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Bibliometric Analysis for Papers on Topics Related to Particulate Matter (PM)

This is a bibliometric analysis of the papers prepared by intramural and extramural researchers of the U.S. Environmental Protection Agency (EPA) on topics related to particulate matter (PM). For this analysis, 904 papers were reviewed. These 904 papers, published from 1998 to 2005, were cited 9,578 times in the journals covered by Thomson's Web of Science.[1] Of these 904 papers, 723 (80%) have been cited at least once in a journal.

The analysis was completed using Thomson's Essential Science Indicators (ESI) and Journal Citation Reports (JCR) as benchmarks. ESI provides access to a unique and comprehensive compilation of essential science performance statistics and science trends data derived from Thomson's databases. The chief indicators of output, or productivity, are journal article publication counts. For influence and impact measures, ESI employs both total citation counts and cites per paper scores. The former reveals gross influence while the latter shows weighted influence, also called impact. JCR presents quantifiable statistical data that provide a systematic, objective way to evaluate the world's leading journals and their impact and influence in the global research community.

Summary of Analysis

More than one-third of the PM publications are highly cited papers. A review of the citations indicates that 321 (35.5%) of the PM papers qualify as highly cited when using the ESI criteria for the top 10% of highly cited publications. Seventy-four (8.2%) of the PM papers qualify as highly cited when using the criteria for the top 1%. Thirteen (1.4%) of these papers qualify as very highly cited (in the top 0.1%), and two papers actually meet the top 0.01% threshold.

The PM papers are more highly cited than the average paper. Using the ESI average citation rates for papers published by field as the benchmark, in 10 of the 12 fields in which the EPA PM papers were published, the ratio of actual to expected cites is greater than 1, indicating that the PM papers are more highly cited than the average papers in those fields.

Nearly one-third of the PM papers are published in very high impact journals. Two-hundred fifty-four (254) of 904 papers were published in the top 10% of journals ranked by JCR Impact Factor, representing 28% of EPA's PM papers. Nearly one-third of the PM papers are published in the top 10% of journals ranked by JCR Immediacy Factor. Two-hundred sixty-seven (267) of the 904 papers appear in the top 10% of journals, representing 29.5% of EPA's PM papers.

Twenty-three of the PM papers qualify as hot papers. Using the hot paper thresholds established by ESI as a benchmark, 23 hot papers, representing 2.5% of the PM papers, were identified in the analysis.

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[1] Thomson's *Web of Science* provides access to current and retrospective multidisciplinary information from approximately 8,700 of the most prestigious, high impact research journals in the world. *Web of Science* also provides cited reference searching.

The author self-citation rate is below average. Five hundred thirty-seven (537) of the 9,578 cites are author self-cites. This 5.6% author self-citation rate is below the accepted range of 10-30% author self-citation rate.

Highly Cited PM Publications

The 904 PM papers reviewed for this analysis covered 12 of the 22 ESI fields. The distribution of the papers among these 12 fields and the number of citations by field are presented in Table 1.

Table 1. PM Papers by ESI Fields

No. of Citations	ESI Field	No. of EPA PM Papers	Average Cites/Paper
2,674	Environment/Ecology	263	10.17
2,067	Engineering	236	8.76
1,432	Pharmacology & Toxicology	146	9.81
872	Biology & Biochemistry	68	12.49
859	Clinical Medicine	42	20.45
823	Multidisciplinary	66	12.47
368	Molecular Biology & Genetics	19	19.37
295	Chemistry	35	8.43
144	Immunology	13	11.08
23	Neuroscience & Behavior	1	23.00
11	Physics	8	1.38
10	Mathematics	7	1.43
Total = 9,578		**Total = 904**	

There were 321 (35.5% of the papers analyzed) highly cited EPA PM papers in 10 of the 12 fields—Environment/Ecology, Engineering, Pharmacology & Toxicology, Clinical Medicine, Multidisciplinary, Biology & Biochemistry, Chemistry, Molecular Biology & Genetics, Immunology, and Mathematics—when using the ESI criteria for the **top 10% of papers**. Table 2 shows the number of EPA papers in those 10 fields that met the **top 10% threshold in ESI**. Seventy-four (8.2%) of the papers analyzed qualified as highly cited when using the ESI criteria for the **top 1% of papers**. These papers covered five fields—Environment/Ecology, Engineering, Clinical Medicine, Biology & Biochemistry, and Multidisciplinary. Table 3 shows the 74 papers by field that met the **top 1% threshold in ESI**. There were 13 very highly cited EPA PM papers in three fields—Engineering, Environment/Ecology, and Clinical Medicine. These 13 papers met the **top 0.1% threshold in ESI** (1.4% of the papers analyzed). Two of these 13 PM papers actually met the **top 0.01% threshold in ESI** (i.e., the two papers by Drewnick).

Table 2. Number of Highly Cited PM Papers by Field (top 10%)

Citations	ESI Field	No. of Papers	Average Cites/Paper	% of EPA Papers in Field
2,073	Environment/Ecology	106	19.56	40.3%
1,863	Engineering	123	15.15	52.12%
873	Pharmacology & Toxicology	30	29.10	20.55%
757	Clinical Medicine	14	54.07	33.33%
632	Multidisciplinary	23	27.48	34.85%
395	Biology & Biochemistry	9	43.89	13.24%
182	Chemistry	9	20.22	25.71%
134	Molecular Biology & Genetics	2	67.00	10.53%
119	Immunology	3	39.67	23.08%
5	Mathematics	2	2.50	28.57%

Table 3. Number of Highly Cited PM Papers by Field (top 1%)

Citations	ESI Field	No. of Papers	Average Cites/Paper	% of EPA Papers in Field
1,206	Engineering	50	24.12	21.19%
778	Environment/Ecology	18	43.22	6.84%
399	Clinical Medicine	2	199.5	4.76%
226	Biology & Biochemistry	3	75.33	4.35%
88	Multidisciplinary	1	88.00	1.52%

The citations for the highly cited papers in the top 1% are presented in Tables 4 through 8. The citations for the very highly cited papers are listed in Table 9.

Table 4. Highly Cited PM Papers in the Field of Engineering (top 1%)

No. of Cites	First Author	Paper
79	Yu JZ	Identification of products containing -COOH, -OH, and -C=O in atmospheric oxidation of hydrocarbons. *Environmental Science & Technology* 1998;32(16):2357-2370.
33	Kleeman MJ	Source contributions to the size and composition distribution of atmospheric particles: Southern California in September1996. *Environmental Science & Technology* 1999;33(23):4331-4341.
33	Zhang Y	Simulation of aerosol dynamics: A comparative review of algorithms used in air quality models. *Aerosol Science and Technology* 1999;31(6):487-514.
37	Hughes LS	Size and composition distribution of atmospheric particles in southern California. *Environmental Science & Technology* 1999;33(20):3506-3515.
25	Mallina RV	High speed particle beam generation: A dynamic focusing mechanism for selecting ultrafine particles, *Aerosol Science and Technology* 2000;33(1-2):87-104.
26	Christoforou CS	Trends in fine particle concentration and chemical composition in Southern California. *Journal of the Air & Waste Management Association* 2000;50(1):43-53.
29	Hughes LS	Evolution of atmospheric particles along trajectories crossing the Los Angeles basin. *Environmental Science & Technology* 2000;34(15):3058-3068.
32	Ansari AS	Water absorption by secondary organic aerosol and its effect an inorganic aerosol behavior. *Environmental Science & Technology* 2000;34(1):71-77.
33	Tobias HJ	Thermal desorption mass spectrometric analysis of organic aerosol formed from reactions of 1-tetradecene and O-3 in the presence of alcohols and carboxylic acids. *Environmental Science & Technology* 2000;34(11):2105-2115.
37	Allen JO	Particle detection efficiencies of aerosol time of flight mass spectrometers under ambient sampling conditions. *Environmental Science & Technology* 2000;34(1):211-217.
40	Long CM	Characterization of indoor particle sources using continuous mass and size monitors. *Journal of the Air & Waste Management Association* 2000;50(7):1236-1250.
40	Sarnat JA	Assessing the relationship between personal particulate and gaseous exposures of senior citizens living in Baltimore, MD. *Journal of the Air & Waste Management Association* 2000;50(7):1184-1198.

No. of Cites	First Author	Paper
43	Stolzenburg MR	Method for the automated measurement of fine particle nitrate in the atmosphere. *Environmental Science & Technology* 2000;34(5):907-914.
75	Jayne JT	Development of an aerosol mass spectrometer for size and composition analysis of submicron particles. *Aerosol Science and Technology* 2000;33(1-2):49-70.
19	Vette AF	Characterization of indoor-outdoor aerosol concentration relationships during the Fresno PM exposure studies. *Aerosol Science and Technology* 2001;34(1):118-126.
21	Mosley RB	Penetration of ambient fine particles into the indoor environment. *Aerosol Science and Technology* 2001;34(1):127-136.
23	Tolocka MP	East versus West in the US: Chemical characteristics of PM2.5 during the winter of 1999. *Aerosol Science and Technology* 2001;34(1):88-96.
24	Seinfeld JH	Modeling the formation of secondary organic aerosol (SOA). 2. The predicted effects of relative humidity on aerosol formation in the alpha-pinene-, beta-pinene-, sabinene-, Delta(3)-Carene-, and cyclohexene-ozone systems. *Environmental Science & Technology* 2001;35(9):1806-1817.
26	Pankow JF	Modeling the formation of secondary organic aerosol. 1. Application of theoretical principles to measurements obtained in the alpha-pinene/, beta- pinene/, sabinene/, Delta(3)-carene/, and cyclohexene/ozone systems. *Environmental Science & Technology* 2001;35(6):1164-1172.
29	Fine PM	Chemical characterization of fine particle emissions from fireplace combustion of woods grown in the northeastern United States. *Environmental Science & Technology* 2001;35(13):2665-2675.
31	Lewtas J	Comparison of sampling methods for semi-volatile organic carbon associated with $PM_{2.5}$. *Aerosol Science and Technology* 2001;34 (1):9-22.
31	Kamens RM	Modeling aerosol formation from alpha-pinene plus NO_x in the presence of natural sunlight using gas-phase kinetics and gas-particle partitioning theory. *Environmental Science & Technology* 2001;35 (7):1394-1405.
33	Jang MS	Atmospheric secondary aerosol formation by heterogeneous reactions of aldehydes in the presence of a sulfuric acid aerosol catalyst. *Environmental Science & Technology* 2001;35(24):4758-4766.
34	Long CM	Using time- and size-resolved particulate data to quantify indoor penetration and deposition behavior. *Environmental Science & Technology* 2001;35(10):2089-2099.

No. of Cites	First Author	Paper
50	Woo KS	Measurement of Atlanta aerosol size distributions: Observations of ultrafine particle events. *Aerosol Science and Technology* 2001;34(1):75-87.
56	Weber RJ	A particle-into-liquid collector for rapid measurement of aerosol bulk chemical composition. *Aerosol Science and Technology* 2001;35(3):718-727.
12	Hays MD	Speciation of gas-phase and fine particle emissions from burning of foliar fuels. *Environmental Science & Technology* 2002;36(11):2281-2295.
13	Frey HC	Quantification of variability and uncertainty in lawn and garden equipment NOx and total hydrocarbon emission factors. *Journal of the Air & Waste Management Association* 2002;52(4):435-448.
13	Kim S	Size distribution and diurnal and seasonal trends of ultrafine particles in source and receptor sites of the Los Angeles basin. *Journal of the Air & Waste Management Association* 2002;52(3):297-307.
14	Zhang XF	A numerical characterization of particle beam collimation by an aerodynamic lens-nozzle system: Part I. An individual lens or nozzle. *Aerosol Science and Technology* 2002;36(5):617-631.
14	Lim HJ	Origins of primary and secondary organic aerosol in Atlanta: Results' of time-resolved measurements during the Atlanta Supersite experiment. *Environmental Science & Technology* 2002;36(21):4489-4496.
15	Phares DJ	Performance of a single ultrafine particle mass spectrometer. *Aerosol Science and Technology* 2002;36(5):583-592.
28	McMurry PH	The relationship between mass and mobility for atmospheric particles: A new technique for measuring particle density. *Aerosol Science and Technology* 2002;36(2):227-238.
35	Zhu YF	Concentration and size distribution of ultrafine particles near a major highway. *Journal of the Air & Waste Management Association* 2002;52(9):1032-1042.
7	Maykut NN	Source apportionment of $PM_{2.5}$ at an urban IMPROVE site in Seattle, Washington. *Environmental Science & Technology* 2003;37(22):5135-5142.
8	Lake DA	Mass spectrometry of individual particles between 50 and 750 nm in diameter at the Baltimore Supersite. *Environmental Science & Technology* 2003;37(15):3268-3274.
9	Jang MS	Particle growth by acid-catalyzed heterogeneous reactions of organic carbonyls on preexisting aerosols.

No. of Cites	First Author	Paper
12	Offenberg JH	Persistent organic pollutants in the dusts that settled across lower Manhattan after September 11, 2001. *Environmental Science & Technology* 2003;37(3):502-508.
12	Lewis CW	Source apportionment of phoenix PM2.5 aerosol with the Unmix receptor model. *Journal of the Air & Waste Management Association* 2003;53(3):325-338.
20	Park K	Relationship between particle mass and mobility for diesel exhaust particles. *Environmental Science & Technology* 2003;37(3):577-583.
3	Stanier CO	A method for the in situ measurement of fine aerosol water content of ambient aerosols: The dry-ambient aerosol size spectrometer (DAASS). *Aerosol Science and Technology* 2004;38(Suppl 1):215-228.
6	Stanier CO	Nucleation events during the Pittsburgh air quality study: Description and relation to key meteorological, gas phase, and aerosol parameters. *Aerosol Science and Technology* 2004;38(Suppl 1):253-264.
3	Huggins FE	Quantifying hazardous species in particulate matter derived from fossil-fuel. *Environmental Science & Technology* 2004;38(6):1836-1842.
3	Kim E	Analysis of ambient particle size distributions using unmix and positive matrix factorization. *Environmental Science & Technology* 2004;38(1):202-209.
3	Keywood MD	Secondary organic aerosol formation from cyclohexene ozonolysis: Effect of OH scavenger and the role of radical chemistry. *Environmental Science & Technology* 2004;38(12):3343-3350.
7	Cho AK	Determination of four quinones in diesel exhaust particles, SRM 1649a, an atmospheric $PM_{2.5}$. *Aerosol Science and Technology* 2004;38(Suppl 1):68-81.
5	Canagaratna MR	Chase studies of particulate emissions from in-use New York City vehicles. *Aerosol Science and Technology* 2004;38(6):555-573.
6	Hogrefe O	Development, operation and applications of an aerosol generation, calibration and research facility. *Aerosol Science and Technology* 2004;38(Suppl 1):196-214.
8	Drewnick F	Measurement of ambient aerosol composition during the PMTACS-NY 2001 using an aerosol mass spectrometer. Part II: Chemically speciated mass distributions. *Aerosol Science and Technology* 2004;38(Suppl 1):104-117.
11	Drewnick F	Measurement of ambient aerosol composition during the PMTACS-NY 2001 using an aerosol mass spectrometer. Part I: Mass concentrations. *Aerosol Science and Technology* 2004;38 (Suppl 1):92-103.

Table 5. Highly Cited PM Papers in the Field of Environment/Ecology (top 1%)

No. of Cites	First Author	Paper
92	Simoneit BRT	Levoglucosan, a tracer for cellulose in biomass burning and atmospheric particles. *Atmospheric Environment* 1999;33(2):173-182.
97	Yu JZ	Gas-phase ozone oxidation of monoterpenes: Gaseous and particulate products. *Journal of Atmospheric Chemistry* 1999;34(2):207-258.
110	Liao DP	Daily variation of particulate air pollution and poor cardiac autonomic control in the elderly. *Environmental Health Perspectives* 1999;107(7):521-525.
74	Schwartz J	Fine particles are more strongly associated than coarse particles with acute respiratory health effects in schoolchildren. *Epidemiology* 2000;11(1):6-10.
96	Laden F	Association of fine particulate matter from different sources with daily mortality in six US cities. *Environmental Health Perspectives* 2000;108(10):941-947.
43	Dockery DW	Epidemiologic evidence of cardiovascular effects of particulate air pollution. *Environmental Health Perspectives* 2001;109(Suppl 4):483-486.
69	Oberdorster G	Pulmonary effects of inhaled ultrafine particles. *International Archives of Occupational and Environmental Health* 2001;74 (1):1-8.
26	Zanobetti A	The temporal pattern of mortality responses to air pollution: A multicity assessment of mortality. *Epidemiology* 2002;13(1):87-93.
32	Zhu YF	Study of ultrafine particles near a major highway with heavy-duty diesel traffic. *Atmospheric Environment* 2002;36(27):4323-4335.
32	Lioy PJ	Characterization of the dust/smoke aerosol that settled east of the World Trade Center (WTC) in Lower Manhattan after the collapse of the WTC 11 September 2001. *Environmental Health Perspectives* 2002;110(7):703-714.
11	Drewnick F	Intercomparison and evaluation of four semi-continuous $PM_{2.5}$ sulfate instruments. *Atmospheric Environment* 2003;37(24):3335-3350.
11	Jang M	Organic aerosol growth by acid-catalyzed heterogeneous reactions of octanal in a flow reactor. *Atmospheric Environment* 2003;37(15):2125-2138.
11	McGee JK	Chemical analysis of World Trade Center fine particulate matter for use in toxicologic assessment. *Environmental Health Perspectives* 2003;111(7):972-980.

No. of Cites	First Author	Paper
21	Orsini DA	Refinements to the particle-into-liquid sampler (PILS) for ground and airborne measurements of water soluble aerosol composition. *Atmospheric Environment* 2003;37(9-10):1243-1259.
41	Li N	Ultrafine particulate pollutants induce oxidative stress and mitochondrial damage. *Environmental Health Perspectives* 2003;111(4):455-460.
4	DeMarini DM	Bioassay-directed fractionation and Salmonella mutagenicity of automobile and forklift diesel exhaust particles. *Environmental Health Perspectives* 2004;112(8):814-819.
4	Landrigan PJ	Health and environmental consequences of the World Trade Center disaster. *Environmental Health Perspectives* 2004;112(6):731-739.
4	Singh P	Sample characterization of automobile and forklift diesel exhaust particles and comparative pulmonary toxicity in mice. *Environmental Health Perspectives* 2004;112(8):820-825.

Table 6. Highly Cited PM Papers in the Field of Clinical Medicine (top 1%)

No. of Cites	First Author	Paper
124	Abbey DE	Long-term inhalable particles and other air pollutants related to mortality in nonsmokers. *American Journal of Respiratory and Critical Care Medicine* 1999;159(2):373-382.
275	Pope CA	Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *JAMA-Journal of the American Medical Association* 2002;287(9):1132-1141.

Table 7. Highly Cited PM Papers in the Field of Biology & Biochemistry (top 1%)

No. of Cites	First Author	Paper
6	Pope CA	Cardiovascular mortality and long-term exposure to particulate air pollution–epidemiological evidence of general pathophysiological pathways of disease. *Circulation* 2004;109(1):71-77.
96	Peters A	Increased particulate air pollution and the triggering of myocardial infarction. *Circulation* 2001;103(23):2810-2815.
124	Gold DR	Ambient pollution and heart rate variability. *Circulation* 2000;101(11):1267-1273.

Table 8. Highly Cited PM Papers in the Field of Multidisciplinary (top 1%)

No. of Cites	First Author	Paper
88	Gard EE	Direct observation of heterogeneous chemistry in the atmosphere. *Science* 1998;279(5354):1184-1187.

Table 9. Very Highly Cited PM Papers (Top 0.1%)

Field	No. of Cites	First Author	Paper
Clinical Medicine	275	Pope CA	Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *JAMA-Journal of the American Medical Association* 2002;287(9):1132-1141.
Engineering	75	Jayne JT	Development of an aerosol mass spectrometer for size and composition analysis of submicron particles. *Aerosol Science and Technology* 2000;33(1-2):49-70.
	50	Woo KS	Measurement of Atlanta aerosol size distributions: Observations of ultrafine particle events. *Aerosol Science and Technology* 2001;34(1):75-87.
	56	Weber RJ	A particle-into-liquid collector for rapid measurement of aerosol bulk chemical composition. *Aerosol Science and Technology* 2001;35(3):718-727.
	35	Zhu YF	Concentration and size distribution of ultrafine particles near a major highway. *Journal of the Air & Waste Management Association* 2002;52(9):1032-1042.
	20	Park K	Relationship between particle mass and mobility for diesel exhaust particles. *Environmental Science & Technology* 2003;37(3):577-583.
Engineering	11	Drewnick	Measurement of ambient aerosol composition during the PMTACS-NY 2001 using an aerosol mass spectrometer. Part I: Mass concentrations. *Aerosol Science and Technology* 2004;38 (Suppl 1):92-103.
	8	Drewnick	Measurement of ambient aerosol composition during the PMTACS-NY 2001 using an aerosol mass spectrometer. Part II: Chemically speciated mass distributions. *Aerosol Science and Technology* 2004;38(Suppl 1):104-117.

Field	No. of Cites	First Author	Paper
	7	Cho AK	Determination of four quinones in diesel exhaust particles, SRM 1649a, an atmospheric $PM_{2.5}$. *Aerosol Science and Technology* 2004;38(Suppl 1):68-81.
	6	Hogrefe O	Development, operation and applications of an aerosol generation, calibration and research facility. *Aerosol Science and Technology* 2004;38(Suppl 1):196-214.
	6	Stanier CO	Nucleation events during the Pittsburgh air quality study: Description and relation to key meteorological, gas phase, and aerosol parameters. *Aerosol Science and Technology* 2004;38(Suppl 1):253-264.
	5	Canagaratna MR	Chase studies of particulate emissions from in-use New York City vehicles. *Aerosol Science and Technology* 2004;38(6):555-573.
Environment/ Ecology	41	Li N	Ultrafine particulate pollutants induce oxidative stress and mitochondrial damage. *Environmental Health Perspectives* 2003;111(4):455-460.

<u>**Ratio of Actual Cites to Expected Citation Rates**</u>

The expected citation rate is the average number of cites that a paper published in the same journal in the same year and of the same document type (article, review, editorial, etc.) has received from the year of publication to the present. Using the ESI average citation rates for papers published by field as the benchmark, in 10 of the 12 fields in which the EPA PM papers were published, the ratio of actual to expected cites is greater than 1, indicating that the EPA papers are more highly cited than the average papers in those fields (see Table 10).

Table 10. Ratio of Average Cites to Expected Cites for PM Papers by Field

ESI Field	Total Cites	Expected Cite Rate	Ratio
Biology & Biochemistry	872	787.66	1.11
Chemistry	295	211.66	1.39
Clinical Medicine	859	226.30	3.80
Engineering	2,067	378.11	5.45
Environment/Ecology	2,674	966.32	2.77
Immunology	144	103.38	1.39
Mathematics	10	6.34	1.58
Molecular Biology & Genetics	368	374.93	0.98
Multidisciplinary	823	268.71	3.06
Neuroscience & Behavior	23	18.39	1.25
Pharmacology & Toxicology	1,432	841.16	1.70
Physics	11	37.85	0.29

JCR Benchmarks

The Impact Factor is a well known metric in citation analysis. It is a measure of the frequency with which the *average article* in a journal has been cited in a particular year. The Impact Factor helps evaluate a journal's relative importance, especially when compared to others in the same field. The Impact Factor is calculated by dividing the number of citations in the current year to articles published in the 2 previous years by the total number of articles published in the 2 previous years.

Table 11 indicates the number of PM papers published in the top 10% of journals, based on the JCR Impact Factor. Two-hundred fifty-four (254) of 904 papers were published in the top 10% of journals, representing 28% of EPA's PM papers.

Table 11. PM Papers in Top 10% of Journals by JCR Impact Factor

EPA PM Papers in that Journal	Journal	Impact Factor (IF)	JCR IF Rank
64	Environmental Health Perspectives	3.408	538
62	Environmental Science & Technology	3.592	487
26	American Journal of Physiology-Lung Cellular and Molecular Physiology	3.735	435
20	Epidemiology	4.220	350
17	American Journal of Respiratory and Critical Care Medicine	8.876	100
17	American Journal of Respiratory Cell and Molecular Biology	4.015	380
7	Analytical Chemistry	5.250	248
5	Circulation	11.164	72
4	Journal of Biological Chemistry	6.482	179
4	Journal of Immunology	6.702	167
3	Science	29.781	11
3	Free Radical Biology and Medicine	5.063	260
3	American Journal of Epidemiology	4.486	310
3	Thorax	4.188	356
2	Lancet	18.316	28
2	Chest	3.264	585
2	Chemical Research in Toxicology	3.332	555
1	New England Journal of Medicine	34.833	5
1	JAMA-Journal of the American Medical Association	21.455	22
1	Journal of Clinical Investigation	14.307	44
1	Proceedings of the National Academy of Sciences	10.272	81
1	Cancer Research	8.649	105
1	FASEB Journal	7.172	149
1	Journal of Allergy and Clinical Immunology	6.831	162
1	Advanced Drug Delivery Reviews	6.588	170
1	Critical Care Medicine	4.195	353

EPA PM Papers in that Journal	Journal	Impact Factor (IF)	JCR IF Rank
1	Journal of Leukocyte Biology	4.180	357
Total = 254			

Immediacy Index

The journal Immediacy Index is a measure of how quickly the *average article* in a journal is cited. It indicates how often articles published in a journal are cited within the year they are published. The Immediacy Index is calculated by dividing the number of citations to articles published in a given year by the number of articles published in that year.

Table 12 indicates the number of EPA papers published in the top 10% of journals, based on the JCR Immediacy Index. Two-hundred sixty-seven (267) of the 904 papers appear in the top 10% of journals, representing 29.5% of EPA's PM papers.

Table 12. PM Papers in Top 10% of Journals by JCR Immediacy Index

EPA Papers in that Journal	Journal	Immediacy Index (II)	JCR II Rank
64	Environmental Health Perspectives	0.869	304
52	Journal of Geophysical Research - Atmospheres	0.827	334
26	American Journal of Physiology-Lung Cellular and Molecular Physiology	0.654	496
20	Epidemiology	0.938	264
19	Journal of Aerosol Science	0.686	462
17	American Journal of Respiratory Cell and Molecular Biology	0.623	546
17	American Journal of Respiratory and Critical Care Medicine	2.461	56
7	Analytical Chemistry	0.657	493
5	Circulation	1.946	82
4	Journal of Immunology	0.988	239
4	Philosophical Transactions of the Royal Society of London Series A-Mathematical Physical and Engineering Sciences	0.867	305

EPA Papers in that Journal	Journal	Immediacy Index (II)	JCR II Rank
4	Journal of Biological Chemistry	1.231	160
3	American Journal of Epidemiology	0.908	281
3	Free Radical Biology and Medicine	0.712	432
3	Thorax	1.237	158
3	Science	5.589	12
2	Biometals	0.717	424
2	Lancet	5.826	10
1	Journal of Chemical Physics	0.661	487
1	Journal of Clinical Investigation	2.946	41
1	Critical Care Medicine	1.103	192
1	Journal of Allergy and Clinical Immunology	1.465	123
1	Journal of Leukocyte Biology	0.671	473
1	Cancer Research	0.935	268
1	FASEB Journal	1.247	154
1	New England Journal of Medicine	11.719	2
1	Advanced Drug Delivery Reviews	0.805	352
1	Proceedings of the National Academy of Sciences	1.935	83
1	American Journal of Industrial Medicine	0.616	552
1	JAMA-Journal of the American Medical Association	6.048	9
Total = 267			

Hot Papers

ESI establishes citation thresholds for hot papers, which are selected from the highly cited papers in different fields, but the time frame for citing and cited papers is much shorter—papers must be cited within 2 years of publication and the citations must occur in a 2-month time period. Papers are assigned to 2-month periods and thresholds are set for each period and field to select 0.1% of papers. There were no hot papers identified for the current 2-month period (i.e., January-February 2005), but there were a number of hot papers identified from previous periods.

Using the hot paper thresholds established by ESI as a benchmark, 23 hot papers, representing 2.5% of the PM papers, were identified in four fields—Biology & Biochemistry, Clinical Medicine, Environment/Ecology, and Engineering. The hot papers are listed in Table 13.

Table 13. Hot Papers Identified Using ESI Thresholds

Field	ESI Hot Papers Threshold	No. of Cites in 2-Month Period	Paper
Biology & Biochemistry	10	11 cites in July-August 2001	Gold DR, et al. Ambient pollution and heart rate variability. *Circulation* 2000;101(11):1267-1273.
Clinical Medicine	12	15 cites in November-December 2003	Pope CA, et al. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *JAMA–Journal of the American Medical Association* 2002;287(9):1132-1141.
Environment/ Ecology	8	9 cites in May-June 2004	Li N, et al. Ultrafine particle pollutants induce oxidative stress and mitochondrial damage. *Environmental Health Perspectives* 2003;111(4):455-460.
		10 cites in June-July 2004	Orsini DA, et al. Refinements to the particle-into-liquid sampler (PILS) for ground and airborne measurements of water soluble aerosol composition. *Atmospheric Environment* 2003;37(9-10):1243-1259.
		9 cites in April-May 2004	Lioy PJ, et al. Characterization of the dust/smoke aerosol that settled east of the World Trade Center (WTC) in Lower Manhattan after the collapse of the WTC 11 September 2001. *Environmental Health Perspectives* 2002;110(7):703-714.
		9 cites in September-October 2002	Laden F, et al. Association of fine particulate matter from different sources with daily mortality in six US cities. *Environmental Health Perspectives* 2000;108(10):941-947.
Engineering	4	4 cites in May-June 2002	Hughes LS, et al. Evolution of atmospheric particles along trajectories crossing the Los Angeles basin. *Environmental Science & Technology* 2000;34(15):3058-3068.
Engineering	4	4 cites in November-December 2001	Ansari AS, Pandis SN. Water absorption by secondary organic aerosol and its effect on inorganic aerosol behavior. *Environmental Science & Technology* 2000;34(1):71-77.

Field	ESI Hot Papers Threshold	No. of Cites in 2-Month Period	Paper
		4 cites in July 2002	Long CM, et al. Characterization of indoor particle sources using continuous mass and size monitors. *Journal of the Air & Waste Management Association* 2000;50(7):1236-1250.
		4 cites in May-June 2002	Jayne JT, et al. Development of an aerosol mass spectrometer for size and composition analysis of submicron particles. *Aerosol Science & Technology* 2000;33(1-2):49-70.
		4 cites in December 2002-January 2003	Fine PM, et al. Chemical characterization of fine particle emissions from fireplace combustion of woods grown in the northeastern United States. *Environmental Science & Technology* 2001;35(13):2665-2675.
		5 cites in September-October 2003	Jang MS, Kamens RM. Atmospheric secondary aerosol formation by heterogeneous reactions of aldehydes in the presence of a sulfuric acid aerosol catalyst. *Environmental Science & Technology* 2001;35(24):4758:4766.
		4 cites in June-July 2000	Yu JZ, et al. Identification of products containing -COOH, -OH, and -C=O in atmospheric oxidation of hydrocarbons. *Environmental Science & Technology* 1998;32(16):2357-2370.
		5 cites in October-November 2001	Kleeman MJ, et al. Source contributions to the size and composition distribution of atmospheric particles: Southern California in September 1996. *Environmental Science & Technology* 1999;33(23):4331-4341.
		4 cites in May 2002	Mallina RV, et al. High speed particle beam generation: a dynamic focusing mechanism for selecting ultrafine particles. *Aerosol Science and Technology* 2000;33(1-2):87-104.
		4 cites in November-December 2001	Christoforou CS, et al. Trends in fine particle concentration and chemical composition in Southern California. *Journal of the Air & Waste Management Association* 2000;50(1):43-53.
Engineering	4	4 cites in June-July 2002	Sarnat JA, et al. Assessing the relationship between personal particulate and gaseous exposures of senior citizens living in Baltimore, MD. *Journal of the Air & Waste Management Association* 2000;50(7):1184-1198.

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		4 cites in February-March 2003	McMurry PH, et al. The relationship between mass and mobility for atmospheric particles: a new technique for measuring particle density. *Aerosol Science and Technology* 2002;36(2):227-238.
		6 cites in April-May 2004	Zhu YF, et al. Concentration and size distribution of ultrafine particles near a major highway. *Journal of the Air & Waste Management Association* 2002;52(9):1032-1042.
		4 cites in April-May 2004	Offenberg JH, et al. Persistent organic pollutants in the dusts that settled across lower Manhattan after September 11, 2001. *Environmental Science & Technology* 2003;37(3):502-508.
		5 cites in May-June 2004	Park K, et al. Relationship between particle mass and mobility for diesel exhaust particles. *Environmental Science & Technology* 2003;37(3):577-583.
		4 cites in November 2004	Canagaratna MR, et al. Chase studies of particulate emissions from in-use New York City vehicles. *Aerosol Science and Technology* 2004;38(6):555-573.
		4 cites in November-December 2004	Drewnick F, et al. Measurement of ambient aerosol composition during the PMTACS-NY 2001 using an aerosol mass spectrometer, Part I: mass concentrations. Aerosol Science and Technology 2004;38(Suppl 1):92-103.

Author Self-Citation

Self-citations are journal article references to articles from that same author (i.e., the first author). Because higher author self-citation rates can inflate the number of citations, the author self-citation rate was calculated for the PM papers. Of the 9,578 total cites, 537 are author self-cites—a 5.6% author self-citation rate. Garfield and Sher[2] found that authors working in research-based disciplines tend to cite themselves on the average of 20% of the time. MacRoberts and MacRoberts[3] claim that approximately 10% to 30% of all the citations listed fall into the category of author self-citation. Therefore, the 5.6% self-cite rate for the PM papers is below the range for author self-citation.

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[2] Garfield E, Sher IH. New factors in the evaluation of scientific literature through citation indexing. *American Documentation* 1963;18(July):195-201.

[3] MacRoberts MH, MacRoberts BR. Problems of citation analysis: a critical review. Journal of the American Society of Information Science 1989;40(5):342-349.