

Nauru OR19-7 Site – Atmospheric Corrosivity

Site OR19-7



Nauru Site (Image by Geosun).

Background:

The site is positioned in the southern region of Nauru Island, about 1.2-1.5 km from the Pacific Ocean [1]. Nauru is a small island (21 km²), surrounded by a coral reef located approximately 56 km south of the equator [2]. Its population is nearly 11 000 people, with the villages/urban areas primarily located along the island's southern, western, and northern coastlines [1]. The economy depends on tourism, small-scale phosphate mining and other business activities [2].

According to the Köppen-Geiger system, the island has a hot and humid tropical climate (Köppen Af), with average low (nighttime) temperatures of about 25°C and daily highs of 30-37°C year-round [2]. The average annual precipitation is roughly 2 000 mm per annum, although it can vary considerably due to the El Niño–Southern Oscillation [2]. The highest precipitation is recorded during late Spring and Summer, i.e., November-February, when the island experiences monsoon rains [2].

Apart from some water-soluble salts, other airborne contaminations include cadmium residue and phosphate dust [3] due to mining operations, including typical urban-related pollution. The average yearly temperature for the site is $28.4 \pm 0.7^\circ\text{C}$, fluctuating between 14.6°C and 30.2°C, and the mean annual humidity level is $83.1 \pm 5.5\%$. The yearly precipitation is roughly 851 mm, with the wettest period from January to May. The average wind speed at the site is 2.6 ± 1.3 m/s, with gusts of 18.0 m/s, in a predominant southeasterly direction [4].

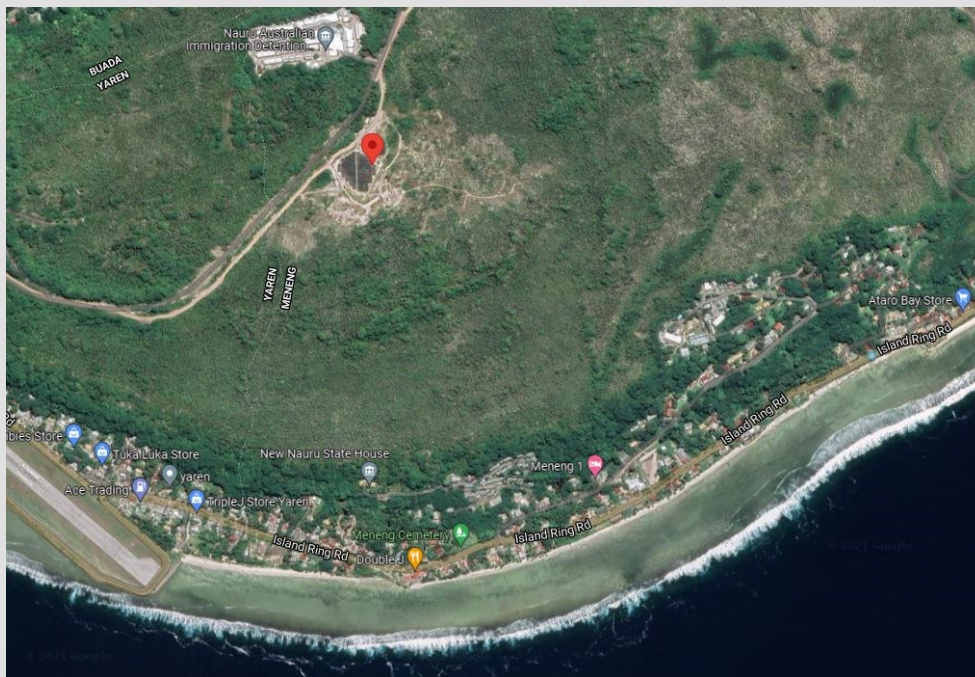
Per the atmospheric corrosion data below, this tropical marine site is classified as Medium to Highly (C3-C4) corrosive with substantial effect/deposition of chlorides (ISO 9223) [5] from the surrounding ocean.

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Position of the Test Site [1].



Satellite view of the Nauru Site [6].

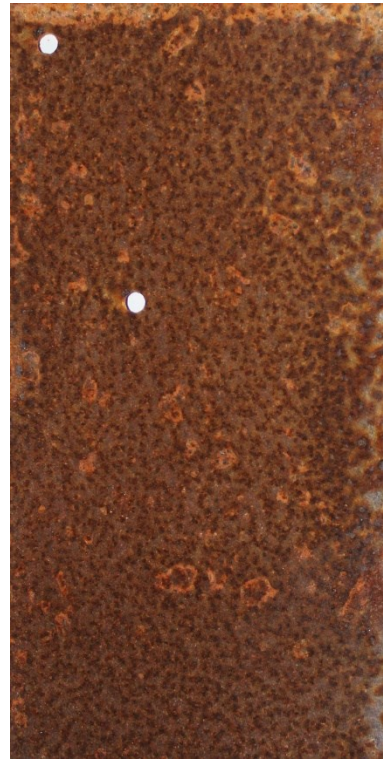
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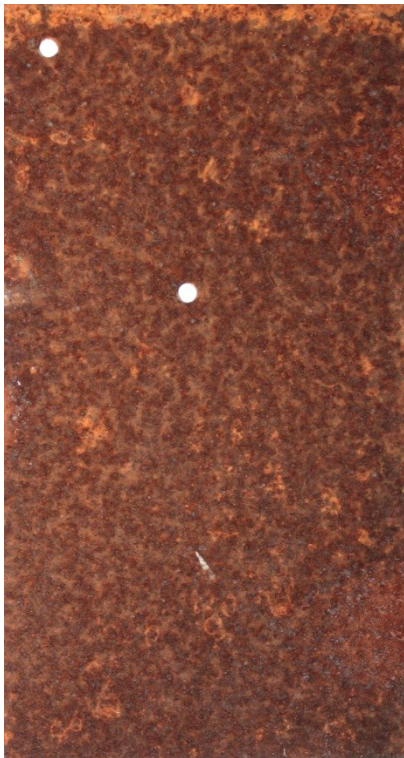
GPS Coordinates of Site:	0°32'36.4"S 166°55'55.1"E	Elevation above Sea Level (m):	~25 m	Distance from Ocean:	~1.2 km
ISO 9226 Corrosion Rates and ISO 9223 Corrosivity Classification					
R_{CORR} Mild steel (µm/yr)	59.2 ± 3.5 µm/yr (1 st year) and 31.8 ± 0.1 µm/yr (2 nd year)				
R_{CORR} Aluminium (µm/yr)	0.2 ± 0.1 µm/yr (1 st year) and 0.1 ± 0.05 µm/yr (2 nd year)				
R_{CORR} Hot Dip Galvanised Steel (µm/yr)	1.7 ± 0.1 µm/yr (1 st year) and 0.8 ± 0.1 µm/yr (2 nd year)				
R_{CORR} Copper (µm/yr)	2.2 ± 0.2 µm/yr (1 st year) and 1.4 ± 0.1 µm/yr (2 nd year)				
ISO 9223 Corrosivity Classification	Medium to High (C3-C4)				
Typical surface contaminants	Pollution: Medium to high salt mix deposition Specific contaminants include: Water-soluble salts – 12-30 mg/m ² Phosphates – >0.15 ppm Chlorides – 4-20 ppm pH – Neutral				



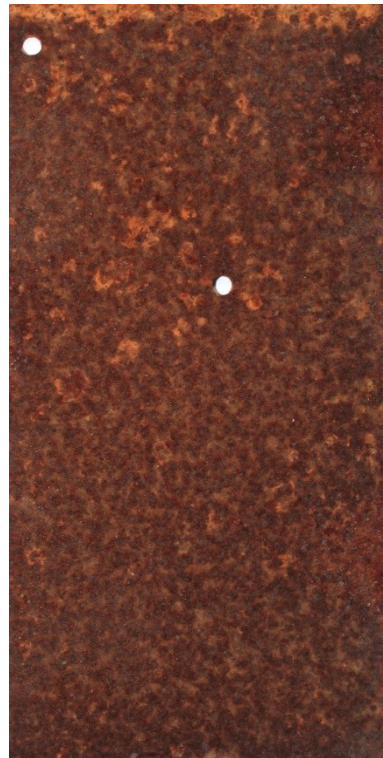
Mild steel – 12 months



Mild steel – 12 months



Mild steel – 24 months



Mild steel – 24 months



Aluminium – 12 months



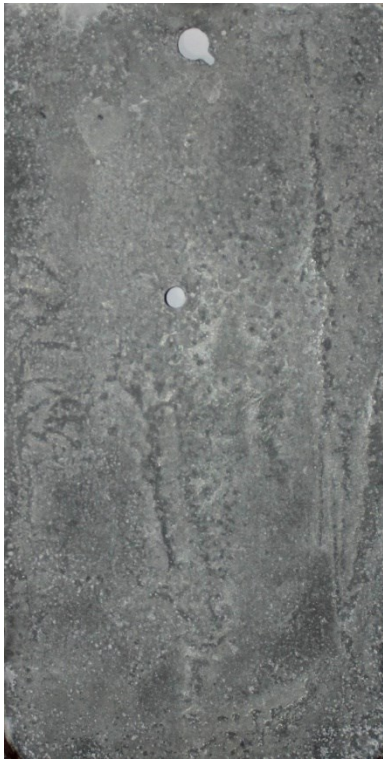
Aluminium – 12 months



Aluminium – 24 months



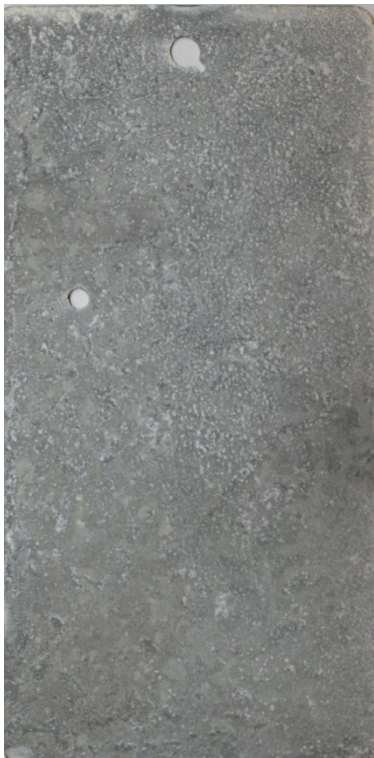
Aluminium – 24 months



HDG – 12 months



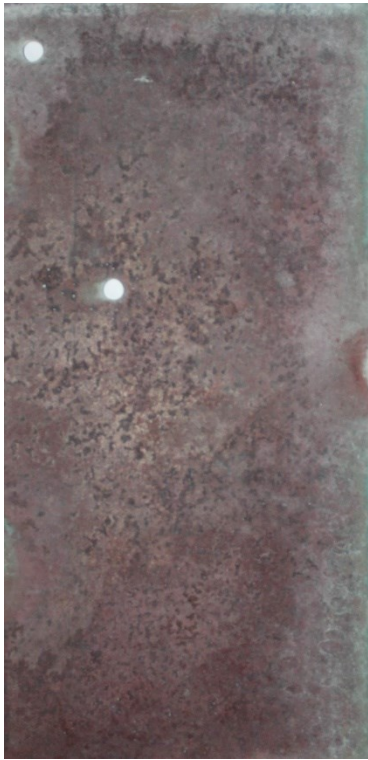
HDG – 12 months



HDG – 24 months



HDG – 24 months



Copper – 12 months



Copper – 12 months



Copper – 24 months



Copper – 24 months

Works Cited

- [1] Google Inc, "Google Maps," [Online]. Available: <https://www.google.com/maps/place/0%C2%B032'36.4%22S+166%C2%B055'55.1%22E/@-0.5300333,166.9339081,10278m/data=!3m1!1e3!4m5!3m4!1s0x0:0x0!8m2!3d-0.543447!4d166.93197>. [Accessed 10 November 2021].
- [2] Wikipedia, "Nauru," 5 November 2021. [Online]. Available: <https://en.wikipedia.org/wiki/Nauru>. [Accessed 10 November 2021].
- [3] N. Hasham, "UN's Nauru verdict: A poor, isolated island ravaged by phosphate mining," 3 November 2015. [Online]. Available: <https://www.smh.com.au/politics/federal/uns-nauru-verdict-a-poor-isolated-island-ravaged-by-phosphate-mining-20151102-gkp145.html>. [Accessed 10 November 2021].
- [4] Geosun, *109-World Bank-Nauru - Meteorological Data, 2020-2021*.
- [5] ISO (International Organization for Standardization), *ISO 9223 - Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*, Geneva, Switzerland: ISO, 2012.
- [6] Google Inc, "Google Maps," [Online]. Available: <https://www.google.com/maps/place/0%C2%B032'36.4%22S+166%C2%B055'55.1%22E/@-0.5486775,166.9316718,2417m/data=!3m1!1e3!4m5!3m4!1s0x0:0x67d1239dbeefa9ff!8m2!3d-0.5434444!4d166.9319722!5m1!1e4>. [Accessed 16 November 2021].