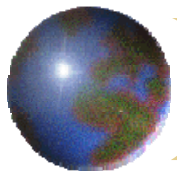


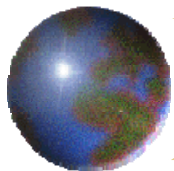
PARTICOLATO ATMOSFERICO

*CARATTERIZZAZIONE CHIMICA E
PROPRIETÀ BIOLOGICHE DI FRAZIONI A
DIVERSA GRANULOMETRIA E POLARITÀ DEL
PARTICOLATO ATMOSFERICO E TENTATIVO
DI INDIVIDUAZIONE DELLE SORGENTI
EMISSIVE MEDIANTE PROFILI GC-MS*



PARTICOLATO ATMOSFERICO

- *Sito a basso livello di inquinamento*
- *Diverse stagionalità*
- *Studio delle frazioni a diversa polarità*
 - *apolare*
 - *media polarità*
 - *polare*
- *Rapporti tra i costituenti le frazioni nel tentativo d'individuazione delle sorgenti emissive*



FRAZIONE PARAFFINICA

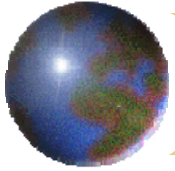
Tabella sinottica Paraffine

Periodo Invernale

n-Alcani presenti nell'aerosol
atmosferico

concentrazioni medie espresse in ng/m⁻³

	PM10	TSP
n-C16	1.4	1.7
n-C17	3.0	4.0
n-C18	3.3	2.6
n-C19	5.1	4.8
n-C20	5.9	6.0
n-C21	10.3	12.7
n-C22	14.4	18.4
n-C23	15.4	20.5
n-C24	12.7	17.3
n-C25	9.3	12.6
n-C26	5.5	7.7
n-C27	7.5	10.0
n-C28	3.9	5.6
n-C29	9.2	13.3
n-C30	3.3	4.3
n-C31	9.1	12.4
n-C32	2.8	3.7
n-C33	6.0	8.2
n-C34	2.0	2.1
Totale	130.1	167.9



FRAZIONE PARAFFINICA

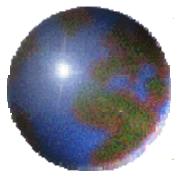
Tabella sinottica Paraffine

Periodo Primaverile

n-Alcani presenti nell'aerosol
atmosferico

concentrazioni medie espresse in ng/m⁻³

	PM10	TSP
n-C15	0.1	0.1
n-C16	0.4	0.3
n-C17	0.6	0.4
n-C18	0.7	0.4
n-C19	1.1	0.5
n-C20	1.5	0.7
n-C21	2.7	1.4
n-C22	3.9	2.4
n-C23	6.4	4.5
n-C24	5.9	4.8
n-C25	6.2	5.2
n-C26	4.1	3.5
n-C27	5.8	4.5
n-C28	2.7	2.4
n-C29	8.1	6.9
n-C30	2.3	1.8
n-C31	10.6	8.6
n-C32	2.4	2.2
n-C33	7.8	6.1
n-C34	1.7	1.2
n-C35	2.1	2.1
n-C36	0.5	0.3
Totale	77.63	60.53



FRAZIONE PARAFFINICA

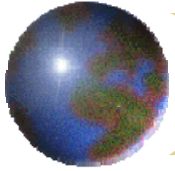
Tabella sinottica Paraffine

Periodo Estivo

n-Alcani presenti nell'aerosol
atmosferico

concentrazioni medie espresse in ng/m³

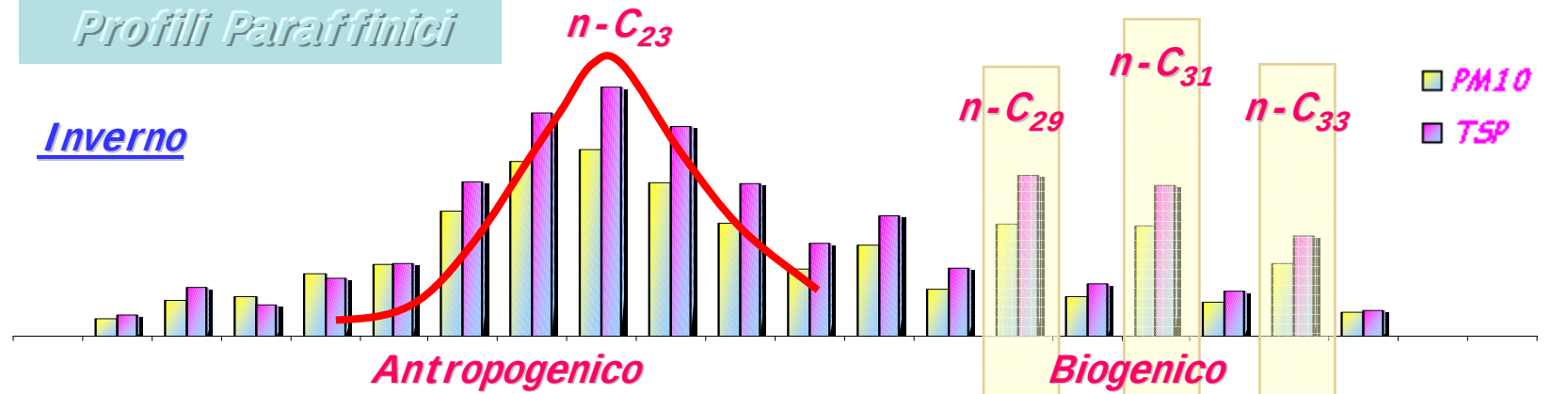
	PM10	TSP
n-C17	0.9	0.6
n-C18	0.7	0.6
n-C19	0.9	0.7
n-C20	0.7	0.6
n-C21	1.0	1.0
n-C22	1.3	1.2
n-C23	2.1	2.1
n-C24	3.0	3.1
n-C25	4.3	4.6
n-C26	3.7	4.4
n-C27	8.3	10.2
n-C28	3.7	5.1
n-C29	10.8	15.2
n-C30	3.5	5.6
n-C31	10.6	14.8
n-C32	3.3	5.4
n-C33	5.9	8.6
n-C34	3.1	5.0
Totale	67.7	88.7



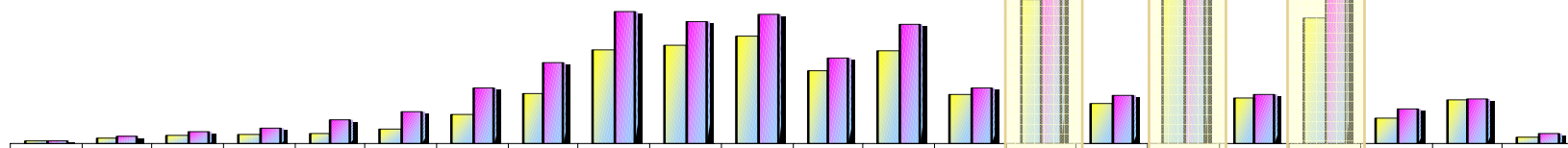
FRAZIONE PARAFFINICA

Profili Paraffinici

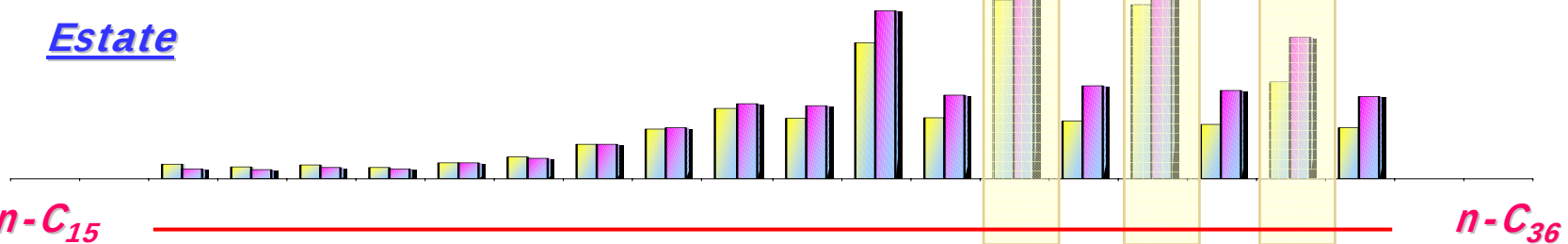
Inverno

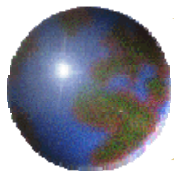


Primavera



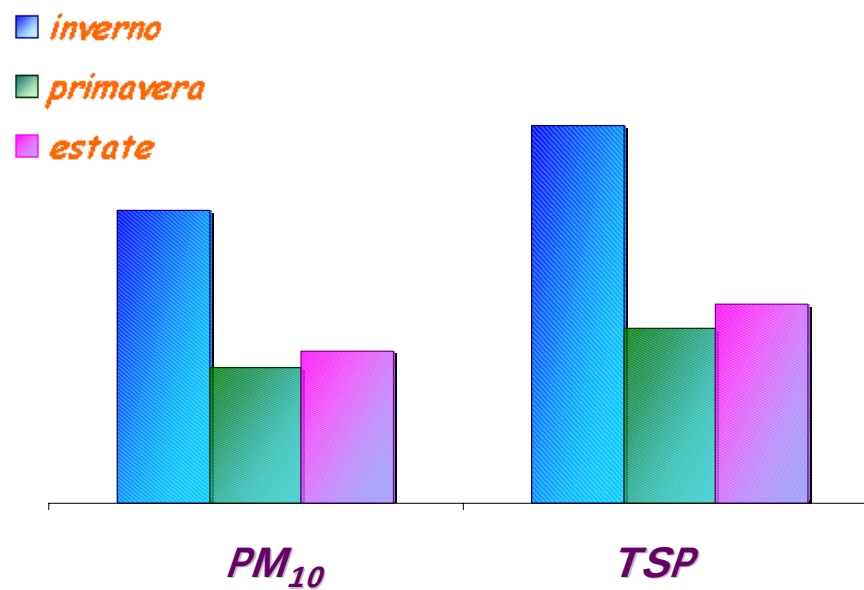
Estate





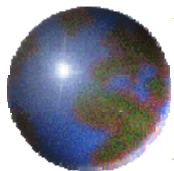
FRAZIONE PARAFFINICA

Paraffine totali



	PM10 Tot	TSP Tot
inverno	130,1	167,9
primavera	60,5	77,6
estate	67,7	88,8

concentrazioni medie espresse in ng/m⁻³

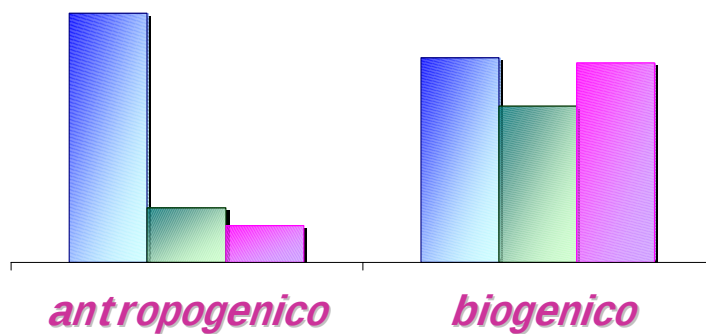


FRAZIONE PARAFFINICA

Antropogenico vs Biogenico

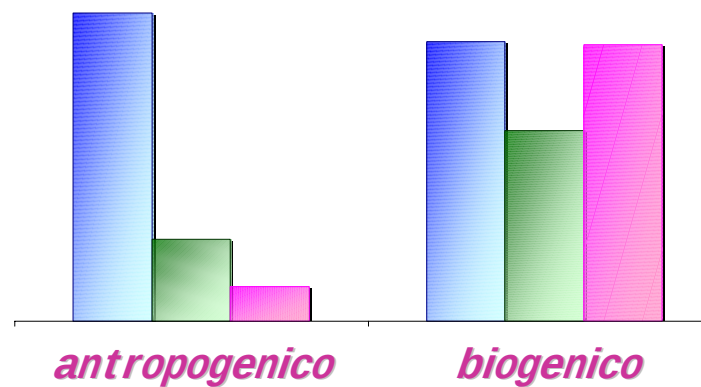
PM₁₀

■ *inverno*
■ *primavera*
■ *estate*



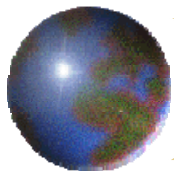
	n-C<25	n-C>25
inverno	71,4	58,6
primavera	15,5	45,0
estate	10,6	57,1

TSP



	n-C<25	n-C>25
inverno	88,0	80,0
primavera	23,3	54,3
estate	9,8	78,9

concentrazioni medie espresse in ng/m⁻³



FRAZIONE PARAFFINICA

Carbon Preference Index

$$CPI_{25} = 0,5 \times \left\{ \frac{(C_{25}+C_{27}+C_{29}+C_{31}+C_{33})}{(C_{24}+C_{26}+C_{28}+C_{30}+C_{32})} + \frac{(C_{25}+C_{27}+C_{29}+C_{31}+C_{33})}{(C_{26}+C_{28}+C_{30}+C_{32}+C_{34})} \right\}$$

$$CPI \cong 1$$



Antropogenico

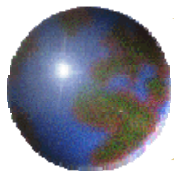
$$CPI > 1$$



Biogenico

Tabella sinottica dei valori CPI_{25} relativi alle tre stagionalità

	<i>inverno</i>	<i>primavera</i>	<i>estate</i>
<i>PM10</i>	2,0	2,3	2,6
<i>TSP</i>	1,8	2,1	2,4

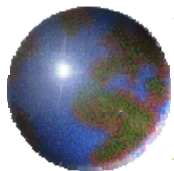


IDROCARBURI POLICILICI AROMATICI

Tabella sinottica IPA

	Inverno		Primavera		Estate	
	PM10	TSP	PM10	TSP	PM10	TSP
Fenantrene	0.44	0.49	0.16	0.23	0.09	0.11
Antracene	0.06	0.07	0.03	0.05	0.01	0.02
Fluorantene	0.89	1.04	0.25	0.13	0.12	0.12
Pirene	1.23	1.45	0.29	0.37	0.13	0.13
Benzo(ghi)fluorantene	0.68	0.85	0.25	0.31	0.08	0.10
Benzo(a)Antracene	0.76	1.02	0.26	0.34	0.06	0.08
Ciclopentapirene	0.76	1.02	0.10	0.14	0.14	0.17
Crisene + Trifenilene	0.77	0.96	0.59	0.74	0.16	0.17
Benzo(b+j)Fluorantene	1.51	1.85	0.93	1.17	0.38	0.44
Benzo(K)Fluorantene	0.43	0.54	0.18	0.26	0.07	0.09
Benzo(e)Pirene	0.67	0.82	0.42	0.51	0.21	0.25
Benzo(a)Pirene	0.93	1.11	0.33	0.44	0.16	0.19
Perilene	0.16	0.19	0.04	0.05	0.02	0.02
Indeno(1,2,3-cd)Pirene	1.13	1.38	0.53	0.60	0.25	0.30
Dibenzo(ac+ah)Antracene	0.37	0.47	0.07	0.10	0.13	0.17
Benzo(ghi)Perilene	1.76	2.19	0.62	0.70	0.37	0.45
Coronene	1.04	1.32	0.69	0.78	0.29	0.37
Σ DibenzoPireni (al,ae,ai,ah)	1.61	2.00	0.59	0.67	0.43	0.47
Totale	15.21	18.85	6.34	7.58	3.11	3.64

concentrazioni medie espresse in ng/m⁻³

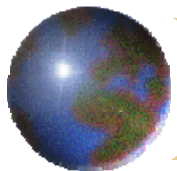


IDROCARBURI POLICILICI AROMATICI

Tabella sinottica IPA

	Inverno		Primavera		Estate	
	PM10	TSP	PM10	TSP	PM10	TSP
metil Fenantreni / Antraceni	0.61	0.71	0.11	0.13	0.08	0.07
dimetil Fenantreni / Antraceni	0.72	0.76	0.11	0.14	0.08	0.07
metil Fluoranteni / Pireni	0.64	0.73	0.21	0.26	0.10	0.10
metil Benzantraceni / Criseni	0.82	1.06	0.47	0.53	0.16	0.19
Totale metilati	2.79	3.26	0.93	1.14	0.41	0.44

concentrazioni medie espresse in ng/m⁻³



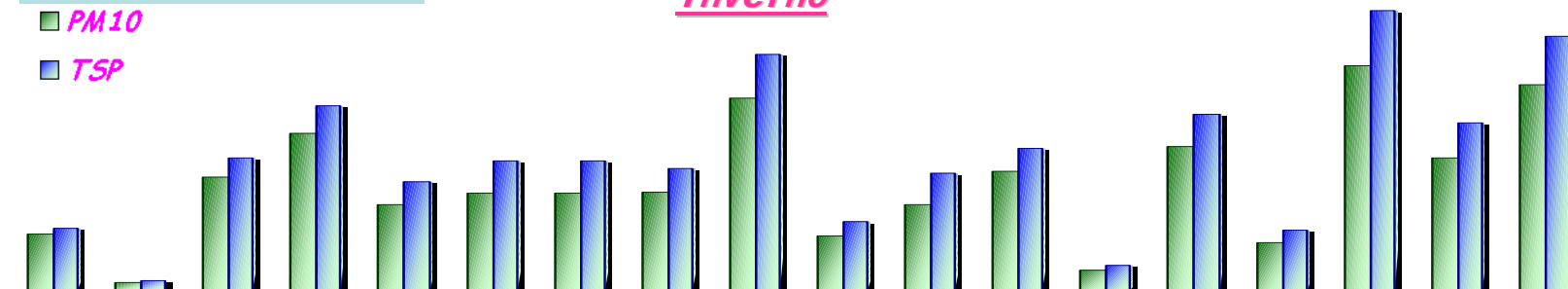
IDROCARBURI POLICICLICI AROMATICI

Profili IPA

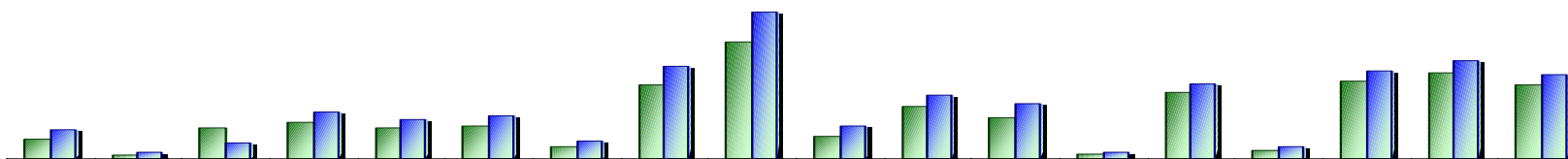
PM10

TSP

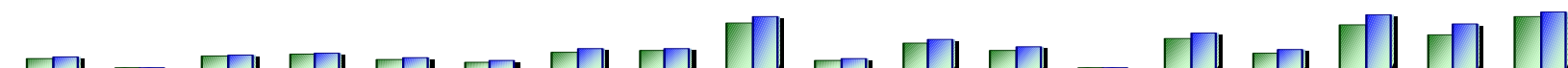
Inverno



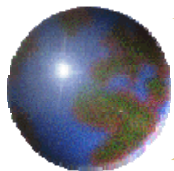
Primavera



Estate



F A FI PY BgF CPP BaA CHR BbjF BkF BeP BaP PE IP DBA BgP CO DBP



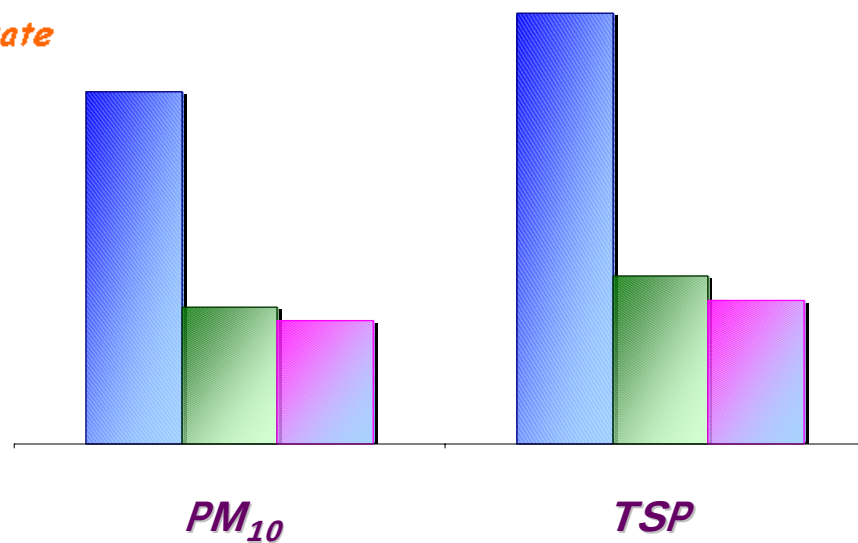
IDROCARBURI POLICICLICI AROMATICI

IPA totali

■ *inverno*

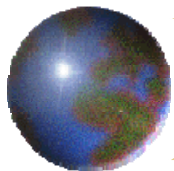
■ *primavera*

■ *estate*



	PM10	TSP
INVERNO	19,3	23,7
PRIMAVERA	7,5	9,2
ESTATE	6,7	7,9

concentrazioni medie espresse in ng/m⁻³



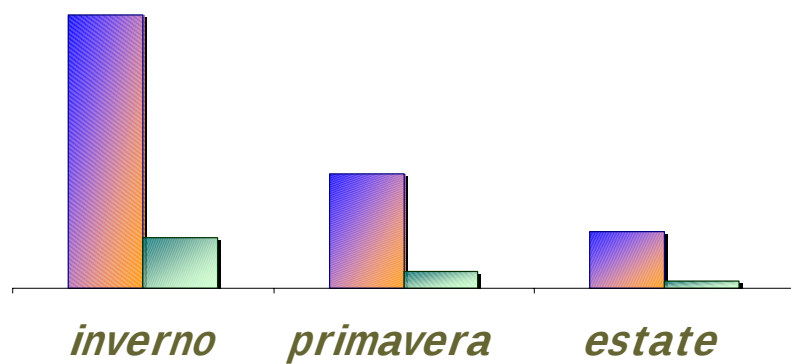
IDROCARBURI POLICICLICI AROMATICI

Contributo % metilati

PM₁₀

■ *progenitori*

■ *metilati*



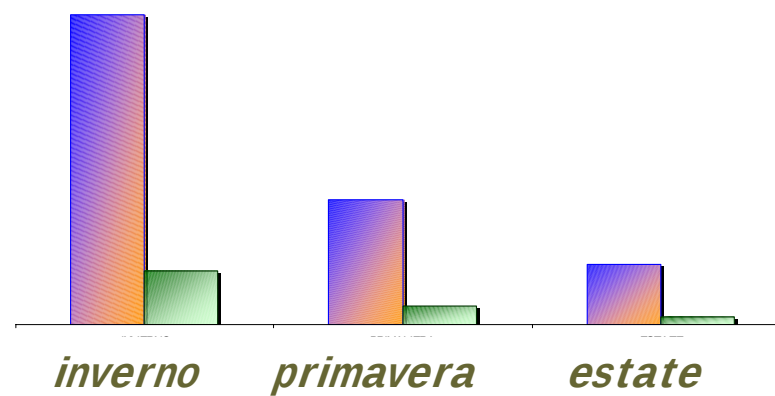
18

15

13

%

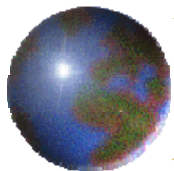
TSP



17

15

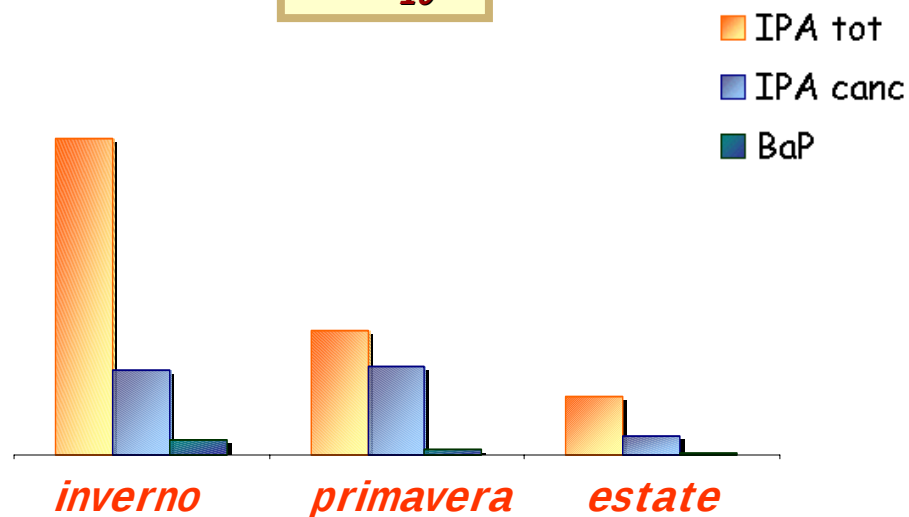
12



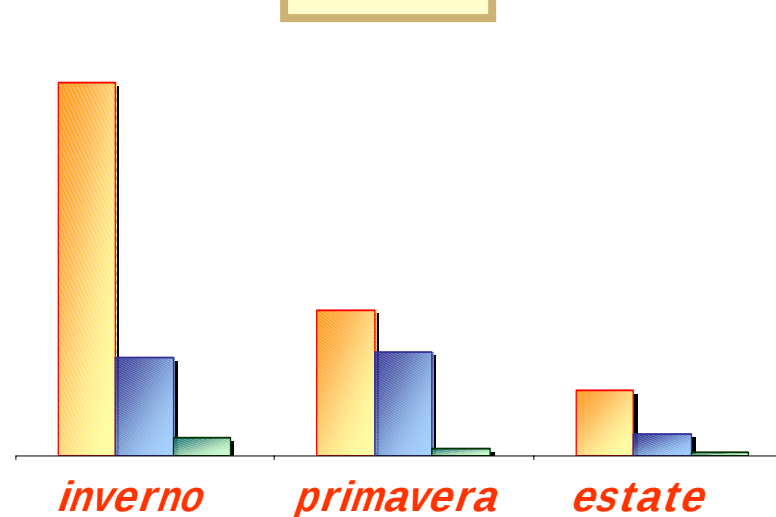
IDROCARBURI POLICICLICI AROMATICI

Contributo BaP e Cancerogeni

PM₁₀



TSP

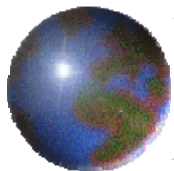


	INVERNO	ESTATE	PRIMAVERA
IPA tot	19,40	3,64	7,59
IPA canc	5,20	1,14	5,47
BaP	0,90	0,16	0,33

	INVERNO	ESTATE	PRIMAVERA
IPA tot	23,70	4,21	9,23
IPA canc	6,30	1,36	6,64
BaP	1,10	0,19	0,44

concentrazioni medie espresse in ng/m⁻³

IPA cancerogeni: BbJkF, BaP DBA, DBP



IDROCARBURI POLICILICI AROMATICI

Contributo % BaP e IPA Cancerogeni

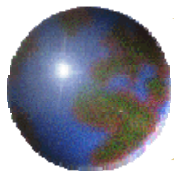
TSP

	IPA canc/tot	BaP/ IPA tot	Bap/ IPA canc
INVERNO	26,6	4,6	17,5
ESTATE	32,3	4,8	6,6
PRIMAVERA	71,9	4,5	14,0

PM₁₀

	IPA canc/tot	BaP/ IPA tot	Bap/ IPA canc
INVERNO	26,8	4,6	17,3
ESTATE	31,3	4,4	14,0
PRIMAVERA	72,1	4,3	6,0

IPA cancerogeni: Bb_kF, BaP DBA, DBP

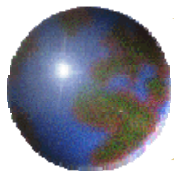


IDROCARBURI POLICILICI AROMATICI

Rapporti Indice IPA

	<i>Inverno</i>		<i>Primavera</i>		<i>Estate</i>		<i>Pirolitico</i>	<i>Petrogenico</i>
	PM ₁₀	TSP	PM ₁₀	TSP	PM ₁₀	TSP		
LIPA/HIPA	0.3	0.3	0.2	0.2	0.2	0.2	< 1	> 1
Fen/Ant	7.0	6.8	5.6	4.3	7.6	6.8	< 10	> 15
Flu/Pir	0.7	0.7	0.9	0.4	0.9	0.9	> 1	< 1
Cris/BaA	1.0	0.9	2.2	2.2	1.0	1.1	< 1	> 1
Flu/(Flu+Pir)	0.4	0.4	0.5	0.3	0.5	0.5	> 0,5	< 0,5

- LIPA = Fen, Ant, Fluor, Pir;
- HIPA = BaA, Cris, B(b,j,k)F, BeP, BaP, IP, BghiP;

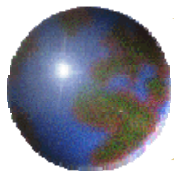


FRAZIONE POLARE

Tabella sinottica nitro- IPA

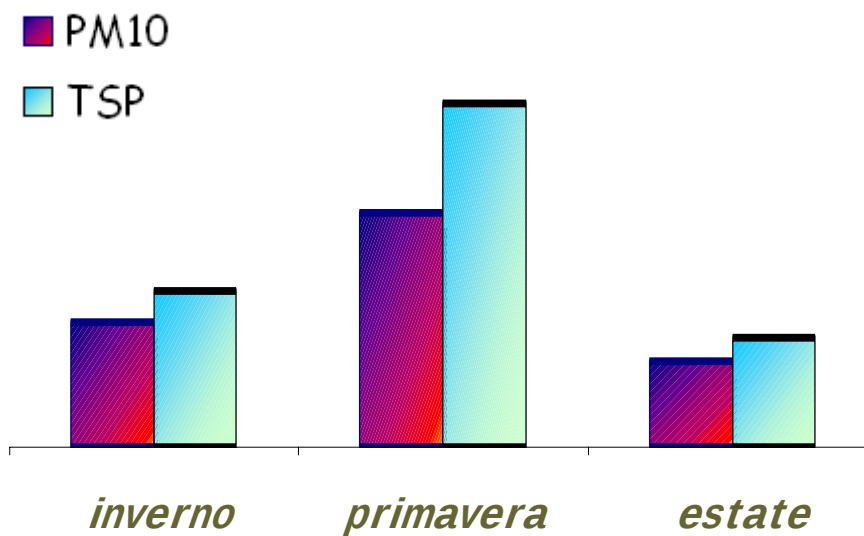
	Inverno		Primavera		Estate	
	PM10	TSP	PM10	TSP	PM10	TSP
2-nitro Fluorene	27.8	31.2	29.3	39.0	10.9	18.0
9-nitro Antracene	n.d.	n.d.	183.2	160.8	108.2	134.0
2-nitro Fluorantene	73.8	82.9	197.9	378.7	59.8	77.8
3-nitro Fluorantene	94.8	111.6	n.d.	n.d.	n.d.	n.d.
1-nitro Pirene	71.2	115.3	114.0	201.0	14.0	18.4
2-nitro Pirene	35.0	36.0	30.3	37.7	15.6	17.6
Totale	303.5	377.0	554.7	817.2	208.4	265.9

concentrazioni medie espresse in pg/m^{-3}



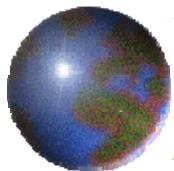
FRAZIONE POLARE

nitro-IPA totali



	inverno	primavera	estate
PM10	303,5	554,7	208,4
TSP	377,0	817,2	265,9

concentrazioni medie espresse in pg/m⁻³



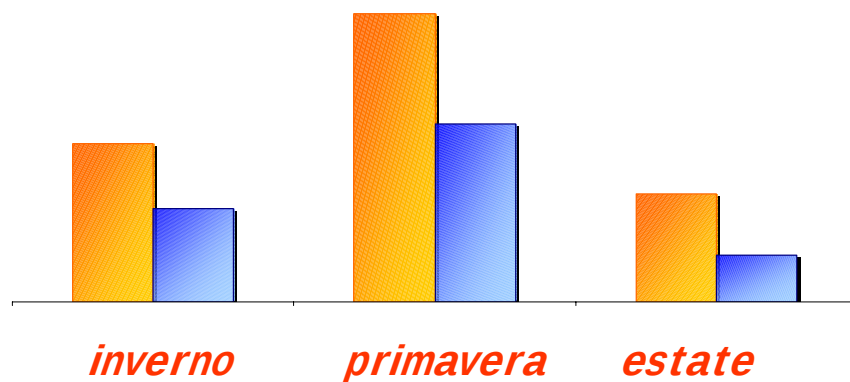
FRAZIONE POLARE

Contributo Cancerogeni

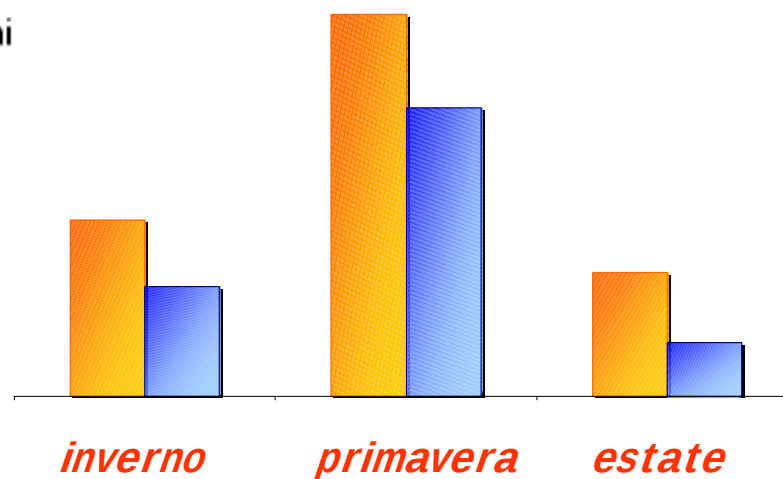
PM₁₀

TSP

■ totale
■ cancerogeni



totale	304	555	208
cancerogeni	180	342	89



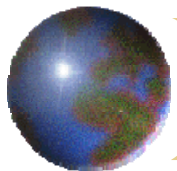
totale	377	817	266
cancerogeni	234	617	114

concentrazioni medie espresse in pg/m^3

59	62	43
----	----	----

%

62	76	43
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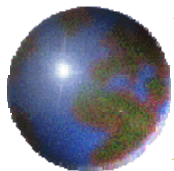


IDROCARBURI POLICILICI AROMATICI

Rapporti Indice nitro-IPA

	<i>Inverno</i>		<i>Primavera</i>		<i>Estate</i>	
	PM ₁₀	TSP	PM ₁₀	TSP	PM ₁₀	TSP
2-NFA / 1NPY	1.0	2.7	1.9	10.0	4.3	4.0
2-NFA / 2NPY	0.7	2.8	1.7	6.5	4.0	5.2

- 2-NFA/1NPY = conc. 2-nitro Fluorantene / conc. 1-nitro Pirene
- 2-NFA/2NPY = conc. 2-nitro Fluorantene / conc. 2-nitro Pirene



FRAZIONE POLARE

IPA-CHINONI

	PM	INC. RS.1	INC. RS.2	INC. R.SPEC.2
Benzofenone	-	-	X	X
9H - Fluoren - 9 - one	X	X	X	X
Xantone	-	X	-	X
9,10 - Antracendione	X	X	-	X
Ciclopenta(def)fenantrenone	-	X	-	X
9,10 - Antracendione, 1-etil-	-	X	-	-
2H - Benzotiopiran, 2-etil-3,4-diidro	X	-	-	-
7H - Benzo(de)antracen - 7 - one	-	X	-	-
7H - Benzo(de)antracen - 7 - one	-	X	-	-
7H - Benzo(de)antracen - 7 - one	X	X	-	-
7H - Benzo(de)antracen - 7 - one	X	X	-	-
Benzo(a)antracen - 7,12 - dione	-	X	-	-
9,10 - Antracendione	X	X	-	-
9,10 - Antracendione	-	X	-	-
9,10 - Antracendione	-	X	-	-

- X = *presente*
- - = *non rilevato*