

Curriculum Vitae

Biographical data

Name: Gjengedal, Elin Lovise
Date of birth: 28th May 1960
Marital status: Married, 4 Children (born 1986, 1988, 1990, 1994)
Nationality: Norwegian
Languages: English

Address: Norwegian University of Life Sciences, P.O. Box 5003, N-1432 Aas, Norway

Phone/ fax: +47 64 96 55 33/ +47 64 96 56 01

E-mail, web address Dept.: elin.gjengedal@umb.no www.umb.no/ipm

Education

1985 M.Sc. Chemistry; University of Trondheim, Norway
1992 Ph.D. Environmental chemistry; University of Trondheim, Norway
2006 Technical assessor ISO/IEC 17025:2005, Norwegian Accreditation

Key Qualifications

Environmental chemistry
Inorganic analytical chemistry
Waste handling

Present position

1995.08.15 -	Responsible lecturer	KJM120 Inorganic chemistry 10 credits (2003-2006)
Associate professor analytical chemistry	Responsible lecturer	KJM240 Analytical chemistry 10 credits (Started 1995, reorganized 2003, -)
	Responsible lecturer	VU-KJM240 Analytical chemistry with chemistry didactic 10 credits (2010 -)
	Responsible lecturer	KJM340 Instrumental inorganic chemistry 10 credits (2003 -)
	Responsible lecturer	Measurement of trace element bioavailability and exposure in the environment; Syllabus 5 credits (2005 -)
	Lecturer	FMI210 Pollution – Environment 10 credits (Until 2003)
	Lecturer	MINA310 Project management and research methods (2010 -)
	Supervisor M.Sc. thesis works	
	Supervisor Ph.D. thesis works	
	Project Manager	

Administrative working experience

1995.08.15. – 2001.06.30	Section manager, Laboratory of analytical chemistry, Inorganic analytical section
1999.01.01 – 2001 .06.30	Vice department manager, Dept. of chemistry and biotechnology
2001 – 2005	Project manager NFR 143 800-NYTEK DEBORA part D-2 “Natural based purification technologies” (Budget 1.550 kNOK; NFR and industry)
2002 – 2004	Project manager NFR 143 800-NYTEK DEBORA part D-1 “Environmental impacts” (Budget 300 kNOK; NFR and industry)
2002.08.01 – 2003.07.30	Deputy laboratory manager, Dept. of Soil and Water Sciences
2003 – 2007	Project manager NFR 143 800-NYTEK DEBORA part G “Black carbon particles” (Budget 2.135 kNOK; NFR and industry)

2004 – 2007	Project manager ‘Content of hazardous trace elements in gas, organic liquids, water and solids from microwave pyrolysed municipal solid waste’ (Budgett 80 kNOK; AUN)
2008-2009	Subcontractor on ‘Sammenlignende laboratorieprøving av direktevisende instrumenter for bestemmelse av Hg-damp i luft’ – (Budget 406 kNOK; StatoilHydro and National Institute of Occupational Health)
2008 -	Project manager different small projects; i.e. funding for commissioning scientific papers, termination of PhD studies, travel funding, initiatives for new research areas, installation grants.
2009-2010	Subcontractor on ‘Stjernøymineraler for landbruk: Kan barium være et problem?’ – (Budget 200 kNOK; VRI Finnmark)

International Experience/Membership:

- Member Organizing Committee for the ‘Colloquium Spectroscopicum Internationale XXXVII’ Tromsø, 2013
- Member Organizing Committee for the ‘5th Nordic Conference on Plasma Spectrochemistry’. Loen, June 5.-8., 2010.
- Member Adjudication Committee PhD student Lovisa Stjernman Forsberg, Natural Resources and Agricultural Science, Dept. of Soil and Environment, Swedish University of Agricultural Sciences, Uppsala, December 4th 2008
- Opponent Thesis defence PhD student Monica Östman, Natural Resources and Agricultural Science, Dept. of Soil and Environment, Swedish University of Agricultural Sciences, Uppsala, November 21st 2008
- Member Organizing Committee for the ‘4th Nordic Conference on Plasma Spectrochemistry’. Loen, June 15.-18., 2008.
- Norwegian member Organizing Committee for the ‘19th Nordic Atomic Spectroscopy and Trace Element Conference’. Laugarvatn, Iceland. June 25th - 29th, 2007.
- Member Organizing Committee for the ‘3rd Nordic Conference on Plasma Spectrochemistry’. Loen, June 11.-14., 2006
- Invited member of ‘Network of excellence on pathways of pollutants and mitigation of their impact on ecosystems’, organized by Institute of Environmental Protection Engineering, Lublin University of Technology, Polen, 2005
- Member expert panel Formas, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning, 2005-2008
- Member Organizing Committee ‘Nordic Conference on Plasma Spectrochemistry’, 2005 –
- Norwegian member Organizing Committee for the ‘18th Nordic Conference on Measurements of Elements and their Compounds’. Naantali, Finland, August 18.-21. 2002.
- Norwegian representative Organizing Committee ‘Nordic Atomic Spectroscopy and Trace Element Conference’ (NASTECC), 2001 – 2008
- Invited author 1991 in J.-P. Vernet (Ed.) Heavy Metals in the Environment. Trace Metals in the Environment Vol.1. Series Ed. J.O. Nriagu. Elsevier Science Publishers, Amsterdam, pp 37-53.

National Experience/ Membership:

- Member National committee for the International Year of Chemistry 2011 (IYC 2011) <http://www.chemistry2011.org/>
- Member Organizing Committee for the Seminar ‘Dataanalyse - anvendelser innenfor analytisk kjemi og bioinformatikk’, Norwegian Chemical Society – Division Analytical Sciences and Division of Chemometrics. Ås, January 21st, 2010.
- Opponent and Member Adjudication Committee Doctor scientarium student Monica Lian Svendsen, NTNU, June 6th 2008.
- Chairman Organizing Committee for the Seminar ‘Kvalitetssikring og akkreditering av analyselaboratorier – Hva er “Godt nok”? One parallel session at the 18th Norwegian Chemical Society National Congress, Lillestrøm, October 18th, 2007.
- Member Adjudication Committee Prime Science Teacher position in Horticulture, Agder University College, 2006.

- Member Adjudication Committee Doctor philos student Hans-Christian Teien, UMB, September 1st and September 2nd 2005.
- Chairman Organizing Committee for the Seminar ‘Sikkerhet på laboratoriet – Kjemisk helsefare’; Norwegian Chemical Society – Division Analytical Sciences. Ås, June 3rd, 2005.
- Chairman Organizing Committee for the Seminar ‘Kjemometri – Anvendelser på instrumentelle data’; Norwegian Chemical Society – Division Analytical Sciences. Ås, June 2nd, 2005.
- Opponent and Member Adjudication Committee Doctor scientarium student Lena Kjøbli Grønflaten, NTNU, February 25th, 2005
- Member Adjudication Committee Doctor scientarium student Lindis Skipperud, UMB, February 4th, 2005
- Chairman Organizing Committee for the Seminar ‘Mikrobølgeteknikk til dekomponering, ekstraksjon, syntese, hydrolyse, forasking eller renkjemi’; Norwegian Chemical Society – Division Analytical Sciences. Ås, Mars 19th, 2004.
- Chairman Organizing Committee for the Seminar ‘Sikkerhet på laboratoriet – Kjemisk helsefare’; Norwegian Chemical Society – Division Analytical Sciences. Ås, June 13th 2003.
- Member Organizing Committee for the Seminar ‘Innføringskurs i Kjemometri (multivariate dataanalyse og modellering). Pattern Recognition Systems in corporation with the Norwegian Chemical Society – Division Analytical Sciences. Langesund, February 3.-5. 2003.
- Chairman Organizing Committee for the Seminar ‘Prøvetaking og forbehandling – betydning for tolking av data’; Norwegian Chemical Society – Division Analytical Sciences. Ås, May 31st, 2002.
- Vice Chairman Board of ITAS (Instrumenttjenesten AS); 2002 – 2008
- Chairman Executive Board Norwegian Chemical Society – Division Analytical Sciences (about 700 members); 2002 –
- Member Adjudication Committee PhD position in Environmental Chemistry, Østfold University College, 2002.
- Member Adjudication Committee Doctor scientarium student William John Fisher Standing, AUN, June 26th 2002.
- Member Adjudication Committee Doctor scientarium student Peer Børretzen, AUN, Mars 23rd, 2001.
- Member Project Group Alliance Agricultural University of Norway (AUN) – The Norwegian School of Veterinary Science (NVH)
- Member Organizing Committee for the Seminar ‘Kvalitetssikring og akkreditering av analyselaboratorier – Hva er “Godt nok”? Norwegian Chemical Society – Division Analytical Sciences. Nycomed Imaging AS, Oslo. November 20th, 2000.
- Member Adjudication Committee Associate professor Position in Inorganic Chemistry, Stavanger University College, 2000.
- Vice Chairman Executive Board Norwegian Chemical Society – Analytical Chemistry Section (about 800 members); 2000 – 2001.
- Member Adjudication Committee Doctor scientarium student Åsgeir Almås, AUN, November 23rd 1999.
- Management experience from multiple committees within UMB

Teaching Experience in addition to lecturing

- *Supervisor MSc student Analytical Chemistry*
Torill Kalfoss (2009 - 2010), Logana Mohanathas (2009- 2010), Per Ole M. Gundersen (2004 - 2005), Karl Andreas Jensen (1999-2001; Co-supervisor UiO/NLH), Berit Elin Ørjasæter (1999-2000)
- *Supervisor MSc student Environmental Chemistry*
Maria Hestholm Hillersøy (2009 -), Thomas Martinsen (2006 – 2008; Co-supervisor NTNU/UMB), Birgit Bjørhovde Rindal (2006 - 2007), Eirin Pettersen (2006 - 2007), Loella Bakka (2006 - 2007), Tomas A. Blakseth (2004 - 2005)
- *Supervisor BSc student Chemistry*
Abraham Yohannes Adam (2008 -2009)
- *Supervisor MSc student Environment and Natural Resources*
Malin Torp (2010 -), Inga Greipsland (2010 -), Rune Lian (2010 -), Inger Haugsgjerd (2009 -), Karoline Ottestad Rød (2009 - 2010), Berit Glomstad (2009 - 2010), Hannah Hildonen (2009 - 2010), Sara Zambon (2009 - 2010; Co-supervisor), Geir Henrik Sund Sæther(2008 -2009; Co-supervisor), Mona Bakke (2008 - 2009), Rune Landsem (2008 - 2009), Stine Thalberg (2004 - 2005), Zoreh Ranjbarirani (2004 - 2005)

- *Supervisor MSc student Plant Sciences*
Kismita Silwal (2010 - ; Co-supervisor)
- *Supervisor MSc student Environmental Physics*
Liselotte Katharina Schmitz (2003-2004; Co-supervisor)
- *Supervisor Ph.D. student Chemistry*
Elena Lourie (2002 -), Joar Øygard (2003 - 2006), Mikolaj Jankowski (2010- ; Co-supervisor)

Publications

Articles in popular scientific papers, scientific papers without referee, scientific reports, and newspapers (since 2003):

- Bakke, M., M. Haukås, **E. Gjengedal**, A. Borgen & E. Mariussen 2008 Polybromerte difenyletere i Åsefjorden. *KJEMI* **8**, s. 11-14.
- Bye, R. 2003, 'Store nordiske kjemikere'. In: **E. Gjengedal** (editor) *KJEMI spesialnummer*, 41 p.
- Jensen, K.A., **E. Gjengedal** & Y. Thomassen 2009, 'Sammenliknende laboratorieforsøk av direktevisende instrumenter for bestemmelse av Hg-damp i luft'. Rapport til StatoilHydro. Nr. 2 (2009) Årgang 10, Serie STAMI-Rapport, Statens arbeidsmiljøinstitutt, Oslo, 23 sider.
- Gjengedal, E.** 2005, 'Forenkla risikovurdering ved sanering av tomt – Problembeskriving og forslag til tiltak'. Universitet for miljø- og biovitenskap, Ås, 12 sider.
- Gjengedal, E.** 2006, 'Plasma Spectrochemistry mellom fagre fjell i syningom'. *KJEMI* **8**, s. 6-8.
- Gjengedal, E.** 2008, 'Kvalitetssikring og akkreditering - Kva er "godt nok"?'. *KJEMI* **1**, s.21-22.
- Hillersøy, M.H., **E. Gjengedal**, M.A. Bleken og M. Heim 2010, 'Noen biogeokjemiske aspekter: Biotitt-karbonatitt fra Stjernøy, Finnmark - en potensiell gjødselbergart'. *KJEMI* **6** (in press).
- Rindal, B.B., **E. Gjengedal**, G. Gilpin & P.H. Heyerdahl 2010, 'Impregnert returtrevirke - Frå miljøproblem til framtidig ressurs?'. *KJEMI* (submitted).
- Riise, G., T. Krogstad, I. Blakar, **E. Gjengedal**, S. Haaland, J. Kristiansen, K Naas, T. Reierstad, A.T. Romarheim, J. Rutsinda & S.B. Zambon 2010, 'Akkumulering av næringsstoffer og spormetaller i Årungen sedimenter – Sedimentenes betydning som fosforkilde', rapport til PURA og Fylkesmannen i Oslo og Akershus. Serie IPM-Rapport Nr. 2 (2010), Universitet for miljø- og biovitenskap, Ås, 23 sider.
- Øygard, J., **E. Gjengedal** & A. Måge 2004 'Avfall – frå miljøproblem til ein framtidig ressurs?'. *KJEMI* **4**, s.14-16.
- Øygard, J. & **E. Gjengedal** 2007 'Tungmetallforureining som følgje av avrenning ifrå avfallsdeponi for kommunalt avfall – Eit potensielt miljøproblem?'. *KJEMI* **2**, s. 6-8.

Papers with referee (since 2003):

- Gjengedal, E.** & E. Steinnes 2010, 'Establishment of the background levels of some major and trace elements in indigenous plant species growing in Norway and the influence of seasonal variation on these levels'. *Communications in Soil Science and Plant Analysis* (In prep.)
- Gjengedal, E.**, P.O. Gundersen & S. Lohne 2010, 'Effect of storage containers and storage time on mercury concentrations in frozen muscle tissue of northern pike (*Esox lucius*)' (In prep).
- Hildonen, H. & **E. Gjengedal** 2010, 'Plant-availability of trace elements in soil fertilized with ash residue of microwave-pyrolyzed contaminated feedstock'. *Biomass & bioenergy* (In prep.).
- Jensen, K.A., J.K. Øygard, **E. Gjengedal**, P. H. Heyerdahl & W. Lund 2005, 'Determination of metals in flue gases from a small-scale incinerator plant, with emphasis on the sampling method'. *Fresenius Environmental Bulletin* **14** (7), 620-624.
- Lourie, E., V. Patil & **E. Gjengedal** 2009, 'Efficient purification of heavy-metal-contaminated water by microalgae-activated pine bark'. *Water, Air and Soil Pollution* (DOI 10.1007/s11270-009-0275-6).
- Lourie, E. & **E. Gjengedal** 2010, 'Kinetic of the sorption process by bark and bark treated with microalgae'. *Journal of Chemical Technology & Biotechnology* (Submitted).
- Lourie, E. & **E. Gjengedal** 2010, 'Removal of heavy metals from contaminated water by peat activated by microalgae'. (In prep.).
- Øygard, J.K. & **E. Gjengedal** 2009, 'Uranium in MSW landfill leachate'. *International Journal Environmental Research* **3** (1), 61-68.
- Øygard, J.K., **E. Gjengedal** & K. Julshamn 2009, 'Biotransformation of arsenic during composting of sewage sludge'. *Journal of Hazardous materials* (In prep.).
- Øygard, J.K., **E. Gjengedal** & H. Mobbs 2008, 'Trace element exosure in the environment from MSW landfill leachate sediments measured by a sequential extraction technique'. *Journal of Hazardous Materials* **153**, 751-758.

- Øygard, J.K., **E. Gjengedal** & A. Måge 2005, 'Mass-balance estimation of heavy metals and selected anions at a landfill receiving MSWI bottom ash and mixed inert wastes'. Journal of Hazardous Materials **A123**, 70-75.
- Øygard, J.K., **E. Gjengedal** & O. Røyset 2007, 'Fractionation and determination of selected metals in solid waste landfill leachate', Water research **41**, 47-54.
- Øygard, J.K., A. Måge & **E. Gjengedal** 2004, 'Estimation of the mass-balance of selected metals in four sanitary landfills in Western Norway, with emphasis on the metal content of the deposited waste and the leachate'. Water research **38**, 2851-2858.
- Øygard, J.K., A. Måge & **E. Gjengedal** 2009, 'The effects of reduction of the deposited waste on short term landfill leachate composition of a landfill: a case study in Norway'. Water and Environment Journal (DOI: 10.1111/j.1747-6593.2009.00212.x).
- Øygard, J.K., A. Måge, **E. Gjengedal** & T. Svane 2005, 'Effect of an uncontrolled fire on the chemical composition of landfill leachate'. Waste Management **25**, 712-718.
- Øygard, J.K., G. Åberg, E. Steinnes & **E. Gjengedal** 2010, 'Mass fractionation effects of Pb isotopes in incinerator processes' (*In prep*).

Conference papers and abstract oral presentations/ posters (since 2003):

1. Bakka, L., **E. Gjengedal** & A.E. Strømseng 2007 Use of speciation techniques on heavy metal contaminated run-off from military shooting ranges to identify the uptake mechanisms in different filter medias. 19th Nordic Conference on Measurements of Elements and their Compounds, Laugarvatn, Iceland. June 25th - 29th, 2007.
2. Bakke, M., M. Haukås, **E. Gjengedal**, A. Borgen & E. Mariussen 2008, 'Accumulation of polybrominated diphenyl ethers (PBDEs) in a marine foodweb from Åsefjorden, western Norway'. Miljøkemiskt möte 2008. Norsk Kjemisk Selskap and Svenska Kemistsamfundet, Sigtuna, Stockholm, 22.-24. September 2008.
3. **Gjengedal, E.** 2003, 'Naturbaserte reinsemetodar fangar tungmetall!'. Distribuert energi – Om morgendagens løsninger for lokale energisystemer. Seminar Quality Hotel Mastemyr, Oslo, Norway, 22.-23. September 2003
4. **Gjengedal, E.** 2005, 'Nature-based cleaning of effluent streams: New opportunities for industry and society'. Conference on Dispersed Energy Systems – Experience, Applications and Visions, Quality Hotel Mastemyr, Oslo, Norway, 15.-16. November 2005.
5. Glomstad, B., L. Mohanathas, K.A. Jensen, S. Lohne & **E. Gjengedal**, 2010, 'Simple determination of methylmercury in sediment and biota'. Nordic Environmental Chemistry Conference (NECC 2010), Longyearbyen, Svalbard, March 2-5, 2010.
6. Gundersen, P.O.M., T.A. Blakseth, **E. Gjengedal**, and O. Røyset 2006, 'Measurement of arsenic fractions in freshwater with SCF and DGT technology'. 2nd Int. Passive Sampling Workshop and Symposium (IPSW 2006), Bratislava, Slovakia, May 3.-6. 2006.
7. Heim, M., M. A. Bleken, **E. L. Gjengedal**, M.H. Hillersøy, & H. Gautneb 2010, 'The agrogeological potential of apatite-biotite-carbonatite (Stjernøy, Northern Norway) as slow release rock fertilizer'. 29th Nordic Geological Winter Meeting, Radisson SAS Hotel Scandinavia, Oslo, Norway, January 11-13, 2010.
8. Hildonen, H., K.O. Rød, A. Norheim, P.H. Heyerdahl & **E. Gjengedal** 2010, 'Plant-availability of trace elements in soil fertilized with ash residue of microwave-heated pyrolyzed contaminated fuel'. 3rd Norwegian Environmental Toxicology Symposium – 3. NETS, VilVite, Bergen, April 14-16, 2010.
9. Hillersøy, M.H., **E. Gjengedal**, M.A. Bleken & M. Heim 2010, 'The agrogeological potential of the Stjernøy apatite-biotite-carbonatite as slow release rock fertilizer depends on the bioavailability of barium'. 5th Nordic Conference on Plasma Spectrochemistry, Loen, Norway, 6.-9. June 2010.
10. Irani, Z.R. & **E. Gjengedal** 2005, 'Content of hazardous trace elements in products from microwave-heating pyrolysis of municipal solid waste'. Miljøkemiskt möte 2005. Norsk Kjemisk Selskap and Svenska Kemistsamfundet, Strömstad, Sweden, 4.-7. september 2005.
11. Kalfoss, T., C. Holm, K.A. Jensen, J.E. Dahl & **E. Gjengedal** 2010. 'Determination of element leakage from dental alloys into cell culture medium using ICP-MS'. 5th Nordic Conference on Plasma Spectrochemistry, Loen, Norway, 6.-9. June 2010.

12. Landsem, R., K.A. Jensen, O.Røyset & E. **Gjengedal** 2008, 'Speciation of mercury by liquid separation hydride generation ICPMS' 4th Nordic Conference on Plasma Spectrochemistry, Loen, Norway, 15.-18. June 2008
13. Lourie, E. & E. **Gjengedal** 2004 'Naturbasert rensing av metaller - Optimale betingelser for ulike biologiske "filtermedier" '. Konferanse om distribuert energi. Innovasjon – Hvordan skape næringsutvikling basert på forskning og utvikling. Quality Hotel Mastemyr, Oslo, Norway, 7.-8. September 2004
14. Lourie, E. & E. **Gjengedal** 2005 'Comparison of heavy metal removing from water by peat and algae treated peat'. The 2nd International workshop on "Pathways of pollutants and mitigation strategies of their impact on the ecosystems", Kazimierz Dolny, Poland, July 7-10, 2005.
15. Lourie, E. & E. **Gjengedal** 2005, 'Use of bark activated by microalgae for purification of heavy metal contaminated water'. Technology 2005. 2nd Joint Specialty Conference for Sustainable Management of Water Quality Systems for the 21st Century, San Francisco, California, USA, August 28-31, 2005. [Proceedings of the Water Environment Federation](#), Technology 2005 , pp. 50-57(8)
16. Lourie, E. & **Gjengedal, E.** 2005, 'The practical impact of using bark activated by microalgae for purification of heavy metal contaminated water'. Conference on Dispersed Energy Systems – Experience, Applications and Visions, Quality Hotel Mastemyr, Oslo, Norway, 15.-16. November 2005
17. Lourie, E., E. **Gjengedal**, V. Patil & H.R. Gislerød 2003, 'Influence of bark and algae treatment on heavy metal accumulation'. Distribuert energi – om morgendagens løsninger for lokale energisystemer. Seminar Quality Hotel Mastemyr, Oslo, 22.-23. September 2003.
18. Lourie, E., E. **Gjengedal** & S. Thalberg 2005, 'Water purification of heavy metals by use of biological medias – A nature-based technology'. Miljøkjemisk møte 2005. Norsk Kjemisk Selskap and Svenska Kemistsamfundet, Strömstad, Sweden, 4.-7. September 2005.
19. Pettersen, E., E. **Gjengedal** & T. Krogstad 2005, 'Iodine in berries from *Vaccinium myrtillus* as infant nutrition. Focus on Soils Symposium. Uppsala, Sweden, September 14 - 16, 2005.
20. Pettersen, E., E. **Gjengedal** & T. Krogstad 2006, 'Iodine in *Vaccinium myrtillus* in relation to distance from the coast'. 3rd Nordic Conference on Plasma Spectrochemistry, Loen, Norway, 11. – 14. June 2006.
21. Pettersen, E., E. **Gjengedal** & T. Krogstad 2006, 'Iodine in berries from *Vaccinium myrtillus* in relation to distance from the coast'. 1st European Chemistry Congress, Budapest, Hungary, August 27-31, 2006.
22. Rindal, B.B., E. **Gjengedal**, G. Gilpin & P.H. Heyerdahl 2007, 'Arsenic, chromium, and copper in products from microwave-heating pyrolysis of cca contaminated wood waste'. Biotechnology & Bioenergy Workshop, University of Minnesota, Minneapolis and St. Paul, Minnesota, 13-15 May, 2007.
23. Riise, G., T. Krogstad, I. Blakar, E. **Gjengedal**, S. Haaland, J. Kristiansen, K Naas, T. Reierstad, A.T. Romarheim, J. Rutsinda & S.B. Zambon 2010, 'Accumulation of nutrients and trace metals in eutrophic lake sediments – Spatial variation within a lake basin'. 31st Congress of the Int. Limnological Society, Cape Town, 15-20 August, 2010.
24. Saether, G.H S., G. Riise, E. **Gjengedal** & D. Oughton 2009, 'Accumulation of trace metals in lakes with different catchment area and input of organic matter'. 6th International Symposium on Ecosystem Behavior BIOGEMON 2009. Helsinki, June 29 - July 3, 2009.
25. Schmitz, L.K., E. **Gjengedal**, P.H. Heyerdahl & O. Paulsen 2003, 'Bio-availability of metals in fly ash from MSWI, vitrified with wine-bottle glass'. Distribuert energi – om morgendagens løsninger for lokale energisystemer. Seminar Quality Hotel Mastemyr, Oslo, 22.-23. September 2003
26. Øygard, J.K, K.A. Jensen, G. Åberg. & E. **Gjengedal** 2003, 'Development of a method for determination of fuel-impurities in waste-fuel from incineration plants'. Distribuert energi – om morgendagens løsninger for lokale energisystemer. Seminar Quality Hotel Mastemyr, Oslo, Norway, 22.-23. September 2003
27. Øygard, J.K, G. Åberg & E. **Gjengedal** 2004, 'Development of a method for identification of impurities in waste fuels by use of isotopic ratio technique'. 2nd Nordic Conference on Plasma Spectrochemistry. Loen, Norway, 6. – 9. June 2004

28. Øygaard, J.K, G. Åberg & **E. Gjengedal** 2004, 'Kvalitetssikring av utslipp av miljøgifter ved forbrenning av fast brensel'. Konferanse om distribuert energi. Innovasjon – Hvordan skape næringsutvikling basert på forskning og utvikling. Quality Hotel Mastemyr, Oslo, 7.-8. September 2004
29. Øygaard, J.K., **E. Gjengedal** & O. Røyset 2006, 'Size charge fractionation of heavy metals in landfill leachate'. Fourth Intercontinental Landfill Research Symposium", Gällivare, Sweden, 14. – 16. June 2006.
30. Øygaard, J.K., **E. Gjengedal** & O. Røyset 2006, 'Size charge fractionation of heavy metals in landfill leachate'. The 3rd International workshop on "Pathways of pollutants and mitigation strategies of their impact on the ecosystems", Kazimierz Dolny, Poland, September 13-16, 2006.
31. Øygaard, J.K. & **E. Gjengedal** 2008, 'Tungmetaller i deponier'. Fra deponi til forurenset grunn. Framtiden for et avsluttet deponi. Seminar Clarion hotel, Stavanger, 16. – 17. June 2008.

Appendix to Curriculum Vitae - Elin Gjengedal

Research areas of specific interest

i): Bioenergy

Microwave Assisted Pyrolysis (MWP) is suggested as a promising method to convert different waste materials to profitable, storable and transportable fuels. In the case of waste as pyrolysis feedstock, knowledge of the fate of hazardous trace elements in the pyrolysis products is crucial. It is believed that the transfer behaviour of hazardous trace elements and their contents in different pyrolysis products, besides the nature of the solid waste, may depend strongly on the process conditions and configuration, such as pyrolysis temperature. The present research aims on identifying MWP process configurations for preferably enriching trace metal in the solid residue while optimizing for a liquid and gaseous fraction suitable for further refining. Thus the principal objectives are to develop the MWP technology for sustainable production of valuable chemicals and liquid fuels from metal-contaminated biomass and biomass waste streams – Emphasis in our work are put on 1) Soil carbon sequestration, and 2) In-process separation (entrapment) of heavy metals. The suitability as feedstock for MWP of different biological waste and industrial and agricultural surplus products, harvest from short-rotation energy forestry grown on polluted land, as well as infectious waste will be investigated. Based on estimates of metal exposure in the environment, data obtained from sequential extraction experiments, pot experiments and field trials (see research area iii) below), areas for utility of solids residues after pyrolysis of polluted feedstock will be suggested.

ii): Nature-based cleaning of effluent streams

In Norway about 3000 sites are registered as having or may have an adverse impact on the environment; 363 sites were identified as seriously polluted (State of the Environment Norway, 2006). Considering the diffuse nature of the sources, e.g. old landfills, shooting ranges, sewage, or dumping grounds for items containing hazardous products, the options for soil remediation are often either not satisfactory or too expensive. There are several ways to deal with heavy metal contaminated water: physical-chemical methods, such as precipitation-filtration, ion exchange, reverse osmosis, and oxidation-reduction reactions. These physical-chemical methods may lead to secondary contamination of water due to use of chemicals, and may be ineffective and/or expensive when applied to wastewater with low metal content. Taking these arguments into account, the search for alternative technologies has focused on the use of biological materials, such as bacteria, peat, fungi, algae, bark and moss. These materials are easily accessible, inexpensive, and some of them such as bark and algae are by-products of industrial processes that should be utilized.

When applying biological material, one can either use the processes of biosorption (passive uptake) or bioaccumulation (when sorption occurs via the metabolic activity of living organisms). Although viable organisms have shown promising capabilities in sewage water treatment, their use has been limited, especially for acidic waters and waters with high metal content. The advantages of using non-viable biomass are numerous. Dead cells may be stored at room temperature and used for extended periods without losing their qualitative characteristics. Moreover, the biosorption capacity of the dead cells can be even greater than that of the living organisms. Biosorption in algae has mainly been attributed to the cell wall properties, where electrostatic interaction, ion-exchange and complexation and formation of chelate compounds can play a role.

Bark, peat, and microalgae are known for their ability to accumulate heavy metals; however, the metal uptake capacity of both materials individually is not high enough to be used for industrial purposes. In our work, after development of a new sorbent pre-treatment procedure, microalgae in combination with either bark or a granulated peat material are used for purifying heavy metal contaminated wastewater. Method development has been conducted as PhD and MSc thesis works in our laboratory since 2002. However, recently a field experiment on purification of run-off from the old Follidal Mining Area was conducted. The results are promising.

iii): Measurement of trace element bioavailability and exposure in the environment

Evaluation of the risks related to contaminated soil or sediment are based on chemical analysis. Measurement of trace element bioavailability is a challenging task. Contaminant phase distribution and speciation has to be considered. Analysis in-situ is preferable, but often not possible. Thus we have through MSc and PhD thesis works been working with different approaches, like size charge fractionation in field or use of passive sampling techniques (Diffusive Gradients in Thin Films; DGT).

Living organisms provide monitoring capabilities which take into account the actual responses of organisms or populations to environmental variables including pollutants. The accumulation of pollutants in e.g. plants or their reaction to them is a better indication of a system's pollution stress than direct pollution measurement, provided that enough is known about the system itself. The plant availability of the potential toxic element barium, occurring in the carbonatite at Stjernøy, Finnmark, is under investigation in a most recent project. The rock is high in CaCO₃, K₂O and P₂O₅ offering grate possibilities as fertilizer – provided that the barium is unavailable for plant uptake.

Another ongoing work is related to Microwave Assisted Pyrolysis (see research area i)). Data obtained from sequential extraction and pot experiments have shown that the binding of metals (As, Cu, Cr, Cd) in the solid residue after pyrolysis is strong, compared with binding in polluted natural soils. Thus the bioavailability and exposure in the environment is less than expected, and the areas for utility of solids residues after pyrolysis of polluted feedstock are wider.

iv): Mercury in the environment

One hazardous element is of specific interest in the research community – mercury. The need for an analytical method to differentiate naturally occurring species of mercury is important, i.e. to understand the distribution and pathways of the highly toxic methylmercury (MeHg, CH₃Hg⁺) into the food web. The two most common chemical forms of mercury present in environmental samples are MeHg, and ionic mercury (Hg²⁺), where MeHg is up to 100 times more toxic than inorganic ionic mercury. We have been working with method development on methylmercury in selected sample matrices; sediments, muscle, liver, roe, hair, whole blood and urine. Techniques used include both instrumentation for direct (HR-ICPMS) and indirectly measurements (CVAAS); the last technique after acid decomposition in high pressure microwave autoclave (UltraClave, Milestone).

Ongoing work in this research area include a) a survey of total and methylmercury in a fresh water lake (both sediments and fish), and b) mercury in cosmetics.