The Effects of Oil Pollution Exposure and Its Pathways on Pregnant Women in Unity State

A report from a joint assessment in Rubkona, Guit and Koch Counties of Unity State between April 18th to 30th 2023.

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Above. Unfenced ponds of chemical water treatment plant at Tharjaith Oilfields operated by *SPOC*, 27th April 2023. Photo: Kor Leek/SEA

1. Introduction

1-1.Background

Unity State has a total land surface area of 37,800 square kilometres (14,600 square miles) (Wikipedia). According to a United Nations report published in 2022 and republished by Eye Radio on 12 September 2023, about 95% of its land surface is submerged in water. Bentiu town, the UNIMISS base and the Protection of Civilians sites were all surrounded by strong, heavy dykes to protect against flooding, including Rubkona airstrip. Despite the grave concern reported by the lead UN institution in the country, the central government in Juba has not acted swiftly to rescue the situation in Unity State nor declared a state of emergency. The issue of climate change is still a low priority, with little attention being paid to it.

South Sudan depends entirely on oil revenues which makes up some 98% of GDP. The high demand for oil revenues has encouraged foreign investors to increase oil production and the transportation of crude oil through pipelines. One official stated that "the pipelines are old and many of them leak oil into the environment, sometimes bursting due to the heat and pressure of the crude oil itself". He described an incident in Budang Payam where a pipe leaked a large amount of crude oil onto the land, which later caught fire and caused significant damage to the land, trees and people. The government took no action against GNPOC. It was the local community and the environment that paid the price.

There are four crude oil exploration blocks in Unity State where this research was conducted: Blocks 1, 2 and 4 in the Unity oilfields, and Block 5A in the Tharjath oilfield. Blocks 1, 2 and 4 are operated by the Greater Nile Petroleum Operating Company (GNPOC), a consortium primarily owned by CNPC (China), Petronas (Malaysia), ONGC Videsh (India), and Nilepet (South Sudan). Block 5A which includes the Tharjiath oilfields of Koch County, is operated by the Sudd Petroleum Operating Company (SPOC).

SPOC is a consortium of Petronas (Malaysia), CNPC (China), ONGC Vildesh (India) and Sudapet (Sudan).

Oil exploration and production is taking place in the Rubkona, Guit, Koch and Ruweng administrative areas. The local communities in these areas have reported the inappropriate dumping and disposal of oil wastes chemicals and drilling fluids, which are being discharged openly and into unfenced ponds. This poses a high risk of environmental contamination.

This work assessed causes of miscarriages, birth deformities, and environmental concerns occurring in Unity State alleged to have links with oil contamination on the environment. The assessment targeted Rubkona Primary Healthcare Centre, Budang Primary Health Care Centre, including Bentiu State Hospital in Rubkona County. It also targeted Kuch Lual Hospital, Mirmir Primary Health Care Center, and Rier Primary healthcare Unit in Koch County. In Guit, it targeted Kuach Primary healthcare Center. It also targeted the State Ministry of Health, and the community leaders in those counties. According to PAX report (May 2023), human health is being compromised by the activities of crude oil extractives due to broken pipelines, leaking open-air oil waste pits, fires at wells, oil dumping and related chemical waste. Heavy metals seeping deep underground have polluted groundwater and surface water used for drinking and agriculture, making it taste salty and bitter (PAX, 2023, Kluas and Sabine, 2016). The State Minister of Health echoed the concern that babies born with deformities, infertility and impact on livestock and wildlife around oilfields, evidenced with laboratory results, pointed to environmental pollution (Eye Radio Report, Oct 2023). A study by a local advocacy group (which has asked to remain anonymous) found that deformed infants comprised between 19% and 54% of all births in a three-year period (2015-2017) in Pariang of Ruweng Administrative area (Associated Press Report, Feb., 2020). The group found that a certain section of communities Pariang, Ruweng Administrative Area had 118 cases of premature deliveries during the period of their research (Associated Press

Report, February 2020). A child with no toes and short hands was reported in Mayiandit County to the south of the target counties (Sudd Environment Agency Report, 2020).

1-2.Problem statement

Exposure to Oil pollution has become a major health risk to the local communities inhabiting areas near oil production (Titmamer, Malak; 2015, forsouthsudan.com). Water, soil and air are the pathways by which the pollutants come into contact with local communities in Unity and Upper Nile States (PAX, 2023). Of particular concern is the exposure faced by pregnant women: cases of miscarriages and birth defects are being reported by individuals, research institutions, and humanitarian organizations (Tiitmamer & Malak, 2021; Stagliet and Sabine, 2016,), as a result of this pollution.

Communities in the areas of Budang in Rubkona, Pariang, Mala in Guit, Rier and Mirmir in Koch, and Manken in Mayom Counties has raised concern about the effects of oil pollution on their health and that of their livestock, water and soil. Research and assessment reports by some humanitarian agencies, independent research institutions and the Government of South Sudan have reported negative reproductive health impacts related to oil pollution.

1-3. Objectives:

To Assess the Effects of Oil Pollution Exposure and Its Pathways on Pregnant Women in Rubkona, Guit and Koch Counties in Unity State

Specific Objectives:

1. How does pregnant women get expose to oil pollutions in Rubkona, Guit and Koch Counties?
2. How oil pollution exposure effects are on pregnant women in Rubkona, Guit, and Koch Counties?
3. Why is it important to address the oil exploration exposure pathways on pregnant women in Rubkona, Guit and Koch Counties?

1-4. Justification

At its core, this assessment is a means by which rule of law, and Government and oil sector responsibility for citizens is upheld. It serves as a vital tool in ensuring that the oil-exploring corporations adhere to international and national environmental laws, regulations and standards; and respect local community health rights. By carrying out such an assessment, illegal deviations from these requirements can be identified, helping to mitigate legal and regulatory risks. This would ensure that the consortiums operate within the legal boundaries, prevent environmental violations and promote accountability. This involves a thorough examination of the processes, practices, and indicators recorded both in the government bureaus and health facilities. This investigation tracks the number of childbirths and their kinds recorded on the different levels of health facilities, which are namely hospitals, Primary Health Care Centers (PHCCs) and Primary Health Care Units (PHCUs).

Through this evaluation, geographical areas of damage can be traced. This is an opportunity to minimize pollution, and integrate ethical practice and environmental sustainability into the core operations of oil exploration and extraction in Unity State. This research therefore, plays a pivotal role in driving continuous improvement in environmental management. Based on the findings, the responsible oil consortiums which composes of Greater Pioneer Operating Company (GPOC), and Sudd Petroleum Operating Company (SPOC) can take proactive measures to prevent environmental harm and health risks as required by law. By anticipating and addressing potential environmental crises, this report serves as a shield against disasters that could have far-reaching ecological, health and financial consequences.

1-5. Significance of the assessment

The significance of this assessment is to foster transparency and accountability in the fields of interest, specifically in South Sudan. The alliance of MHA, SEA and JVC advocates that corporations and/or governmental entities that openly share audit results and actions taken to address environmental issues are able to enhance trust with

stakeholders, both domestic and foreign. This includes government agencies, shareholders, customers, and most importantly the general public. Such transparency demonstrates a commitment to environmental responsibility and accountability for one's actions. It fosters a culture of trust and responsibility that is essential in today's environmentally conscious society.

In conclusion, the overarching objective of this research is to uphold responsible environmental stewardship. This work will, evaluate environmental performance, identify and mitigate risks, and enhance transparency and accountability, to encourage regulatory compliance. In doing so, this report aims to contribute significantly to the broader goal of sustainable and environmentally conscious business practices, playing a pivotal role in shaping a greener and more responsible future for the activities of the oil sector in Unity state, South Sudan.

2. The areas targeted for this assessment

This assessment covers three counties in Unity State: Rubkona, Guit and Koch Counties. They are chosen because of their proximity to extractive facilities in the Unity and Tharjaith oilfields. These three counties are also most affected by the devastating floods ongoing since 2019, destroying natural habitat and cultivation, and forcing civilians to move to new areas. The profiles of these counties are illustrated below, noting that some data has not been updated since the floods (2019-) and South Sudan's civil war (2013-2018).

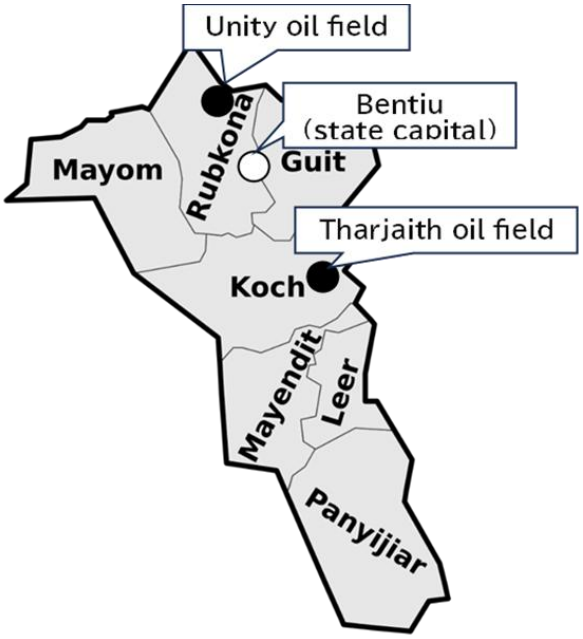


Table below. Data for the three Counties

County	Population census (2008)	Population projection (2025)	Area	Population Density	Annual population increase (%)
Guit	33,004	73,878	3,456 Km2	14.18 Km2	4.4%
Koch	74,863	115,158	4,417Km2	25.37/Km2	4.5%
Rubkona	100,236	361,802	3,569 Km2	41.94 Km2	4.5%

Source: *https://www.citypopulation.de/en/southsudan/admin/73__unity/*, *https://csrf-southsudan.org*

2-1.Rubkona County

According to 2008 census, Rubkona County has 8 Payams and 37 Bomas (Statistical Year book for South Sudan, 2008). It has several health facilities which includes Rubkona Primary Health Care, Budang Primary Health Care Center, Kaljaak Primary Health Care Center, Wathjaak Primary Health Care Unit, Yoanyang Primary Health Care Unit, Panhiany Primary Health Care Unit, Dhorbor Primary Health Care Unit, Ngop Primary Health Care Unit.

Rubkona fall under Blocks, 1, 2 and 4 which is run by the concession of China National Petroleum Cooperation (CNPC) together with Malaysian state owned company, Petronas and other mini companies. Much of oil exploration in covers Budang Payam of Rubkona County which lies to the northern part of Unity State bordering Sudan. Many cases of birth defects reported from the village of Nokpuot adjacent to Unity Oilfields. This is reported in BBC documentary released in 2024.

2-2.Guit County,

Geographically, it is characterized by lush green vegetation (including papyrus, reeds, and Napier grass), black cotton soils, and swamp/wetlands. The County has 7 Payams

and 27 Bomas. The Payams are: Guit, Kedad, Kuach, Kuerguini, Niemni, Nyathoar, and Wathnyona.

Guit has five health facilities, including Guit PHCC, Niemni PHCC, Kuach PHCU. Only two are functional in their place of origin, the other three health facilities, submerged by flooding, have been relocated to high grounds where community are displaced to.

Guit share part of bloc 5A with of Tharjaith oilfield together with Koch County. It has a production area called Mala Oil Production. It was shut down during the conflict and later all the wells submerged in water, posing health risk to the environment and the community. It was not accessible during the time of our assessment due to floods. After the 2018 Peace Agreement, exploration resumed at Mala Processing Plan.

2-3.Koch County

According to 2008 census, Koch County has total 7 payams and 33 Bomas. The 7 Payams comprised of Boaw, Gany, Jaak, Kuaclual, Norbor, Ngony, and Pakur.

The County has 9 health facilities and one County Civil Hospital. There are three Primary Health Care Centers, namely Buow PHCC, Mirmir PHCC and Patit PHCC, which provide secondary healthcare services. There are also Primary Health Care Units which include: Ngony PHCU, Gany PHCU, Pakur PHCU, Rier PHCU, Petpet PHCU and Jaak PHCU.

Koch County fall under Block 5A of Tharjaith oilfields. Exploration is taking place in Rier, a small village 20 km from Koch Town. Between Tharjaith and Koch is lush green marshes locally known as 'toic'. This particular is Toic Riang-Yian, named after a sub-clan section of Jagei-Nuer. Tharjaith, known as "Thar-jaith Lic" has deep historical roots among the Western Nuer. Traditional sources believed that Nuer people came out from Jaith-Lic making the area sacred, with important rituals conducted by the Nuer elders at Thar-jiath-lic. "Thar" refers to "under", while "Jiath" refers to "tree". "Tharjiath" means "under-tree".

Oil production started in 2006 before South Sudan Independence under the concession of White Nile Petroleum Operating Company (WNPOC). Later, the name was changed to Sudd petroleum Operating Company (SPOC). In the same year of 2006, water saltiness, miscarriages, skin and eye infections and many unknown ailments were noticed and reported by the community (Klaus & Sabine, 2016). It was the beginning of oil pollution suspicions from the locals which generates worries about the black oil. Malformed births of unknown causes were reported by the local community linked to oil pollution.

3. Methodology

The assessment used a qualitative research approach, with empirical evidence from human surveys, data held at medical centres and direct observations. The team did not have the means to conduct scientific testing of water quality, but this should be the next step following the information in this report. It is used to understand the community perceptions and knowledge about the effects of oil pollution exposure on pregnant women. It was used to generate first-hand information through one-to-one interviews with key informants, group interviews with participants, observation in order to understand the birth outcomes and social health risks factors on the communities inhabiting at the vicinities of oilfields. A joint field assessment visit to the targeted areas to interact with health workers, community and local authorities in Unity State was one approach to understanding local customs and traditions and the social health impacts on local communities.

3.1 Targeted areas

The assessment has targeted 6 health facilities Rubkona, Guit and Koch Counties and Bentiu State Hospital. In Rubkona, It targeted Rubkona Primary Health Care Center, and Budang Primary Healthcare Center. In Guit, it was Kuach Primary Health Care Center

and in Koch, it has targeted Kuach-Lual County Hospital, Mirmir Primary Healh Care Center, and Rier Primary Health Care Unit.

3.2 Target audience

The participants targeted in this assessment were health care providers engaged as a whole, and not just as individual participants at the mentioned health facilities. The key informants targeted were the Director General at the State Ministry of Health, Director of Bentiu State Hospitals, Doctors at the department of Obstetrics and Gynecology, three County Medical Directors at Counties Health Departments of Guit, Koch and Rubkona, Community leaders and Chiefs. They were engaged on one to one interviews. Beside health departments, Participants from the community were interviewed in Riers, Koch County, and Rotriak in Budang Payam of Rubkona. Interview settings prioritized formal communication.

3-3. Ethical principles

Ethical considerations formed the bedrock of the research methodology. We maintain standard and informed the authority of the objective of the assessment. The Government of Unity State granted us permission letter to produce on demand to the local authorities when visited the targeted counties. We first consults with responsible persons in all areas of our assessment. Most of focus groups discussions were done at the targeted health facilities, public intuitions and community centers. We maintain flexibility in scheduling interviews which was crucial, recognizing that villagers may have had other responsibilities or commitments.

In order to gain informed consent, the goals and the purposes of the research were transparently communicated to the villagers, before they agreed to cooperate with the interviews. Participants comprehended the process well and participation was voluntary.

Most communities also required collective consent from the elders or the community chiefs. Also, privacy and confidentiality were rigorously upheld, assuring participants that their information would remain confidential and anonymized in the research report.

3-4.Cultural sensitivity

This research was conducted using a sensitive approach, demonstrating a profound commitment and respect for local culture and tradition. The Team of four interviewers representing the three organizations, conducted prior desk-based research to understand the social and health effects on customs and traditions. Once on the ground, initial contact was made with the local leaders and elders in Rubkona/Bentiu, Guit and Koch, before conducting the interviews, seeking guidance and permission. It was kept in mind that the preservation and respect of the community's cultural heritage should be at the forefront of interactions, setting the stage for a successful research. Outsiders are often viewed with suspicion in rural villages, making trust-building essential. A culturally sensitive approach helped bridge the gap between the interviewers and the community, encouraging local individuals to participate more openly in the interviews.

3-5.Active listening

The importance of active listening as a core skill was also noted. Being respectful, empathetic listeners who allow participants to express themselves without interruption fostered an atmosphere of trust and cooperation. Researchers utilized open-ended questions that encouraged participants to share their thoughts and experiences in their own words. Finally, the research findings gained from this investigation will be shared with the communities to acknowledge their contributions and to reinforce transparency. This practice would leave a lasting legacy of collaboration and understanding, fostering positive relationships between the researching parties and the communities of interest.

3-6.Effective communication

Two of the four researchers involved in this investigation are local to Unity State., . They partnered with Japan International Volunteer Center (JVC) acting both as researchers and interpreters and played a crucial role in bridging linguistic and cultural gaps. Working with such intermediaries improved the overall research experience by providing insights into the local context and helping to build trust and rapport with community members. The interview questions were asked in the local language to promote clarity and full understanding. The use of simple, clear language, devoid of jargon, ensured that participants could fully express their thoughts.

4. Findings

This part is about the findings of the assessment in all the targeted locations in Guit, Koch and Rubkona Counties. The findings were based on the objectives of the assessment and what the community, healthcare workers, and the key informants expressed in relation to the pregnancy out comes at the seven health facilities. The data collected during the assessment is from 2021, 2022, and the quarter of 2023 from January to April. It also aims to assess whether there have been cases of birth defects recorded in the last two years of 2021 and 2022 and what could be the related cause of such spontaneous abortions or miscarriages. Finally, the findings were analyzed in relation to pregnancy outcomes links with oil pollution. The local communities complained that the extraction of crude oil in Unity and Tharjiath oil blocks exposes residents' health at risk due to outraged oil pollution.

The table below shows the pregnancies outcomes collected from the selected health facilities visited in the three counties and Bentiu State Hospital during the assessment.

The data collected is for the year 2021, 2022, and first four months of 2023 (Jan-April)

Descriptions	Deliveries	Stillbirth	Miscarriages	Birth Defects
Bentiu Hospital	2,237	13	448	2
Rubkona County	11,669	0	784	125
Guit County	1,827	16	3	8
Koch County	1119	15	404	9

4-1.Miscarriages and their causes

4-1-1.Flooding exposure

According to the Dr. Duol Biem, the Director General at the State Ministry of Health, **"most pregnant women do not have access to antenatal care till the delivery period due to flooding".** The Head of Obstetrics and Gynecology department of Maternity at Bentiu State Hospital reported that, **"There are 448 miscarriages between the periods of 2021 to April 2023".** This works out to an average of 96 cases every six months and 16 cases per month. The maternity birth registry recorded an average of 110-120 deliveries per month. **"The cause of miscarriages is linked to the devastating flood."** A health official stated **"most women choose to give birth at homes other than hospitals or health centers"**. He further said **"Boma Health Workers reports most cases of miscarriages occurring in the community".** In Rubkona County, the Director of County Health Department said **"Frequent miscarriages are experienced by most pregnant women who walk too much in water in long distance to collect water lilies, fire woods for cooking".** In Koch County, traditional birth attendants in Kuachlual Civil Hospital echoed the same. They said, **"Miscarriages are too much because of floods and contaminated dirty water".**

4-1-2. Oil pollution exposure

The Director General at the State Ministry of Health said, **"Oil contamination on water is the leading cause of miscarriages as most communities depend on fishing, waterlilies as source of living".** He showed the photos of massive fish allegedly died

from contamination in one of the ponds near Unity oilfields. The Chief Executive Officer for Bentiu State Hospital said, **"the cause is environmental, genetics, and maternal".** He did not give more explanation on the causes he mentioned. In Rubkona, a County health department administrator and some health workers reported that **"People in communities drink highly dirty polluted water. This puts their health at risk due to their proximity to the oilfields, leading to miscarriages".**

The health workers in Kuach Primary Healthcare Unit of Guit County reported that **"The average of miscarriage cases are approximately three cases every month which makes the total of approximately 36 miscarriage a year".** They linked this high number of miscarriages to the oil pollution chemicals on flood surface water. According to the said health workers, the miscarriages are high from June to October every year. They claims it is the period with heavy rainfalls, the seasonal floods increase as well as water which comes in contact with oil chemicals, leaks and oil spills. They linked the condition to the oil pollutants because the community are very near to oil production operated by SPOC.

In Mirmir Primary healthcare in Koch County, the rate of miscarriages range from 4-5 cases per a week. They claimed most cases of miscarriages came from a village called Buok which they said had oil wells. They linked it to contaminated surface water from the oil chemicals.

4-1-3.Malaria prevalence

Healthcare providers in Bentiu State Hospital, Koch, and Rier reported that most miscarriages are caused by malaria during pregnancy. They also identified malnutrition due to lack of food during pregnancy as another contributing factor. Another leading cause is anemia, which is also caused by malaria. However, some of the health facilities visited during the assessment did not report malaria as the leading cause of miscarriages.

4-1-4.Exposure due to other factors

Health workers in the selected health facilities of the three counties pointed out other factors with links to miscarriages. In Rubotna, insufficient food, hunger, and

consumption of dirty, unpurified flood water were reported. Health workers in Kuachlual Hospital in Koch Town reported that excessive heat in March, physical violence, and home domestic workload during pregnancy as the keys causes of miscarriages.

4-2.Birth defects

A total of 144 cases of birth defects reported in the three Counties including Bentiu State Hospital. In Rubkona alone 125 cases were reported. One respondent said, **"Two cases of deformed babies were referred to Bentiu State Hospital in 2022".** Medical personnel were unable to do anything for both babies. Photos of those deformed babies were shown as evidence. No illustration was given relating to the deformities nor were the causes stated. Health workers in Rotriak of Rubkona County said that, **"there were cases of malformed births in the community but they had not been reported to health facilities due to negative community perceptions".** According to the Community chief of the area, he stated that **"birth defects and frequent deaths of livestock are caused by the contaminated water mixed with oil waste chemicals".** During our assessment at Rubkona and Budang Primary Healthcare centers, no cases of birth defects were reported despite the data of birth deformities reported by the monitoring and evaluation department. This work covers health facilities inside Protection of Civilians sites (PoCs) but the protection mandate of the United Mission in South Sudan can be perceived that it is not directly extended to protection of civilians from environmental pollution caused by the oil activities, however, UNMISS warned in 2022 that, civilian should avoid eating fish due to floods water surface contamination.

At Kuach Primary Healthcare Unit in Guit County, health workers reported seven babies with different deformities at birth (one case in 2021, and six cases in 2022). One baby had no arms or elbows on one side (one case in 2021). Another baby was born with only one leg; one with no legs, and four with no female genitalia (six cases in 2022). Informants

interviewed at Kuachlual Civil Hospital in Koch reported that, babies born without eyes, ears, or lacking other body parts are commonly seen in the hospital and others payams in the County. They linked those cases to oil pollution contamination.

In Koch, four cases of deformed births were reported according to health worker interviewed. Two of these occurred in the community in 2019; one child was born with no limbs and another with no eyes. The other two cases were reported in Rier health Unit in the same year; one child was born with no nose and another with no ears. The TBA in Koch recount her experience and said, **"There were two cases: In February a child was born with disconnected body parts, and in March, a child was born with no spine or neck".**

Health workers in Rier also reported that, most malformed births are reported in the villages. They said that communities do not report some of those cases because of fears and shame. They reported two cases which occurred in July 2022. "One child was born with no body bones and died on the spot and the other was just a placenta". The parents (names withheld) are said to have moved to Koch Town for living. In February 2022, a clinical Officer in charge of Mirmir Primary Healt Care Center said **"one child was born with a defect in a village called Patit in Mirmir"**

One informant in Guit County reported that a child with an unknown deformity was born at Guit PHCC. Neither the month nor the year was remembered by the reporter. The informant also reported that cows were giving birth to deformed calves. Guit has Mala Oil Production shutdown during the conflict and the oil wells were left unprotected. When floods submerged area in 2021, it washed away the waste pits. They linked this to the effect of contaminated water. During the wet season, the community also takes water directly from surface water. Another informant said that the company (SPOC) brings clean drinking water twice a day for period from January to May but stops during the rainy season. (https://www.csrf-southsudan.org/county_profile/koch/)

4-3.Other health conditions

In Budang of Rubkona County, health workers reported other related health conditions including skin rashes, body swelling, and wounds on the genitals of young male boys. In Kuach of Guit County, health workers reported cases of abdominal distension, skin rashes, and cracked palms.

One respondent reported a case of a man with a distended abdomen who died en route to Bentiu. Other illnesses in animals (cows, goats and dogs) were reported. Strange symptoms were reported in the eyes of cows, which slowly turned inwards until the cow died. Similar conditions in livestock were reported in Rier and Koch. A humanitarian worker in Koch reported that brucellosis and syphilis are other causes of miscarriage and birth defects. There were few cases of hypertension in pregnancy in Bentiu State Hospital, with three cases recorded between January and April 2023. One case of pre-eclampsia was reported in Budang PHCC and a few unrecorded cases were reported in the Kuach Primary Healthcare Unit in Guit County.

4-4.Environmental contamination

Unity state surface land is much affected by floods. There are four oil producing counties, Rubkona, Guit, Koch, and Pariang (Now Ruweng Administrative Area). Guit County, has 55 oil wells, all submerged by floods which halted oil production according to County Health Department Director. He fears the oil spills are furthering the pollution to the Sudd complex diverse ecosystem. Air pollution due to smog being released from oil production processing facilities and power plant, causing respiratory illness, was also reported. The Executive Director for Relief and Rehabilitation Commission in Unity State, John Juang pointed out that **"the oil companies rushed for oil drilling without considering the feasibility study to help in protection of the environment",** blaming the lack of government commitment to apply the environmental policies to effect the environmental protection.

According to Director General at the State Ministry of Health, GPOC discharge waste chemicals on the ambient environment recklessly. He gave reference of a pipeline

ruptured in Budang Payam of Rubkona County in 2019 where a large quantity of oil spills filled vast surface of land. He admitted that oil leaks from the oil pipelines and drilling fluids contributed negatively to pollution of the environment. He shared the experience from the State Ministry of Health, stating that **"oil pollution has been a reality for a long time but its magnitude is unclear. It becomes difficult to determine the impact that flooding has had on aggravation of the pollution".** He further added **"oil is doing more harm than good".** The Ministry of Health in Bentiu admitted that the state government lacks the capacity to assess the environmental damage caused by oil pollution. The Director at the State Ministry of Health reported that Petronas had sold its oil share to a British oil firm called Savanah Energy. He believed that the company was trying to avoid taking responsibilities for the environmental damage it had caused.

Dr Banen Non, the Chief Executive Officer of Bentiu State Hospital, said that the devastating floods had submerged and destroyed much of the community homes, making living conditions poor. James Nyanya Puol, the Director of the Guit County Health Department, pointed out that 80% of the land has been submerged since 2019, with most of the population relocating to the highlands and some being displaced to other counties and Protection of Civilians Sites (PoCs). He reported that the Maale oil production site in Guit, including the 55 oil wells in the area, has been submerged by floodwater since the floods took over the area. Oil chemicals and pollutants from waste pits and flood surface water have become mixed up. This causes bioaccumulation in fish, animals and humans. He reported that, from June to December, community members fetch drinking water directly from swamps, as roads accessibility is impossible during the rainy season but during the dry season, communities near industrial sites benefit from clean drinking



Footage of SPOC water tanks and plastic barrels of water at Kuach Payam, Guit County on 19th April 2023 by Kor Leek

water provided by oil company, SPOC. During our visit to Kuach Payam, which has a population of more than 24,000, we saw a water tank. Before the flood, there was only one borehole.

In a separate statement, the County Health Director for Rubkona County, Mr Jal Kuol Malou, said that "environmental pollution has a direct effect on pregnant women because waste chemicals in ponds come into contact with flood surface water". He recommended fencing off waste pits and ponds to restrict community access, including that of domestic animals. He also said that the floods had displaced communities from their homes, causing them to move to dry land near the Unity Oilfields, which he said increased their health risks.

Chilop Puok, a Paramount Chief in Budang Payam, said that environmental degradation in his area is the biggest threat. He described how grazing lands had been affected by the floods, which had mixed with oil pollutants.

In Roriak, a community leader reported that, GPOC was "disposing of chemical waste in the river and floodwaters". He said that large company trucks carrying oil waste occasionally head towards the river and dump oil wastes chemicals there. The community recounted how they had rejected a request from the company (GPOC) to use their land as a dumping ground. He recounts, the community did not know where the company had dumped the waste. He recalled that the trucks carrying oil wastes went back in the direction of Pariang.

Jackson Gatluak, the Director of Koch County Health Department, said **"environmental poisoning poses a significant threat, as oil companies are irresponsibly dumping chemicals".** He expressed concern that the streams flowing through all 11 payams are transporting contaminants.

An eyewitness said that SIPET, a subcontractor company contracted by SPOC at the Tharjaith oilfields, had dumped oil chemical wastes along the roadside between Rier and Koch Town. He described how such 'reckless chemical wastes disposal has poisoned

swamps and pastures used for cattle grazing, risking the health of livestock and humans'. Other health department officials said that the driver who dumped the waste was arrested by the police, but no case has been opened against the company since then. They said that the case had been referred to Juba, but they were not aware of the outcome.

A community chief from Rier said, "There is too much pollution here, which is affecting the health of humans and animals because of contaminated water and air." He mentioned new, unknown diseases that are killing their livestock, especially cows. He linked these diseases to oil wastes chemicals from the Tharjiath oilfields. He also mentioned that the water from hand pumps in Rier is salty and bitter, making it unsuitable for consumption. He mentioned that a subcontractor company named Panloy conducted an assessment and took soil samples for testing last year. He referred to an environmental audit conducted by the said company along with other two international firms. Health workers in Reir revealed that health problems worsened in 2018 when oil production abruptly shut down due to conflict.

4-5.The impact of oil pollution on livestock

Livestock are a source of income and livelihoods for the local community in Unity State. The devastating floods and ongoing oil activities in the Unity and Tharjiath oilfields are a cause for concern. Local communities in Roriak, Kuach and Rier have reported that **"oil pollution is endangering the health of their livestock".** They said that **"their cattle are dying daily because of the oil which has contaminated the water and grazing grounds for their livestock".** The chief of the Roriak community explained that **"if a cow dies,**



Footage of dead cow at the road side in Rier Tharjiath oilfields 29th April 2023 by Kor Leek

even the birds and dogs cannot eat its meat". A Payam leader called for the vaccination of cows to prevent them from dying.

A community member in Rier described the new symptoms being experienced by the cows. "The cows die suddenly after returning from the grazing sites." The majority of community members said that when cows sustained an injury, the wounds developed an infection very quickly, with lumps appearing inside them. In Guit and Koch counties, cows have developed a disease where their eyes disappeared shrinking in and they die after a few days. One community member said that they had approached the SPOC Company through the Office of Community Development (CD) about the problems facing their cattle, but had not received a response.

A veterinarian in Koch Town said that cattle herders from the community had reported cases of deformed calves being born to their cows. He reported one deformed calf and frequent premature births of female animals, which he attributed to poisoned water and contaminated grass. The picture shown in the report is a dead, undecomposed cow near the Tharjiath oilfields in Rier. It is unclear whether the cow died from poisoning or from animal diseases. Neither birds nor insects ate its meat.

5. Discussions and analysis of the empirical findings

5-1.Deliveries

A delivery is the normal birth of a child after a full nine months of pregnancy. The findings on deliveries illustrated in the above table reflects the birth registry data for Bentiu State Hospital, Rubkona County Health Facilities, Guit County Health Facilities and Koch County Health Facilities from 2021 to April 2023. The data indicates that Rubkona has a significantly higher number of births than Bentiu Hospital and the two counties combined. Rubkona County is home to the largest IDP camp (formerly a Protection of Civilians site). The IDP population in Unity State lives inside the camp, which falls under the aforementioned County.

Many NGOs, including MSF, have set up healthcare facilities in the IDP camp to provide services to civilians. Reports from these facilities are submitted to the County Health Department in Rubkona. Bentiu Hospital ranks second, followed by Guit and then Koch. However, the data obtained by our assessment may not be accurate for the last two and a quarter years. Although the delivery data was extracted from the health facilities' systems, we have not provided or seen the weekly or monthly reports generated by these facilities, except for Budang PHCC, which only provided a three-month report. Most of the health facilities assessed lack qualified healthcare staff. Insecurity and displacement also disrupt the management of health facility data, which affects proper recording. The Director General at the State Ministry of Health, Dr. Duol Biem, confirmed that reproductive health data is inconsistent because most reports entered into the national ministry of health's DHIS 2 system are incorrect (he referred to reports generated by maternity departments).

5-2.Still birth

Stillbirth (also known as fetal death) occurs when a baby dies between 20 and 27 weeks of pregnancy. It is sometimes referred to as an early, late or pre-term birth. In total, there were 44 stillbirths reported, with Guit County leading with 16, followed by Koch. Rubkona registered zero. In the case of Rubkona, the health department registry has not reflected stillbirths records for the last two years and three months, and no justification provided. This may be due to poor record-keeping. Rubkona has three specifications:
(1) It is highly populated, with a large number of births records. (2) It has been severely affected by devastating floods. (3) It has more healthcare centres, which are mostly run by well-trained midwives recruited by international organizations, compared to Guit and Koch.

Generally, the data quality of the health departments in Rubkona County and the other two counties is inconsistent. There are no explanations for the causes of stillbirths, though communities near oil production sites reported a high incidence of stillbirths. There is no substantiated evidence to support these claims.

5-3.Miscarriages

A total of 1,639 miscarriage cases were collected from six health facilities, including Bentiu Hospital. The empirical findings are as follows: Rubkona registered 784 cases, Bentiu Hospital registered 448 cases, Guit registered three cases, and Koch registered 404 cases. The causes can be attributed to the following factors: Malaria was regarded as the leading cause of miscarriage at Bentiu State Hospital and Rier and Kuaclual Hospital in Koch County, which have been linked to heavy flooding. The floods offered a breeding ground for mosquitoes, which carry malaria. Pregnant women infected with malaria could not easily access health facilities for early treatment due to flooding, which cut off most of the facilities. Mobility in flood-affected communities is challenging. Canoes are the only means for local transportation use as means to generate incomes, but they are expensive to hire and the water is too deep to walk through to access healthcare. Canoes are also tiresome and time-consuming, except for those residing in IDP camps (formerly PoC). About 700,000 people are displaced every year since 2019 by seasonal floods caused by climate change amongst a number of likely factors (PAX report, May 2023). In Guit, 80% of the county's land is submerged. Guit Primary Health Care Centre is reported submerged. The Office of the County Health Department has relocated to Bentiu State Hospital to coordinate health activities. Community believes that, since floods submerged many places, Malaria prevalence is high which they linked that malaria is a major contributor to miscarriage and premature births.

Malnutrition due to hunger is the third leading cause of miscarriage in pregnant women. The catastrophic floods which displaced the community, submerging their farmlands and increasing the risk of starvation. They cannot grow or produce their own food. Civilians in Unity State now depend on water lilies and fishes. Women collect water lilies in swamps that are allegedly contaminated by oil leaks and spills. Pregnant women need a balanced diet for the health of both mother and fetus. Lack of balanced diets during

pregnancy compromises the mother's immune system, making her susceptible to many infections.

Oil contaminants passing through food chains are the fourth leading cause of miscarriages. Health staff in the Rubkona, Guit and Koch counties said that frequent miscarriages are caused by oil pollutants coming into contact with floodwaters. Community suspects oil pollutants to be responsible for many new health ailments, such as increased infertility in women, a higher number of miscarriages and eye and skin problems (Cordaid report, 2021). The food chain is the main pathway to the human body. A community chief in Melut County, Upper Nile, was quoted in a PAX report as saying:

> "We are getting contamination from water, milk and food because of the petroleum pollution. Before the oil, there were no diseases. Oil has brought diseases."

Floods caused by climate change pose health in Unity State. It furthered environmental pollution when floods surface water mixed up with oil spills and leaks from pipelines. Chemical wastes, drilling fluids and produced water are disposed in ponds near residential areas. The unsafe handling of oil wastewater poses a high risk to surface and groundwater (PAX Report, 2023). According to a report by the Sudd Institute (January 2021), produced water carries harmful contaminants, which is risky when it comes into contact with rainwater and floods, resulting in loss of life. There is no strong scientific evidence to support the claims that frequent miscarriages, stillbirths and birth defects are the result of oil pollution. During interviews with officials, community leaders and healthcare workers, no clients or victims claimed to have been affected by oil pollution. This report advise that, it is imperative to talk to oil victims so that samples can be taken for scientific testing to prove the claims.

5-4.Birth defects

Birth defects refer to abnormalities in a baby's body at birth. Cases of birth defects have been reported by the local community and healthcare workers in various assessed health facilities in Unity State. This coincides with some literature. In Melut County, Upper Nile State, about 13 cases of birth defects were reported, including spinal bifida, facial and head deformities, deformities of the sexual organs, limb deformities and growth retardation (Sudd Institute Report, 2021).

Our work found a total of 135 cases of birth defects in various visited health facilities, as indicated in the above table. Rubkotna County alone accounted for 125 cases of birth defects. Unfortunately, no single victim met to prove or to justify what had happened for example to a child. We saw photos of birth defects at Bentiu Hospital and Kuachlual Civil Hospital in Koch. Health workers and the local community attributed these to chemicals mixed with the floodwaters, as pointed out in the PAX report (2023). Birth defects are being reported in communities close to oil areas. Some sources have reported a link between birth defects and oil contamination. A report by Sign of Hope in Germany revealed a strong link based on laboratory analysis of samples they investigated comprising of hair, milk, water, drilling fluids, produced water, oil spills and leaks, soil, grass, fish and meat, to mention a few. The chemical composition of these samples revealed the presence of heavy metals. (Klaus and Sabine, 2016). This joint assessment work has not commissioned this step, which is recommendable.

5-5.Environmental Impact and the livestock

Some respondents interviewed in Rotriak, Koch, and Guit expressed concerns about oil poisoning, as seasonal flooding brings surface water into contact with drilling fluids and heavy metals such as lead and cadmium. The presence of heavy metals was confirmed by Sign of Hope's scientific research on samples collected in Block 5A of the Tharjiath Oilfields (Klaus and Sabine, 2016).

The four years of devastating floods have destroyed the ecosystem, having an adverse effect on the ecology. Forests have withered and plants have died, including grassland.

The community chief in Rotriak village stated that “floods and oil pollution had caused land degradation, leaving nowhere safe for cattle to graze”. One official stated that:

'The government rushed to start drilling for oil without considering the environmental impact.'



Destroyed ecosystem in Guit County, photo taken on 22nd April 2023 by Kor Leek

A government official interviewed for this study stated that, Unity State Government lacks the capacity to conduct environmental assessments to measure the damage caused by oil pollution and flooding. Another respondent in Roriak village pointed out that they had witnessed large trucks carrying oil production waste being disposed of in swamps near their villages, and sometimes in the direction of Paraing. They suspected that the truck drivers were looking for places to dispose of oil waste.

Livestock represent an important source of livelihood for the local community in the oil-rich state of Unity. Oil investment has not changed their economic situation. They rely on farming, which has been destroyed by flooding, as well as depending on fishing and cattle. They reported that the health of their livestock is being affected by oil pollution. They claim that their cattle are dying daily from what they suspect is oil poisoning. In Rotriak, a community chief explained that 'if a cow dies, not even the birds or dogs can eat its meat'. A Payam leader called for the vaccination of cows to prevent them from dying. A vet in Koch pointed out that the cattle-rearing community in Koch has reported frequent premature births, which they had not experienced before. He is worried about this. A local trader in Rier reported the deaths of 200 cattle in 2009 and linked these to oil poisoning. During our visits to the oil fields in Rier including Petpet, we saw some dead cows by the roadsides. The freguent death of those cattles could be linked to some diseases reported by communities in Guit, Koch and Roriak.

However, it is not possible to directly link these causes of death to oil pollution. These cases should be noted and further investigations carried out, such as sample testing. Floods are one of the leading causes of death for cattle or livestock. This is because cattle move and graze in water. Water-borne diseases related to animals cannot be excluded or contained in such scenarios. Drinking from unsafe water and a lack of vaccinations are some of the issues the community has to consider as problems affecting their cattle.

6. Challenges of the assessment

6-1. Insufficiency of basic data in local health facilities

During our interviews, we requested that local health facilities (hospitals, PHCCs/PHCUs) disclose their data on pregnancy, delivery and miscarriage cases to help in establishing a critical analysis, but they did not have proper data recording systems in place, such as a monthly rate of spontaneous abortions. We relied on information obtained from respondents through oral interviews, which do not scientific proof and less accurate.

The county health departments provided some data o miscarriages at counties levels, but not at the levels of each PHCC/PHCU. Although we presumed that PHCC/PHCUs closer to oil facilities had a higher miscarriages rate than other PHCC/PHCUs, we could not verify this.

6-2.People either don't have or don't reveal information about birth defects

As the issue of birth defects is very sensitive within the community, health personnel and community members do not have or reveal specific information about cases of birth defects. Health workers told us that cases of deformity are perceived as a kind of 'taboo' in the community. In many cases, we were told that families with deformed babies had already left the community and that their whereabouts were unknown. Therefore, we were unable to meet any family members of deformed babies or their mothers.

6-3.Logistics

As our team does not have its own offices or cars in the target counties (Rubkona, Guit and Koch), we had to hire four-wheel-drive vehicles. As car hire was so limited there, the poor condition of the cars we hired caused us a lot of difficulties. The cars often got stuck due to the poor road conditions, which significantly affected our schedule. We had to shorten our time in the communities and even cancel some visits.

6-4.Floods

Access to some target communities was unavailable due to flooding. In particular, some remote locations such as the Mala oilfields in Guit and Buok village in Koch were not accessible by car or on foot, despite being potentially seriously affected by oil pollution according to interviews with the local community. We were advised not to visit those locations.

6-5.Access to oil facilities

As the oil companies' security did not give us permission to enter the facilities due to sensitivity, we could not observe the chemicals wastes disposal systems. However, near the Thar Jath oil field, we had an opportunity to visit the waste treatment ponds on the side of the road.

7. Conclusions

1. The wider negative impacts of oil facilities:

   Most health personals, including local government officials and community members, said that oil facilities have wider negative impacts on the environment,

human health and animal health. Local government officials in Unity State say that appropriate assessments should be conducted by independent bodies.

2. Less data to support the negative impacts:

   More scientific study is needed to support these claims since the objective data obtained requires more verification. Despite many reports published by international research organizations and individual's researches regarding this outrageous concern, South Sudan government has not made public any reports on the negative impact of oil pollution based on data collected from local health facilities. Furthermore, it is imperative establish a causal relationship between oil pollution and health/environmental issues to help identify oil polluted related birth defects from other birth defects related to other health conditions.

   Additionally, cross-sectional study is recommended on birth defects to enable comparisons to be made between Unity State and other states in the country, between areas near and far from oil fields, or between particular periods before and after the operation of oil facilities.

3. Responsibilities of oil companies:

   Oil companies have acknowledged the issue of oil pollution. However, the community reported that, despite this acknowledgement, the companies are not doing enough to address the issue. No effective mechanisms applied to ensure environmental protection and community health. Oil activities continue to pose risks to the communities and their livestock without compensation on oil victims. This was reported by communities in Kuach and Rier. The oil consortia have not investigated the impact of their chemicals oil wastes (oil wastes chemicals) or oil leakage on local residents. They have even made unlawful dumping in the vicinity of the villages several times, according to the communities. Their chemicals wastes is not being managed appropriately. We found that their chemicals disposal and wastes pools are not fenced, meaning that domestic and wild animals, as well as

children, can enter and access the water. Health workers called for more investigations on oil risks factors stemmed from waste chemicals and demanded a holistic crude oil exploration, safe drilling and complete protection of the environment from the oil pollution that meets environmentally practicing standards.

4. The most severely affected people are hidden/unknown:

   According to local health personnel, certain communities, such as Buok and Maale, have been severely affected by the oil pollution. However, due to their remote location and the flooding, it is difficult to access these villages. A Paramedic in Mirmir suggested that the reason for the heavy impact of pollution in these villages is that people depend on surface water, as water tankers providing clean water cannot access these communities. He further said that, the birth defects linked to oil pollution on those locations are difficult to be traced, making it hard to be reported by the health authorities. He pointed out that **"Some families feel ashame to report such cases because of fear of taboo and negative misconceptions without relating it to oil pollution impact".**

8. Recommendations

This field research assessment is a critical component of current efforts to promote responsible environmental management and sustainability in the villages surrounding oil fields in Unity State, South Sudan. These systematic interviews and assessments are designed to scrutinize the processes and outcomes of exploration and extraction activities carried out by the oil sector.

1. The government should investigate the data and records of local health facilities (PHCCs, PHCUs and hospitals) to identify negative impacts on the health of local populations in Rubkona, Guit and Koch Counties. A comparison should be made

between the possible affected areas and other areas. Additionally, changes in the number of birth defects over time should be investigated.

2. The government should assess cases of illegal chemicals wastes dumping carried out by oil companies and take action to stop it.

3. Regarding the current environmental audit, the government should disclose its progress and hold open sessions/meetings so that civil society and local residents can attend and express their opinions.

4. The government should allow civil society organizations, including institutes, universities and NGOs, to conduct further research into the impacts of oil pollution. More field assessments should be carried out, with interviews of the affected populations, particularly in remote locations. On the other hand, scientific research into soil, water, livestock, wild animals and humans should be conducted to determine the impact of different chemical substances.

5. Health institutions in oil-producing areas should raise awareness in the community and encourage reporting of any children born with defects for documentation, which will help with data analysis for decision-making purposes.

6. The government should develop long-term solutions to address the climate change crisis particular the issue of floods in oil producing areas.

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APPENDIX

The schedule of the assessment

April, 2023

		Location	Meetings and interviews
19th	Wed	Bentiu Rubkona County	State RRC, State Ministry of Health, Bentiu Hospital, Health Department of Rubkona County
20th	Thu	Guit County	Health Department of Guit County, Kuach PHCU
21st	Fri	Rubkona County Budang Payam	Payam Director, Roriak community office, Budang PHCC, Traditional leaders in Roriak
22nd	Sat	Unity Oilfields Manga	Oil fields(observation) Oil Refinery in Manga (observation)
23rd	Sun		Holiday
24th	Mon	Bentiu Rubkona County	Health Department of Rubkona County, State Government Office
25th	Tue	Koch Koch County	Koch County RRC, County Commissioner, Health Department of Koch County, Koch Hospital
26th	Wed	Koch Koch County	NNGO（UNIDOR）, Midwives in Koch Hospital, Local veterinarian in Koch
27th	Thu	Rier village Koch County	Local officials in Jaak Payam, Payam chiefs, Rier PHCU, Chemical water treatment plant at Tharjaith Oilfields(observation)
28th	Fri	Mirmir Payam Koch County	Mirmir Payam Leader, Mirmir PHCU
29th	Sat	Rier village Koch County	Rier local residents