

CURRICULUM VITAE

Name: Paul Frederick Sorensen

Position: Consultant

Name of Firm: Freyaafdrammen

Profession: Chemical Engineer

Date of birth: 6th April 1950

Years with Firm/Entity: 2

Nationality: South African

Membership in Professional Societies:

Class	Professional Society	Year of Registration
Pr. Eng.	Engineering Council of South Africa	1979
Member	South African Archaeological Society	1992
Member	Canadian Institute of Mining, Metallurgy and Petroleum (CIM)	2007

Key Qualifications:

Project management, technical experience, organisation, presentations, proposals and technical report writing in the fields listed below:

- ✓ Petrochemical process design (Sasol, Fluor (Nederland))
- ✓ Nickel refinery management (Trojan Nickel Mine, Zimbabwe)
- ✓ Hydrometallurgy
- ✓ Mixing technology
- ✓ Milling
- ✓ Factorial experimental design
- ✓ Pilot planting
- ✓ Environmental processes (water ion exchange)
- ✓ Gold consulting
 - ✓ Carbon-in-Pulp (development, process design)
 - ✓ MinataurTM Refining (development (solvent extraction))
 - ✓ Techno-economics
 - ✓ Plant design and operating manuals
 - ✓ Design and direction of training courses in plant operations
 - ✓ HAZOP studies for new plant
 - ✓ Risk assessments for new plant
 - ✓ Environmental impact assessments for new plant
 - ✓ Technical audits of operating plants
- ✓ Techno-economics/feasibility studies
 - ✓ Metallurgical Unit Operations
 - ✓ Pyrometallurgy (also PYROSIM(ulations))
 - ✓ Precious metals (gold, silver, platinum group metals)
 - ✓ Energy minerals (uranium)

- ✓ Base metals (zinc, lead, nickel, cobalt, tin)
- ✓ Ferrous metals (manganese, electric arc furnace dust)
- ✓ Light metals (magnesium, aluminium)
- ✓ Minor metals and alloys (antimony, tantalum, ferroboron)
- ✓ Rare earths
- ✓ Industrial minerals (magnesia, dolomite, asbestos)
- ✓ Agri-chemicals (phosphates, potash, nitrates, lime, sulphur)
- ✓ Mineral economics
 - ✓ Commodity surveys of minerals/products including gold, silver, phosphates, nitrates, potassium, lime/dolomite, gypsum, magnesite, asbestos, arsenic, cement, uranium
 - ✓ Regional Mineral Scans (Kwazulu-Natal (KZN), Limpopo Province, Mopani Municipality)
 - ✓ Spatial Development Initiative (SDI) studies in Africa
 - ✓ Regional mineral studies (Trade and Investment Kwazulu-Natal, Angola, Mozambique, Free State-Public Works)
 - ✓ Strategies for industrialisation (Gauteng Department of Economic Development, KZN Department of Economic Development)
 - ✓ Input into mining legislation (Mineral and Petroleum Resources Development Act of 2002, Mineral and Petroleum Resources Royalty Act of 2008)
- ✓ Sustainable development
 - ✓ Mine closure
- ✓ Beneficiation strategies and education
 - ✓ Minerals and Energy Education and Training Institute (MEETI) lectures
- ✓ Physical metallurgy
 - ✓ Continuous casting of platinum
 - ✓ Ceramics
- ✓ Scenario Planning
- ✓ Competent Persons Reports (CPR)

Open publications/references in:

- ✓ Thermodynamics^{1,6,9}
- ✓ Mixing technology^{2,3, 5}
- ✓ Hydrometallurgy^{7,8, 11, 12—15,18,19}
- ✓ In-pulp processes^{16,17}
- ✓ Computer science¹⁰
- ✓ Mineral economics^{20,21, 23, 25-28, 30}
- ✓ Sustainable development^{22,24, 29, 31-38}

Computer proficiency in:

- ✓ MS Windows^{XP} Professional (Excel, Word, Powerpoint etc.)
- ✓ MS Project 2000 (Gantt charts)
- ✓ MS Outlook
- ✓ Internet Explorer
- ✓ Languages: Pascal, Basic, Fortran

Education:

Degree/Diploma	Field	Institution	Year
M. Eng. ⁴	Engineering	Rand Afrikaans University	1987
B. A.	English and Logic	University of South Africa	1977
B. Sc. (Chem. Eng.)	Chemical Engineering	University of Cape Town	1972

Employment Record:

Position	Company	Job description	Duration
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South Africa:			
Consultant	Freyaafdrammen	Sustainable Development	2010-present
Head: Regional Mineral Economics	Mintek	Mineral Economics, Techno-Economics, Metallurgical Research	1982- 2010
Senior Research Engineer	Anglo American Research Laboratory	Metallurgical Research	1979-1982
Zimbabwe:			
Plant Metallurgist	Trojan Nickel Mine	Plant Management	1976-1979
The Netherlands:			
Process Engineer	Fluor (Nederland)	Petrochem. Process Design	1975-1976
South Africa:			
Assistant Process Engineer	Sasol	Petrochem. Process Design	1973-1975

Languages:

- ✓ Bilingual in English (first language) and Afrikaans
- ✓ Read French, write & speak some
- ✓ Read Dutch, speak some

REFERENCES

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2. Sorensen, P.F. "A Simple Mathematical Model for the Calculation of Pumping Rate in an Air-Agitated Pachuca Tank". Journal of S. Afr. Inst. Min. Met. Jan. 1985. pp 23-27.
3. Hiskey, J.B. "Technical Developments in Hydrometallurgy". Journal of Metals. July 1986. pp. 41-46.
4. Sorensen, P.F. "Predicting the Power Requirements in the Mixing of Mineral Slurries". Dissertation submitted in fulfillment of the requirements of Master of Engineering at the Rand Afrikaans University, Sept. 1987.
5. Sorensen, P.F. "A Comparison of Mixing Times in Air-agitated and Mechanically-agitated Mixing Tanks". From: *Separation Processes in Hydrometallurgy*. Ed. G.A. Davies. Horwood Publishers. Chichester. UK. 1987.
6. Sorensen, P.F. "The Recovery and Conservation of Heat in Uranium Leaching". Mintek Report M342. 1987.
7. Sorensen, P.F. and Davidson, R.J. "Gold Recovery". S.Afr. Pat. 81/8894. Appl. cf. *The Extractive Metallurgy of Gold in South Africa*. Edited by G.G. Stanley. The South African Institute of Mining and Metallurgy. 1987.
8. Sorensen, P.F. "Gold Recovery from Carbon-In-Pulp Eluates by Precipitation with a Mineral Acid. Parts I, II and III". Hydrometallurgy, vol. 21, 1988. pp. 235-254.
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11. Sorensen, P.F. "The Origins and Treatment of Fine Carbon in Carbon-In-Pulp Plants". Mine Met. Manager's Assoc. of S. Africa. From "The Role of the Practical Metallurgist". Symposium. Johannesburg 1989. 19-21 June.
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13. Sorensen, P.F. "The Recovery of Gold by Activated Carbon in a NIMCIX Column". from: "Cyanide in Gold Processing: The Next 100 Years". Conference. The S. African Chem. Inst. Sandton Holiday Inn. 5-6 Nov. 1990.
14. Industrial Minerals. Nov. 1990. p77.
15. Engineering News. 15-21 Mar. 1991.
16. Davidson, R.J. and Schoeman, N. "The Management of Carbon in a High-Tonnage CIP Operation". Journal of S. Afr. Inst. Min. Met. June 1991. pp. 195-208.
17. Sorensen, P.F. "In-Pulp Technology-Process Choices". from: School. Recent Developments in In-Pulp Technology. Mintek. Randburg. October 1991.
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20. Sorensen, Paul. "Beneficiation of Industrial Minerals" presented at Course: "Opportunities in Beneficiation". Minerals and Energy Education and Training Institute (MEETI). Randburg. 3-5 April 2006.
21. Sorensen, Paul. "Fertilizers and Some Other Industrial Minerals" presented at Course: "Opportunities in Beneficiation". Minerals and Energy Education and Training Institute (MEETI). Randburg. 17-19 April 2007.

22. Sorensen, Paul. "Mine Closure Costs". Mine Closure and Rehabilitation Conference 2007. Southern Sun Grayston, Sandton. 22-24 May 2007.
23. Sorensen, Paul. "Beneficiation-In search of a New Trajectory". Chamber of Mines' Sustainable Development Conference. Sandton Sun Hotel. 18-19 October 2007.
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30. Sorensen, Paul. "Beneficiation of South African Minerals" presented at Course: "Certificate of Competence in Mining and Minerals Policy and Industry". Minerals and Energy Education and Training Institute (MEETI). Randburg. 20-24 July 2009.
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