Recommendations

For most members of the current Ogoniland community, chronic oil pollution has been a fact of life
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Recommendations

It is clear from UNEP's field observations and scientific investigations that oil contamination in Ogoniland is widespread and severely impacting many components of the environment. The Ogoni people live with this pollution every minute of every day, 365 days a year. Since average life expectancy in Nigeria is less than 50 years, it is a fair assumption that most members of the current Ogoniland community have lived with chronic oil pollution throughout their lives. Children born in Ogoniland soon sense oil pollution as the odour of hydrocarbons pervades the air day in, day out. Oil continues to spill from periodic pipeline fractures and the illegal practice of artisanal refining, contaminating creeks and soil, staining and killing vegetation and seeping metres deep into ground, polluting water tables. Smoke from artisanal refining is a daily presence and fire close to inhabited areas is a constant threat from pools of oil which gather after a spill due to corrosion or bunkering or where artisanal refining of crude oil takes place.

A multiplicity of technical and non-technical reasons lie behind this tragic situation. UNEP is aware that not all spills in Ogoniland are caused by corrosion of oilfield equipment. Illegal extraction of oil, locally referred to as bunkering, is also a cause of spills and the ensuing environmental damage. It was not within UNEP's scope to indentify the cause of the individual spills, nor is it scientifically possible to detect the original cause of spills after an unknown time period. From an environmental impact perspective, mangroves would be no less damaged by oil spilled from a pipeline leak due to lack of maintenance than from a pipeline tapped for bunkering. Technical solutions for the clean-up of contamination are also not impacted by the original cause of the spill. However, when it comes to finding lasting solutions to improve the environmental situation in Ogoniland, all root causes need to be addressed.

Smoke from artisanal refining is a common sight in Ogoniland

At the technical level, measures have to be taken to clean up the contamination and restore the environment. And at a more strategic level, action is needed to prevent a repeat of this tragedy in Ogoniland. UNEP's recommendations are therefore divided into two parts.

In this chapter we present recommendations that, once implemented, will have an immediate positive impact on Ogoniland. They are not of equal priority. In fact some can only be carried out after others have been fully implemented.

In Chapter 7 we give recommendations that have longer timelines and which, when implemented, are a path to sustainability that will bring lasting improvements for Ogoniland and for Nigeria as a whole.

While the overall environmental situation in Ogoniland needs urgent and focused attention, the assessment has indicated a number of segments where there is an immediate danger to public health.

Emergency Measures

1. Ensure that all drinking water wells where hydrocarbons were detected are marked and that people are informed of the danger
2. Provide adequate sources of drinking water to those households whose drinking water supply is impacted
3. People in Nsisioken Ogale who have been consuming water with benzene over 900 times the WHO guideline are recorded on a medical registry and their health status assessed and followed up
4. Initiate a survey of all drinking water wells around those wells where hydrocarbons were observed and arrange measures (1-3) as appropriate based on the results
5. Post signs around all the sites identified as having contamination exceeding intervention values warning the community not to walk through or engage in any other activities at these sites
6. Post signs in areas where hydrocarbons were observed on surface water warning people not to fish, swim or bathe in these areas
7. Inform all families whose rainwater samples tested positive for hydrocarbons and advise them not to consume the water, and
8. Mount a public awareness campaign to warn the individuals who are undertaking artisanal refining that such activities are damaging their health.

From a duty of care point of view, these need to be acted upon immediately. The following is a list of such emergency measures needed to be initiated.

6.1 Operational recommendations

Before cleaning up the existing oil pollution and restoring the environment, there are a number of other measures which should be taken to achieve both environmental improvement and prevention of further oil spills.

Maintenance of oilfield facilities

SPDC should conduct a comprehensive review of its assets in Ogoniland, including a thorough test of the integrity of current oilfield infrastructure. Following the review, SPDC should develop an 'Asset Integrity Management Plan for Ogoniland' as well as a comprehensive decommissioning plan. For the assets that SPDC would like to retain, the plan should specify risk levels, inspection routines and maintenance schedules. These plans should be communicated to the Ogoni people.

Decommissioning of oilfield facilities

Prior to decommissioning, an environmental due diligence assessment of the plan should be undertaken, to include feedback from the Ogoni people. Based on the decommissioning plan, prepared as part of the asset integrity assessment, SPDC should initiate decommissioning of those facilities that the company will no longer use.

Prevention of illegal activities

A campaign to bring to an end illegal oil-related activities (tapping into oil wells/pipelines, transportation of crude, artisanal refining) should be conducted across Ogoniland. The campaign should be a joint initiative between the Government of Nigeria, the oil companies, Rivers State and local community authorities. The campaign should include an awareness component highlighting the disproportionate environmental footprint (borne by all sections of the community) of artisanal refining in relation to the marginal benefits derived. The campaign could also spell out training, employment and livelihood incentives that will encourage people away from participating in illegal activities.

The products derived from illegal refining can be seen at roadside stalls

Oil spill response

While a National Oil Spill Contingency Plan exists in Ogoniland and NOSDRA has a clear legislative role, the situation on-the-ground indicates that spills are not being dealt with in an adequate or timely manner. In order to ensure that all oil spills, regardless of the cause, are dealt with within the shortest possible time, an Oil Spill Contingency Plan (OSCP) for Ogoniland, covering both land areas and water bodies, should be prepared. The plan should be communicated to the community, with particular emphasis on how any delay in reporting or responding to a spill will have disproportionate environmental consequences.

When an oil spill occurs, adequate resources should then be deployed to put the plan into operation. Practice drills should be carried out periodically to ensure rapid responses to future oil spill incidents. Results of drills and OSCP improvements should be communicated to the Ogoni people in public meetings. Better still, as key stakeholders the communities themselves should take part in drills, with training provided and roles assigned. In this way the communities will come to understand the response process and learn to work with the oil response agencies and vice versa, instead of using the spill site as an 'environmental hostage'.

Ongoing remediation of contaminated sites

The current approach by SPDC to clean-up contaminated sites through remediation by enhanced natural attenuation (RENA) should be discontinued. Even SPDC's revised Remediation Management System does not address the issues observed in UNEP's assessment.

Instead, procedures should be put in place for any new spills to be assessed within the shortest possible time and heavily contaminated soil excavated and sent to the centralized facility (see under 'Technical recommendations', below) for treatment and disposal. The final clean-up standards and ongoing monitoring plans should be discussed and agreed with the relevant government agencies.

6.2 Technical recommendations for environmental restoration

Environmental degradation in Ogoniland impacts soil, water and biota. Achieving environmental restoration demands more than simple technological intervention. Sustainable recovery will only be possible when technological interventions for clean up of contaminated land and water bodies is backed up by practical action at the regulatory, operational and monitoring levels [9]. Specific recommendations in each of these areas are given below.

Prior to discussing clean-up options, one issue needs to be clarified. It is often stated that unless ongoing pollution is stopped, any clean-up undertaken is futile. However, this statement is only partially valid. In the case of land contamination, the locations of pollution sources and the extent of contamination emanating from them are relatively clearly defined and can be cleaned up independently from spills in other areas. The potential for future spillages, either from operational accidents or illegal activities, should not preclude the decision to initiate clean-up action where the source and extent of contamination are known.

The situation concerning pollution of water bodies is somewhat different because the physical extent of pollution is much less clearly defined or limited than in the case of land-based pollution. So long as any inflow of oil into any part of the creeks is continuing, all interconnected creeks are in danger of contamination. Therefore, clean-up activities of the mangroves and soil should not be initiated before all possible measures are taken to stop ongoing pollution from reaching the creeks. However, in the case of creeks which do not flush naturally, the floating hydrocarbon should be removed.

Clean-up of contaminated soil and sediments

Pollution of soil by petroleum hydrocarbons is widespread in Ogoniland – in land areas, in sediments and in swampland – and has occurred both in recent times and over a period of decades. Most of the contamination is from crude oil, though contamination by refined products was found at three locations. The decision to clean up individual sites has to be done based on detailed site-by-site risk assessments which must include consultation with the community and regulators.

The immediate removal of existing floating hydrocarbon from creeks, and on an ongoing basis thereafter, will help to minimize further contamination downstream

Owing to the diverse nature of hydrocarbon pollution, solutions for clean-up will require a combination of approaches. A detailed review of the available technologies is presented in Table 48. The following sections describe the operational philosophy of contaminated soil management.

Establishment of an Integrated Contaminated Soil Management Centre (ICSMC)

The UNEP investigation found oil contaminants exceeding Nigerian intervention values at 42 locations on land and at 10 locations in creeks. In addition, the surface water throughout the creeks contains hydrocarbons. The chemical structure and physical nature of the contamination and the characteristics of the soil all vary according to site. As explained above, site-specific risk assessments will be needed to determine whether clean up will be needed and if yes, what technologies are appropriate. However, based on the observed contamination and risk factors (contamination of pathways and proximity of receptors), it can already be stated with conviction that clean up intervention will be needed at a number of the investigated sites.

It is not feasible, however, either technically or economically, to set up multiple treatment units around Ogoniland for clean-up of contaminated soil. UNEP therefore recommends the establishment of a modern Integrated Contaminated Soil Management Centre in Ogoniland. Such a facility should contain the following technical components:

- **Incinerator.** Using contaminated soil and vegetation as feedstock, this will burn off hydrocarbons from contaminated soil with a high bitumen content. Organic matter (e.g. contaminated shrubs and bushes) will be reduced to ash during this process. Specially suitable for dealing with burnt-out crusts

- **Thermal desorption unit.** Thermal desorption can achieve rapid reduction of hydrocarbons, possibly recover some of the oil and make the treated soil re-usable for backfilling

- **Soil washing unit.** This will be most appropriate for treating contaminated soil with lower fractions of clay particles polluted with light-end hydrocarbons. The cleaned soil may also be used for backfilling excavation trenches

- **Contaminated water treatment unit.** Soil washing will result in large quantities of water being contaminated with hydrocarbons, necessitating the recovery of these hydrocarbons and cleaning of the water prior to discharge into the environment

- **Waste oil treatment centre.** The thermal desorption unit will recover some hydrocarbons but the unit will often be contaminated with other organic and inorganic substances. There will also be waste oil recovered from the contaminated water treatment. The output from these two units will need to be treated in a waste-oil treatment unit in order to recover hydrocarbons, which may be used as fuel in the thermal desorption unit or sold for co-mingling or re-refining with crude oil

- **Containment cells.** Contaminated materials collected in the field (e.g. barium-contaminated soil), as well as materials produced during the treatment process (e.g. incinerated ash), will need to be disposed in properly engineered containment cells

The ICSMC, once established, will be a modern industrial enterprise occupying many hectares of land and employing hundreds of people, offering job opportunities for many in the Ogoni community. The transport of soil, from contaminated sites to the ICSMC and back to the sites after clean-up, alone will require considerable manpower. There will be need for testing and weighbridge facilities and a state-of-the-art management system to document the operations. Once the task of cleaning up Ogoniland is complete, the centre will be able to cater for future spills both inside Ogoniland and in other parts of the Niger Delta. A suitable location for the ICSMC will need to be identified, with construction subject to the results of an integrated environmental and social impact assessment, including community consultations.

Mini treatment centres

In areas where heavy contamination has to be excavated, excavation water will need to be treated before it can be discharged into nearby water courses. In addition, in areas where contamination is below the current EGASPIN intervention values, but above target values or

new clean-up targets based on risk assessments, high-technology treatment may not be necessary. In such cases, multiple 'mini treatment centres' for bioremediation of lightly contaminated soil and excavation water are proposed.

Based on the experience in Ogoniland, bio-remediation should be done after the contaminated soil is excavated and spread over an impermeable layer protected from rain. These mini treatment centres should be close to the contaminated sites to minimize transportation and facilitate return of the treated soil to the original trenches.

Mini treatment centres should be created based on a common template but scaled to individual site requirements. The centres could be managed by the local community, offering job opportunities for young people, but they would first need to be trained in operation and maintenance of soil remediation and water clean-up. This would contribute to both environmental and social objectives.

These local centres would also act as staging areas for materials passing to and from the ICSMC.

Treatment of contaminated sediments

Decisions on intervention for sediment treatment are more complicated than simply basing them on an intervention value. Issues of erosion, vegetation damage and impact on local aquatic ecosystems as well as potential for natural recovery all need to be part of the decision-making process. Thus, every site at which contaminant concentration in the sediment exceeds the intervention value needs to be assessed on a case-by-case basis. Once a decision on intervention is taken, additional investigations will be needed, including analysis of the sediment for other contaminants and particle size. Only then can a final decision be made on the most appropriate clean-up technology to be used. This could involve, for example, a portable system which can be operated from a barge used for dredging, or transportation of sediments to the ICSMC.

Mini treatment centres for contaminated soil should be created based on a common template

Restoration of contaminated soil in swampy areas

The most extensive area in terms of treatment of contamination will be topsoil from the swamplands. Given that the parameters to be considered are depth of the contamination, the presence of vegetation and frequency of flooding (and therefore difficulty of access), a single approach to clean-up is unfeasible. It must also be noted that a comprehensive clean-up of the contaminated soil all over the creeks is not what is anticipated. There may be areas where no intervention is made and the contamination is overlaid by new sediments which in turn provide healthy substrate for new vegetation. There may be other areas where manual excavation and removal may be most appropriate. All such decisions have to be made based on site-by-site risk assessment. Available options are presented in Table 49.

Moving the soil and sediment to a treatment facility in Ogoniland could be both time-consuming and expensive. A portable facility mounted on a barge which can move through the bigger creeks should be considered. Such a facility could carry the high-technology treatment system (a combination of incineration and soil-washing facilities) and act as a base for the decontamination crew. This would allow a greater degree of flexibility in reaching all or most parts of the swampland.

Decontamination of groundwater

The issue of hydrocarbon contamination in wells needs to be addressed in a comprehensive manner, but clean-up actions must be site-specific. In principle, two forms of contamination need to be dealt with: product spills, in which the contaminants of concern are BTEX and other low molecular weight hydrocarbons, MTBE and other fuel additives; and crude oil spills, in which the whole range of hydrocarbons will need to be treated. In the case of hydrocarbon contamination, centralized treatment will not be possible and on-site treatment units will have to deployed. In making decisions about the clean-up of groundwater, additional factors such as proximity to the community, absorption characteristics of the soil, leaching behaviour of the pollutants, permeability of the soil layer and all possible pathways must be considered.

Topsoil from the swamplands will be the most extensive area in terms of treatment of contamination

Mangrove restoration in Ogoniland will take up to 30 years, once ongoing pollution is stopped

This will required additional data gathering at specific locations. However, in the case of groundwater treatment, based on information gathered so far, it is clear that there will be locations where groundwater treatment will be needed. Contaminated water may be treated after pumping it out from the aquifer or while the water is still *in situ*. The appropriate technologies are described in Table 50.

Rehabilitation of mangroves

As observed in chapter 5, there is significant damage to the mangroves in Ogoniland. Part of the mangroves have died, some of the mangroves are degraded and even those which are currently not showing any stress are constantly under threat. Mangrove rehabilitation is important from both ecological and economic point of view.

There is substantial international experience in restoration of impacted mangroves, including those impacted by oil pollution [64]. The challenge is to decide what exact approaches are appropriate in the context of Ogoniland based on the ecology and hydrology of the area. The following enabling actions should be undertaken prior to initiating mangrove restoration;

- Bringing the ongoing activities of artisanal refining in the entire area (not only in Ogoniland but other areas which are hydraulically linked to Ogoniland) to an end
- Study of the hydrologic regime in the area to see if there are changes in this which could impact the restoration process. In particular, the impact of the recent road construction in the area and its impact on the hydraulic regime should be evaluated
- Reviewing the state of degradation of the various sections and prioritizing areas for intervention.

Table 48. Soil remediation technologies for hydrocarbons

Treatment location	Technology genre	Description	Relevance to Ogoniland context
In situ	Containment (in situ)	Contain the polluted soil in the ground by creating impermeable barriers around it (side/top); barriers on the sides should reach down to a natural impermeable barrier	Inappropriate as the community needs access to the land for their livelihoods
	Natural remediation	No active intervention at site; natural processes, evaporation, dilution, photo-oxidation and biodegradation to reduce pollution	Inappropriate due to proximity of the community to contamination, shallow aquifer and heavy rainfall
	Enhanced natural attenuation	Active intervention at the site to enhance the above processes; primarily periodic tilling of the land and addition of nutrients	Inappropriate due to proximity of the community, shallow aquifer and heavy rainfall
	Fixation	Mix with chemical or physical binding agents to prevent the hydrocarbons from leaching out	Inappropriate as the long-term stability of the binding, as well as the impact of the binding agents, are both unknown
	Soil vapour extraction	Strip off the hydrocarbons from the soil matrix by creating a negative pressure in the subsoil	Appropriate only in the case of highly volatile hydrocarbons; not fit for crude oil which is the main pollutant in Ogoniland; may be applicable at the NNPC product spill sites

Table 49. Restoration approaches for swamp areas

Treatment location	Technology genre	Description	Relevance to Ogoniland context
In situ	Natural attenuation	No active intervention; instead leave the contaminated soil in place and wait for natural processes (e.g.sedimentation, evaporation, flushing by tidal water, biological action) to reduce pollution	Unacceptable given the current social, environmental and health situation, and aesthetics
	Enhancing bioremediation	Minimal intervention apart from spraying nutrients to promote bioremediation	Not possible in areas which are under daily inundation
	Enhancing flushing	Low or high-pressure water jetting of sediments and allowing tidal water to carry away the pollution	High-pressure water jetting may cause extensive disturbance; low-pressure water jetting can be used in conjunction with collection of re-suspended oil
	Absorbent materials	Spread absorbent materials (e.g. sawdust) or mats over contaminated soil to achieve hydrocarbon reduction	Inappropriate for bituminous substances accumulated over periods of a decade or more
	Containment	Cap the polluted area with cleaner material	Oil may still rise to the top
	Revegetation	Plant more hydrocarbon-tolerant vegetation in swamps	Inappropriate as this will alter the marsh ecology
Ex situ	Mechanical intervention	Remove contaminated soil with heavy machinery	Intervention with heavy machinery may leave large environmental footprint
	Manual intervention	Remove contaminated soil by manual labour and remove for clean-up	Least disturbing option

Table 50. Treatment technologies for contaminated groundwater

Treatment location	Technology genre	Description	Relevance to Ogoniland context
In situ	Passive remediation	No active intervention; instead leave the contamination to reduce itself by dilution, diffusion, adsorption and biodegradation	Inappropriate due to proximity of the community and their use of untreated groundwater for drinking
	Enhanced bioremediation	Promote bioremediation of hydrocarbon by pumping in nutrients and oxygen	Inappropriate due to proximity of community and the fact that they use the groundwater for drinking without treatment
	Biosparging	Strip off hydrocarbons in the groundwater by injecting air into the groundwater	Suitable for highly volatile substances only; may be applicable at the NNPC product spill sites
	Recovery of floating hydrocarbons	In cases of severe contamination, recover floating products using submersible pumps	May be appropriate in instances where heavy pollution is observed
Ex situ	Air stripping	Bring up the mixture of groundwater and hydrocarbons and strip off the hydrocarbon in a tank or column	Appropriate only for highly volatile substances and with additional control for air pollution; may be applicable only at NNPC product spill sites
	Phase separation	Bring up the mixture of groundwater and hydrocarbons and separate the two phases by physicochemical processes	Suitable for application; main constraint will be low permeability of the soil
	Trenching and treatment	Create large ponds or trenches in polluted areas where the water level is depressed to enable the draining of hydrocarbons into the area; remove hydrocarbons via 'pump and treat' approach	May be the most appropriate method due to high rainfall, low permeability and presence of large quantity of excavation water

Table 51. Restoration approaches for mangroves

Treatment location	Technology genre	Description	Relevance to Ogoniland context
Cleaning of vegetation	Manual cleaning	Manual cleaning of impacted mangrove stems with absorbent wipes or other wipes	Highly labour-intensive and needs to be done with care, but a possible option
	Low-pressure water jetting	Cleaning of impacted mangrove vegetation using low-pressure water jets	Bituminous substances are recalcitrant and may not be amenable to low-pressure water jetting
	High-pressure water jetting	Cleaning of impacted mangrove vegetation using high-pressure water jets	High-pressure water jetting may damage live plants but is appropriate for dead plants
	Surfactants and vegetation cleaners	Apply surfactants and vegetation cleaners to impacted mangrove vegetation to remove oil	Bituminous substances are recalcitrant and may not be amenable; may have a role in combination with other technologies
Vegetation clearing	Burning	Clear vegetation by burning to create room for new growth	Destruction of mangrove vegetation may accelerate coastline erosion
	Felling	Clear vegetation by cutting away existing plants	This may be attempted once the new plants have taken root to secure the land
Replanting the area	Within the existing root structure	Retain existing vegetation, including the roots of dead mangroves, and undertake replanting	Proven effective elsewhere; key issue is the remaining pollution in substrata
	Within open area	Replant in open areas and remove dead roots if necessary	Proven effective elsewhere; key issue is the remaining pollution in substrata

Public health studies in Ogoniland should continue

- A plan for control and management of alien and invasive species should be developed prior to active intervention in the field

Due to the wide extent of contamination (in Ogoniland and nearby areas) and the varying degrees of degradation, there will not be one single technique appropriate for the entire area. A combination of approaches will therefore need to be considered. This would range from active intervention for cleaning the top soil and replanting mangrove to passive monitoring of natural regeneration. Mangrove restoration in Ogoniland will be a project which will take up to 30 years, once the ongoing pollution is stopped, and an appropriate approach will be to initiate restoration in number of largescale experimental pilot sites (of 10 hectares each) and apply the lessons learnt in each of the locations to rest of the area with similar ecological and hydrological conditions. In locations where the mangrove trees have died, a more active intervention approach which involve clean up of the hydrocarbons on the top soil and bituminous substances on the dead stems followed by artificial replanting should be attempted. A summary of the possible approches are given in Table 51.

6.3 Recommendations for public health

This environmental assessment revealed that in addition to chronic exposure to oil, there are at least three groups of people in the Ogoniland whose health and safety are acutely impacted by the environmental contamination:

- those exposed to hydrocarbon pollution in their drinking water, including one community where benzene concentrations are extremely elevated
- those living on oil pipeline rights of way, and
- those involved in bunkering and artisanal refining.

For each of these groups, reducing the threat that petroleum hydrocarbon poses to their health is an immediate and necessary first step.

Communities exposed to petroleum hydrocarbons in their drinking water

UNEP monitoring showed that there is one community, at Nisisioken Ogale, where families

are drinking water highly contaminated with petroleum hydrocarbons, most notably benzene, at concentrations far above the threshold of acceptability according to WHO guidelines. Exposure to such high levels of hydrocarbons is certain to lead to long-term health consequences for community members. This situation warrants the immediate action of stopping people from drinking water from the contaminated wells and providing them with alternative an source of safe water.

The assessment results at Nisisioken Ogale mean that there could well be other households exposed to similar high levels of contamination. All other communities which are impacted, whether in Ogoniland or in surrounding areas, should be identified and provided with alternative access to clean drinking water as a matter of urgency.

The UNEP assessment also found hydrocarbons exceeding Nigerian drinking water standards in 28 drinking water wells used by Ogoni communities. Again, since the assessment was sample based, there could be other households exposed to hydrocarbons through their drinking water. The Government should take appropriate action in cases where Nigerian national standards on drinking water have been exceeded as per the Ministry of Health guidelines. Like the highly contaminated wells in Nisisioken Ogale, some of these wells may warrant immediate action to identify all affected families and to provide them with clean drinking water and medical care. Other wells may require clean-up and ongoing monitoring until such time as the upstream sources of petroleum contamination are eliminated.

It is further recommended that all members of households who have ingested water from hydrocarbon-contaminated sources are registered in a central data base and requested to undergo a **comprehensive medical examination** by medical personnel familiar with adverse health effects arising from contaminated drinking water. In addition, their health should be tracked during ther lifetime as some of the impacts of hydrocarbon exposure, such as cancer, may not manifest, for a very long time.

Communities living on rights of way

From a safety perspective, as well as for the security of oil installations, people living on rights of way should be moved from such locations as soon as possible. However, UNEP is conscious that those affected come from marginalized sections of Nigerian society and that such cases need to be handled with tact and sensitivity. Alternative locations for housing should be found regardless of the legal status of the people involved.

People involved in bunkering and artisanal refining

While bunkering and artisanal refining are criminal activities, the majority of young people who engage in it do so primarily as a means of employment. While it was not possible for UNEP to monitor the health status of those involved in bunkering and artisanal refining, it can be stated with conviction that they are exposing themselves to extreme safety risks (from fire and explosion) as well as health risks (from exposure to crude oil and volatile hydrocarbons). Regardless of the fact that they are working outside the boundaries of the law, it is important that efforts are made to draw them away from such dangerous activities. This may require awareness campaigns on, for example, the disproportionate nature of the short-term financial gain set against the medium to long-term health consequences, both to the individual and to the broader community. Job schemes offering alternative employment opportunities also need to be put in place.

6.4 Recommendations on follow-up monitoring

During and following clean-up operations in Ogoniland, a monitoring programme with three separate objectives should be put in place which will:

- monitor ongoing pollution in all environmental segments
- track the impacts on the health of communities exposed to hydrocarbon pollution, especially those exposed over many years, and
- track the progress of all clean-up projects and provide documentation to support their effectiveness

Monitoring should be prepared and implemented in consultation with the national institutions mandated to deal with specific environmental issues.

Comprehensive preventive surveillance should be undertaken by teams comprising representatives from the oil industry, environmental agencies and local communities

All monitoring activities should be communicated to the community and all results should be made publicly available.

Below, UNEP makes a series of recommendations for monitoring in specific areas. Table 52 summarizes the approaches and frequencies to monitoring in each of the subject areas.

Preventive surveillance

It was clear from the UNEP investigation that there is little, if any, preventive surveillance at oilfield sites in Ogoniland. Polluting activities go unhindered and when an incident occurs there is a (sometimes considerable) time lag between the event and it coming to the notice of the appropriate authority. UNEP recommends that comprehensive preventive surveillance is established, with the following elements:

- Weekly aerial scouting (conditions permitting) of the entire Ogoni oilfield (including the creeks and pipeline rights of way) to identify any new incidents or activities which may result in environmental damage
- Weekly surveillance visits (by boat) to the creeks to check for any indications of pollution and any ongoing incidents or activities which may cause pollution. Surveillance by boat could be directed by aerial observations
- Weekly visits to all oilfield installations, including pipeline rights of way and contaminated sites, to look for signs of any new spills or encroachments, and also to check on progress with remediation where this is taking place.

Preventive surveillance should be undertaken by a team consisting of oil industry representatives and environmental agencies, together with an appointed local community representative as guide and to achieve local 'buy in'. Daily information reports should be presented to all relevant stakeholders, including the community. However, UNEP recognizes that surveillance activities by boat and on land can only be implemented once the entire security situation within Ogoniland is significantly improved.

Monitoring of groundwater

Hydrocarbons were present in a number of community wells monitored in Ogoniland. UNEP also observed at other contaminated sites that the contamination has reached the groundwater, though it is currently not used for drinking. The following broad approach to groundwater monitoring is therefore recommended:

- In all communities where hydrocarbon was observed in at least one well, carry out a one-off monitoring visit to all households to assess/verify the presence of hydrocarbons in their various drinking water sources. The analytes to be checked should be decided upon based on the likely source of pollution
- In order to protect public health, establish systematic monitoring around all contaminated sites to provide early warning of contaminant migration to groundwater. Monitoring should be carried out monthly and reports made public. The analytes to be checked should be decided upon based on the likely source of pollution.

Monitoring of water bodies, fish and aquatic sediments

A comprehensive monitoring plan focusing on the water bodies, including the Imo River, around Ogoniland should be initiated. It should cover water, fish, sediments and benthic communities and can be used to:

- inform guidelines for zoning of areas where fishing and recreational activities are temporarily suspended owing to excessive pollution
- track improvements in environmental quality as remediation activities are undertaken.

Monitoring of water along established transects should be carried out monthly. Monitoring of sediments and benthic communities should be completed every quarter.

Monitoring of vegetation and fauna

Monitoring of vegetation recovery should be carried out within the creeks and at all oilfield sites. The approach should involve a combination of field transects, undertaken once a year, and analysis of satellite imagery to supplement the field transects, also undertaken once a year.

In due course, as the quality of vegetation and water improve, surveys should include mangrove fauna in order to provide a real indication of habitat restoration.

Air quality monitoring

Comprehensive air quality monitoring across Ogoniland should be initiated to track ongoing pollution, to help establish guidelines for protecting public health and to track improvements at sites where clean-up activities are under way.

Public health monitoring

A public health registry should be established for the entire Ogoniland population in order to track health trends and take proactive action individually and/or collectively where impacts relating to long-term exposure to hydrocarbon pollution are evident.

UNEP observed some communities experiencing extraordinarily high exposures to petroleum. In addition to the recommended health registry, a cohort registry of these exposed individuals would allow for a better and more extensive study than was possible given UNEP's scope of work. Such a cohort registry would list individuals who live in the highly exposed communities and provide the infrastructure to study the health status of cohort members. Ideally, a standardized health service system would be established for the cohort for the purpose of implementing the health status assessments.

6.5 Recommendations for changes to regulatory framework

In this section, UNEP makes specific recommendations to strengthen the legal and institutional weaknesses identified during the environmental assessment of Ogoniland.

Legislative matters

The regulation dealing with the oil industry is the Environmental Guidelines and Standards for Petroleum

A public health registry should be established for the Ogoniland population to track health trends and take action where impacts relating to long-term hydrocarbon pollution exposure are evident

Table 52. Monitoring sectors, approaches and frequencies

Monitoring sector	Monitoring approach	Frequency
Preventive surveillance	Aerial scouting	Weekly
	Surveillance from boats	Weekly
	Surveillance of facilities and incident sites	Weekly
Groundwater	Household visits in impacted communities	One-off
	Wells around impacted sites and facilities	Monthly
Water bodies	Surface water	Monthly
	Sediments	Quarterly
	Fish	Quarterly
	Benthic organisms	Quarterly
Vegetation	Transects in creeks and oilfield sites	Once a year
	Mangrove fauna	Once a year
	Analysis of satellite imagery	Once a year
Air quality	Particulate measurements, hydrocarbons	Monthly
Public health	Cohort registry of highly exposed communities	Yearly
	Public health registry of entire Ogoniland community	Yearly

Industry in Nigeria (EGASPIN). Oversight of the regulation lies with the Department of Petroleum Resources within the Ministry of Petroleum Resources.

1. Transfer oversight of the EGASPIN to the Federal Ministry of Environment, if necessary with appropriate staff or by recruiting and training new staff

2. Make the following operational changes to the regulation:

   (i) Make the provision for social and health impact assessment an integral part of the overall environmental impact assessment (EIA) process for all new oil and gas facilities and upgrades to existing facilities, in line with international best practice

   (ii) Clarify the approach to be taken for clean up of oil spills and other contaminated land, giving clear guidance on remediation criteria and realistic timeframes within which remediation has to be achieved

   (iii) Clarify the present inconsistency between 'intervention value' and 'target value' should such an approach continue to be adopted

   (iv) Include guidance on decommissioning and the environmental due diligence assessment to be undertaken while completing the decommissioning process

   (v) Add new guidance on: (a) surface water quality management; (b) ambient air quality; and (c) mangroves and coastal vegetation

(vi) Ensure all provisions of the regulation are internally consistent with one another

3. Establish guidelines on the circumstances in which recreational and/or commercial fishery closures should be implemented in water bodies subjected to pollution

4. Establish guidelines on the circumstances in which swimming, bathing and other recreational activities should be closed in a water body subjected to pollution

5. Improve public access to information, particularly non-classified information regarding the oil industry, such as EIAs, monitoring reports, spill reports and remediation closure reports

6. Increase access to environmental legislation. The high prices currently charged for legal texts make it difficult for citizens, non-governmental organizations, smaller companies and even governmental institutions to obtain them. Ensure that all legislation related to the oil and gas sector, as well as environmental legislation, is publicly and freely accessible on a single website (comparable to Eur-Lex in the European Union [72]). Legislation should be catalogued and search engines should allow for different inquiries (according to subject, full name of the Act, type of legislation, year of coming into force, etc.). In addition, governmental departments and agencies should make available, though their websites, their respective governing Acts, related legislation, guidelines, standards and procedures.

Institutional arrangements

1. In cases where specific mandates are given to newly formed agencies, EITHER:

   (i) all existing mandates held by older/other institutions and covering the same subject area should be revoked, OR:

   (ii) similar mandates of two or more institutions should be revised to clearly delineate the roles and responsibilities of each of the institutions. A clear example is the overlapping mandates of DPR and NOSDRA

2. Review the provisions of the NOSDRA (Establishment) Act, 2006 against NOSDRA's current operational responsibilities. The Act should either be expanded to include responsibility for environmental contamination in general (other than oil spills) or oversight of clean-up should be given to a separate governmental department

3. Clarify the mandates for the regulation and oversight of the following key issues:

   (i) Water quality in the creeks

   (ii) Standard setting for various uses of the creeks (e.g. for recreation, fishing), similar to environmental quality objectives and standards developed in other countries

   (iii) Monitoring of public health

   (iv) Restoration, management and monitoring of mangroves

4. Lack of resources is a constant theme across many Nigerian institutions (central, state and local). Build the capacity of government and non-governmental agencies to enable them to fulfil their mandates. In particular:

   (i) increase human resources

   (ii) increase the availability of material resources (hardware, vehicles, maintenance budgets, etc.), particularly of those agencies that currently depend on the oil industry for logistical support

   (iii) improve the technical skills of individuals in the various agencies to enable them to deal effectively with the oil industry.

6.6 Recommendations for follow-up

In the field of contaminated site assessment, trade-offs have been made between the amount of money spent on gathering field information versus the amount spent on clean-up activities. This trade-off has given rise to the phased approach

to contaminated site assessment. At the end of each phase, the entity who must undertake the clean-up action has to decide whether to initiate a clean-up based on available information or to gather additional information which may assist in better understanding the risk so that the resources can be better directed.

Additional data gathering will be needed even when sufficient information exists about the risk posed by a given site and a decision to remediate it has been made. This will include determining the presence of co-contaminants (such as heavy metals) which may interfere with the possible clean-up technologies and soil characteristics (particle size analyses and permeability, among others).

In this study, systematic information has been gathered for 69 contaminated locations. The observed concentrations of chemical contamination have been compared with Nigerian legislation. Whenever the concentrations have exceeded Nigerian intervention values or drinking water quality standards, recommendations have been made to follow up.

The next logical step in the clean-up and restoration of Ogoniland is to review the available information and set priorities for action. However, two things must precede that:

- Firstly, it is important that the ongoing contamination, from all possible sources, is brought to an end with minimum delay
- Secondly, at each of the individual sites, actions must be taken to prevent them from being secondary sources of ongoing contamination while further risk assessments or investigations are undertaken.

In terms of prioritizing specific locations to be cleaned up, restored or rehabilitated, the following framework is suggested.

Priority 1

All instances where the Ogoni community is known to be at risk. This includes treating contaminated drinking water sources and re-housing families living on or adjacent to contaminated oilfield facilities, such as well pads or rights of way.

Priority 2

Instances where contamination could potentially affect the community (e.g. where groundwater, fishing grounds or agricultural land are impacted).

Priority 3

Instances where a community's livelihood support base is impacted (mangroves, swamps, surface water).

Priority 4

Instances where there is no immediate risk to the community but where there is non-compliance with the law.

It must be emphasised that it is not intended that all priority 1 actions should be completed before initiating priority 2 actions, and so on. As environmental restoration in Ogoniland will be an

Ongoing contamination from all possible sources should be curtailed with minimum delay

While environmental restoration in Ogoniland will take decades, concurrently implementing priority actions will have an immediate and positive impact

activity taking decades, many of these actions will be – indeed must be – implemented in parallel.

Based on the prioritization process, at individual sites additional information gathering will be needed, which may include:

- Details of the geological and hydrogeological properties (e.g. soil type, particle size and hydraulic conductivity/permeability)
- Concentration of metals in the sites: Some metals (Ni and V) are present with crude oil while Pb was added in the past to refined product as an additive. In addition, heavy metals may be present in the soil as natural constituents. Regardless of the orgin, they can interfere with the clean-up and can also cause additional risk.
- Apart from determining the concentration of contaminants in a given site's soils and water component, an important property is the transport behavior of the contaminant when in contact with aqueous solution. This behavior can provide insights into the potential for transfer of contaminants to potential receptors. Hence, a leaching/desorption test is desirable to determine how contaminants partition from the solid phase to the liquid phase. For the groundwater and surface water, an adsorption test is also desirable for the same reason.
- Further speciated analyses of the hydrocarbons, in particular PAHs, may be of interest in detailed risk assessments.