



Exposure Site Catalogue

Catalogue of atmospheric corrosion
field exposure sites in Europe

It is with great pleasure we launch this first edition of the Exposure Site Catalogue! Corrosion testing is an important part of corrosion work to estimate, assess, predict, and verify the performance and lifetimes of individual materials, systems, and components. This is an essential input for selection of appropriate corrosion protection systems and, in the end, to achieve sustainable products.

Exposure sites and outdoor exposure have always been a part of atmospheric corrosion research providing the “final answer”, although at the cost of long exposure times. Individual exposure programs such as ISOCORRAG, MICAT and ICP Materials have resulted in collaborative networks of exposure sites. So far, however, there has been no collective effort to put together currently active sites in a comprehensive manner and across programs and nations. The information collected here is possible thanks to the work of all individual site managers listed as contact persons, efforts of members of Working Party 25 (WP25) Atmospheric Corrosion of the European Federation of Corrosion (EFC) and financial support of the EFC. With this Catalogue it is our hope that you can both get a general overview of what is available and be guided if you are looking for a particular environment with certain characteristics.

You will notice that there are several references to information contained in *ISO 9223 Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination, and estimation*. It is recommended to be familiar with this standard, but if you are not, a brief recapitulation of its most important concepts is given in the explanatory notes.

Please do not hesitate to contact us if you are missing anything or have suggestions for improvement!



Tomáš Prošek



Johan Tidblad

EXPLANATORY NOTES

(more information can be found in ISO 9223¹)

Corrosivity category or category of corrosivity of atmosphere

This is a standardized rating of the corrosivity of the atmosphere in relation to the one-year corrosion effect. Currently, six different categories are defined, C1 (very low corrosivity), C2 (low), C3 (medium), C4 (high), C5 (very high) and CX (extreme). The categories can be derived in different ways:

- Corrosivity determination based on corrosion rate measurement of standard specimens (recommended), normative based on exposure at test sites such as those in this Catalogue!
- Corrosivity estimation based on environmental information, normative based on dose-response functions including temperature, relative humidity sulphur dioxide level (deposition or concentration[#]), and chloride deposition.
- Corrosivity estimation based on environmental information, informative based on description of exposure conditions.

[#] In ISO 9223, SO₂ values determined by a deposition method and concentration values are considered equivalent and can be derived from each other by a constant factor with the physical interpretation as a constant deposition velocity. However, the deposition velocity can vary depending on the location, to a great extent depending on the wind speed.

Categories of environment and environmental parameters

Environmental parameters can be classified into different types:

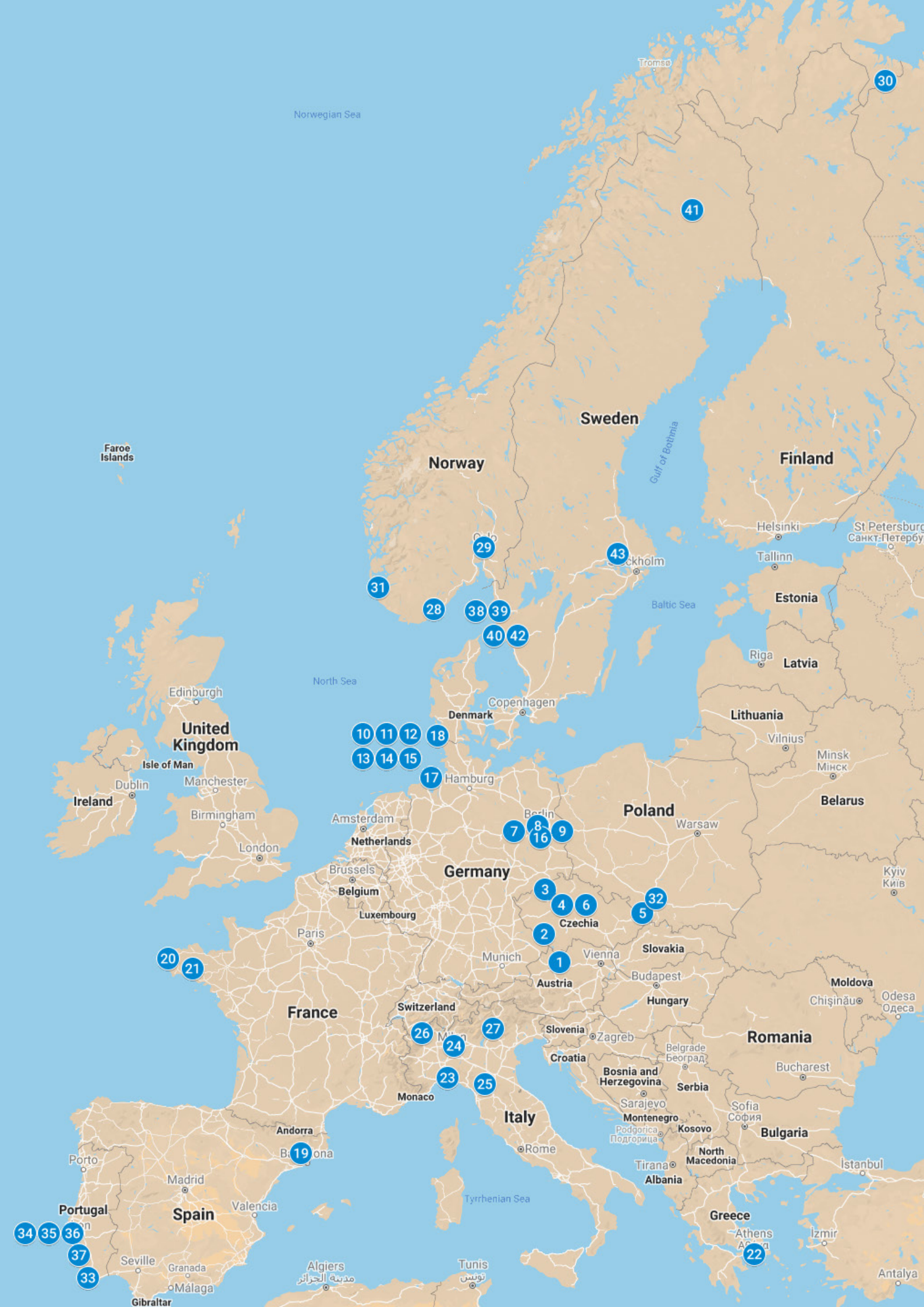
- Climatic parameters including temperature, relative humidity, precipitation amount, etc.
- Gaseous pollutants including SO₂, NO_x, O₃, etc.
- Particulate deposition including chloride deposition and other particles.
- Characteristics of precipitation influenced by long-range and local effects including pH, sulfate, nitrate, and chloride content, etc.

The environment in general is also frequently characterized into different types such as rural, urban, marine, and industrial. It is however important to note that this description does not indicate the corrosivity category but only the type of the environment (and the types of pollutants that typically dominate in this environment). It is possible to find rural atmospheres having a high corrosivity category and urban sites having a low corrosivity category, even if the opposite is more frequent.

Category of location

This is conventionally defined as typical exposure conditions of a component or structure, for example, exposure in the open air, under shelter, in a closed space, etc. Some of the sites in this Catalogue provide exposure under shelter. It is however important to note that results obtained from one type of shelter are not easily extrapolated to other types of shelters due to the influence of microclimatic factors.

¹ ISO 9223:2012. Corrosion of Metals and Alloys—Corrosivity of Atmospheres—Classification, Determination and Estimation, 2nd ed.; International Organization for Standardization: Geneva, Switzerland, 2012



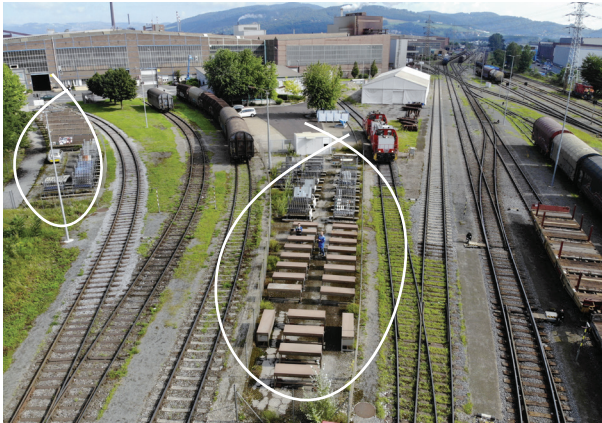
OVERVIEW OF EXPOSURE SITES WITH SELECTED PARAMETERS

No.	Site name	Atmosphere	Corrosion rate [g/m ² year]				Environmental parameters					
			Steel	Zinc	Copper	Aluminium	Temp. [°C]	Rainfall [mm/year]	Relative humidity [%]	Time of wetness [%]	SO ₂ [µg/m ³]	Chloride deposition [mg/m ² day]
1	AT, Linz	Urban, Industrial	106	11.4	8.2	0.3	12	735	70	41	7	3
2	CZ, Kasperske Hory	Rural	53	4.5	8.7	0.01	8	693	74		8	
3	CZ, Kopisty	Industrial	131	4.9	11.9	0.2	10	489	73		12	2
4	CZ, Kralupy	Urban	41	2.0	5.0	0.1	11	581	73	42	5	<1
5	CZ, Ostrava	Industrial	164	10.0			11	488	73		17	
6	CZ, Prague	Urban	56	3.1	3.1	0.1	11	473	70		5	3
7	DE, Berlin A103	Urban	159	4.9	14.0	1.1	11	460	73	35	2	94
8	DE, Berlin B1	Urban	38	4.3	15.9	0.2	10	725	79	46	2	12
9	DE, Berlin BAM	Urban	56	5.3	9.1	0.2	10	505	79	45	2	12
10	DE, Helgoland IFAM	Marine	2390				11	874	80			
11	DE, Helgoland Seawater	Marine	2376	60.0	62.5	1.9	9	718	75	52		
12	DE, Helgoland Südhafen	Marine	251	24.5	22.3	0.5	11	648	81	54		
13	DE, Helgoland Uplands	Marine		8.5			9	719	75	52		431
14	DE, Helgoland Seawater IFAM	Marine	2084	21.0	89.0	3.3	10	874	80			
15	DE, Helgoland-Westkaje	Marine	296	10.5	13.5	0.4	9	719	75	52		431
16	DE, Horstwalde	Rural	44	4.0	19.7	0.1	10	636	79	45		
17	DE, Leuchtturm alte Weser IFAM	Marine					11		82			
18	DE, Sylt Seawater IFAM	Marine			87.0		10	797	79			
19	ES, Barcelona	Rural, Urban	53	6.5			15	600	66	51	3	≤3
20	FR, Brest	Marine	750	11.0	20.0	0.6	13	1100	83	60	<1	1300
21	FR, Le Croisty	Rural	140	9.0	7.0	0.2	12	1000	84	67		<5
22	GR, Athens	Urban	77	6.4	5.0	0.1	20	448	58		9	
23	IT, Genoa	Marine, Urban	130	11.0	14.0	1.1	18	1254	64	9		57
24	IT, Milano	Urban			4.5		15	825	61		5	
25	IT, Monte Cimone	High UV					2		79		<1	
26	IT, Plateau Rosa	High UV										
27	IT, Trento	Urban					13	1306	27	30	3	
28	NO, Birkenes	Rural	58	8.1	7.6	0.4	6	1567	79		<1	7
29	NO, Oslo	Urban	19	5.8	3.5		7	716	73		2	
30	NO, Svanvik	Rural, Industrial	69	7.9	7.9	0.7	1	411	78		7	
31	NO, Tananger	Marine	600				9	1552			3	211
32	PL, Katowice	Urban	18	2.5	0.6	0.1	10	726	74		8	2
33	PT, Alfanizina	Marine	214	9.8	24.0	1.0	17	417	77	42	14	80
34	PT, Guincho	Marine			61.0		16	451	76	48		768
35	PT, Lisbon	Urban		9.5	8.3	0.7	16	723	71	38	32	9
36	PT, Lumiar	Urban	147	7.0	12.0	0.2	17		72	41	22	18
37	PT, Sines	Marine/Industrial	928	45.0	57.0	2.0	17		81	59	132	140
38	SE, Bohus-Malmön Kattesand	Marine	237	6.9	12.0	0.5	9	967	81	57	<1	75
39	SE, Bohus-Malmön Kvarnvik	Marine	751	11.0	26.0	2.3	9	967	81	57	<1	577
40	SE, Bohus-Malmön Kvarnvik 3	Marine	269	8.5	14.0	0.8	9	967	81	57	<1	125
41	SE, Gällivare	Rural	38	4.4	1.7	0.3	0		77	20		
42	SE, Kristineberg	Marine	378	5.3	18.9		10	1017	81	59		
43	SE, Ryda	Rural	28	2.9	3.9	0.1						

Colour code (for explanation, see ISO 9223)

C1	C1	C1	C1
C2	C2	C2	C2
C3	C3	C3	C3
C4	C4	C4	C4
C5	C5	C5	C5
CX	CX	CX	CX


	P ₀	S ₀
τ ₃	P ₁	S ₁
τ ₄	P ₂	S ₂
τ ₅	P ₃	S ₃

Site name	voestalpine Linz				
Country, region	Austria, Upper Austria, Linz				
Atmosphere	Urban, Industrial				
Location (GPS)	48.2671389N, 14.3398333E				
Altitude	257 m				
Address	Voestalpine Strasse 3, 4020 Linz, Austria				
Description	<p>This site is embedded in the St. Peter industrial area of Linz with voestalpine Stahl Linz steel mill as leading company. It consists of two separate fields. Field 1 is committed to accelerated, high salinity experiments (e.g. "VDA 621-414 - like") and individual adapted exposure methods. Field 2, separated several meters from Nr.1 to avoid any cross contamination, is dedicated to classical atmospheric exposure. Being completely fenced and locating within the secured limits of the steel mill all fields are well protected against unauthorized influences and persons. Due to the vicinity of railroad tracks there are typical particle depositions (brake dust) present.</p>				
Photographs					
Operational since	2015				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	106	11.4	8.2	0.3
	Corrosivity category	C2	C3	C3	C2
	Measurement period	2015–2019			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	735	2015–2019		
	Temperature [°C]	11.9	2015–2019		
	SO₂ [µg/m³]	6.6 ^l	–		
	Chloride deposition [mg/m² day]	3.3 ^l	–		
	Relative humidity [%]	70	2015–2019		
	Time [h] of radiation >10 klx	3276	2015–2019		
	Time of wetness [%]	41	2015–2019		
	Time of wetness [h]	3593	2015–2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: 0° sheltered (VDA 621-414) and non-sheltered				
Available space	More than 50 m ²				
Additional information	All relevant racks are orientated in north/south direction and shadow because of trees, other racks, etc. is avoided to fulfil the standards.				
Managing organization	voestalpine Stahl Linz, R&D dept. CTE				
Contact person	Dr. Gerald Luckeneder ✉ gerald.luckeneder@voestalpine.com				

l. From public database; to be measured in the future

CZ, Kasperske Hory

Site name Kašperské Hory
Country, region Czech Republic, South Bohemia – Czech Forest
Atmosphere Rural
Location (GPS) 49.1428914N, 13.5561608E
Altitude 427 m
Address Vimperická 348, 341 92 Kašperské Hory, Czech Republic


Description	Green grass field on the edge of small village. Mountains climate, cold and humid environment.				
Photographs					
Operational since	1970				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	53	4.5	8.7	0.01
	Corrosivity category	C2	C2	C3	C1
	Measurement period	2015–2016			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	693	2014–2019		
	Temperature [°C]	8.3	2014–2019		
	SO₂ [µg/m³]	7.7	2014–2019		
	NO_x [µg/m³]	18.7	2014–2019		
	pH of rain	5.4	2014–2019		
	Relative humidity [%]	74	2014–2019		
Exposure racks	<input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: Exposure under shelter				
Available space	100 m ²				
Additional information	All environmental parameters are measured on site.				
Managing organization	SVÚOM Ltd., U Mestanskeho pivovaru 934/4, 170 00 Prague, Czech Republic				
Contact person	Kateřina Kreislová ✉ kreislova@svuom.cz ☎ +420 775 159 552				

Site name Kopisty u Mostu
Country, region Czech Republic, Northern Bohemia
Atmosphere Industrial
Location (GPS) 50.5442339N, 13.6231767E
Altitude 240 m
Address Meteorologická observatoř Kopisty, ÚFA AV ČR v.v.i., 434 01 Most, Czech Republic


Description	Green field located near an industrial plant (ca 3 km, Chempark, UNIPETROL) and town Most				
Photographs					
Operational since	1969				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	131	4.9	11.9	0.2
	Corrosivity category	C2	C2	C3	C2
	Measurement period	2017-2018			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	489	2014-2019		
	Temperature [°C]	10.4	2014-2019		
	SO₂ [µg/m³]	11.7	2014-2019		
	NO_x [µg/m³]	22.3	2014-2019		
	Chloride deposition [mg/m² day]	2.3	2016-2019		
	pH of rain	6.1	2014-2019		
	Relative humidity [%]	73	2014-2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: Exposure under shelter				
Available space	250 m ²				
Additional information	Atmospheric test site is included in the UN ECE ICP Materials programme since 1986. All environmental parameters are measured on site. The chloride deposition is measured using the wet candle method.				
Managing organization	SVÚOM Ltd., U Mestanskeho pivovaru 934/4, 170 00 Prague, Czech Republic				
Contact person	Kateřina Kreislová ✉ kreislova@svuom.cz ☎ +420 775 159 552				

Site name Kralupy nad Vltavou
Country, region Czech Republic, Central Bohemia
Atmosphere Urban
Location (GPS) 50.2411539N, 14.3122694E
Altitude 175 m
Address Nám. G. Karse 7, 278 01 Kralupy nad Vltavou, Czech Republic

Description	Roof of a 4-floor building located in a centre of an industrial town (oil refinery, chemical industry) with 10,000 inhabitants				
Photographs					
Operational since	2016				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	41 ± 1	2.0 ± 0.1	5.0 ± 0.6	0.1 ± 0.1
	Corrosivity category	C2	C2	C3	C2
	Measurement period	02/2020-02/2021			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	581	02/2020-02/2021		
	Temperature [°C]	11.4	02/2020-02/2021		
	SO₂ [µg/m³]	5	Long-term average		
	NO_x [µg/m³]	16	Long-term average		
	Chloride deposition [mg/m² day]	0.7±0.3	Long-term average		
	pH of rain	5.2	Long-term average		
	Relative humidity [%]	73	02/2020-02/2021		
	Time of wetness [%]	42	06/2018-05/2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: Exposure under shelter				
Available space	More than 10 m ²				
Managing organization	University of Chemistry and Technology Prague, Technopark Kralupy, Nám. G. Karse 7, 278 01 Kralupy nad Vltavou, Czech Republic				
Contact person	Tomáš Prošek ✉ prosekt@vscht.cz ☎ +420 723 242 41				

Site name	Ostrava-Radvanice				
Country, region	Czech Republic, Silesia				
Atmosphere	Industrial				
Location (GPS)	49.8084786N, 18.3437678E				
Altitude	260 m				
Address	Podlesní 6, 716 00 Ostrava-Radvanice, Czech Republic				
Description	The site is located in an industrial region of Silesia with steel industry and coal mining. The region is polluted mainly with SO ₂ . The site is close to a steel producing facility. Due to the prevailing west winds, Ostrava-Radvanice is the most polluted part of the city of Ostrava. The site is located in a fenced garden.				
Photographs					
Operational since	2017				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m ² year]	164 ± 3	10 ± 1	–	–
	Corrosivity category	C2	C3	–	–
	Measurement period	07/2017–07/2018			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	488	01/2018–12/2018		
	Temperature [°C]	10.5	01/2018–12/2018		
	SO ₂ [µg/m ³]	17	01/2018–12/2018		
	NO _x [µg/m ³]	22	01/2018–12/2018		
	NO ₂ [µg/m ³]	31	01/2018–12/2018		
	O ₃ [µg/m ³]	52	01/2018–12/2018		
	H ₂ S [µg/m ³]	3.9	01/2017–09/2017		
	PM ₁₀ [µg/m ³]	44	01/2018–12/2018		
	Relative humidity [%]	73	01/2018–12/2018		
Exposure racks	<input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: Exposure under shelter				
Available space	More than 10 m ²				
Additional information	Permanent meteorological site Ostrava-Radvanice ZÚ is situated 400 meters from the site, where temperature, relative humidity, wind speed and direction, SO ₂ , NO ₂ , NO, CO, O ₃ , PM10 and PM 2.5 concentrations are measured. Data on precipitation are available from the site Ostrava-Poruba.				
Managing organization	University of Chemistry and Technology Prague, Technopark Kralupy, Nám. G. Karse 7, 278 01 Kralupy nad Vltavou, Czech Republic				
Contact person	Tomáš Prošek ✉ prosekt@vscht.cz ☎ +420 723 242 41				

Site name Prague 7 - Holešovice
Country, region Czech Republic, Central Bohemia
Atmosphere Urban
Location (GPS) 50.1057378N, 14.4478275E
Altitude 200 m
Address SVÚOM Ltd., U Měšťanského pivovaru 934/4, 170 00 Praha, Czech Republic

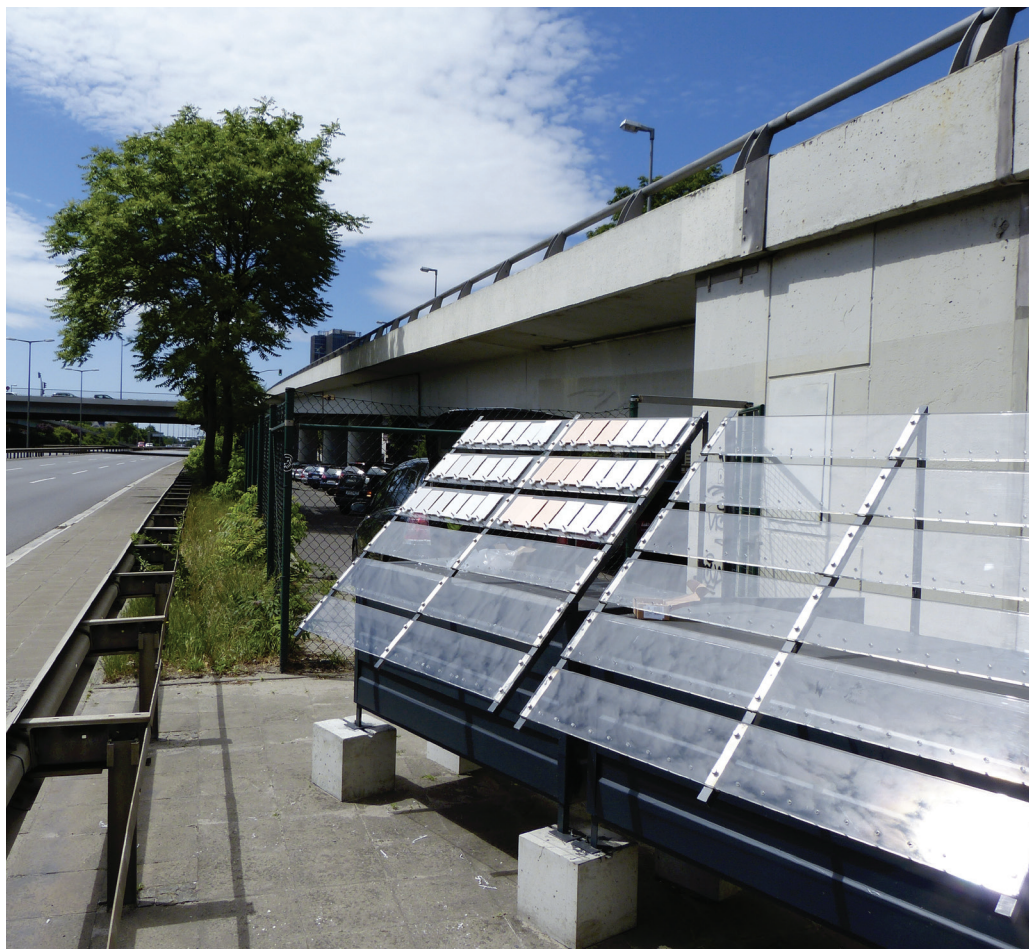
Description	Roof of a 1-floor building located in a centre of capital city Prague with 1,3 million of inhabitants				
Photographs					
Operational since	1980				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	56	3.1	3.1	0.1
	Corrosivity category	C2	C2	C2	C2
	Measurement period	2017–2018			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	473	2014–2019		
	Temperature [°C]	10.8	2014–2019		
	SO₂ [µg/m³]	4.9	2014–2019		
	NO_x [µg/m³]	27.7	2014–2019		
	Chloride deposition [mg/m² day]	2.5	2016–2019		
	pH of rain	6.4	2014–2019		
	Relative humidity [%]	70	2014–2019		
Exposure racks	<input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks Other: Exposure under shelter				
Available space	50 m ²				
Additional information	Atmospheric test site is included in the UN ECE ICP Materials programme since 1986, but the racks were moved. All environmental parameters are measured on site. The chloride deposition is measured using the wet candle method.				
Managing organization	SVÚOM Ltd., U Mestanskeho pivovaru 934/4, 170 00 Prague, Czech Republic				
Contact person	Kateřina Kreislová ✉ kreislova@svuom.cz ☎ +420 775 159 552				

DE, Berlin A103

Site name Berlin, motorway A103
Country, region Germany, Berlin
Atmosphere Urban
Location (GPS) 52.4615278N, 13.3291667E
Altitude 50 m
Address 12163 Berlin, Germany

Description The site is located in Berlin-Steglitz at 3 m distance from the A103 motorway (6 lanes) at street level. The stand is aligned to the road in order to allow for the influence of de-icing salt in winter. It has the possibility to expose samples under free weathering and under sheltered conditions. The racks are oriented to the southeast.

Photographs



Operational since 2016

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium	
	Corrosion rate [g/m² year]	159 ± 3	4.9 ± 0.5	14.0 ± 1.0	1.1 ± 0.1
	Corrosivity category	C2	C2	C4	C3
	Measurement period	06/2016-06/2017			

Corrosivity: sheltered	Steel	Zinc	Copper	Aluminium	
	Corrosion rate [g/m² year]	101 ± 13	2.4 ± 0.2	5.3 ± 0.3	0.2 ± 0.0
	Corrosivity category	C2	C2	C3	C2
	Measurement period	06/2016-06/2017			

DE, Berlin A103

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	460	06/2016–06/2017
	Temperature [°C]	10.7	06/2016–06/2017
	SO ₂ [mg/m ² day]	1.4 ^I	2016–2017
	SO ₂ [µg/m ³]	1.8 ^{II}	2016–2017
	Amount of sulphate deposited on sheltered metal surface, horizontally [mg/m ²]	192	06/2016–06/2017
	Amount of sulphate deposited on sheltered metal surface, vertically [mg/m ²]	6	06/2016–06/2017
	Chloride deposition [mg/m ² day]	94	01/2019–02/2019
	Amount of chloride deposited on sheltered metal surface, horizontally [mg/m ²]	282	06/2016–06/2017
	Amount of chloride deposited on sheltered metal surface, vertically [mg/m ²]	6	06/2016–06/2017
	Relative humidity [%]	73	06/2016–06/2017
	Time of wetness [%]	35	06/2016–06/2017
Exposure racks	<input checked="" type="checkbox"/> 0° (only sheltered) <input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° (only sheltered) <input checked="" type="checkbox"/> Possible to install customized racks		
Available space	4.5 m ² (free weathering); 6.3 m ² (sheltered)		
Additional information	Test racks installed are BAM standard test racks, meaning that all test racks of the BAM have the same size and same dimensions especially for the sheltered part of the test racks. Thus, the different locations are comparable to each other. Sheltered part has the following size: 1500×700×700 mm.		
Managing organization	Bundesanstalt für Materialforschung und -prüfung (BAM), Division 7.6 Corrosion and Corrosion Protection, Unter den Eichen 87, 12205 Berlin, Germany		
Contact person	Martin Babutzka ✉ martin.babutzka@bam.de ☎ +49 30 81 04 45 91		

I. Value of UBA

II. Value of UBA, estimated from SO₂ deposition using the factor defined in ISO 9223

DE, Berlin B1

Site name Berlin, federal street B1
Country, region Germany, Berlin
Atmosphere Urban
Location (GPS) 52.4423333N, 13.2850833E
Altitude 50 m
Address Unter den Eichen 87, 12205 Berlin, Germany

Description The site is located on BAM's headquarters in Berlin-Steglitz at 8 m distance from the B1 federal road (6 lanes) at street level. The stand is aligned to the road in order to allow for the influence of de-icing salt in winter. The test rack is installed at 1 m above ground level. It has the possibility to expose samples under free weathering and under sheltered conditions. The racks are oriented to the northwest.

Photographs



Operational since 2016

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	38 ± 5	4.3 ± 0.0	15.9 ± 1.3	0.2 ± 0.0
Corrosivity category	C2	C2	C4	C2
Measurement period	08/2016–08/2017			

Corrosivity: <i>sheltered</i>	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	15 ± 2	0.6 ± 0.0	8.3 ± 0.0	0.1 ± 0.0
Corrosivity category	C2	C1	C3	C2
Measurement period	08/2016–08/2017			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	725	08/2016–08/2017
	Temperature [°C]	10.0	08/2016–08/2017
	SO ₂ [mg/m ² day]	1.4 ^I	2016–2017
	SO ₂ [µg/m ³]	1.8 ^{II}	2016–2017
	Amount of sulphate deposited on open metal surface, horizontally [mg/m ²]	64	08/2016–08/2017
	Amount of sulphate deposited on open metal surface, vertically [mg/m ²]	6	08/2016–08/2017
	Chloride deposition [mg/m ² day]	12	01/2019–02/2019
	Amount of chloride deposited on sheltered metal surface, horizontally [mg/m ²]	103	08/2016–08/2017
	Amount of chloride deposited on sheltered metal surface, vertically [mg/m ²]	3	08/2016–08/2017
	Relative humidity [%]	79	08/2016–08/2017
	Time of wetness [%]	46	08/2016–08/2017
Exposure racks	<input checked="" type="checkbox"/> 0° (only sheltered) <input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° (only sheltered) <input checked="" type="checkbox"/> Possible to install customized racks		
Available space	4.5 m ² (free weathering); 6.3 m ² (sheltered)		
Additional information	Test racks installed are BAM standard test racks, meaning that all test racks of the BAM have the same size and same dimensions especially for the sheltered part of the test racks. Thus, the different locations are comparable to each other. Sheltered part has the following size: 1500×700×700 mm.		
Managing organization	Bundesanstalt für Materialforschung und -prüfung (BAM), Division 7.6 Corrosion and Corrosion Protection, Unter den Eichen 87, 12205 Berlin, Germany		
Contact person	Martin Babutzka <input type="email"/> martin.babutzka@bam.de <input type="tel"/> +49 30 81 04 45 91		

I. Value of UBA

II. Value of UBA, estimated from SO₂ deposition using the factor defined in ISO 9223

Site name Berlin, rooftop of BAM headquarters
Country, region Germany, Berlin
Atmosphere Urban
Location (GPS) 52.4428889N, 13.2873889E
Altitude 67 m
Address Unter den Eichen 87, 12205 Berlin, Germany

Description The site is located on BAM's headquarters in Berlin-Steglitz on the roof of the main building at a height of 17 m relative to street (ground) level. The distance to the B1 federal road is 25 m. It has the possibility to expose samples under free weathering and under sheltered conditions. The racks are oriented to the southwest.

Photographs



Operational since 2016

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium	
	Corrosion rate [g/m² year]	56 ± 3	5.3 ± 0.8	9.1 ± 0.5	0.2 ± 0.0
	Corrosivity category	C2	C3	C3	C2
	Measurement period	08/2016–08/2017			
Corrosivity: sheltered	Steel	Zinc	Copper	Aluminium	
	Corrosion rate [g/m² year]	16.6 ± 0.2	2.8 ± 0.8	4.5 ± 0.4	0.1 ± 0.0
	Corrosivity category	C2	C2	C2	C2
	Measurement period	05/2016–05/2017			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	505	05/2016 - 05/2017
	Temperature [°C]	10.2	05/2016 - 05/2017
	SO ₂ [mg/m ² day]	1.4 ^I	2016–2017
	SO ₂ [µg/m ³]	1.8 ^{II}	2016–2017
	Amount of sulphate deposited on sheltered metal surface, horizontally [mg/m ²]	26	05/2016–05/2017
	Amount of sulphate deposited on sheltered metal surface, vertically [mg/m ²]	<1	05/2016–05/2017
	Chloride deposition [mg/m ² day]	12	01/2019–02/2019
	Amount of chloride deposited on sheltered metal surface, horizontally [mg/m ²]	26	05/2016–05/2017
	Amount of chloride deposited on sheltered metal surface, vertically [mg/m ²]	<1	05/2016–05/2017
	pH of rain	5.4	08/2017
	Relative humidity [%]	79	05/2016–05/2017
	Time of wetness [%]	45	05/2016–05/2017
Exposure racks	<input checked="" type="checkbox"/> 0° (only sheltered) <input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° (only sheltered) <input checked="" type="checkbox"/> Possible to install customized racks		
Available space	2.25 m ² (free weathering); 3.15 m ² (sheltered)		
Additional information	Test racks installed are BAM standard test racks, meaning that all test racks of the BAM have the same size and same dimensions especially for the sheltered part of the test racks. Thus, the different locations are comparable to each other. Sheltered part has the following size: 1500×700×700 mm.		
Managing organization	Bundesanstalt für Materialforschung und -prüfung (BAM), Division 7.6 Corrosion and Corrosion Protection, Unter den Eichen 87, 12205 Berlin, Germany		
Contact person	Martin Babutzka ✉ martin.babutzka@bam.de ☎ +49 30 81 04 45 91		

I. Value of UBA

II. Value of UBA, estimated from SO₂ deposition using the factor defined in ISO 9223

DE, Helgoland IFAM

Site name	Helgoland south harbour, atmospheric weathering site, Fraunhofer IFAM
Country, region	Germany, Schleswig Holstein, North Sea Isle
Atmosphere	Marine
Location (GPS)	54.173149N, 7.889775E
Altitude	2 m
Address	Fraunhofer IFAM Südkaje / Am Wassersturzbecken 27498 Helgoland, Germany

Description Atmospheric weathering site with rigs close to the west mole exposed to sea water salt spray.

Photographs



Operational since 2016

Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	2390	–	–	–
	Corrosivity category	CX	–	–	–
	Measurement period	07/2019–06/2020			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	874	01/2019–12/2019
	Temperature [°C]	10.9	01/2019–12/2019
	Relative humidity [%]	80	01/2019–12/2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space Depending on the utilization rate / more than 10 m² capacity can be increased quickly

Additional information Standard sample size is 150×100 mm, other sizes are possible. Exposure of parts is also possible

Managing organization Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Wiener Strasse 12, 28359 Bremen, Germany

Contact person Oliver Kranz [✉ oliver.kranz@ifam.fraunhofer.de](mailto:oliver.kranz@ifam.fraunhofer.de) [☎ +49 \(0\)421 2246 7378](tel:+49(0)42122467378)

DE, Helgoland Seawater

Site name Helgoland, Seawater test rack, MPA Stuttgart
Country, region Germany, Schleswig-Holstein, North Sea
Atmosphere Marine
Location (GPS) 54.1709469N, 7.8905731E
Altitude -2 to 2 m
Address 27498 Helgoland, West Mole, Germany

Description A seawater testing installation is available. There samples can be taken out of the quay for the simulation of offshore applications in the splash zone, the tidal zone and the immersion zone.

Photographs



Operational since 1995

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	2190–2562	55–65	60–65	1.8–2.0
Corrosivity category	CX	C5–CX	CX	C3
Measurement period	05/2019–06/2020			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	718	Long-term average
	Temperature [°C]	9.1	Long-term average
	Relative humidity [%]	75	Long-term average
	Time of wetness [%]	52	06/2018–05/2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space Different/ depending on the utilization rate

Additional information The standard sample size is 400 x 90 x 3 mm

Managing organization Materials Testing Institute University of Stuttgart, Corrosion and Sealing of Buildings, Pfaffenwaldring 2, 70569 Stuttgart, Germany

Contact person Dr.-Ing. Marita Bütetführ [✉ marita.buetefuehr@mpa.uni-stuttgart.de](mailto:marita.buetefuehr@mpa.uni-stuttgart.de) [☎ +49 711 685 66757](tel:+4971168566757)

DE, Helgoland Südhafen

12

Site name Helgoland
Country, region Germany, Schleswig-Holstein, North Sea
Atmosphere Marine
Location (GPS) 54.1752222N, 7.8926111E
Altitude 5 m
Address Südhafen 5, 27498 Helgoland, Germany

Description The site is located in the port area in the southern part of the North Sea island of Helgoland. Helgoland is located about 49 km from the coastline. The site is located 40 m from the edge of the harbour and 300 m from the breakwater. It has the possibility to expose samples under free weathering and under sheltered conditions. The racks are oriented to the southwest.

Photographs



Operational since 2010

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	251 ± 2	24.5 ± 1.2	22.3 ± 0.6	0.5 ± 0.1
Corrosivity category	C3	C4	C4	C2
Measurement period	06/2016-06/2017			

Corrosivity: sheltered	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	130 ± 17	6.0 ± 0.7	23.6 ± 4.5	1.2 ± 0.1
Corrosivity category	C2	C3	C4	C3
Measurement period	06/2016-06/2017			

DE, Helgoland Südhafen

12

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	648	06/2016–06/2017
	Temperature [°C]	10.7	06/2016–06/2017
	Amount of sulphate deposited on sheltered metal surface, horizontally [mg/m ²]	142	06/2016–06/2017
	Amount of sulphate deposited on sheltered metal surface, vertically [mg/m ²]	25	06/2016–06/2017
	Amount of chloride deposited on sheltered metal surface, horizontally [mg/m ²]	533	06/2016–06/2017
	Amount of chloride deposited on sheltered metal surface, vertically [mg/m ²]	8	06/2016–06/2017
	Relative humidity [%]	81	06/2016–06/2017
	Time of wetness [%]	54	06/2016–06/2017
Exposure racks	<input checked="" type="checkbox"/> 0° (only sheltered) <input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° (only sheltered) <input checked="" type="checkbox"/> Possible to install customized racks		
Available space	6.75 m ² (free weathering); 9.45 m ² (sheltered)		
Additional information	Test racks installed are BAM standard test racks, meaning that all test racks of the BAM have the same size and same dimensions especially for the sheltered part of the test racks. Thus, the different locations are comparable to each other. Sheltered part has the following size: 1500×700×700 mm.		
Managing organization	Bundesanstalt für Materialforschung und -prüfung (BAM), Division 7.6 Corrosion and Corrosion Protection, Unter den Eichen 87, 12205 Berlin, Germany		
Contact person	Martin Babutzka ✉ martin.babutzka@bam.de ☎ +49 30 81 04 45 91		

DE, Helgoland Uplands

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Site name Helgoland, marine atmospheric exposure uplands MPA Stuttgart
Country, region Germany, Schleswig-Holstein, North Sea
Atmosphere Marine
Location (GPS) 54.1781700N, 7.8871500E
Altitude 40 m
Address Hafenstr. 1051, 27498 Helgoland, Germany

Description Exposure site with testing installations available located at air-line distance of 50 m from the North Sea on a small hill.

Photographs



Operational since

2012

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	–	5–12	–	–
Corrosivity category	–	C3	–	–
Measurement period	06/2014-06/2015			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	719	Long-term average
Temperature [°C]	9,1	Long-term average
Chloride deposition [mg/m² day]	431	06/2018–05/2019
Relative humidity [%]	75	Long-term average
Time of wetness [%]	52	06/2018 – 05/2019

Exposure racks

5°
 45°
 90°
 Possible to install customized racks

Available space

More than 10 m²

Additional information

On the test side no pre-installed test racks are available. Both the racks and the sample form can be done individually by arrangement. It is possible to expose samples weathered or not weathered, i.e. protected from precipitation.

Managing organization

Materials Testing Institute University of Stuttgart, Corrosion and Sealing of Buildings, Pfaffenwaldring 2, 70569 Stuttgart, Germany

Contact person

Dr.-Ing. Cenk Köse
 [✉ cenk.koese@mpa.uni-stuttgart.de](mailto:cenk.koese@mpa.uni-stuttgart.de)
 [☎ +49 711 685 68035](tel:+4971168568035)

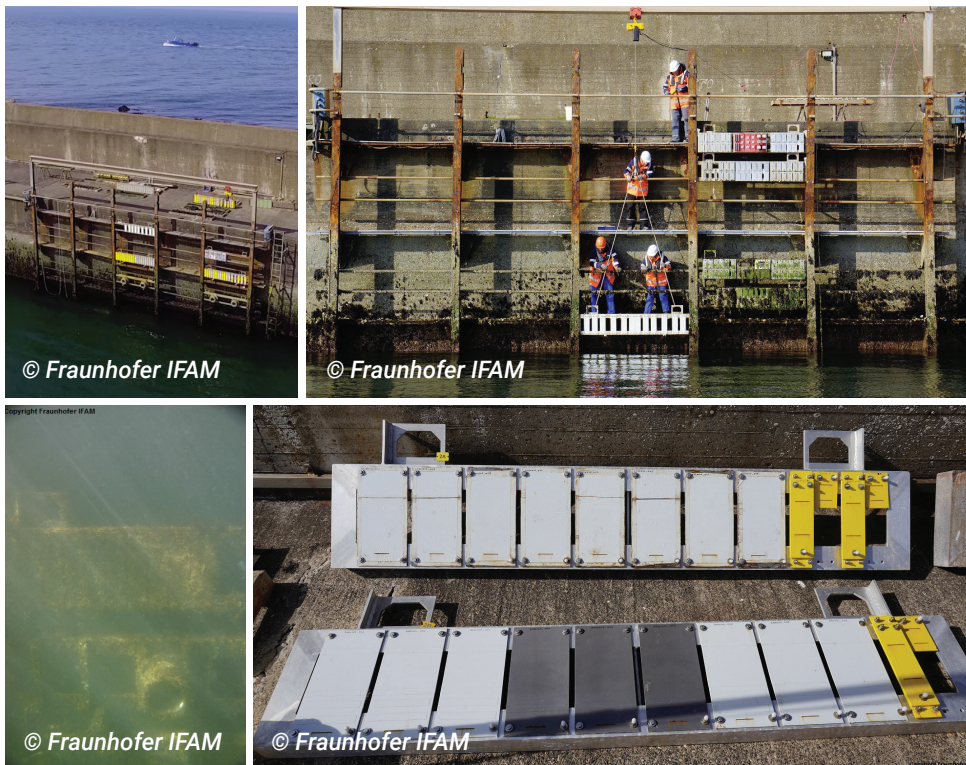
DE, Helgoland Seawater IFAM

14

Site name Heligoland South Harbour, West mole
Country, region Germany, Schleswig Holstein, North Sea Isle test rig, Fraunhofer IFAM
Atmosphere Marine
Location (GPS) 54.170801N, 7.890634E
Altitude -2 to 2 m
Address Fraunhofer IFAM Südkaje / Am Wassersturzbecken, 27498 Helgoland, Germany

Description Test rig fixed at the west mole in the South Harbour of Heligoland, splash zone, tidal zone and immersed zone for samples

Photographs



Operational since 1980

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	2084	21	89	3.3
Corrosivity category	CX	C4	CX	C4
Measurement period	04/2016 – 04/2017			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	874	01/2019-12/2019
Temperature [°C]	10	01/2019-12/2019
Relative humidity [%]	80	01/2019-12/2019

Exposure racks

5°
 45°
 90°
 Possible to install customized racks

Available space

Depending on the utilization rate / max. 36 m², one exposure frame 0,8 m²

Additional information

Standard sample sizes are 400×90×4 mm or 400×200×4 mm, other sizes are possible. Exposure of parts is also possible.

Managing organization

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Wiener Strasse 12, 28359 Bremen, Germany

Contact person

Oliver Kranz
 ✉ oliver.kranz@ifam.fraunhofer.de
 ☎ +49 (0)421 2246 7378

DE, Helgoland Westkaje

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Site name Helgoland, marine atmospheric exposure MPA Stuttgart
Country, region Germany, Schleswig-Holstein, North Sea
Atmosphere Marine
Location (GPS) 54.175191N, 7.892536E
Altitude 2 m
Address Westkaje 1084, 27498 Helgoland, Germany

Description Exposure site with testing installations available located less than 50 m from the North Sea.

Photographs



Operational since 1995

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	294–298	7–14	13–14	0.4–0.45
Corrosivity category	C3	C3	C4	C2
Measurement period	05/2019 – 06/2020			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	719	Long-term average
	Temperature [°C]	9.1	Long-term average
	Chloride deposition [mg/m² day]	431	06/2018–05/2019
	Relative humidity [%]	75	Long-term average
	Time of wetness [%]	52	06/2018–05/2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space More than 10 m²

Additional information Various test racks with different angles of displacement oriented to the southwest are installed. It is possible to expose samples weathered or not weathered, i.e., protected from precipitation. The usual specimen size is 80 x 150 mm or 100 x 150 mm. Other specimen sizes are possible. It is also possible to install own test racks.

Managing organization Materials Testing Institute University of Stuttgart, Corrosion and Sealing of Buildings, Pfaffenwaldring 2, 70569 Stuttgart, Germany

Contact person Dr.-Ing. Marita Bütetführ [✉ marita.buetefuehr@mpa.uni-stuttgart.de](mailto:marita.buetefuehr@mpa.uni-stuttgart.de) [☎ +49 711 685 66757](tel:+4971168566757)

Site name Horstwalde
Country, region Germany, Brandenburg
Atmosphere Rural
Location (GPS) 52.0980556N, 13.4178611E
Altitude 40 m
Address An der Düne 44, 15837 Baruth/Mark, Germany

Description The site is located on the BAM Test Site for Technical Safety in Horstwalde (TTS) in the Federal State of Brandenburg, Germany. It is a forest area in a rural atmosphere. The test rack is installed at ground level. It has the possibility to expose samples under free weathering and under sheltered conditions. The racks are oriented to the southwest.

Photographs



Operational since 2016

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	44 ± 3	4.0 ± 0.6	19.7 ± 0.2
Corrosivity category	C2	C2	C4	C2
Measurement period	08/2016–08/2017			

Corrosivity: <i>sheltered</i>	Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	14 ± 2	1.1 ± 0.0	12.1 ± 1.4
Corrosivity category	C2	C2	C3	C2
Measurement period	08/2016–08/2017			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	636	08/2016–08/2017
	Temperature [°C]	9.8	08/2016–08/2017
	Amount of sulphate deposited on sheltered metal surface, horizontally or vertically [mg/m ²]	<1	08/2016–08/2017
	Amount of chloride deposited on sheltered metal surface, horizontally [mg/m ²]	13	08/2016–08/2017
	Amount of chloride deposited on sheltered metal surface, vertically [mg/m ²]	<1	08/2016–08/2017
	Relative humidity [%]	79	08/2016–08/2017
	Time of wetness [%]	45	08/2016–08/2017
Exposure racks	<input checked="" type="checkbox"/> 0° (only sheltered) <input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° (only sheltered) <input checked="" type="checkbox"/> Possible to install customized racks		
Available space	4.5 m ² (free weathering); 6.3 m ² (sheltered)		
Additional information	Test racks installed are BAM standard test racks, meaning that all test racks of the BAM have the same size and same dimensions especially for the sheltered part of the test racks. Thus, the different locations are comparable to each other. Sheltered part has the following size: 1500×700×700 mm.		
Managing organization	Bundesanstalt für Materialforschung und -prüfung (BAM), Division 7.6 Corrosion and Corrosion Protection, Unter den Eichen 87, 12205 Berlin, Germany		
Contact person	Martin Babutzka ✉ martin.babutzka@bam.de ☎ +49 3 081 044 591		

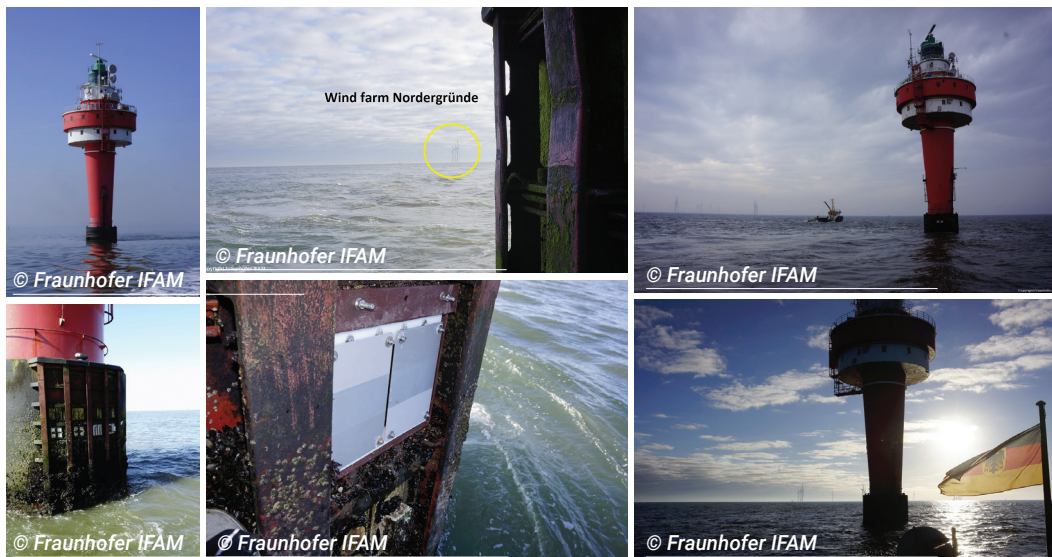
DE, Leuchtturm alte Weser IFAM

17

Site name Lighthouse Alte Weser, test rig, Fraunhofer IFAM
Country, region Germany, Schleswig Holstein, north sea
Atmosphere Marine
Location (GPS) 53.8633333N, 8.1275000E
Altitude -2 to 0 m
Address Lighthouse Alte Weser, Germany

Description Test rig for samples fixed in the tidal zone at the lighthouse

Photographs



Operational since 2010

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	-	-	-	-
Corrosivity category	-	-	-	-
Measurement period	-			

Environmental parameters	Parameter	Value	Measurement period
	Temperature [°C]	10.9	01/2019-12/2019
	Relative humidity [%]	82	01/2019-12/2019
	Wind speed [bft]	4.7	01/2019-12/2019
	Sunshine duration [hour/year]	1833	01/2019-12/2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space Depending on the utilization rate / max. 2 m² one exposure frame 0.1 m²

Additional information Standard sample sizes are 325x70x4 mm or 325x160x4 mm, other sizes are possible. Exposure of small parts is also possible.

Managing organization Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Wiener Strasse 12, 28359 Bremen, Germany

Contact person Oliver Kranz [✉ oliver.kranz@ifam.fraunhofer.de](mailto:oliver.kranz@ifam.fraunhofer.de) [☎ +49 421 2246 7378](tel:+4942122467378)

DE, Sylt Seawater IFAM

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Site name List on Sylt harbour mole sea side test rig, Fraunhofer IFAM
Country, region Germany, Schleswig Holstein, North Sea Isle
Atmosphere Marine
Location (GPS) 55.016053N, 8.440383E
Altitude -2 to 2 m
Address Am Fähranleger, 25992 List, Germany

Description Test rig for samples fixed outside the List harbour at the mole, splash zone, tidal zone and immersed zone for samples

Photographs



Operational since 2011

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	-	-	87	-
Corrosivity category	-	-	CX	-
Measurement period	10/2015-10/2016			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	797	01/2019-12/2019
	Temperature [°C]	10.4	01/2019-12/2019
	Relative humidity [%]	79	01/2019-12/2019
	Wind speed [bft]	4.2	01/2019-12/2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space Depending on the utilization rate / more than 6 m² one frame 0.4 m²

Additional information Standard sample sizes are 325×70×4 mm or 325×160×4 mm, other sizes are possible. Exposure of parts is also possible.

Managing organization Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Wiener Strasse 12, 28359 Bremen, Germany

Contact person Oliver Kranz [✉ oliver.kranz@ifam.fraunhofer.de](mailto:oliver.kranz@ifam.fraunhofer.de) [☎ +49 421 2246 7378](tel:+4942122467378)

Site name EURECAT Manresa
Country, region Manresa, Barcelona, Spain
Atmosphere Rural, Urban
Location (GPS) 41.7448489N, 1.8472711E
Altitude 242 m
Address Plaça de la Ciència 2, 08243 Manresa, Barcelona, Spain

Description Roof of a 2-floor building located in a semi industrial town with 76,000 habitants 50 km far from the sea. The climate is classified as Cfa based on Köppen climate classification.

Photographs



Operational since 2020

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	53 ± 3	6.5 ± 0.4	–	–
Corrosivity category	C2	C3	–	–
Measurement period		–		

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	600	01/2019–12/2019
	Temperature [°C]	15	01/2019–12/2019
	SO₂ [µg/m³]	3	Long-term average
	NO_x [µg/m³]	30	Long-term average
	Chloride deposition [mg/m² day]	≤3	02/2019–06/2019
	pH of rain	5	Long-term average
	Relative humidity [%]	66	01/2018–12/2019
	Total radiation [kWh/year]	2200	01/2018–12/2019
	Time of wetness [%]	51	01/2018–12/2019

Exposure racks 5° 45° 90° Possible to install customized racks


Available space More than 40 m²

Additional information Wind direction and wind speed, solar radiation, humidity, temperature, easy to access.

Managing organization EURECAT, plaça de la ciència 2, 08243 Manresa, Barcelona, Spain (www.eurecat.org)

Contact person Sílvia Molas [✉ silvia.molas@eurecat.org](mailto:silvia.molas@eurecat.org) [☎ +34 938777373](tel:+34938777373)

Site name Brest, Sainte-Anne
Country, region France, Brittany
Atmosphere Marine
Location (GPS) 48.358531N, 4.550574W
Altitude Seawater level
Address Sainte-Anne Du Portzic, F-29280 Plouzané, France

Description	The site is located on a dyke in the bay of Brest (Atlantic Ocean)				
Photographs					
Operational since	2003				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	750	11	20	0.6
	Corrosivity category	C5	C3	C4	C3
	Measurement period	2012–2019			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	1100	2012–2019		
	Temperature [°C]	12.5	2012–2019		
	SO₂ [µg/m³]	<1	–		
	NO_x [µg/m³]	<5	–		
	Chloride deposition [mg/m² day]	1300	2012–2019		
	pH of rain	6.0	2012–2019		
	Relative humidity [%]	83	2012–2019		
	Total radiation [KWh/year]	4100	2012–2019		
	Time of wetness [%]	60	2012–2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	600 m ²				
Additional information	EN10169 referred site for prepainted materials				
Managing organization	French Corrosion Institute, 220 Rue Rivoalon, F-29200 Brest, France				
Contact person	Nathalie LeBozec ✉ nathalie.lebozec@institut-corrosion.fr ☎ +33 298 05 15 52				

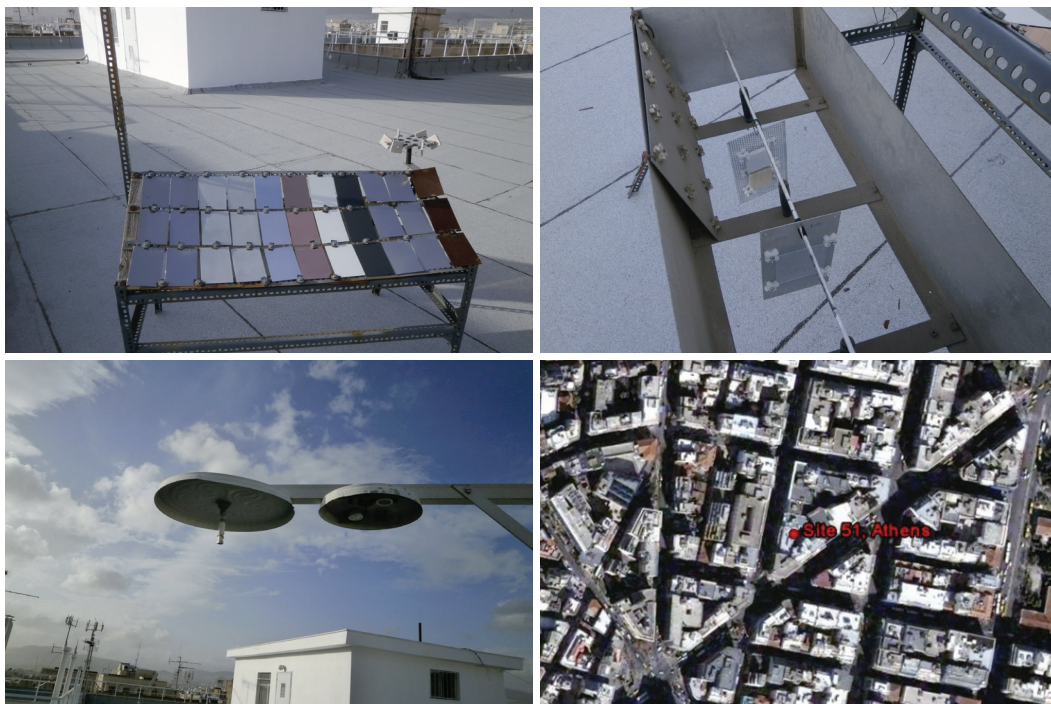
Site name Le Croisty
Country, region France, Brittany
Atmosphere Rural
Location (GPS) 48.044671N, 3.380838W
Altitude 180 m
Address La Croix-Verte, F-56540 Le Croisty, France

Description	The site is located in a field in the centre of Brittany, France				
Photographs					
Operational since	2012				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	140	9	7	0.2
	Corrosivity category	C2	C3	C3	C2
	Measurement period	2015–2019			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	1000	2015–2019		
	Temperature [°C]	12	2015–2019		
	Chloride deposition [mg/m² day]	<5	2015–2017		
	Relative humidity [%]	84	2015–2019		
	Time of wetness [%]	67	2015–2017		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	200 m ²				
Managing organization	French Corrosion Institute, 220 Rue Rivoalon, F-29200 Brest, France				
Contact person	Nathalie LeBozec ✉ nathalie.lebozec@institut-corrosion.fr ☎ +33 298 05 15 52				

Site name Atmospheric Corrosion Athens Station, ACAS
Country, region Greece, Athens
Atmosphere Urban
Location (GPS) 37.988236N, 23.727625E
Altitude 90 m
Address Aristotelous 17, 104 33, Athens, Greece

Description Roof of a 7-floor building located near the centre of Athens, capital of Greece, with about 5 million inhabitants.

Photographs



Operational since 2003

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	77 ± 2	6.4 ± 0.3	5.0 ± 0.1	0.1 ± 0.0
Corrosivity category	C2	C3	C2	C2
Measurement period	11/2017-11/2018			10/2011-10/2015

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	448	12/2017–11/2018
Temperature [°C]	19.6	12/2017–11/2018
SO₂ [µg/m³]	9	12/2017–11/2018
NO_x [µg/m³]	49	12/2017–11/2018
pH of rain	7.2	12/2017–11/2018
Relative humidity [%]	58	12/2017–11/2018

Exposure racks

5° 45° 90° Possible to install customized racks

Available space

About 0.6 m²

Managing organization

Climate Research Group, Section of Environmental Physics and Meteorology, Department of Physics, National and Kapodistrian University of Athens

Contact person

Professor Costas Varotsos [✉ covar@phys.uoa.gr](mailto:covar@phys.uoa.gr) [☎ +2107276838](tel:+2107276838)

Site name	Genoa Experimental Marine Station, GEMS
Country, region	Italy, Liguria region
Atmosphere	Marine, Urban
Location (GPS)	44.3957778N, 8.9313333E
Altitude	0 m
Address	Via dei Pescatori snc, 16128 – Genoa, Italy

Description
Coastal station placed inside the Genoa harbour, with several exposure racks at sea level and over the roof of a small building. Modular labs are also available for pilot plants and services. A floating wharf, used for the static/dynamic immersion tests, is anchored in the harbour area on the left side of GEMS, where a pneumatic boat for biocide-free paints dynamic tests is moored. The site is inside an area of the Genoa Harbour devoted to shipbuilding and with access limited to authorised personnel. The site is in a fenced area.

Photographs



Operational since

2005

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	130 ± 34	11 ± 3	14 ± 4	1.1 ± 0.8
Corrosivity category	C2	C3	C4	C3
Measurement period	2006–2016			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	1254 ± 515	2012–2019
Temperature [°C]	18 ± 1	2012–2019
Sea water temperature [°C]	18.6 ± 0.5	2012–2019
Chloride deposition [mg/m² day]	57	2012–2019
pH of rain	5.7	2016–2020
Relative humidity [%]	64 ± 3	2012–2019
Total radiation [MJ/m² day]	13 ± 1	2014–2019
Total UV radiation [MJ/m² day]	0.8	2019
Time of wetness [%]	9 ± 4	2015–2019
Leaf wetness [%]	18 ± 6	2012–2019

Exposure racks


5° 45° 90° Possible to install customized racks

Available space

About 40 m² distributed on 18 independent, fully customizable racks

<p>Additional information</p>	<p>A full weather station is installed on the building roof (5 meters elevation) measuring data on air temperature, atmospheric pressure, relative humidity, solar irradiance, UV irradiance, rain rate, wind speed and direction, presence of wet film (leaf wetness) and sea water temperature; data are stored every 15 minutes.</p> <p>Chloride deposition is assessed by the wet candle method (ISO 9225).</p> <p>SO₂ and other pollutants are not directly monitored, but values from regional monitoring nearby stations are available.</p> <p>Two webcams are also present for the live evaluation of samples degradation and for the exposure area safety control.</p> <p>GEMS is included in the MARS Network - The European Network of Marine Research Institutes and Stations (http://www.marsnetwork.org), in Eurocean-Marine Research Infrastructures Database (http://www.eurocean.org).</p> <p>A support CNR-IAS team usually assists partners, taking also care of logistic operations.</p> <p>In addition, it is also possible to perform static and dynamic (by boat) immersion tests in natural seawater in-field an in semi-field conditions.</p>
<p>Managing organization</p>	<p>National Research Council of Italy (CNR) – Institut for Anthropic impacts and Sustainability in marine environment (IAS)</p>
<p>Contact person</p>	<p>Roberto Stifanese ✉ roberto.stifanese@cnr.it ☎ +39 010 6475431</p>

Site name	PoliLaPP Milano
Country, region	Italy, Lombardia
Atmosphere	Urban
Location (GPS)	45.4902036N, 9.2265072E
Altitude	120 m
Address	Via Luigi Mancinelli, 7, Milano, Italy

Description	Roof of a 3-floor building located in an urban centre in Milano (north east). The building is part of the Department of Chemistry, Materials and Chemical Engineering „G. Natta“, Politecnico di Milano				
Photographs					
Operational since	2003				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	–	–	4.5	–
	Corrosivity category	–	–	C2–C3	–
	Measurement period	28/09/2006–27/09/2007			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	825	28/09/2006–11/10/2013		
	Temperature [°C]	15	28/09/2006–11/10/2013		
	SO₂ [µg/m³]	4.5	28/09/2006–06/06/2016		
	NO_x [µg/m³]	95	28/09/2006–06/06/2016		
	Relative humidity [%]	61	28/09/2006–11/10/2013		
	Total radiation [W/m²]	161	2019		
Exposure racks	<input type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	Around 10 m ²				
Additional information	Easy accessibility and control. Possible extension of the available space. Renewal and replacement of the exposure racks planned in 2021				
Managing organization	Politecnico di Milano, Dept. Chemistry, Materials and Chemical Engineering „G. Natta“, Laboratory of Corrosion of Materials “Pietro Pedferri”, Via Luigi Mancinelli 7, 20131 Milano (Italy)				
Contact person	Fabio Bolzoni ✉ fabio.bolzoni@polimi.it ☎ +39 02 2399 3151				

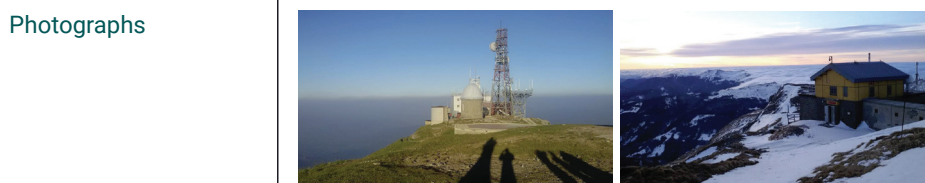
IT, Monte Cimone

Site name	Ottavio Vittori Climate Observatory, Monte Cimone
Country, region	Italy, Northern Italian Apennines
Atmosphere	High UV
Location (GPS)	44.1933628N, 10.7010394E
Altitude	2165 m

Description

The Plateau Rosa Station (PRS) was installed upon a large snow-clad mountain plateau far from urban and polluted zones. PRS is one of the highest monitoring regional stations of the World Meteorological Organization GAW Programme. It is very often located above the planetary boundary layer, suitable for the background measurement of greenhouse gases and other environment background parameters. A meteorological station, managed by the Italian Meteorological Service (WMO code: 16052) is located at a horizontal distance of about one hundred meters from the PRS collecting, in real time, air temperature, relative humidity, pressure and wind (speed and direction) data. The measurement of the most important greenhouse gases (excluding water vapour), such as CO₂, CH₄, and O₃, is regularly carried out. The PRS station is equipped with an electrical heating system and does not use any fossil fuel. A refuge and a cable car are located in the vicinity of the measuring station; both only operate during daylight hours and are open for about eight months a year.

The climate at the Plateau Rosa station is typical of a continental alpine location, with relatively large diurnal and seasonal temperature variations of 6-8°C in a range between -15 and 4°C. Frequent atmospheric pressure variations and strong winds (generally > 4 m s⁻¹) are documented. In the 1971–2008 period, wind speeds < 1 m s⁻¹) occurred during about 17% of the measurements and winds from NE (about 25% of the events) prevailed.



Operational since 1991

Environmental parameters	Parameter	Value	Measurement period
	Temperature [°C]	2.1°C	1996–2015
	SO ₂ [µg/m ³]	0–1	2017–2019
	NO _x [µg/m ³]	0–1	2015–2019
	Relative humidity [%]	79	1996–2015
	Total radiation [W/m ² hour]	1173	2017–2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space To be agreed. Strongly adverse climatology condition has to be taken into account in this site.

Additional information Infrastructure to host samples have to be assembled. Cost could vary depending on necessities (and agreement). No special cost can be indicated at the moment.
Other information: <http://cimone.isac.cnr.it/data-access>, <https://online.ucpress.edu/elementa/article/8/1/00042/114497/Decadal-O3-variability-at-the-Mt-Cimone-WMO-GAW>

Managing organization CNR-ISAC

Contact person Francescopiereo Calzolari (CNR) ✉ Calzolari@isac.cnr.it
Cristiani Pierangela (RSE) ✉ Pierangela.Cristiani@rse-web.it

Site name	Plateau Rosa
Country, region	Italy, north-western Italian Alps
Atmosphere	High UV
Location (GPS)	45.9353611N, 7.7088333E
Altitude	3480 m
Description	<p>The Plateau Rosa Station (PRS) was installed upon a large snow-clad mountain plateau far from urban and polluted zones. PRS is one of the highest monitoring regional stations of the World Meteorological Organization GAW Programme. It is very often located above the planetary boundary layer, suitable for the background measurement of greenhouse gases and other environment background parameters. A meteorological station, managed by the Italian Meteorological Service (WMO code: 16052) is located at a horizontal distance of about one hundred meters from the PRS collecting, in real time, air temperature, relative humidity, pressure and wind (speed and direction) data. The measurement of the most important greenhouse gases (excluding water vapour), such as CO₂, CH₄, and O₃, is regularly carried out. The PRS station is equipped with an electrical heating system and does not use any fossil fuel. A refuge and a cable car are located in the vicinity of the measuring station; both only operate during daylight hours and are open for about eight months a year.</p> <p>The climate at the Plateau Rosa station is typical of a continental alpine location, with relatively large diurnal and seasonal temperature variations of 6-8°C in a range between -15 and 4°C. Frequent atmospheric pressure variations and strong winds (generally > 4 m s⁻¹) are documented. In the 1971–2008 period, wind speeds < 1 m s⁻¹ occurred during about 17% of the measurements and winds from NE (about 25% of the events) prevailed.</p>
Photographs	
Exposure racks	<input type="checkbox"/> 5° <input type="checkbox"/> 45° <input type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks
Available space	To be agreed. Strongly adverse climatology condition has to be taken into account in this site.
Additional information	<p>Infrastructure to host samples have to be assembled. Cost could vary depending on necessities (and agreement). No special cost can be indicated at the moment.</p> <p>Other information: http://cimone.isac.cnr.it/data-access, https://online.ucpress.edu/elementa/article/8/1/00042/114497/Decadal-O3-variability-at-the-Mt-Cimone-WMO-GAW</p>
Managing organization	CNR-DTA, RSE
Contact person	Eros Mariani ✉ eros.mariani@cnr.it Cristiani Pierangela (RSE) ✉ Pierangela.Cristiani@rse-web.it

Site name Povo Hill, Trento
Country, region Trentino, Alto Adige, Italy
Atmosphere Urban
Location (GPS) 46.066667N, 11.116667E
Altitude 398 m
Address Via Sommarive n. 9, 38123 Trento, Italy

Description Roof of a 2-floor building located on a hill close to a city with 120,000 inhabitants surrounded by mountains (around 2000 m height). Alpine climate, pollution deriving mainly from the housing heating systems.



Operational since 2015

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	1306	08.2019–09.2020
Temperature [°C]	13.2	08.2019–09.2020	
SO ₂ [µg/m ³]	3	Average 2019	
NO _x [µg/m ³]	34	Average 2019	
Relative humidity [%]	27	Average 2017–2019	
Total radiation [W/m ²]	4700	Average 2017–2019	
Time of wetness [%]	30	Average 2017–2019	
PM10 [µg/m ³]	19	Average 2019	
PM2,5 [µg/m ³]	13	Average 2019	

Exposure racks 5° 45° 90° Possible to install customized racks

Available space More than 10 m²

Additional information Accessible for free with local support for research activities. Work in progress for the determination of the Corrosivity in compliance with ISO 9223

Managing organization Department of Industrial Engineering, University of Trento, Italy

Contact person Michele Fedel [✉ michele.fedel@unitn.it](mailto:michele.fedel@unitn.it) [☎ +39 0461 285354](tel:+390461285354)

NO, Birkenes

Site name Birkenes
Country, region Norway, Agder
Atmosphere Rural
Location (GPS) 58.389000N, 8.251000E
Altitude 190 m
Address 4760 Birkeland, Norway

Description Location in the southernmost part of Norway receiving some long range transported acid precipitation. Location on open grassy ground with significant topography and tall forest trees 50 to 100 m away. No traffic intensity. EMEP site and national background station.

Photographs



Operational since

1985

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	58 ± 5	8.1±0.9	7.6±0.2	0.4
Corrosivity category	C2	C3	C3	C2
Measurement period	10/2017–10/2018			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	1567	Long-term average
Temperature [°C]	6.2	Long-term average
SO₂ [µg/m³]	0.3	10/2000–10/2018
NO_x [µg/m³]	1.0	10/2017–10/2018
Chloride deposition [mg/m² day]	6.9	2019
pH of rain	5.0	10/2017–10/2018
Relative humidity [%]	79	Long-term average

Exposure racks

5° 45° 90° Possible to install customized racks

Available space

1.2 m² (of 10×15 cm samples)

Managing organization

NILU-Norwegian Institute for Air Research, Instituttveien 17, Box 100, 2027 Kjeller, Norway

Contact person

Dr. Terje Grøntoft [✉ teg@nilu.no](mailto:teg@nilu.no) [☎ +47 63898023](tel:+4763898023)

Site name Oslo-Skøyen
Country, region Norway, Oslo
Atmosphere Urban
Location (GPS) 59.919720N, 10.689700E
Altitude 10 m
Address Drammensveien 118, 0273 Oslo, Norway

Description On ground in backyard garden. The rack is shielded by trees and buildings from heavy traffic on roads on two sides, at distances of ≈ 90 and 130 m.

Photographs



Operational since 2002

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	19 ± 3	5.8±0.9	3.5±0.1	n.a.
Corrosivity category	C2	C3	C2	-
Measurement period	10/2017–10/2018			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	716	Long-term average
Temperature [°C]	7.2	Long-term average
SO₂ [µg/m³]	1.9	10/2000–10/2018
NO_x [µg/m³]	17.0	10/2017–10/2018
pH of rain	5.5	10/2017–10/2018
Relative humidity [%]	73	Long-term average

Exposure racks

5° 45° 90° Possible to install customized racks

Available space

1.1 m² (of 10×15 cm samples)

Additional information

Possibility to install customized racks is uncertain, depending on agreement with property owner.

Managing organization

NILU-Norwegian Institute for Air Research, Instituttveien 17, Box 100, 2027 Kjeller, Norway

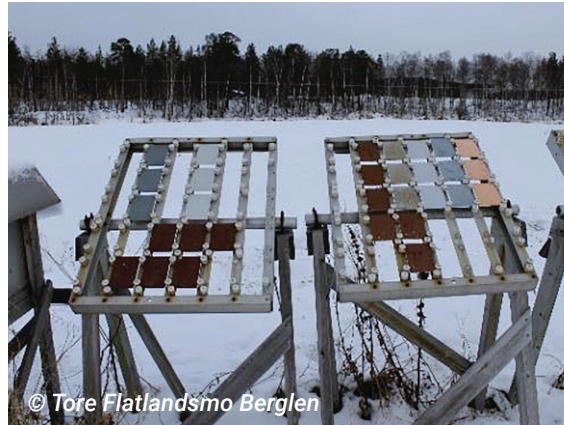
Contact person

Dr. Terje Grøntoft [✉ teg@nilu.no](mailto:teg@nilu.no) [☎ +47 63898023](tel:+4763898023)

Site name Svanvik
Country, region Norway, Troms og Finnmark
Atmosphere Rural, Industrial
Location (GPS) 69.4550000N, 30.0410000E
Altitude 30 m
Address Svanhovd, 9925 Svanvik, Norway

Description Located in the North Eastern part of Norway on the border with Russia. Cold location with low precipitation amounts. Open cultural landscape, about 100 m distance to the nearest trees. Low traffic intensity. The rack is placed on the ground. EMEP site and national background station.

Photographs



Operational since 1987

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	69 ± 2	7.9±1.9	7.9±0.2	0.7
Corrosivity category	C2	C3	C3	C3
Measurement period	10/2017–10/2018			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	411	Long-term average
	Temperature [°C]	0.6	Long-term average
	SO₂ [µg/m³]	6.5 ⁱ	10/2000–10/2018
	NO_x [µg/m³]	1.4	10/2017–10/2018
	pH of rain	4.8	10/2017–10/2018
	Relative humidity [%]	78	Long-term average

Exposure racks 5° 45° 90° Possible to install customized racks

Available space 1.5 m² (of 10×15 cm samples)

Managing organization NILU-Norwegian Institute for Air Research, Instituttveien 17, Box 100, 2027 Kjeller, Norway

Contact person Dr. Terje Grøntoft [✉ teg@nilu.no](mailto:teg@nilu.no) [☎ +47 63898023](tel:+4763898023)

I. Expected to decrease from 2020/21 when nickel works in Nikel, Russia, were closed.

NO, Tananger

Site name Tananger
Country, region Norway, Agder
Atmosphere Marine
Location (GPS) 58.9252000N, 5.572700E
Altitude 1.5 m
Address Mjånesholmen, 4056 Tananger, Norway

Description Located on the South Western coast of Norway. Only few meters from the splash zone. Low traffic intensity.

Photographs



Operational since 2006

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	600±50	n.a	n.a.	n.a.
Corrosivity category	C5	–	–	–
Measurement period	5/2011-4/2012			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	1552	5/2011-4/2012
	Temperature [°C]	9.1	5/2011-4/2012
	SO₂ [µg/m³]	3.0	5/2011-4/2012
	Chloride deposition [mg/m² day]	211	5/2011-4/2012
	pH of rain	5.9	5/2011-4/2012

Exposure racks 5° 45° 90° Possible to install customized racks

Available space 1.5 m² (of 10×15 cm samples)

Additional information The station is subject to direct sea water spray during high wind episodes mainly occurring in winter. Possibility to install customized racks is uncertain, depending on local agreement.

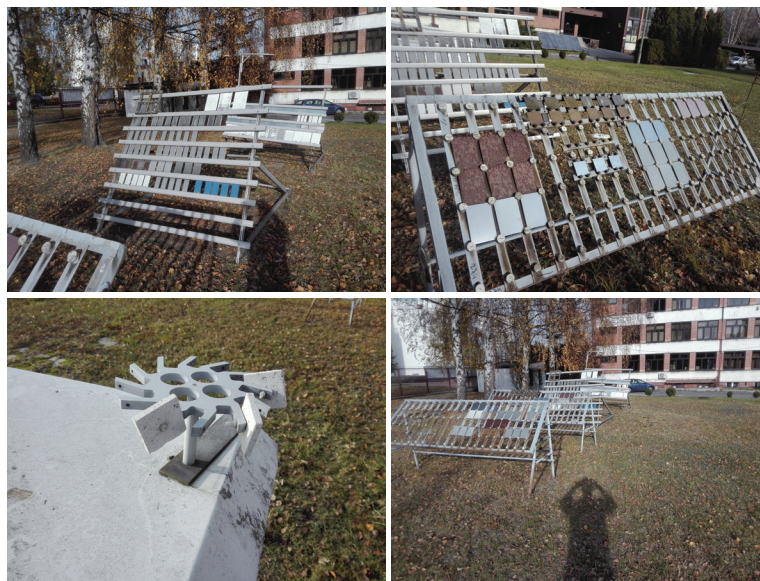
Managing organization NILU-Norwegian Institute for Air Research, Instituttveien 17, Box 100, 2027 Kjeller, Norway

Contact person Dr. Terje Grøntoft [✉ teg@nilu.no](mailto:teg@nilu.no) [☎ +47 63898023](tel:+4763898023)

Site name Katowice
Country, region Poland, Silesian Voivodeship
Atmosphere Urban
Location (GPS) 50.2649769N, 18.9755069E
Altitude 300 m
Address Kossutha street 6, Katowice, Poland

Description Atmospheric corrosivity monitoring site with the adjacent air monitoring station. Located in Katowice. Industrial type of atmosphere. Possibility of exposing a large number of samples, also atypical. One of the five long-term sites of monitoring corrosivity of atmosphere which is located in Poland.

Photographs



Operational since 1990

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	18	2.5	0.6	0.1
Corrosivity category	C2	C2	C1	C2
Measurement period	11/2018–11/2019			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	657–795	2019
	Temperature [°C]	10.4	2019
	SO₂ [µg/m³]	7.7	2019
	NOx [µg/m³]	51	2019
	Chloride deposition [mg/m² day]	1.6–2.0	2019
	pH of rain	6.3–6.6	2019
	Relative humidity [%]	74	2019

Exposure racks 5° 45° 90° Possible to install customized racks

Available space More than 30 m²

Additional information There is a possibility of adding additional racks.

Managing organization Lukaszewicz Research Network, Institute of Precision Mechanics

Contact person Rafal Lutze [✉ rafal.lutze@imp.lukasiewicz.gov.pl](mailto:rafal.lutze@imp.lukasiewicz.gov.pl) [☎ +48 22 56 02 498](tel:+48225602498)

Site name Alfanzina
Country, region Portugal, Algarve
Atmosphere Marine
Location (GPS) 37.0869444N, 8.4425000W
Altitude 63 m
Address Farol de Alfanzina, Carvoeiro, 8400-555 Lagoa, Portugal

Description Field exposure site in the south shoreline, located in the yard of the Alfanzina lighthouse.

Photographs



Operational since 1985

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	214	9.8	24	1.0
Corrosivity category	C3	C3	C4	C3
Measurement period	1991–1993			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	417	1970–2000
Temperature [°C]	16.9	1970–2000
SO₂ [mg/m² day]	11	1991–1992
SO₂ [µg/m³]	14 ^I	1991–1992
Chloride deposition [mg/m² day]	80	1991–1992
Relative humidity [%]	77	1970–2000
Total insolation [hour/year]	2883	1970–2000
Time of wetness [%]	42%	1991–1992

Exposure racks 5° 45° 90° Possible to install customized racks

Available space Around 20 m² (can be expanded)

Additional information

This test site was included in the National Corrosion Map elaborated in the early 90's. Chloride and SO₂ deposition rates were measured by the wet candle method and by the sulphur dioxide method, respectively (ISO 9225). Climatic data from the nearest weather station owned by the Portuguese Institute for Sea and Atmosphere (IPMA) at the time, 8 km distant, also on the shore. It is currently active, measuring data on air temperature, atmospheric pressure, relative humidity, solar irradiance, rainfall, wind speed and direction, which is available on request.

Managing organization

Laboratório Nacional de Engenharia Civil (LNEC)
Av. do Brasil, 101, 1700-066 Lisboa, Portugal

Contact person

Elsa Eustáquio [✉ epereira@lnec.pt](mailto:epereira@lnec.pt) [☎ +351 218 443 775](tel:+351218443775)
Rute Fontinha [✉ rfontinha@lnec.pt](mailto:rfontinha@lnec.pt)

I. Estimated from SO₂ deposition using the factor defined in ISO 9223

Site name Guincho
Country, region Portugal, Estremadura
Atmosphere Marine
Location (GPS) 38.7093861N, 9.4854389W
Altitude 9 m
Address N247, 2750-642 Cascais, Portugal

Description Field exposure site in the west shoreline, located near the Cabo Raso lighthouse.

Photographs



Operational since 2000

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	–	–	61	–
Corrosivity category	–	–	CX	–
Measurement period	01/2004-01/2005			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	451	2002–2006
Temperature [°C]	16	03/2001–07/2007
Chloride deposition [mg/m² day]	768	03/2001–07/2007
Relative humidity [%]	76	03/2001–07/2007
Time of wetness [%]	48	03/2001-05/2006

Exposure racks

5°
 45°
 90°
 Possible to install customized racks

Available space

20 m²

Additional information

Chloride deposition assessed by the wet candle method (ISO 9225). SO₂ deposition rates have not been measured because they are not expected to be relevant. This site has been used mainly for internal research studies on corrosion of steel in concrete, but it has also been used for studying copper alloys atmospheric corrosion protection (within the EU-ARTECH Project) and for testing anodized aluminium coatings. Climatic data from a weather station owned by the Portuguese Institute for Sea and Atmosphere (IPMA), that is installed next to the test site. It is currently active, measuring data on air temperature, atmospheric pressure, relative humidity, solar irradiance, rain rate, wind speed and direction, which is available on request.

Managing organization

Laboratório Nacional de Engenharia Civil (LNEC), Av. do Brasil, 101, 1700-066 Lisboa, Portugal

Contact person

Elsa Eustáquio
 ✉ epereira@lnec.pt
 ☎ +351 218 443 775
 Rute Fontinha
 ✉ rfontinha@lnec.pt

Site name LNEC, Lisboa
Country, region Portugal, Estremadura
Atmosphere Urban
Location (GPS) 38.7586111N, 9.1411111W
Altitude 114 m
Address Av. do Brasil, 101, 1700-066 Lisboa, Portugal

Description Roof of a 3-floor building located in the northeast zone of Lisbon, close to heavy traffic roads and the airport

Photographs



Operational since 1985

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	–	9.5	8.3	0.7
Corrosivity category	–	C3	C3	C3
Measurement period	–	05/1985–05/1986		

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	723	08/1999–07/2000
Temperature [°C]	16.4	08/1999–07/2000
SO₂ [mg/m² day]	26	08/1999–07/2000
SO₂ [µg/m³]	32 ^l	08/1999–07/2000
NO_x [µg/m³]	52	09/1999–07/2000
Chloride deposition [mg/m² day]	9	08/1999–07/2000
Relative humidity [%]	71	2002–2016
Total insolation [hour/year]	2591	1985–1995
Total radiation [MJ/m² day]	16.6	2002–2016
Time of wetness [%]	38	1985–1995

Exposure racks

5° 45° 90° Possible to install customized racks

Available space

More than 20 m²

Additional information

Chloride and SO₂ deposition rates were measured by the wet candle method and by the sulphur dioxide method, respectively (ISO 9225). This site has been used for internal research studies on atmospheric corrosion of several metallic materials and weathering of other types of materials. Former years climatic data was taken from a weather station owned by the Portuguese Institute for Sea and Atmosphere (IPMA), located near the test site (<2 km). In 2002, a weather station was installed at the test site (in the roof) measuring data on air temperature, black globe temperature, relative humidity and solar irradiance (including UV). Extra data are available from the IPMA stations nearby, on request.

Managing organization

Laboratório Nacional de Engenharia Civil (LNEC), Av. do Brasil, 101, 1700-066 Lisboa, Portugal

Contact person

Elsa Eustáquio [✉ epereira@lnec.pt](mailto:epereira@lnec.pt) [☎ +351 218 443 775](tel:+351218443775)
 Rute Fontinha [✉ rfontinha@lnec.pt](mailto:rfontinha@lnec.pt)

^l Estimated from SO₂ deposition using the factor defined in ISO 9223

Site name	Lumiar, Lisboa
Country, region	Portugal, Lisbon Metropolitan Area
Atmosphere	Urban
Location (GPS)	38.7713889N, 9.1797222W
Altitude	116 m
Address	Laboratório Nacional de Energia e Geologia, IP (LNEG) - Campus do Lumiar, Estrada do Paço do Lumiar, 22, Edif. K2, 1649-038 Lisboa, Portugal

Description	Urban testing site located at the roof of a 2-floor building of LNEG with high U.V. exposure and corrosivity C2-C3. It is a RUV 3 test site, according to the classification of EN 10169-2. This OET is recognized by the European Coil Coating Association (ECCA) as a reference testing site since 1990: https://www.prepaintedmetal.eu/890/sites				
Photographs					
Operational since	1990				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	147 ± 34	7 ± 2	12 ± 2	0.2 ± 0.1
	Corrosivity category	C2	C3	C3	C2
	Measurement period	– 2014-2019			
Environmental parameters	Parameter	Value	Measurement period		
	Temperature [°C]	17.3 ± 0.5	2014–2019		
	Relative humidity [%]	72 ± 4	2014–2019		
	Time of wetness [%]	41 ± 1	04/2018–12/2019		
	Chloride deposition [mg/m² day]	18 ± 4	2014–2019		
	SO₂ deposition [mg/m² day]	17 ± 9	2014–2019		
	SO₂ [µg/m³]^I	22 ± 11	2014–2019		
	Solar irradiance [W/m²]^{II}	378 ± 39	2014–2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	About 100 m ² for placing test benches				
Additional information	<p>Monitoring of atmospheric parameters: air temperature, relative humidity, solar irradiance, precipitation, wind speed and direction, time of wetness, with data collection every 10 seconds and storage every 10 minutes.</p> <p>Chloride deposition rate is evaluated by the wet candle method and sulfur dioxide deposition rate on lead dioxide sulfation plates (ISO 9225). The evaluation of the sulfur dioxide content in the atmosphere using a sensor is under development with data collection and storage, similarly to other parameters.</p> <p>The annual global radiation similar to that of Florida, but with a different distribution throughout the year. The cycle of UV radiation at Lumiar / Lisbon Test Site is best suited to the European location than that recorded in Florida, being thus more relevant for many European countries, and consequently for manufacturers of coil coated placing their products in these countries.</p> <p>The average annual temperature, as well as the annual distribution of temperature, relative humidity and rainfall are also more significant for European countries.</p> <p>Materials usually exposed: reference panels of different materials/metals, samples with organic coating, absorbers and reflectors surfaces, thermal solar collectors, polymeric materials, natural materials (e.g. wood), etc.</p> <p>Costs: Cost depends of samples dimensions and exposure time. Cost upon request.</p>				
Managing organization	National Laboratory of Energy and Geology (LNEG) - Laboratory of Materials and Coatings (LMR), Estrada do Paço do Lumiar, 22, Edif. E, R/c, 1649-038 Lisboa – Portugal				
Contact person	Teresa Diamantino <input type="email"/> teresa.diamantino@lneg.pt <input type="tel"/> +351 210 924 651				

I. Estimated from SO₂ deposition using the factor defined in ISO 9223
 II. Average solar irradiance measured at tilt of 45°

Site name	Sines				
Country, region	Portugal, Alentejo region				
Atmosphere	Marine/Industrial				
Location (GPS)	37.9558500N, 8.8853100W				
Altitude	17 m				
Address	Administração do Porto de Sines, S.A., Apartado 16, 7520-953 Sines, Portugal				
Description	Marine-industrial testing site located at the Port of Sines Authority (APS) with corrosivity C5-CX. This OET is recognized by the European Coil Coating Association (ECCA) as a reference testing site: https://www.prepaintedmetal.eu/890/sites				
Photographs					
Operational since	2010				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	928 ± 313	45 ± 10	57 ± 15	2 ± 1
	Corrosivity category	C5	C5	CX	C3
	Measurement period	–			2014–2019
Environmental parameters	Parameter	Value	Measurement period		
	Temperature [°C]	17.1 ± 0.6	2014–2019		
	Relative humidity [%]	81 ± 2	2014–2019		
	Time of wetness [%]	59 ± 11	2016–2019		
	NO_x [µg/m³]	8.6 ± 2.4	2016–2019		
	Chloride deposition [mg/m² day]	140 ± 35	2014–2019		
	SO₂ deposition [mg/m² day]	105 ± 21	2014–2019		
	SO₂ [µg/m³]^I	132 ± 26	2014–2019		
	Solar irradiance [W/m²]^{II}	411 ± 36	2014–2019		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	About 150 m ² for placing test benches				
Additional information	<p>Monitoring of atmospheric parameters: air temperature, relative humidity, solar irradiance, precipitation, wind speed and direction, time of wetness, with data collection every 10 seconds and storage every 60 minutes.</p> <p>Chloride deposition rate is evaluated by the wet candle method and sulfur dioxide deposition rate on lead dioxide sulfation plates (ISO 9225). The evaluation of the sulfur dioxide content in the atmosphere using a sensor is under development with data collection and storage, similarly to other parameters.</p> <p>Materials usually exposed: reference panels of different materials/metals, samples with organic coating, absorbers and reflectors surfaces, thermal solar collectors, polymeric materials, natural materials (e.g. wood), etc.</p> <p>Costs: Cost depends on samples dimensions and exposure time. Cost upon request.</p>				
Managing organization	National Laboratory of Energy and Geology (LNEG) - Laboratory of Materials and Coatings (LMR) Estrada do Paço do Lumiar, 22, Edif. E, R/c, 1649-038 Lisboa, Portugal				
Contact person	Teresa Diamantino <input type="email"/> teresa.diamantino@lneg.pt <input type="tel"/> +351 210 924 651				

I. Estimated from SO₂ deposition using the factor defined in ISO 9223
 II. Average solar irradiance measured at tilt of 45°

SE, Bohus-Malmön Kattesand

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Site name Bohus-Malmön Kattesand
Country, region Sweden, West coast
Atmosphere Marine
Location (GPS) 58.334722N, 11.334167E
Altitude 40 m

Description Marine test site located on an island on the Swedish west coast in Kattegatt.. The site is positioned approximately 350 meters from the sea.

Photographs



Operational since

1958

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	237 ± 1	6.9 ± 0.3	12 ± 0.6	0.5 ± 0.1
Corrosivity category	C3	C3	C3	C2
Measurement period	10/2018–10/2019			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	967	01/2019–01/2020
Temperature [°C]	9.4	01/2019–01/2020
SO₂ [µg/m³]	< 1	01/2019–01/2020
Chloride deposition [mg/m² day]	75	01/2019–01/2020
pH of rain	5.1-7.7	01/2019–01/2020
Relative humidity [%]	81	01/2019–01/2020
Total radiation [kWh/m² year]	992	01/2019–01/2020
Time of wetness [%]	57	01/2019–01/2020

Exposure racks

5°
 45°
 90°
 Possible to install customized racks

Available space

More than 4000 m²

Managing organization

RISE KIMAB AB, Box 7047, SE-164 07, Kista, Sweden
 Visiting address: Isafjordsgatan 28 A, Kista, Sweden

Contact person

Carolina Schneiker
 ✉ carolina.schneiker@ri.se
 ☎ +46 10 228 48 61
 Bo Rendahl
 ✉ bo.rendahl@ri.se
 ☎ +46 10 228 48 58

SE, Bohus-Malmön Kvarnvik

39

Site name Bohus-Malmön Kvarnvik
Country, region Sweden, West coast
Atmosphere Marine
Location (GPS) 58.338333N, 11.315833E
Altitude 5 m

Description Marine test site located on an island on the Swedish west coast in Kattegatt. The corrosivity is measured at three different positions with different distances to the sea. The data given below is measured at approximately 50 meters from the sea.

Photographs



Operational since

1967

Corrosivity (ISO 9223)

	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	751 ± 179	11.0	26.0	2.3
Corrosivity category	C5	C3	C5	C4
Measurement period	10/2018–10/2019			

Environmental parameters

Parameter	Value	Measurement period
Rainfall [mm/year]	967	01/2019–01/2020
Temperature [°C]	9.4	01/2019–01/2020
SO₂ [µg/m³]	< 1	01/2019–01/2020
Chloride deposition [mg/m² day]	577	01/2019–01/2020
pH of rain	5.1-7.7	01/2019–01/2020
Relative humidity [%]	81	01/2019–01/2020
Total radiation [kWh/m² year]	992	01/2019–01/2020
Time of wetness [%]	57	01/2019–01/2020

Exposure racks

5°
 45°
 90°
 Possible to install customized racks

Available space

More than 5000 m²

Additional information

Possibility to expose samples at different corrosivity classes due to the large area of the test site. Chloride deposition and corrosivity class is measured at three different positions with different distances to the sea.

Managing organization

RISE KIMAB AB, Box 7047, SE-164 07, Kista, Sweden
 Visiting address: Isafjordsgatan 28 A, Kista, Sweden

Contact person

Carolina Schneiker ✉ carolina.schneiker@ri.se ☎ +46 10 228 48 61
 Bo Rendahl ✉ bo.rendahl@ri.se ☎ +46 10 228 48 58

SE, Bohus-Malmön Kvarnvik 3

Site name Bohus-Malmön Kvarnvik 3
 Country, region Sweden, West coast
 Atmosphere Marine
 Location (GPS) 58.341404N, 11.317398E
 Altitude 40 m

Description Marine test site located on an island on the Swedish west coast in Kattegatt. The site is positioned approximately 200 meters from the sea.

Photographs



Operational since 2008

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	269 ± 3	8.5 ± 0.5	14.0 ± 0.6	0.8 ± 0
Corrosivity category	C3	C3	C4	C3
Measurement period	10/2018–10/2019			

Environmental parameters	Parameter	Value	Measurement period
	Rainfall [mm/year]	967	01/2019–01/2020
	Temperature [°C]	9.4	01/2019–01/2020
	SO₂ [µg/m³]	< 1	01/2019–01/2020
	Chloride deposition [mg/m² day]	125	01/2019–01/2020
	pH of rain	5.1-7.7	01/2019–01/2020
	Relative humidity [%]	81	01/2019–01/2020
	Total radiation [kWh/m² year]	992	01/2019–01/2020
	Time of wetness [%]	57	01/2019–01/2020

Exposure racks 5° 45° 90° Possible to install customized racks

Available space More than 2000 m²

Managing organization RISE KIMAB AB, Box 7047, SE-164 07, Kista, Sweden
 Visiting address: Isafjordsgatan 28 A, Kista, Sweden

Contact person Carolina Schneiker [✉ carolina.schneiker@ri.se](mailto:carolina.schneiker@ri.se) [☎ +46 10 228 48 61](tel:+46102284861)
 Bo Rendahl [✉ bo.rendahl@ri.se](mailto:bo.rendahl@ri.se) [☎ +46 10 228 48 58](tel:+46102284858)

Site name Gällivare, Kavaheden
Country, region Sweden, North of Sweden
Atmosphere Rural
Location (GPS) 67.150316N, 20.748453E
Altitude 300 m

Description Subarctic test site located in the north of Sweden.

Photographs



Operational since 2017

Corrosivity (ISO 9223)	Steel	Zinc	Copper	Aluminium
Corrosion rate [g/m² year]	38 ± 3	4.4 ± 0.6	1.7 ± 0.1	0.3 ± 0.1
Corrosivity category	C2	C2	C2	C2
Measurement period	10/2018–10/2019			

Environmental parameters	Parameter	Value	Measurement period
	Temperature [°C]	-0.2	01/2019–01/2020
	Relative humidity [%]	77	01/2019–01/2020
	Total radiation [kWh/m² year]	711	01/2019–01/2020
	Time of wetness [%]	20	01/2019–01/2020

Exposure racks 5° 45° 90° Possible to install customized racks


Available space 100 m²

Managing organization RISE KIMAB AB, Box 7047, SE-164 07, Kista, Sweden
 Visiting address: Isafjordsgatan 28 A, Kista, Sweden

Contact person Carolina Schneiker [✉ carolina.schneiker@ri.se](mailto:carolina.schneiker@ri.se) [☎ +46 10 228 48 61](tel:+46102284861)
 Bo Rendahl [✉ bo.rendahl@ri.se](mailto:bo.rendahl@ri.se) [☎ +46 10 228 48 58](tel:+46102284858)

SE, Kristineberg

Site name Kristineberg Marine Research and Innovation Centre
Country, region Sweden, West-Coast
Atmosphere Marine
Location (GPS) 58.2498611N, 11.4445556E
Altitude -6 to 2 m
Address Kristineberg 566, 450 34 Fiskebäckskil, Sweden

Description	Stands/Racks/Frames on and under a jetty.				
Photographs	   				
Operational since	2019				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	378 ± 35	5.3 ± 0.8	18.9 ± 4.6	–
	Corrosivity category	C3	C3	C4	–
	Measurement period	10/2019–10/2020			
Environmental parameters	Parameter	Value	Measurement period		
	Rainfall [mm/year]	1017	10/2019-10/2020		
	Temperature [°C]	9.6	10/2019-10/2020		
	Relative humidity [%]	81	10/2019-10/2020		
	Time of wetness [%]	59	10/2019-10/2020		
	Sea temperature [°C]	8.2	10/2019-10/2020		
	Surface water salinity [PSU]	26	10/2019-10/2020		
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	20 stands/racks 1.5x0.9 m for atmospheric/splash exposure, 20 frames 1.9x0.8m for submerged or antifouling exposure				
Additional information	Standard are 0° from the vertical and the natural movement of the jetty makes the exposure angle difficult to maintain.				
Managing organization	RISE Research Institutes of Sweden, Division of Materials and Production, Corrosion department, Product Durability Unit. ri.se, Brinellgatan 4, 504 62 Borås, Box 857, SE-501 15 Borås, Sweden				
Contact person	Kjell-Åke Andersson ✉ kjell-ake.andersson@ri.se Johan B. Lindén ✉ johan.b.linden@ri.se				

Site name Ryda Kungsgård
Country, region Sweden, Uppland
Atmosphere Rural
Location (GPS) 59.7613889N, 17.1283331E
Altitude 50 m

Description	Rural atmosphere in the inland of Sweden located approximately 80 km from Stockholm.				
Photographs					
Operational since	Beginning of 1960s				
Corrosivity (ISO 9223)		Steel	Zinc	Copper	Aluminium
	Corrosion rate [g/m² year]	28 ± 22	2.9 ± 0.1	3.9 ± 0.2	0.1 ± 0.0
	Corrosivity category	C2	C2	C2	C2
	Measurement period	10/2017–10/2018			
Exposure racks	<input checked="" type="checkbox"/> 5° <input checked="" type="checkbox"/> 45° <input checked="" type="checkbox"/> 90° <input checked="" type="checkbox"/> Possible to install customized racks				
Available space	3000 m ²				
Managing organization	RISE KIMAB AB, Box 7047, SE-164 07, Kista, Sweden Visiting address: Isafjordsgatan 28 A, Kista, Sweden				
Contact person	Carolina Schneiker ✉ carolina.schneiker@ri.se ☎ +46 10 228 48 61 Bo Rendahl ✉ bo.rendahl@ri.se ☎ +46 10 228 48 58				

