COMPARATIVE AIR QUALITY OF PETROLEUM DEPOTS AND REFUELLING STATIONS ATMOSPHERIC ENVIRONMENTS IN NIGERIA

PRESENTED BY

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INTRODUCTION:

- Petroleum and petroleum products (including diesel, gasoline and kerosene) are known to be very useful in domestic and industrial activities.
- Gasoline and kerosene are known to be very volatile, and release some toxic chemical substances into the environment.
- These chemical substances constitute chemical contaminants in the atmospheric air.

- The chemical constituents of petroleum products that contaminate the air on their release are mainly the hydrocarbons.
- Most of these hydrocarbons, including benzene, are known to pose adverse effects to the environments
- Hence, the use of petroleum products, either in automobiles and industrial operations, or domestic activities has been reported to pose adverse effects to quality of the air (Guarieiro,2013)

- Particularly, a high level of benzene in the breathing zone of fuel service station during refueling of automobiles has been reported (Tatrai et al, 1981).
- Exposure to toxic substances, which constitute pollutants in the environment, has been a major concern in recent times.
- Exposures to toxic environmental pollutants are known to cause several hazardous conditions and health challenges to both animals and humans (Briggs, 2003; Ajugwo,2013)

- Duarte-Davidson *et al*, 2001 reported that during refueling, the content of benzene in petrol (about 2%) is dependent on petrol station exposure, time spent at the petrol station and availability of vapour control devices.

- According to Tatrai *et al*, 1981, levels of benzene around the breathing zone are on significant increase in refueling stations, petroleum product depot and flaring sites which apparently humans inhale in the process of refuelling.

- Modifications of genetic compositions with consequential environmental and health consequences are among the hazardous conditions associated with exposure to environmental pollutants (Grether, 2005).

- **Hence this study assessed the comparative air quality of petroleum depots and petroleum products refueling stations and gas flaring sites in Nigeria.**

MATERIALS AND METHODS:

- Air quality measurement assay was carried out at ten NNPC depots, twenty refuelling stations, storage facilities and gas flaring sites via the Gaussian approach across the Niger- Delta regions of Nigeria

- using instrumental methods -aeroqual air quality kit (aeroqual environmental monitor series 300) by Aeroqual limited.

- The determination of the prevailing meteorological parameters such as noise levels, relative humidity, wind speed, wind direction (south-westerly wind),and temperature using pre- calibrated Envirotech meters.

Materials and Methods Cont'd

After the initialization of the equipment, the following parameters were measured with time, prevailing wind (south westerly wind) and weather conditions (a cloudy and partially sunny day) such as: Noise level, Temperature, Relative humidity, Wind speed.

The noise level was measured using Extech instrument (407730) sound level meter. The Extech meteorological meter (45170, CPILU China) was used to measure wind-speed, temperature and humidity.

Nigerian Ambient Air Quality

Pollutants	Time of Average	Limit
Particulates	Daily average of hourly values Hourly value	250µg/m^3 600*µg/m^3
SO_x as SO_2	Daily average of hourly values Hourly value	0.01ppm (26µg/m^3) 0.1ppm (260µg/m^3)
NO_x as NO_2	Daily average of hourly values (range)	0.04 – 0.06ppm (75-113µg/m^3)
Carbon Monoxide	Daily average of hourly values 8 - hourly range	10ppm (11.4mg/m^3) 20ppm (22.8mg/m^3)
Petrochemical Oxidants	Hourly value	0.66ppm
Non-Methane Hydrocarbon	Daily average of 3-hourly values	160µg/m^3

WHO Air Quality Guidelines

Pollutants	Time- Weighted Average[a]	Averaging time
SO_2	500	10min
	300	1h
	100 - 150[b]	24h
	40 - 60[b]	1yr
CO	30	1h
	10	8h
NO_2	400	1h
	150	24h
O_3	150 - 200	1h
	100 – 120	8h
Black smoke	100 - 150	24hr
	40 - 60[b]	1yr
Total suspended particulates	150 - 230[b]	24hr
	60 - 90[b]	1yr
Thoracic particles (PM_{10})	70[b]	24hr
Pb	0.5 – 1	1yr

[a]All concentrations in μgm^{-3} except CO in mgm^{-3}

[b]Guideline values for combined exposure to SO_2 and suspended particulate matter (they may not apply to situations where only one of the components is present)

US National Ambient Air Quality Standards (NAAQS

Pollutants	Average Time	Primary Standard[a]
SO_2	3h 24h Annual average	- 365µgm^{-3} (0.14ppm) 80µgm^{-3}
NO_2	Annual average	100µgm^{-3} (0.05ppm)
NO	1h 8h	40mgm^{-3} (35ppm) 10mgm^{-3} (9ppm)
O_3	1h	235µgm^{-3} (0.12ppm)
Black smoke	100-150 40-60[b]	24hr 1yr
PM_{10} (d≤10µm)	24h Annual average	150µgm^{-3} 50µgm^{-3}
Pb	3months	1.5µgm^{-3}

RESULTS

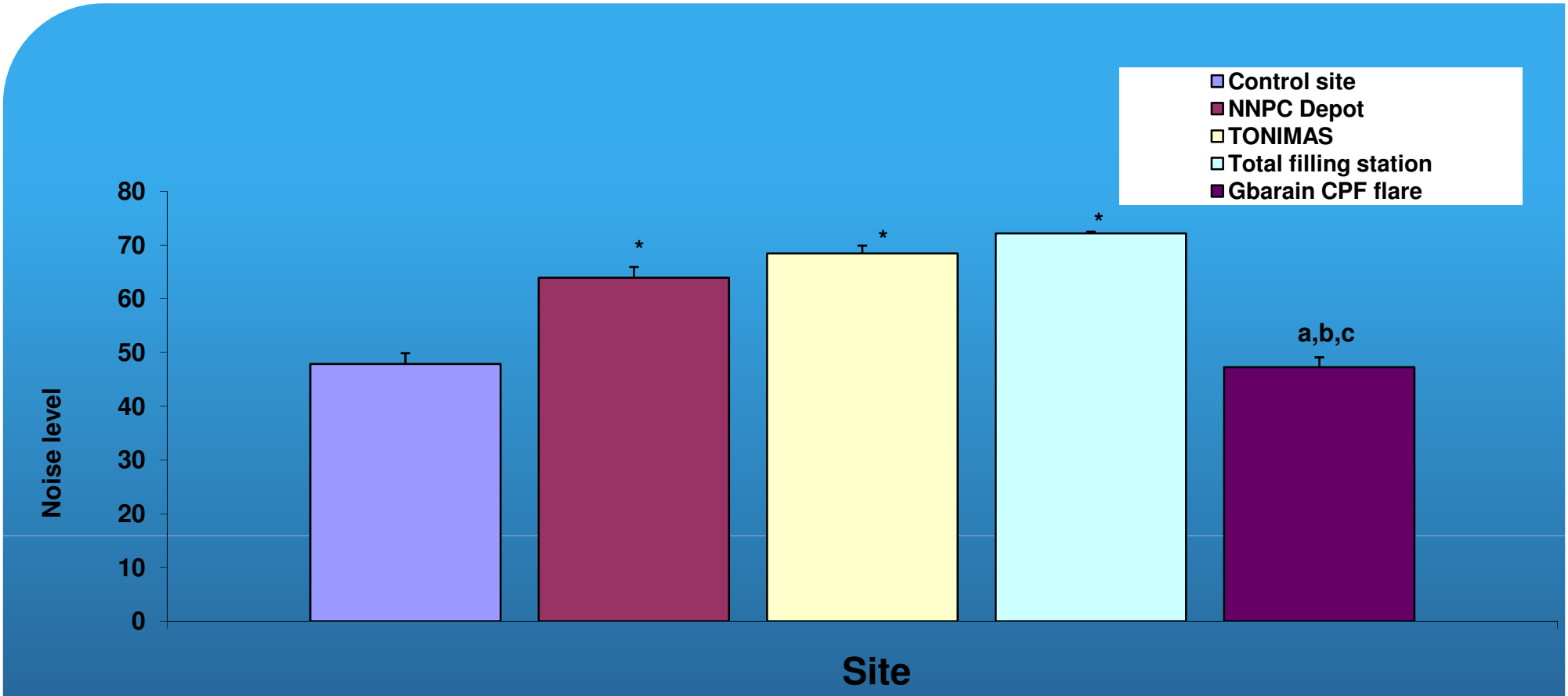

Figure 1: Noise levels measured in control site, flaring sites and different filling stations in Nigeria.
Values are expressed as mean ± SEM.

***significantly different from control site at p<0.05;**
a = significantly different from NNPC Depot at p<0.05;
b = significantly different from TONIMAS at p<0.05;
c = significantly different from Total filling station at p<0.05

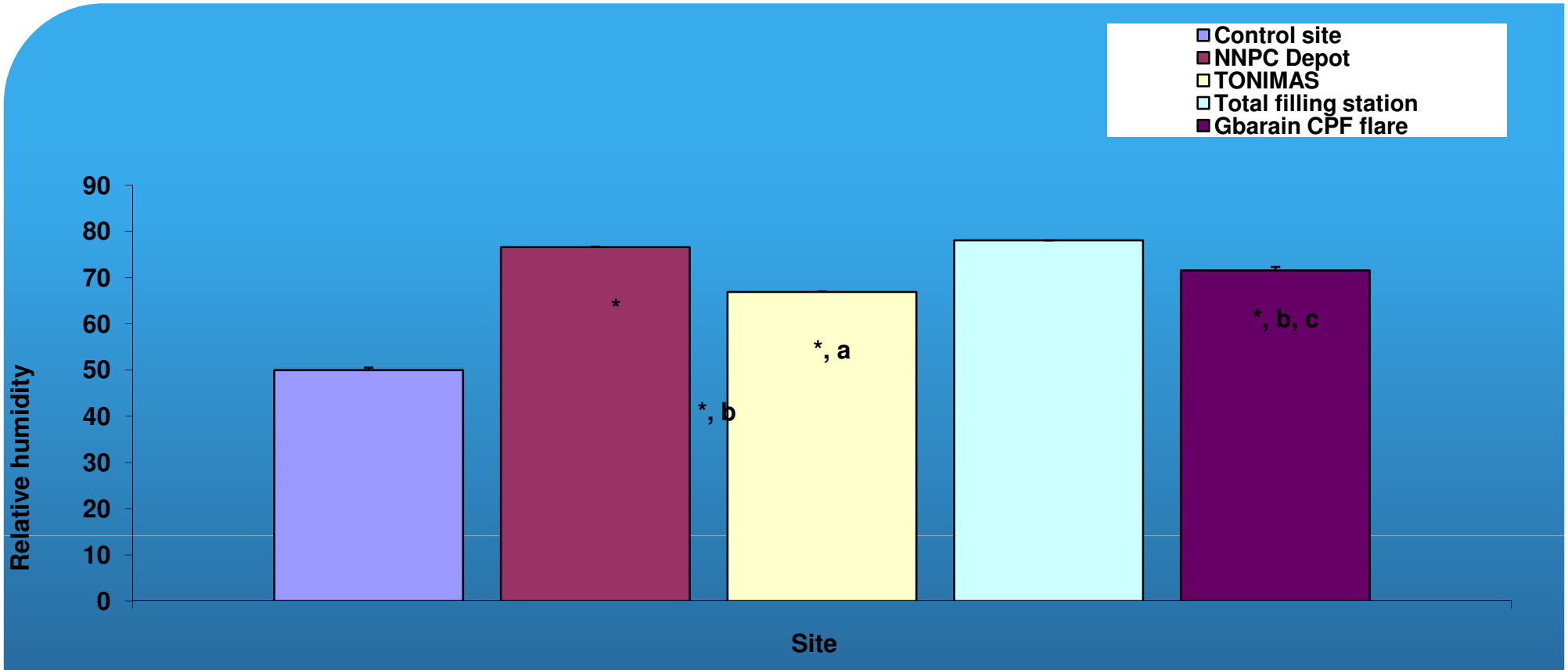

Figure 2: Relative humidity measured in control site, flaring sites and different filling stations in Nigeria. Values are expressed as mean ± SEM.

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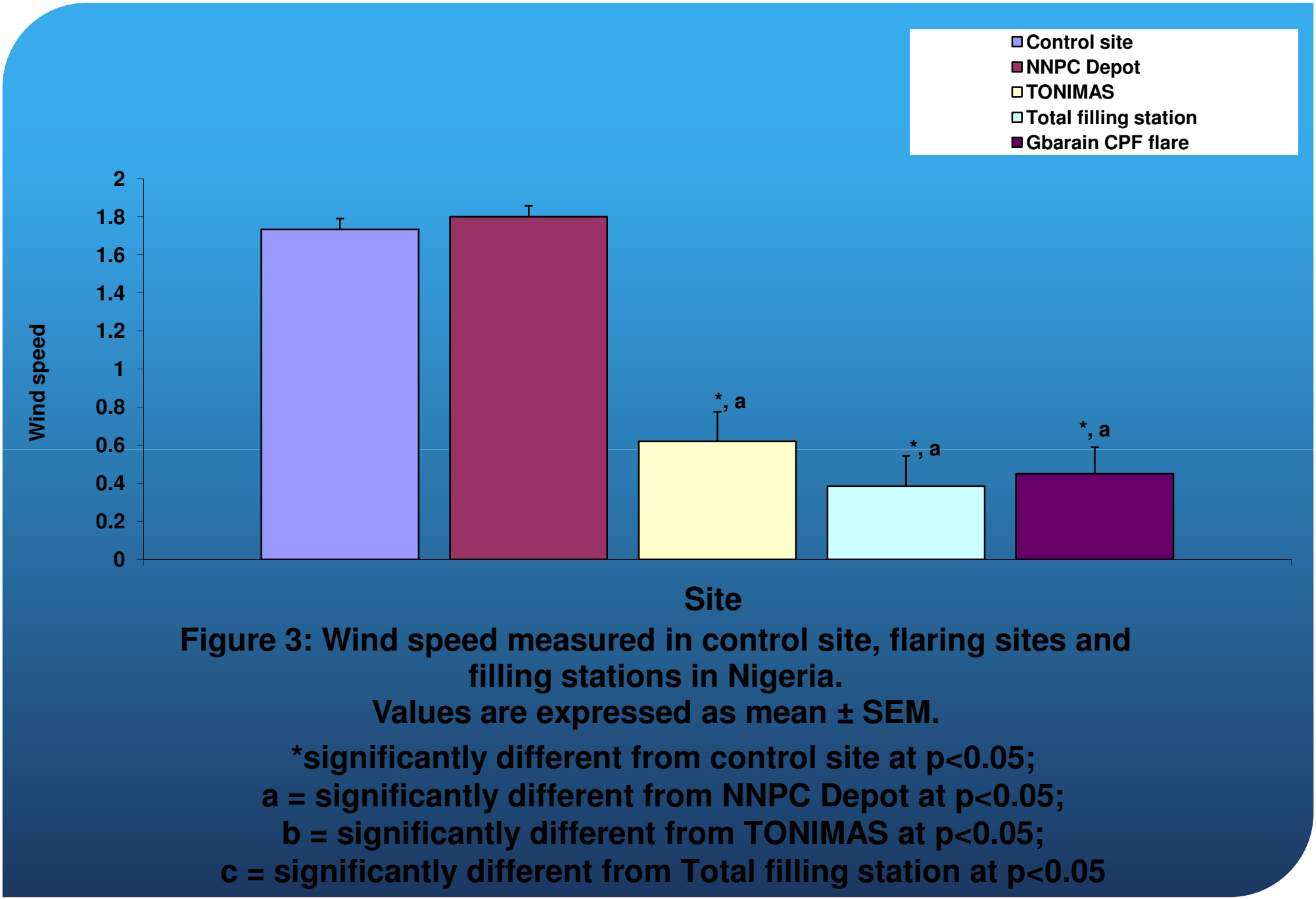

Figure 3: Wind speed measured in control site, flaring sites and filling stations in Nigeria.
Values are expressed as mean ± SEM.

***significantly different from control site at p<0.05;**
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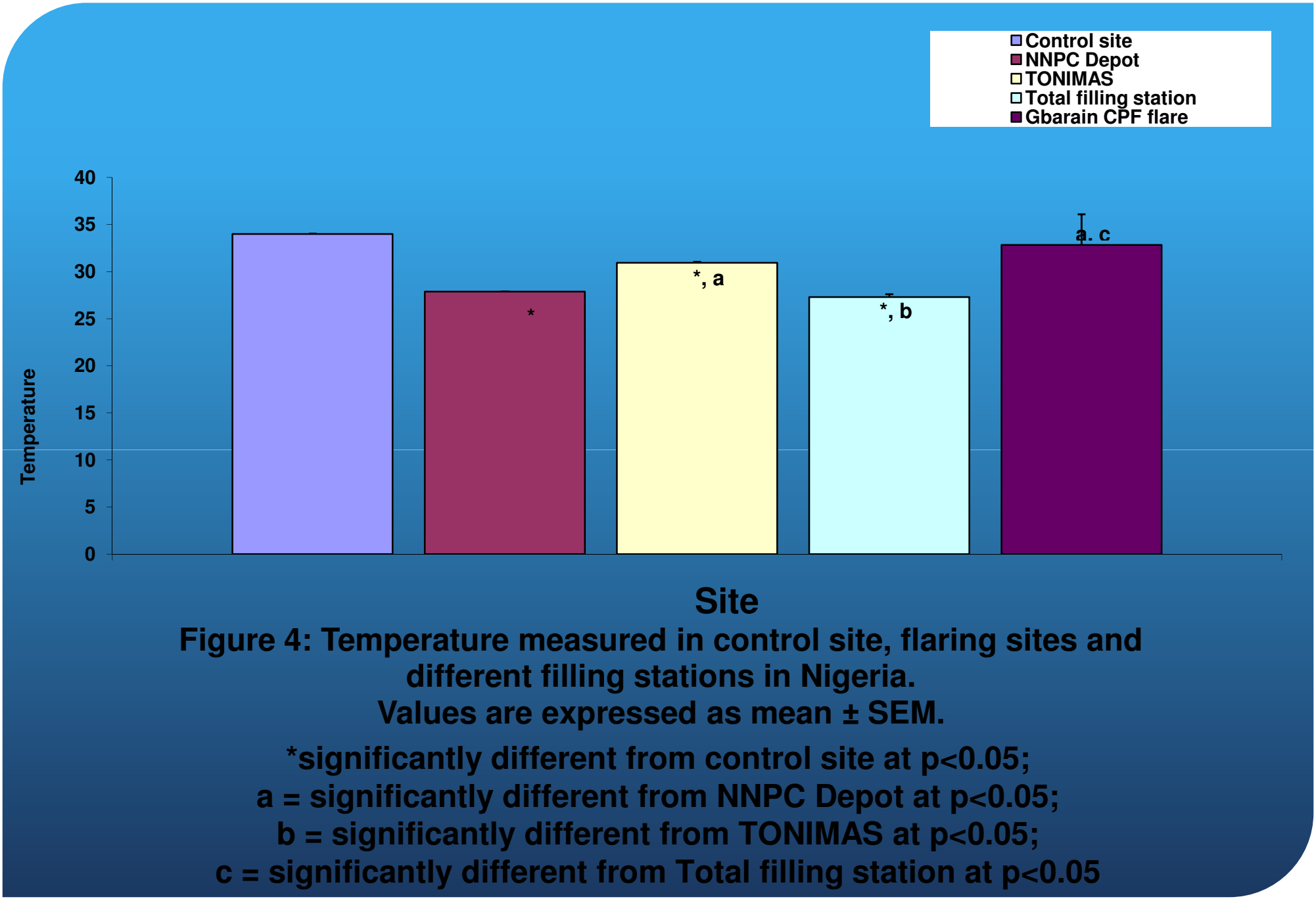

Figure 4: Temperature measured in control site, flaring sites and different filling stations in Nigeria.
Values are expressed as mean ± SEM.

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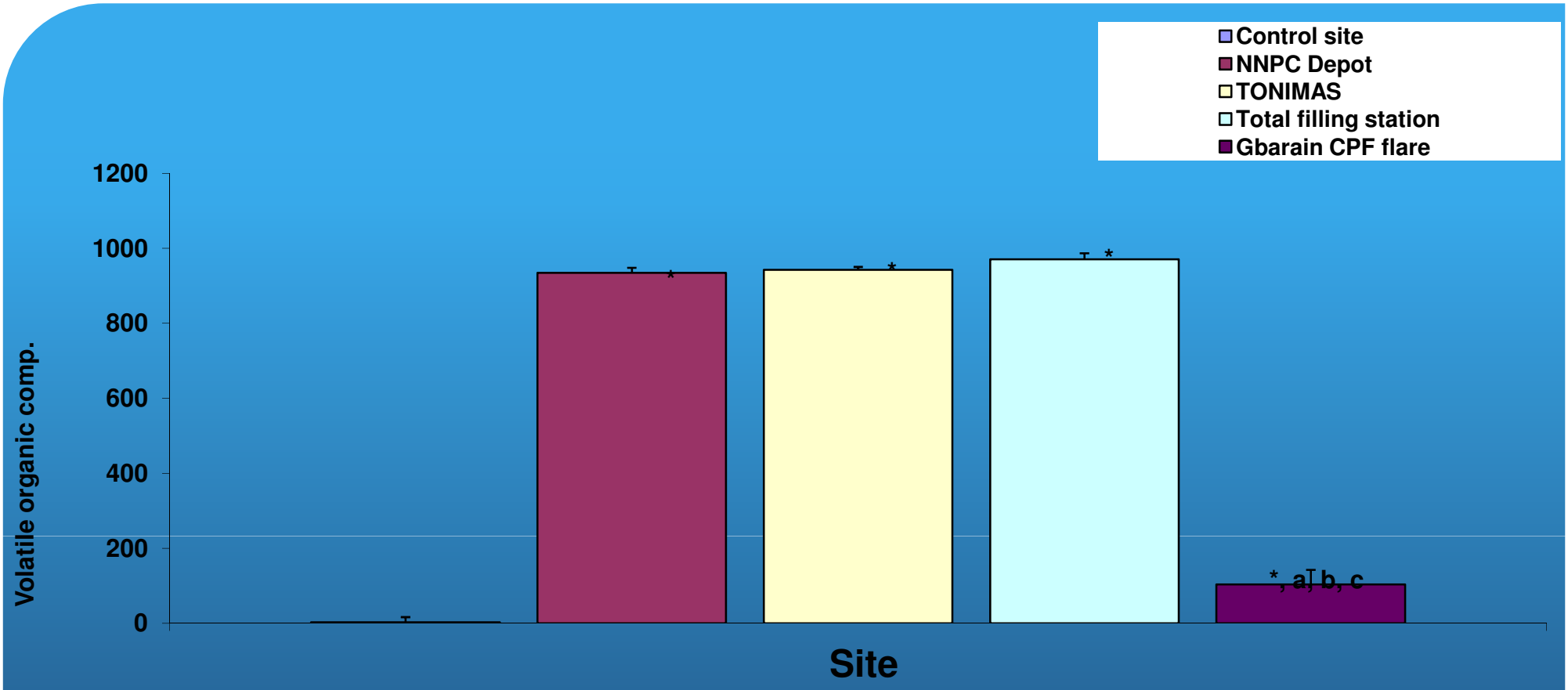

Figure 5: Concentrations of Volatile organic compounds measured in control site, flaring sites and different filling stations in Nigeria. Values are expressed as mean ± SEM.

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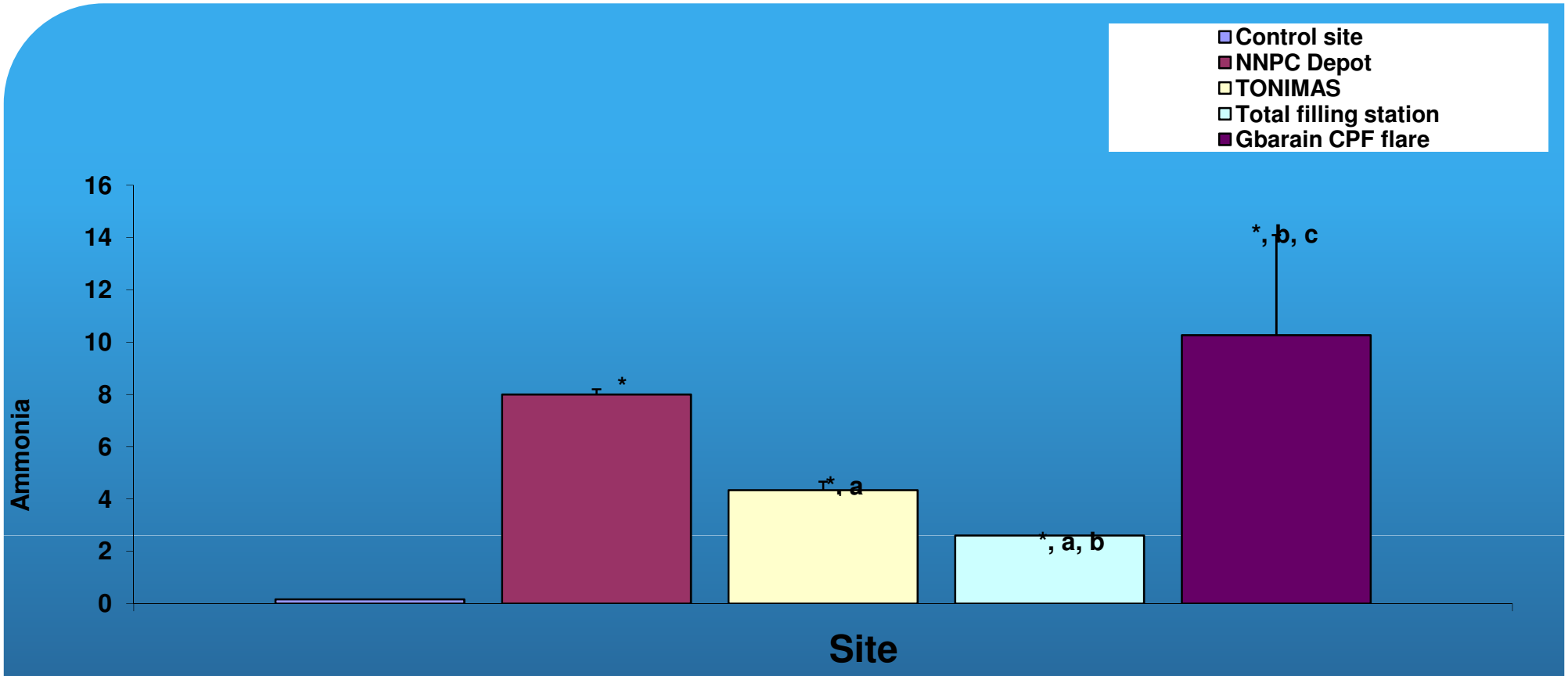

Figure 6: Levels of ammonia measured in control site, flaring sites and different filling stations in Nigeria.
Values are expressed as mean ± SEM.

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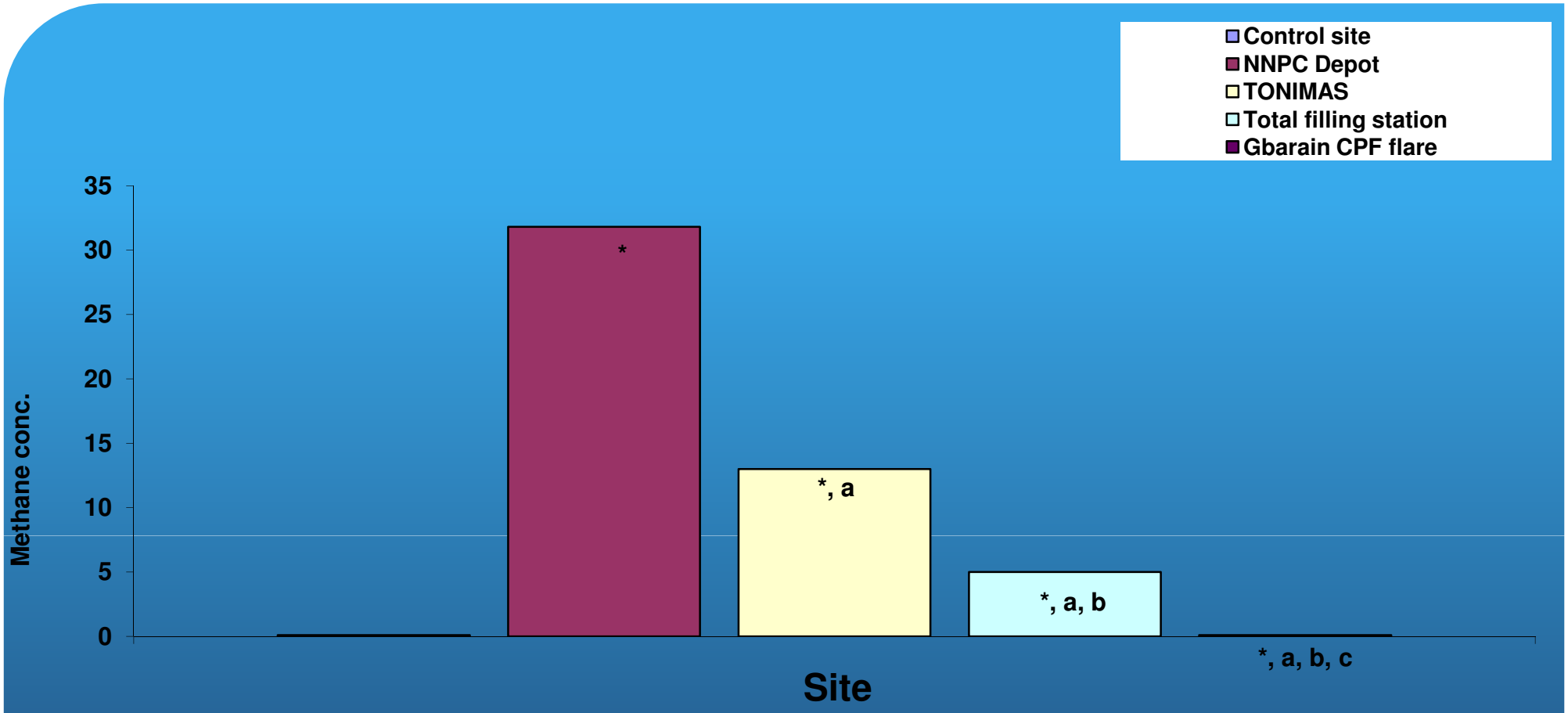

Figure 7: Comparison of methane levels in control site, flaring sites and different filling stations in Nigeria.
Values are expressed as mean ± SEM.

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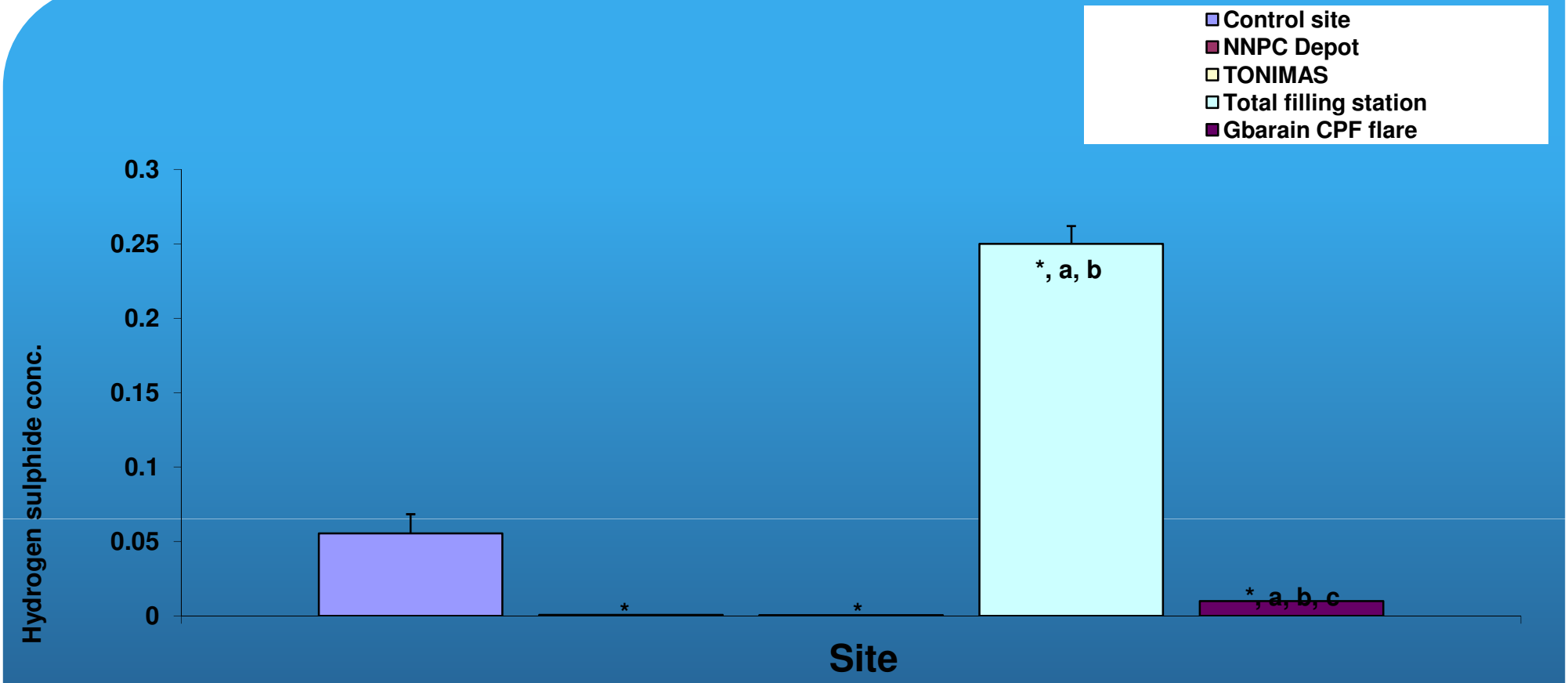

Figure 8: Comparison of hydrogen sulphide levels in control site, flaring sites and different filling stations in Nigeria. Values are expressed as mean ± SEM.

***significantly different from control site at p<0.05;**
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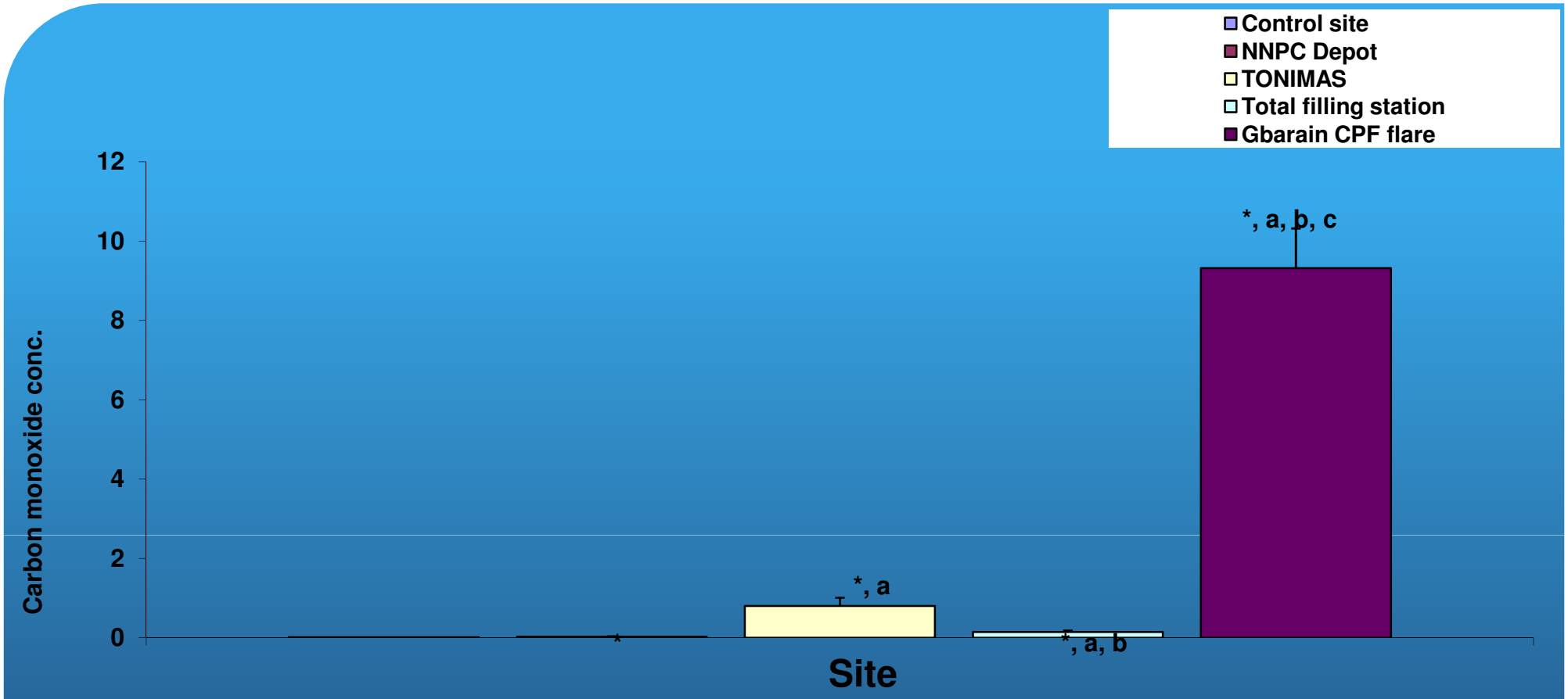

Figure 9: Comparison of carbon monoxide levels in control site, flaring sites and different filling stations in Nigeria. Values are expressed as mean ± SEM.

***significantly different from control site at p<0.05;**
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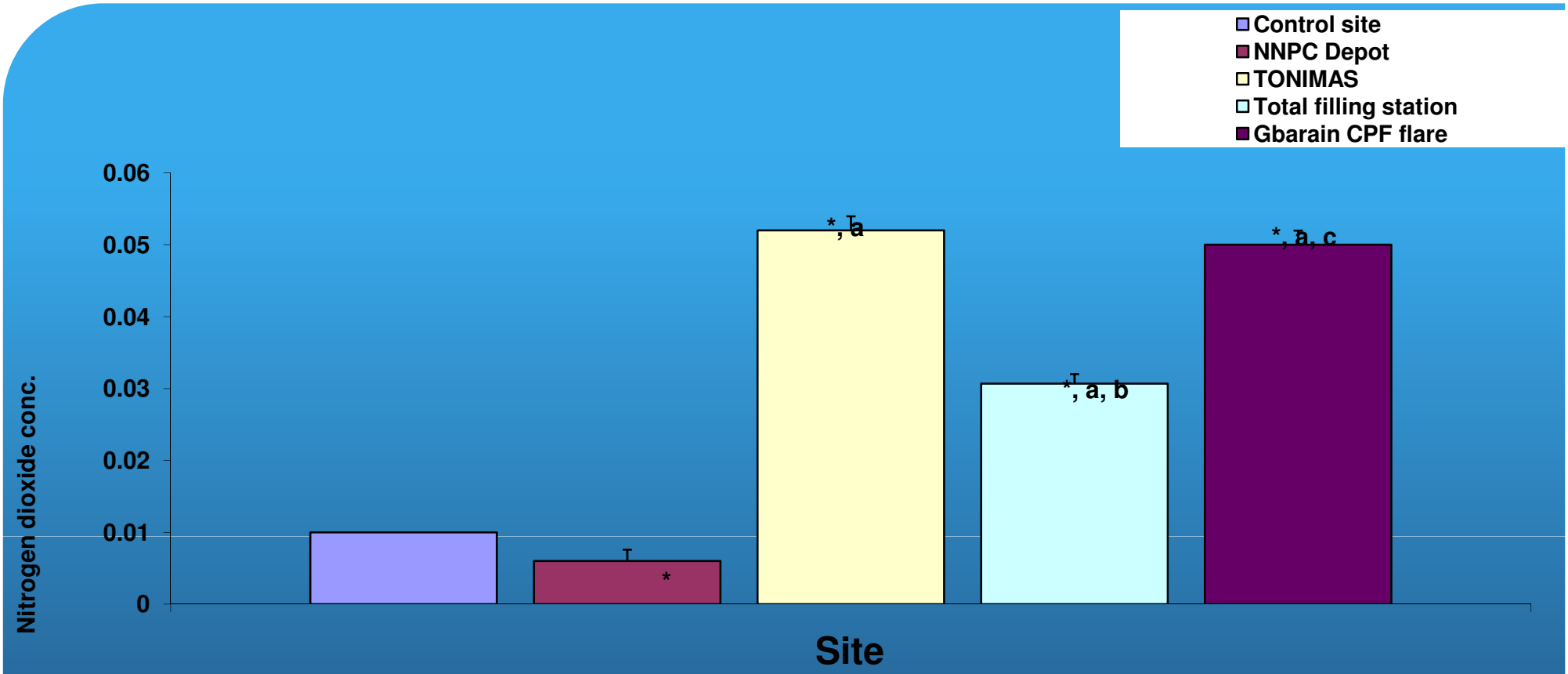

Figure 10: Comparison of Nitrogen dioxide levels in three different filling stations in Cross River State, Nigeria. Values are expressed as mean ± SEM.

***significantly different from control site at p<0.05;**
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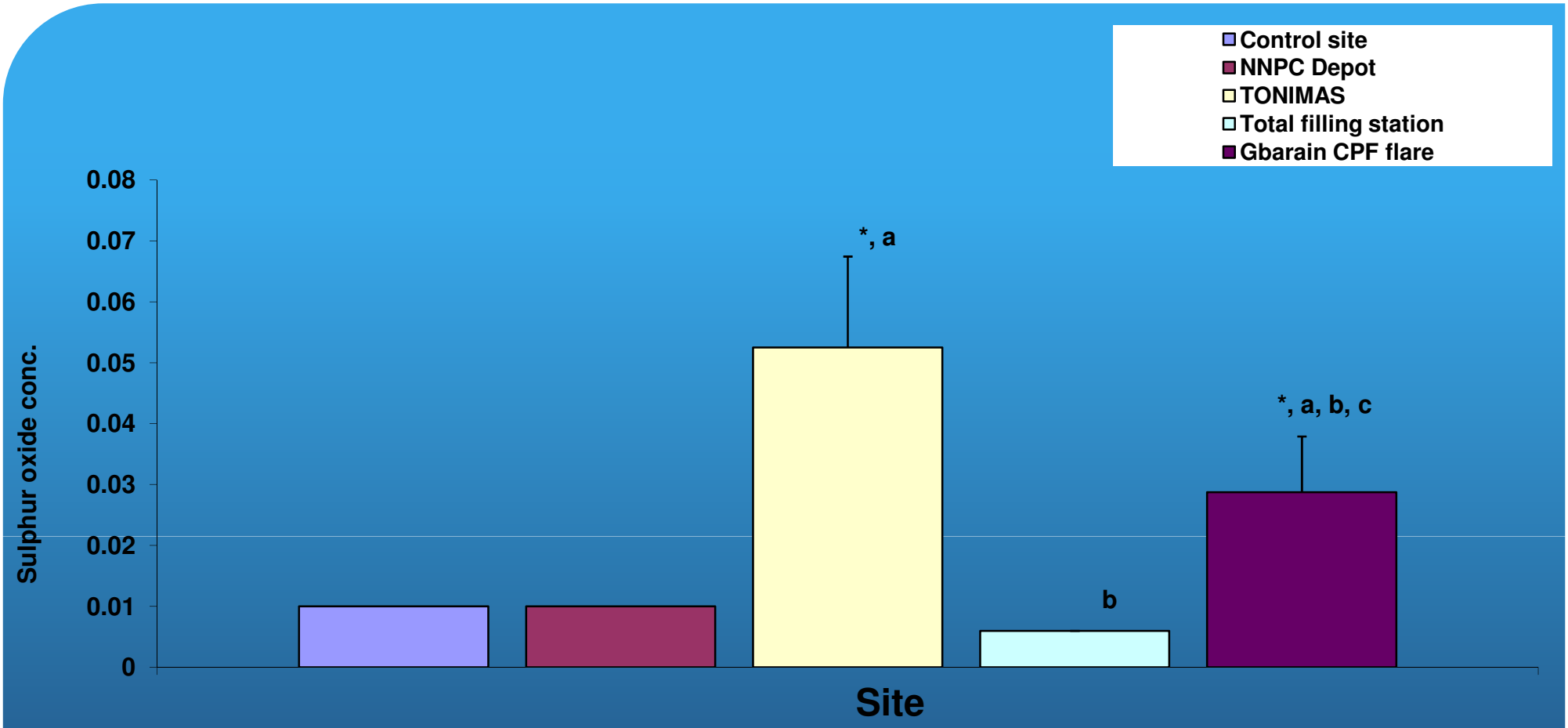

Figure 11: Comparison of sulphure oxide levels in control site and three different filling stations in Cross River State, Nigeria. Values are expressed as mean ± SEM.

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c = significantly different from Total filling station at p<0.05

The results showed a significant increase in ammonia, methane, hydrogen sulphide, carbon monoxide, nitrogen oxide and sulphur VI oxide levels recorded at the refueling stations and storage depot, compared with the levels recorded for remote rural areas.

- The levels of these indices were significantly higher compared to the control sites but most of the indices were not significantly higher than the environmental standard permissible limits.

- It may therefore be concluded that petroleum depots, flaring sites and refueling stations atmospheric environments harbor chemical substances that can contaminate the air quality, and constitute environmental pollution in these areas over an extended period of time .

THANK YOU

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