6.1 Study Questionnaire:

Sudan University Of Science And Technology

Haemoglobin F (Hb F) Levels and Haematological indices in Hydroxyurea Treated Compared to Conventionally Treated Sickle Cell Anemia (SCA) Pediatric Patients in Sudan

Sample No: ***( )***

Sample from Group ( )

Date: ----------

1. Name

2. Age

3. Gender

1- Male 2- Female

4. Place of Leaving

5. Tribe

6. History of Crises

1- Yes

2- No

3- First

7. Type Of Crises:

1- Haemolytic Crises

2- Vaso-occlusive crisis

3- Sequestration Crises

4- A plastic Crises

8. Onset (Frequency / Year) :

9. Duration of Crises: (Hospitalization)

10- On Hydroxyurea

1- Yes

2- No

11. If Yes ...

1- continuous
2- Intermittent
3- The Dose: .....

12. Note The Duration Of Regular Treatments

13.Note about blood transfusions:

14. Sickling Test:

1- Positive +Ve 2- Negative -Ve

15. Haemoglobin Electrophoresis:

16. Complete Haemogram Figures?

® 18. Ethical Consideration:

1- WBC Correction	2- RBC	3- HGB	4- HCT	5- MCV	6- MCH	7- MCHC	8- PLT	9-Retics
10- Normocytic Normochromic		11- Micro	12- Macro	13- Sickled	**17- Hb F %** ----------			

1- Agree 2 - Hesitant 2 - Disagree

□□□□□□□□□□ □□□□□:

انا الموقع أدناه أقر بانني قد علمت تماما الغرض الذي من اجله تم اخذ العينة واوافق بكامل ارادتي علي هذا الغرض عن نفسي او عن الشخص المسئول عنه.

التوقيع: _____

Dear sir; the above inquiries are concerned with a study to Determine (Hb F) Levels and Haematological indices in Hydroxyurea Treated Compared to Conventionally Treated Sickle Cell Anemia (SCA) Pediatric Patients in Sudan . This study has been approved by Sudan University of Science and Technology, and data provided by you will be used for the sake of this study only. We recommend accuracy and honesty in your answers. The researcher will be very happy to answer your questions.

6.2 Heglig hospital

Heglig is an industrial petroleum area in south-west Kordofan (western Sudan). The main residents in the area are the migratory tribes (mainly Mesareia), armed forces with their families, in addition to employees of petroleum companies working there.

Heglig hospital, which is located in the center of the area, was founded in May 1999 by Greater Nile Petroleum Operating Company (GNPOC). Hospital costs are completely funded by the same company. It houses five wards: two medical wards, two surgical wards, a pediatric ward and obstetrics and gynecology ward; with a total of forty two beds. There is also a neonatal nursery, a minor theatre, a major theatre, an ICU, a dental clinic, medical lab. a radiology department , pharmacy , an ambulance and a Helecopter landing station.

The hospital medical staff includes five general practitioners and an obstetrician with 4 weekly rotation , a resident surgeon with a biweekly rotation , three sisters , eight nurses , two anesthesia assistants, two surgical scrub nurses , a midwife, a health visitor, an X-ray technicians , a pharmacist and two lab technicians. All with the same rotation system as the GPs. all medical services are provided totally free to the patients.

The main gate of Heglig hospital

Sudan

6.3 Fuel Composition and Nitrogen Oxide (

Nitrogen oxides are released during the combustion of fo n 2 different ways. The first is called thermal production and arises from t spheric nitrogen and oxygen in the high temperature of a flame to produ $O_2 = 2$ NO).

The second source of NOx comes from organically bound nitrogen in the fuel as amines and other organic compounds and from ammonia and other volatile forms of nitrogen compounds released during pyrolisis by the high temperature. An example of one such oxidation may be represented by the following *schematic* reaction:

$X\text{-}CH_2\ NH_2 + 3O_2 = CO_2 + 2H_2O + NO_2 + X.$

There is no organic nitrogen in natural gas, but it ranges from zero to nearly 2% in petroleum, and 1 to 2% in coal. Wood contains very little nitrogen, but leaves and stalks of grasslike plants contain 1–2%. Coal is by far the largest producer of NOx with the ratio of fuel NOx to thermal NOx being as much as 2:1 depending upon temperature and other combustion conditions.

NO is rapidly further oxidized by several pathways to nitrogen dioxide, NO2, in a matter of minutes. It is the mixture of NO and NO2 that is normally referred to as NOx. (NO + [O] = NO_2).

The amount of NOx produced increases with flame temperature, gas pressure (it is worse in high compression internal combustion engines) and with longer flame contact time. Thermal and fuel nitrogen are oxidized by different mechanisms and hence may not respond similarly to all emission reduction technologies.

The formation of nitric acid provides the major route by which these reactive nitrogen oxides are removed from the atmosphere as acidic precipitation.

The average atmospheric lifetime of NOx is fairly short in the atmosphere; about one day or less in polluted urban atmospheres, and 5 to 10 days in the upper troposphere. Because of their short atmospheric lifetime, NO and NO2 are not uniformly distributed, and the concentration varies by over 5 orders of magnitude from about 1 ppt over the remote Pacific oceans to more than 100 ppb in urban regions like New York or Beijing

Nitrogen Oxides Emissions at Muglad (near Heglig) Basin Area:

Oil production and started on this area on 1995 by Greater Nile Petroleum Company – GNPOC. There are many sources for nitrogen oxides emissions in the area; the major sources are stated below:

1- Crude oil combustion for power generation and massive crude pumping [pump stations].
2- Internal combustion in diesel trucks' engines working in the area.
3- Grass fires during the dry season for agriculture and compacting insects that harm cattle of the local people.
4- Produced gas flaring in the production facilities of GNPOC.

Nitrogen Oxide Emissions Calculations:

Estimates of nitrogen oxides emissions are based on the amounts of elemental oxygen to are transformed to the oxide during combustion. For example, consider the simple compound CH_3-NH_2;

- The molecular weight is 12+3+14+2 = 31
- The percentage of nitrogen in the compound is [14/31] X 100 = 45 %
- So, one kilogram of this material contains 0.45 kg of nitrogen
- If one nitrogen atom gives on e molecule of the oxide NO_2, we can say that 14 kg of nitrogen gives [14 + 16 +16] 46 kg of the oxide
- We can easily calculate the amounts of NO produced from one kg of CH_3-NH_2 [it should be 1.5 kg of NO_2]

As per GNPOC production and power plant daily reports, the fuels consumed in GNPOC fields on a daily basis are shown in table below. The diesel consumption represents the average monthly supply of diesel [number of tanker received in a monthly basis].

Fuel Type	**Total Nitrogen**	**Daily Consumption**		**Nitrogen**	**NO2 Emissions**
	ppm	**m^3/day**	**kg/day**	**tons/day**	**ton/year**
Crude oil	980	98	83.3	0.82	48.3
Diesel	3.5	1000	880	0.003	1.56
Flared Gas	5000	3012	1747	8.73	5166
Total				**8.82**	**5216**

Reference for appendix no 6.3

William R. Moomaw 2002; Energy, Industry & Nitrogen: Strategies for Decreasing Reactive Nitrogen Emissions; Published by Royal Swedish Academy of Sciences; http://fletcher.tufts.edu/ierp/pdfs/184-189.sep.pdf.