADMINISTER THE PERMIT SYSTEM, RESPOND TO CITIZEN COMPLAINTS, VERIFY CORRECTION OF VIOLATIONS, ETC.

IN THE MID-EIGHTIES TWO IMPORTANT CONTROL PROGRAMS WERE SET UP TO CONTROL RESPECTIVELY PM AND SO EMISSIONS FROM INDUSTRIAL AND COMMERCIAL SOURCES. ALTHOUGH BOTH PROGRAMS AIMED POLLUTANT REDUCTIONS WHICH WOULD RESULT IN AIR QUALITY STANDARDS COMPLIANCE, SO FAR ONLY THE SO_x PROGRAM HAS ACHIEVED THIS GOAL.

THE SO_x CONTROL PROGRAM HAS BEEN BASED ON THE REDUCTION OF SULFUR LEVELS FROM THE PETROLEUM-BASED FUELS, USE OF FLUE GAS SO_x REMOVAL EQUIPMENTS, INCREASE OF NATURAL GAS UTILIZATION, ADOPTION OF ENERGY CONSERVATION MEASURES AND HAS ALSO GAINED FROM INDUSTRIAL RELOCATION.

APART FROM THIS, IN SOME REGIONS SUCH AS THE INDUSTRIAL ZONE OF CUBATÃO, WHICH GAINED INTERNATIONAL

NOTORIETY BECAUSE OF ITS HIGH POLLUTION LEVELS, SPECIFIC CONTROL PROGRAMS WERE ESTABLISHED WHICH BENEFITTED FROM WORLD BANK FINANCING FOR THE CORRECTION ACTIONS WHICH FOLLOWED. THE RECOGNITION OF THE SIGNIFICANCE OF MOTOR VEHICLE EMISSIONS TO SPMR'S AIR POLLUTION, LED TO THE ESTABLISHMENT OF THE NATIONAL AIR POLLUTION CONTROL PROGRAM FOR AUTOMOTIVE VEHICLES - PROCONVE, IN 1986. THE STRATEGY ADOPTED TO REDUCE AUTOMOTIVE EMISSIONS IS BASED ON SUCCESSFUL INTERNATIONAL EXPERIENCE, IN ORDER TO PROMOTE INTERNATIONAL HARMONIZATION AND STANDARDIZATION. FOR THE LIGHT DUTY VEHICLES POWERED WITH OTTO ENGINES, THE U.S. APPROACH WAS CHOSEN, HOWEVER, EMISSION LIMIT REQUIREMENTS AND CONTROL PROGRAM CHARACTERISTICS WERE DESIGNED FOR BRAZILIAN CONDITIONS. FOR ALL VEHICLES POWERED WITH DIESEL ENGINES, THE E.E.C. CONTROL CONCEPT WAS PREFERRED AND, SIMILARLY, ADAPTED TO LOCAL CONDITIONS.

FOR THE LIGHT DUTY VEHICLES, EMISSION OF POLLUTANTS HAS ALREADY BEEN REDUCED BY ABOUT 80% WHEN, COMPARING 1992 CERTIFICATION VALUES AND 1986 EMISSION VALUES FOR NEW VEHICLES, AS IT CAN BE OBSERVED BELOW:

EMISSION LIMITS AND CERTIFICATION MEAN VALUES FOR LIGHT DUTY VEHICLES

		CO g/km	HC g/km	NO g/km	ALDEHYDES g/km	EVAPORATIVE g/test
1986 (NO CONTROL)	ALCOHOL	16,9	1,6	1,2	0,160	10
	GASOHOL	28,0	2,4	1,6	0,040	23
1990	LIMITS	24,0	2,1	2,0	-	6,0
	ALCOHOL	10,8	1,3	1,2	0,110	1,8
	GASOHOL	13,3	1,4	1,4	0,040	2,7
1992	LIMITS	12,0	1,2	1,4	0,150	6,0
	ALCOHOL	3,6	0,6	0,6	0,027	1,7
	GASOHOL	5,1	0,6	0,9	0,005	2,0
1997	LIMITS	2,0	0,3	0,6	0.030	6,0

1) TEST PROCEDURE: 1975 U.S. FTP

2) ALCOHOL: HYDROUS ETHANOL

3) GASOHOL: 78% GASOLINE AND 22% ANHYDROUS ETHANOL (BY VOLUME)

4) ALDEHYDES: TOTAL ALDEHYDES

SINCE 1987, THE DIESEL SMOKE LIMIT K = 2,5 (ALSO ADOPTED BY THE E.E.C. COUNTRIES) HAS BEEN IN EFFECT. THIS HAS RESULTED IN AN AVERAGE SMOKE EMISSION REDUCTION OF 40% FOR NEW VEHICLES.

BEGINNING JANUARY 1ST 1993, ALL NEW DIESEL VEHICLES WILL HAVE ALSO TO ATTEND THE FOLLOWING EMISSION LIMITS FOR GASEOUS EMISSIONS:

$$CO = 11{,}20\ g/kW.h$$

$$HC = 2{,}80\ g/kW.h$$

$$NO_x = 18{,}00\ g/kW.h$$

THERE IS A STRONG POSSIBILITY THAT FOR NO_x THE EMISSION LIMIT WILL BE REDUCED TO 14,4 g/kW.h, AND THAT IN 1996 THE EURO I STANDARDS WILL BE IN EFFECT.

THE CHARACTERISTICS OF THE FUELS AVAILABLE FOR THE VEHICLES WITH OTTO ENGINES HAVE CERTAINLY CONTRIBUTED TO CURB EMISSION LEVELS OVER THE EIGHTIES IN THE SPMR. THE USE OF ETHANOL, EITHER AS A GASOLINE BLENDING COMPONENT OR AS AN ALTERNATIVE FUEL, HAS SHOWN CLEAR BENEFITS, SPECIALLY IN TERMS OF CO, SO , PM AND LEAD REDUCTION, ALSO, THE USE OF ETHANOL HAS NOT SHOWN ANY EVIDENCE OF HIGHER SMOG FORMATION DUE TO THE INCREASE OF GASOLINE VOLATILITY (WHEN BLENDED WITH ETHANOL) OR DUE TO ALDEHYDES EMISSION, TODAY ALREADY REDUCED TO THE FORMER GASOHOL VEHICLE LEVELS.

HAVING TO FACE AN ETHANOL SHORTAGE BY THE END OF 1989, CETESB PLAYED AN IMPORTANT ROLE IN THE DEVELOPMENT OF AN ALTERNATIVE TO ETHANOL FUEL. THIS NEW FUEL, WHICH IS A BLEND OF 33% METHANOL, 60% ETHANOL AND 7% GASOLINE (BY VOLUME) REQUIRES NO SPECIAL TUNING, RECALIBRATIONS OR CONVERSIONS FOR THE ETHANOL ENGINES AND, ON THE OVERALL, VEHICLE EMISSIONS MAY BE CONSIDERED VERY SIMILAR TO THOSE RESULTING FROM THE USE OF ETHANOL. THIS TERNARY BLEND HAS BEEN USED IN THE SPMR FOR ABOUT TWO YEARS AND THE AIR QUALITY STUDIES CONDUCTED BY CETESB AND HEALTH EFFECT STUDIES SPONSORED BY THE STATE HEALTH SECRETARY HAVE NOT SHOWN ANY NEGATIVE EVIDENCE DUE TO ITS USE.

THE BAD NEWS RELATE TO THE QUALITY OF DIESEL FUEL WHICH, BESIDES HAVING HIGH SULFUR LEVELS (AROUND 0,6% BY WEIGHT), HAS A GREAT AMOUNT OF HEAVY HYDROCARBONS THAT INCREASE THE FORMATION OF PARTICLES DURING COMBUSTION.

CETESB HAS ALSO LAUNCHED PUBLIC AWARENESS PROGRAMS AND CAMPAIGNS AGAINST AIR POLLUTION.

FOR THE GUIDANCE OF THE POPULATION OF THE STATE CAPITAL, DOZENS OF ELECTRONIC PANELS WERE INSTALLED ALONG MAJOR TRAFFIC WAYS WHICH LEAD TO DOWNTOWN.

THE PANELS ARE CONNECTED TO A CENTRAL COMPUTER AT CETESB AND ARE ABLE TO DISPLAY POLLUTION CONDITIONS FOR CO, PM AND PHOTOCHEMICAL OXIDANTS, WHICH ARE MEASURED BY THE AIR QUALITY MONITORING NETWORK.

IN 1988, CETESB PROMOTED A VOLUNTARY BAN OF VEHICLE TRAFFIC IN THE HEART OF SÃO PAULO'S DOWNTOWN.

THE SIMULATION OF A STATE OF ALERT WAS TO PREPARE THE POPULATION FOR THE POSSIBLE OCCURRENCE OF A STATE OF EMERGENCY. THE BAN WAS A SUCCESS AND RESULTED IN A 60% REDUCTION OF CO AMBIENT LEVELS ON THAT DAY.

ANOTHER EFFORT TO REDUCE POLLUTION WAS TAKEN BY THE SÃO PAULO MUNICIPALITY, WHICH HAS REQUIRED FULL

CONVERSION OF THE PRESENT DIESEL DRIVEN URBAN BUS FLEET (11.000 BUSES) TO NATURAL GAS OVER A PERIOD OF TEN YEARS.

ALTHOUGH CETESB CURRENTLY INSPECTS IN-USE DIESEL VEHICLES FOR THE CONTROL OF BLACK SMOKE (BASED ON THE RINGELMANN SCALE GRADE Nº 2), RESEARCH IS BEING CONDUCTED TO DETERMINE THE VIABILITY OF SETTING UP AN INSPECTION AND MAINTENACE PROGRAM FOR BOTH HEAVY DUTY AND LIGHT DUTY VEHICLES. THE ESTABLISHMENT OF SUCH A SYSTEM IS JUSTIFIED BY THE LARGE NUMBER OF VEHICLES BEING RUN IN BAD CONDITIONS.