

# Appendices

## Appendix 1

### Acronyms and abbreviations

ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ASTM	American Society for Testing and Materials (known as ASTM International)
Ba	barium
bgs	below ground surface
bpd	barrels per day
BTEX	benzene, toluene, ethylbenzene, xylenes
CDU	crude distillation unit
CL	Contaminated Land
cm	centimetre
cps	counts per second
DPR	(Nigerian) Department of Petroleum Resources
EGASPIN	Environmental Guidelines and Standards for Petroleum Industry in Nigeria
EIA	environmental impact assessment
FCCU	fluid catalytic cracking unit
g	gram
GC	gas chromatography
GC-FID	gas chromatograph-flame ionization detector
GC-MS	gas chromatograph-mass spectroscopy
GPS	Global Positioning System
ha	hectare
HDPE	high-density polyethylene
ICP-MS	inductively coupled plasma mass spectrometry
IPIECA	International Petroleum Industry Environmental Conservation Association
ICSMC	Integrated Contaminated Soil Management Centre
keV	kilo-electron volt
kg	kilogram
km	kilometre
km <sup>2</sup>	square kilometre
l	litre
LGA	local government area
LPG	liquefied petroleum gas
m	metre
m <sup>2</sup>	square metre
m <sup>3</sup>	cubic metre
mg	milligram
ml	millilitre
mm	millimetre
MOPOL	Nigerian mobile police
MOSOP	Movement for the Survival of the Ogoni People

m/s	metres per second
msl	mean sea level
MTBE	methyl tertiary butyl ether
MW	megawatt
NNPC	Nigerian National Petroleum Company
NORM	naturally occurring radioactive material
NOSDRA	National Oil Spill Detection and Response Agency
nSv/h	nanosievert per hour
OERA	Ogoniland Environmental Restoration Authority
OGFZ	oil and gas free zone
OSCP	Oil Spill Contingency Plan
PAH	polycyclic aromatic hydrocarbon
PHRC	Port Harcourt Refining Company
PIC	Presidential Implementation Committee
PM	particulate matter
ppm	parts per million
PPMC	Pipelines and Products Marketing Company
QA/QC	quality assurance/quality control
RBCA	Risk-Based Corrective Action
RBSL	risk-based screening level
RENA	remediation by enhanced natural attenuation
RMS	(SPDC) Remediation Management System
RSUST	Rivers State University of Science and Technology
SVOC	semi-volatile organic compound
SEPCiN	Shell Exploration and Production Companies in Nigeria
SPDC	Shell Petroleum Development Company (Nigeria) Ltd
TDU	thermal desorption unit
TPH	Total Petroleum Hydrocarbon
TPHCWG	Total Petroleum Hydrocarbon Criteria Working Group
TWG-CC	Technical Working Group on Community and Communication
TWG-ER	Technical Working Group on Environmental Restoration
TWG-LS	Technical Working Group on Legislation and Standards
TWG-SM	Technical Working Group on Surveillance and Monitoring
TWG-WS	Technical Working Group on Water Supply
UNDP	United Nations Development Programme
UNDSS	United Nations Department of Safety and Security
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
µm	micrometre
µS/cm	micro Siemens per cm
VDU	vacuum distillation unit
VOC	volatile organic compound
WHO	World Health Organization

## Appendix 2

### Glossary

Abandonment	The act of disengaging an oil well or oil facility from active operation
Absorption	The property of some liquids or solids to soak up water or other fluids
Adsorption	The property of some solids and liquids to attract a liquid or a gas to their surfaces
Aliphatic compounds	Acyclic or cyclic, non-aromatic carbon compounds (of, relating to, or designating a group of organic chemical compounds in which the carbon atoms are linked in open chains)
Aquifer	A body of rock whose fluid saturation, porosity and permeability permit production of groundwater
Aromatic hydrocarbon	A hydrocarbon characterized by general alternating double and single bonds between carbons (of, relating to, or containing one or more six-carbon rings characteristic of the benzene series and related organic groups)
Asphalt	A solid or nearly solid form of bitumen that can melt upon heating and contains impurities such as nitrogen, oxygen and sulfur. Forms naturally when the light components or volatiles of petroleum have been removed or evaporated
Associated gas	(Also termed 'formation gas') A natural gas found in association with crude oil either dissolved in the oil or as a cap of free gas above the oil
Benthic	Pertaining to the environment and conditions of organisms living at the water bottom, or benthos
Bitumen	Naturally occurring, inflammable organic matter formed from kerogen in the process of petroleum generation that is soluble in carbon bisulfide. Includes hydrocarbons such as asphalt and mineral wax. Typically solid or nearly so, brown or black, bitumen has a distinctive petroliferous odour
Blowout	An uncontrolled flow of fluids (salt water, oil, gas or a mixture of these) into the borehole, and sometimes catastrophically to the surface. Blowouts occur in all types of exploration and production operations, not just during drilling operations
Borehole	The borehole itself (also termed 'wellbore'), including the open hole or uncased portion of the well. Also refers to the inside diameter of the borehole wall, the rock face that bounds the drilled hole
Bunkering	The act or process of supplying a ship with fuel. In Ogoniland and the wider Niger Delta, also used to refer to illegal tapping into oil industry infrastructure with a view to stealing oil
Clean-up	The act of removing pollutants from a location by treating soil and groundwater contaminated with hydrocarbons

(Petroleum) Cracking	The breaking down of high-molecular value hydrocarbons into low-molecular weight compounds. The process involves very high temperature and pressure and can involve a chemical catalyst to improve the process efficiency
Crude oil	Unrefined petroleum or liquid petroleum
Cuttings / tailings	Small pieces of rock that break away due to the action of the drill-bit teeth. Cuttings are screened out of the liquid mud system and are monitored for composition, size, shape, colour, texture, hydrocarbon content and other properties
Decommissioning	The act of disengaging an oil well or oil facility from active operation but doing so in a safe and environmentally acceptable manner
(Oil) Exploration	The initial phase in petroleum operations that includes the location of an area in which hydrocarbon accumulations may occur and the drilling of an exploration well. Appraisal, development and production phases follow successful exploration
Feedstock	Crude oil – essentially the hundreds of different hydrocarbon molecules in crude oil which, separated in a refinery, can be used in petrochemical processes that manufacture such products as plastics, detergents, solvents, elastomers and fibres such as nylon and polyesters
Flaring	The burning of unwanted gas through a pipe (also called a flare). Flaring is a means of disposal used when there is no way to transport the gas to market and the operator cannot use the gas for another purpose
Flow station	Separation facilities (also called gathering centres) which separate natural gas and water from crude oil extracted from production wells
Formation water	Water that occurs naturally within the pores of rock
Fugitive emissions	Emissions of gases or vapours from pressurized equipment due to leaks and various other unintended or irregular releases
Groundwater	Water held in the pores of rocks in the subsurface below the water table
Gypsum	A highly insoluble sulphate mineral that is the first to precipitate from evaporating seawater
Hydrocarbon	A naturally occurring organic compound comprising hydrogen and carbon. Hydrocarbons can be as simple as methane [CH <sub>4</sub> ], but many are highly complex molecules and can occur as gases, liquids or solids. The molecules can have the shape of chains, branching chains, rings or other structures. Petroleum is a complex mixture of hydrocarbons. The most common hydrocarbons are natural gas, oil and coal
Light hydrocarbons	Hydrocarbons with low molecular weight such as methane, ethane, propane and butane
Liquefied petroleum gas	Gas mainly composed of propane and butane, which has been liquefied at low temperatures and moderate pressures. The gas is obtainable from refinery gases or after the cracking process of crude oil

Manifold	An arrangement of piping or valves designed to control, distribute and often monitor fluid flow
Mineral oil	Oil found within rock formations, specifically petroleum or crude oil
(Drilling) Muds	Fluids prepared by mixing clay and other chemicals along with water, diesel or synthetic oil for use in oil well drilling operations.
Naturally occurring radioactive materials (NORM)	Potentially hazardous materials typically found in certain types of barium or strontium scales that may be deposited in the borehole
Oil industry	Collective term covering the exploration, extraction, production, transportation and exportation of crude oil and associated refined products
Oil spill	Accidental release of crude or refined oil products into the environment
Oil well	A well drilled into oil-bearing geological formations to produce crude oil as the primary commercial product. Oil wells almost always produce some gas and frequently produce water; most eventually produce mostly gas or water
Operator	The company that serves as the overall manager and decision-maker of a drilling project. Generally, but not always, the operator will have the largest financial stake in the project
Petroleum	Generally used to refer to liquid crude oil, a complex mixture of naturally occurring hydrocarbon compounds found in rock, ranging from solid to gas
Pigging	Forcing a device called a pig through a pipeline or a flow line for the purpose of cleaning the interior walls of the pipe, separating different products or displacing fluids
Pipeline	A tube or system of tubes used for transporting crude oil and natural gas from the field or gathering system to the refinery
Produced water	Water produced along with the oil and gas which originates from water trapped in permeable sedimentary rocks within the well bore. Disposal of produced water can be problematic in environmental terms due to its highly saline nature
Receptor	Organisms (including human beings), ecosystems or water resources at risk from exposure to oil contaminants
Remote sensing	The process of measuring, observing or analysing features of the Earth from a distance – satellite photography and radar are techniques commonly used for remote sensing
Right(s) of way	Designated land around oil pipelines or oil industry installations to facilitate access to and protection of oil industry assets
Sediment	Unconsolidated grains of minerals, organic matter or pre-existing rocks, that can be transported by water, ice or wind, and deposited
Tailings	See 'Cuttings'

## Total Petroleum Hydrocarbons (TPH)

The family of hydrocarbons which originate from crude oil

## Valves

Apparatus designed to maintain, restrict or meter the flow of materials through pipes, hoses, tubing or entire systems by using various mechanisms such as a choke, a ball or a gate. Valves generally function by allowing flow while in their open position, and restricting flow when closed

## Wellhead

The topmost point of a well and the structure built over it. Includes control equipment such as outlets, valves, blowout preventers, casing heads and tubing heads

Principal source (adapted): 'The Oilfield Glossary: Where the Oil Field Meets the Dictionary' at [www.glossary.oilfield.slb.com](http://www.glossary.oilfield.slb.com)

## Appendix 3 References

All website addresses last accessed 1 March 2011

1. The World Fact Book.
2. World Bank (1982). *World Development Report 1982*, Volume 1. ISBN 0-19-503224-1. Available at <http://go.worldbank.org/16BEWURYE0>
3. Association of Nigerian Scholars for Dialogue. Ogoni Bill of Rights, November 1990. Available at [www.waado.org/nigerian\\_scholars/archive/docum/ogoni.html](http://www.waado.org/nigerian_scholars/archive/docum/ogoni.html)
4. Boele, R., Fabig, H., and Wheeler, D. (2001), Shell, Nigeria and the Ogoni. A study in unsustainable development: I. The story of Shell, Nigeria and the Ogoni people – environment, economy, relationships: conflict and prospects for resolution, Sustainable Development, Vol. 9, pp74-86
5. Kio, P.R.O. Forest conservation strategies for tropical Africa. Ibadan, Nigeria: University of Ibadan. Available at <http://unu.edu/unupress/unupbooks/80364e/80364E07.htm>
6. National Bureau of Statistics, Federal Republic of Nigeria. 2006 Population Census. Available at [www.nigerianstat.gov.ng/nbsapps/Connections/Pop2006.pdf](http://www.nigerianstat.gov.ng/nbsapps/Connections/Pop2006.pdf)
7. Environmental Guidelines and Standards for the Petroleum Industries in Nigeria (EGASPIN) (1992). issued by the Department of Petroleum Resources, Nigeria. (Revised edition, 2002).
8. UBS (2004). Introduction to the Oil Industry. UBS Investment Research Report.
9. E&P Forum/UNEP (1997). *Environmental management in oil and gas exploration and production: An overview of issues and management approaches*. UNEP IE/PAC Technical Report 37 / E&P Forum Report 2.72/254. ISBN 92-807-1639-5.
10. O'Reilly, K.T., Magaw, R.I. and Rixey, W.G. (2001). *Predicting the Effect of Hydrocarbon and Hydrocarbon-Impacted Soil on Groundwater*. American Petroleum Institute. 14 pp. Available at [www.api.org/ehs/groundwater/upload/14\\_Bull.pdf](http://www.api.org/ehs/groundwater/upload/14_Bull.pdf)
11. Zeiger, E. (2006). *The Effect of Air Pollution on Plants*. A Companion to Plant Physiology, Fourth Edition. Available at <http://4e.plantphys.net/article.php?ch=8&id=262>
12. US Fish and Wildlife Service (2010). *Effects of Oil on Wildlife and Habitat*. Available at <http://alaska.fws.gov/media/unalaska/Oil%20Spill%20Fact%20Sheet.pdf>
13. IPIECA (1991, reprinted 2000). Guidelines on Biological Impacts of Oil Pollution, available at <http://wildlife1.wildlifeinformation.org/s/00Ref/miscellaneouscontents/d171.htm>
14. Aguilera, F., Méndez, J., Pásaro, E. and Laffon, B. (2010). Review on the effects of exposure to spilled oils on human health. *Journal of Applied Toxicology* 30(4): 291-301.
15. ATSDR (Agency for Toxic Substances Disease Registry) (1999). Toxicological Profile for Total Petroleum Hydrocarbons (TPH). US Department of Health and Human Services, Atlanta, GA. Available at [www.atsdr.cdc.gov/ToxProfiles/tp123-p.pdf](http://www.atsdr.cdc.gov/ToxProfiles/tp123-p.pdf)



16. ATSDR (Agency for Toxic Substances Disease Registry) (2009). Interaction Profile for Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX). US Department of Health and Human Services, Atlanta, GA. Available at [www.atsdr.cdc.gov/interactionprofiles/ip05.html](http://www.atsdr.cdc.gov/interactionprofiles/ip05.html)
17. The Encyclopedia of Earth (2008, updated 2010). Health effects of total petroleum hydrocarbons. Available at [www.eoearth.org/article/Health\\_effects\\_of\\_total\\_petroleum\\_hydrocarbons](http://www.eoearth.org/article/Health_effects_of_total_petroleum_hydrocarbons)
18. Rajagopalan, V.K. (2010). Health Concerns Related to Hydrocarbons in Drinking Water. Ezine articles. Available at <http://ezinearticles.com/?Health-Concerns-Related-to-Hydrocarbons-in-Drinking-Water&id=4693741>
19. IOM (Institute of Medicine) (2010). Assessing the effects of the Gulf of Mexico oil spill on human health: A summary of the June 2010 workshop. Washington, DC: The National Academies Press.
20. Edwards, S.C., Jedrychowski, W., Butscher, M., Camann, D., Kieltyka, A., Mroz, E., Flak, E., Li, Z., Wang, S., Rauh, V. and Perera F. 2010. Prenatal exposure to airborne polycyclic aromatic hydrocarbons and children's intelligence at 5 years of age in a prospective cohort study in Poland. *Environ. Health Perspect.* 118(9): 1326-31.
21. Ohio Department of Health. Factsheet: *Benzene, Toluene, Ethyl Benzene and Xylenes*. Bureau of Environmental Health, Health Assessment Section, Columbus, Ohio.
22. Oregon Department of Human Services (1994). Health Effects Information: BTEX. Technical Bulletin, Environmental Toxicology Section, Office of Environmental Public Health, Portland, Oregon.
23. Wisconsin Department of Health Services (2000). Polycyclic Aromatic Hydrocarbon (PAH). Available at [www.dhs.wisconsin.gov/eh/chemfs/fs/pah.htm](http://www.dhs.wisconsin.gov/eh/chemfs/fs/pah.htm)
24. Government of South Australia (2009). Polycyclic Aromatic Hydrocarbons (PAHs): Health effects. Public Health Fact Sheet. Available at [www.health.sa.gov.au/pehs/PDF-files/ph-factsheet-PAHs-health.pdf](http://www.health.sa.gov.au/pehs/PDF-files/ph-factsheet-PAHs-health.pdf)
25. Ana, R.E.E., Sridhar, M.K.C. and Emerole, G.O. (2009). A comparative assessment of soil pollution by polycyclic aromatic hydrocarbons in two Niger Delta communities, Nigeria. *African Journal of Pure and Applied Chemistry* 3(3), pp 31-41.
26. The Agency for Toxic Substances and Diseases, National Center for Environmental Health (2008), Public Health Statement for Barium. Available at [http://www.eoearth.org/article/Public\\_Health\\_Statement\\_for\\_Barium](http://www.eoearth.org/article/Public_Health_Statement_for_Barium)
27. Olsgard, F. and Gray, J.S. (1995), A comprehensive analyses of the effects of oil and gas exploration and production on the benthic communities of the Norwegian continental shelf, *Marine Ecology Progress Series*, Vol.122, 277-306
28. US Department of Energy, Argonne National Laboratory, Environmental Science Division. Naturally Occurring Radioactive Materials (NORM). Available at [http://www.evsnl.gov/project/dsp\\_topicdetail.cfm?topicid=16](http://www.evsnl.gov/project/dsp_topicdetail.cfm?topicid=16)
29. Skrtic, L. (2006), Hydrogen Sulphide and People's Health, Master of Science Thesis, Energy and Resources Group, University of California, Berkeley.

30. Veil, J.A., Puder, M.G., Elcock, D., and Redweick (Jr), R.J. (2004), A White Paper Describing Produced Water from Production of Crude Oil, Natural Gas and Coal Bed Methane, Argonne National Laboratory, U. S. Department of Energy.
31. Port Harcourt Refining Company Limited (PHRC), [www.nnpcgroup.com/NNPCBusiness/Subsidiaries/PHRC.aspx](http://www.nnpcgroup.com/NNPCBusiness/Subsidiaries/PHRC.aspx)
32. Eleme Petrochemicals, <http://www.indorama.com/companies/eleme/profile.htm>
33. International Association of Oil and Gas Producers (2008). *Guidelines for the management of Naturally Occurring Radioactivity Material (NORM) in the oil and gas industry*. Report 412.
34. Igbara, J.W. (2010). Environmental Assessment of Ogoniland Project: Desk Studies on Public Health. Prepared for United Nations Environment Programme, Post-Conflict and Disaster Management Branch in accordance with a project cooperation agreement with the Rivers State University of Science and Technology (RSUST), Port Harcourt, Nigeria, May 18, 2010.
35. Ubong I. (2010). Ogoniland Environmental Assessment Air Quality Review. Prepared for UNEP Environmental Assessment of Ogoniland
36. WHO (2004). *Guidelines for Drinking-water Quality. Volume 1: Recommendations*. 3rd edition. WHO, Geneva.
37. Standards Organization of Nigeria (2007). Nigerian Standard for Drinking Water Quality. NIS 554: 2007. Available at [www.unicef.org/nigeria/ng\\_publications\\_Nigerian\\_Standard\\_for\\_Drinking\\_Water\\_Quality.pdf](http://www.unicef.org/nigeria/ng_publications_Nigerian_Standard_for_Drinking_Water_Quality.pdf)
38. WHO (2010). WHO Guidelines for Indoor Air Quality: Selected Pollutants. Regional Office for Europe. Available at [www.euro.who.int/\\_\\_data/assets/pdf\\_file/0009/128169/e94535.pdf](http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf)
39. National Oil Spill Detection and Response Agency (Establishment) Act, 2006. Available at [www.nosdra.org/faqs.html](http://www.nosdra.org/faqs.html)
40. *The Times* (2010). 'Obama denounces 'big oil blame game' as experts question information on leak'. Available at [www.timesonline.co.uk/tol/news/world/us\\_and\\_america/article7127306.ece](http://www.timesonline.co.uk/tol/news/world/us_and_america/article7127306.ece)
41. ASTM International (2010). Standard Guide for Risk-Based Corrective Action Applied at Petroleum Related Sites. ASTM E1739-95(2010)e1. Available at [www.astm.org/Standards/E1739.htm](http://www.astm.org/Standards/E1739.htm)
42. Shell Petroleum Development Company of Nigeria (2005). Execution Strategy for Oil Spill Response, Clean-up and Remediation of Impacted Sites in East and West.
43. SPDC (2010). Remediation Management System.
44. UNEP (2007). Mangroves of Western and Central Africa. UNEP-Regional Seas Programme/ UNEP-WCMC. Available at [www.unep-wcmc.org/resources/publications/UNEP\\_WCMC\\_bio\\_series/26.htm](http://www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/26.htm)
45. Ohimain, E.I, Gbolagade, J. and Abah, S.O. (2008). Variations in heavy metal concentrations following the dredging of an oil well access canal in the Niger Delta. *Advances in Biological Research* 2(5-6): 97-103.
46. Fagbami, A.A., Udo, E.J. and Odu, C.T.I. (1988). Vegetation damage in an oil field in the Niger Delta of Nigeria. *Journal of Tropical Ecology* 4: 61-75.

47. Ohimain, E.I. (2003). Environmental impacts of oil mining activities in the Niger Delta mangrove ecosystem. Proceedings of the 8<sup>th</sup> International Mine Water Association (IMWA) Conference, Johannesburg, South Africa. pp 503-517.
48. Ohimain, E.I. (2004). Environmental impacts of dredging in the Niger Delta. Options for sediment relocation that will mitigate acidification and enhance natural mangrove restoration. *Terra et Aqua* 97: 9-19.
49. Sunderland, T.C.H. and Morakinyo, T. (2002). *Nypa fruticans*, a weed in West Africa. *Palms* 46(3): 154-155.
50. Isebor, C.E., Ajayi, T.O. and Anyanwu, A. (2003). The incidence of *Nypa fruticans* (Wurmb) and its impact on fisheries production in the Niger Delta mangrove ecosystem. In: 16th Annual Conference of the Fisheries Society of Nigeria (FISON), 4-9 November 2001, Maiduguri, Nigeria. Available at [www.aquaticcommons.org/3588/1/16P013.pdf](http://www.aquaticcommons.org/3588/1/16P013.pdf)
51. Oil Spills in the Marine Environment. Sources, Fates and Effects. National Research Council/ National Academy of Science, US National Research Council (2002). Available at <http://dels.nas.edu/Report/Inputs/10388>
52. Page, D.S., Boehm, P.D., Brown, J.S., Bence, A.E., Douglas, G.S. and Neff, J.M. (2002). Baseline Studies on the Bioavailable Polycyclic Aromatic Hydrocarbons in Prince William Sound, Alaska. Proceedings SETAC 23rd Annual Meeting. Society of Environmental Toxicology and Chemistry.
53. McIntosh, A.D., Moffat, C.F., Packer, G. and Webster, L. (2004). Polycyclic aromatic hydrocarbon (PAH) concentration and composition in framed blue mussels (*Mytilus edulis*) in sea loch pre- and post-closure of an aluminium smelter. *Journal Environmental Monitoring* Vol. 6, pp 208-218.
54. Norena-Barroso, E., Gold-Bouchot, G., Zapata-Perez, O. and Sericano, J. (1999). Polynuclear aromatic hydrocarbons in American oyster *Crassostrea virginica* from Terminos Lagoon, Campeche, Mexico. *Marine Pollution Bulletin* Vol. 38, pp 637-645.
55. Qian, Y.R., Wade T. and Sericano, J. (2001). Sources and bioavailability of polynuclear aromatic hydrocarbons in Galveston Bay, Texas. *Estuaries* Vol. 24, pp 817-827.
56. Villeneuve, J.P., Carvalho, F.P., Fowler, S.W. and Cattini, C. (1999). Levels and trends of PCBs, chlorinated pesticides and petroleum hydrocarbons in mussels from NW Mediterranean coast: comparison of concentrations in 1973/74 and 1988/89. *Science of the Total Environment* Vol. 237-238, pp 57-65.
57. WHO (2008). Guidelines for Drinking-water Quality, Third Edition Incorporating the First and Second Addenda, Volume 1: Recommendations. Geneva
58. WHO (2006). Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005: Summary of risk assessment. WHO/SDE/PHE/OEH/06.02. Available at [whqlibdoc.who.int/hq/2006/WHO\\_SDE\\_PHE\\_OEH\\_06.02\\_eng.pdf](http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf)
59. van Donkelaar, A., Martin, R.V., Brauer, M., Kahn, R., Levy, R., Verduzco, C. and Villeneuve, P.J. (2010). Global Estimates of Ambient Fine Particulate Matter Concentrations from Satellite-Based Aerosol Optical Depth: Development and Application. *Environ. Health Perspect.* 118(6): 847-855.

60. National Population Commission (2009). Nigeria Demographic and Health Survey 2008.
61. National Bureau of Statistics, Federal Republic of Nigeria (2009). Social Statistics in Nigeria. [www.nigerianstat.gov.ng](http://www.nigerianstat.gov.ng)
62. WHO (2006). Country Health System Fact Sheet 2006 – Nigeria.
63. Laye Medical Limited (2004). Health Sector Master Plan for the NDDC States. Final Technical Report. Prepared for the NDDC, February 2004.
64. Klara M. Wanelik, A review of the impacts on and restoration methods for oil polluted mangrove
65. Quintin, A. and Fraiser L. (2010) “Comparison of International Risk Based Screening Levels”, Proceedings of the Annual International Conference on Soil Sediments, Water and Energy: Vo. 15, Art 24.

## Appendix 4

### Collaborating partners

#### **Rivers State University of Science and Technology**

Port Harcourt, Nigeria: <http://www.ust.edu.ng/>

##### **Area of collaboration**

Technical collaboration in area of contaminated soil and groundwater, aquatic, vegetation and public health.

#### **Al Control Laboratories**

Chester, United Kingdom: <http://www.alcontrol.com/>

##### **Area of collaboration**

Analyses of all soil, sediment and water samples. Specialised analyses of crude oil samples.

#### **Spiez Laboratory**

Spiez, Switzerland: <http://www.labor-spiez.ch/en/lab/index.htm>

##### **Area of collaboration**

Analyses of Naturally Occurring Radioactive Materials (NORM).

#### **Fugro Nigeria Limited**

Port Harcourt, Nigeria: <http://www.fugronigeria.com/>

##### **Area of collaboration**

Drilling and installation of groundwater monitoring wells.

#### **Universal Survey Services**

Port Harcourt, Nigeria: <http://www.universalsurveyservices.com>

##### **Area of collaboration**

Topographic survey of the groundwater monitoring wells.

#### **ALS Scandinavia AG**

Luleå, Sweden: [http://www.alsglobal.se/default\\_eng.asp](http://www.alsglobal.se/default_eng.asp)

##### **Area of collaboration**

Analyses of fish samples.

#### **Rivers State Polytechnic**

Bory, Nigeria: <http://rivpoly.net/>

##### **Area of collaboration**

Assistance with site access and community liaison.

#### **Port Harcourt University**

Port Harcourt, Nigeria: <http://www.uniport.edu.ng/>

##### **Area of collaboration**

Technical collaboration during fieldwork.

## Appendix 5

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Concerns over petroleum-related contamination have been at the heart of social unrest in Ogoniland, a kingdom in Rivers State, Nigeria. Although oil industry operations were suspended in Ogoniland in 1993, widespread environmental contamination remains.

Following a request from the Government of the Federal Republic of Nigeria, UNEP conducted an independent study to determine the environmental and public health impacts of oil contamination in Ogoniland, and options for remediation. This report sets out the background and context to the present-day conditions in Ogoniland, provides a synthesis of UNEP's findings and gives a set of overarching recommendations to deal with the multi-faceted environmental challenges currently facing the Ogoni people.

The assessment covers thematic issues of contaminated land, groundwater, surface water, sediments, vegetation, air pollution, public health and institutional reform. It represents the best available understanding as to what has happened to the environment of Ogoniland – and the corresponding implications for affected populations – and provides clear operational guidelines as to how that legacy can be addressed.

UNEP wishes to acknowledge and thank the many members of the Ogoni community who contributed to this study, without whose cooperation the assessment would not have been possible.

The report and data gathered by UNEP as part of its assessment are available online at: [www.unep.org/nigeria](http://www.unep.org/nigeria)