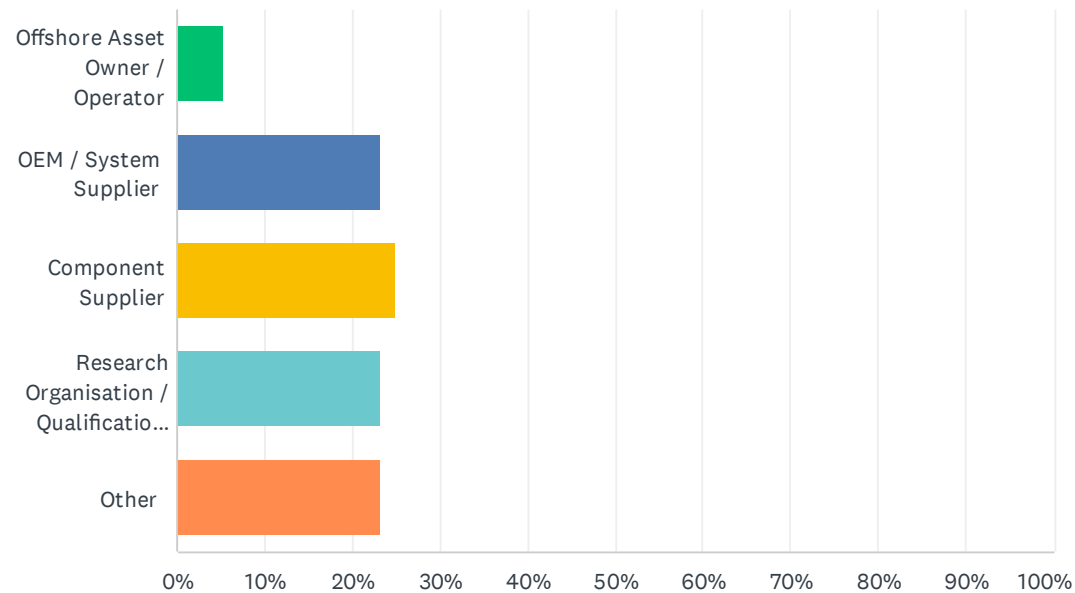


Q1 What kind of company/organisation are you representing?

Answered: 56 Skipped: 0



ANSWER CHOICES	RESPONSES	
Offshore Asset Owner / Operator	5.36%	3
OEM / System Supplier	23.21%	13
Component Supplier	25.00%	14
Research Organisation / Qualification Test Lab	23.21%	13
Other	23.21%	13
TOTAL		56

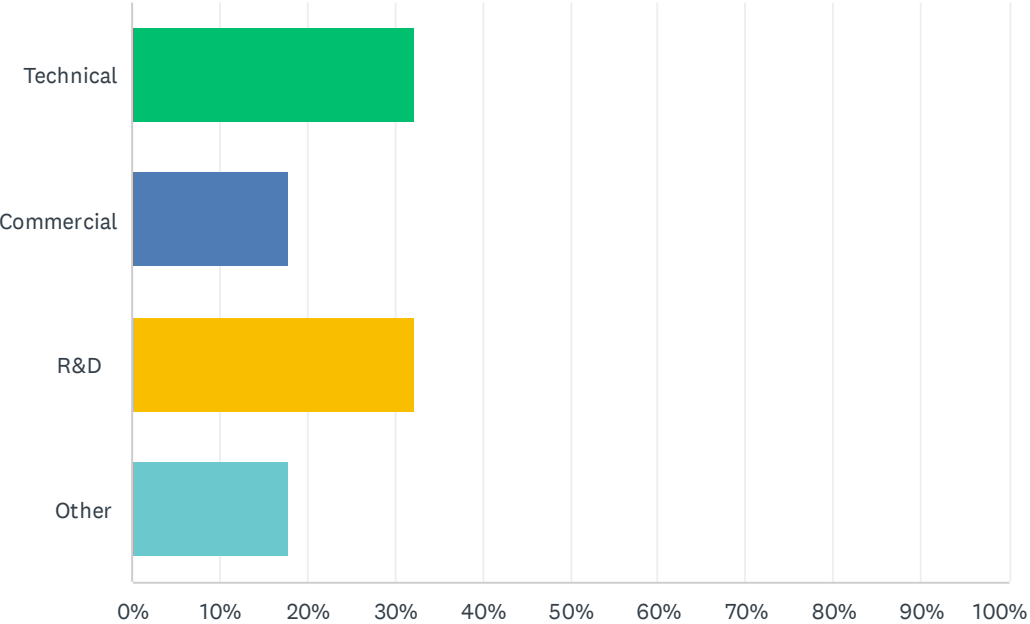
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## MORE: Next Generation Marine Materials (v2)

#	OTHER	DATE
1	SME consultancy	10/16/2024 11:00 AM
2	Designer	10/16/2024 10:58 AM
3	Consultant	10/16/2024 10:57 AM
4	Powder supplier	10/16/2024 10:57 AM
5	Coating material manufacturer	10/16/2024 10:53 AM
6	Recent graduate	10/16/2024 10:15 AM
7	Investor	10/9/2024 12:00 PM
8	University	10/7/2024 9:46 PM
9	Metal Powder producer	9/12/2024 3:28 PM
10	Coating specialist	6/28/2024 12:20 PM
11	Supplier of surface coating (Chrome, Nickel and Laser Cladding)	6/4/2024 2:11 PM
12	Thermal spraying and Machining of new parts for OEM:s and reconditioning	6/4/2024 8:43 AM
13	material supplier	5/31/2024 3:45 PM

Q2 What is your primary role/responsibility within your company?

Answered: 56    Skipped: 0



ANSWER CHOICES		RESPONSES	
Technical		32.14%	18
Commercial		17.86%	10
R&D		32.14%	18
Other		17.86%	10
TOTAL			56

#	OTHER	DATE
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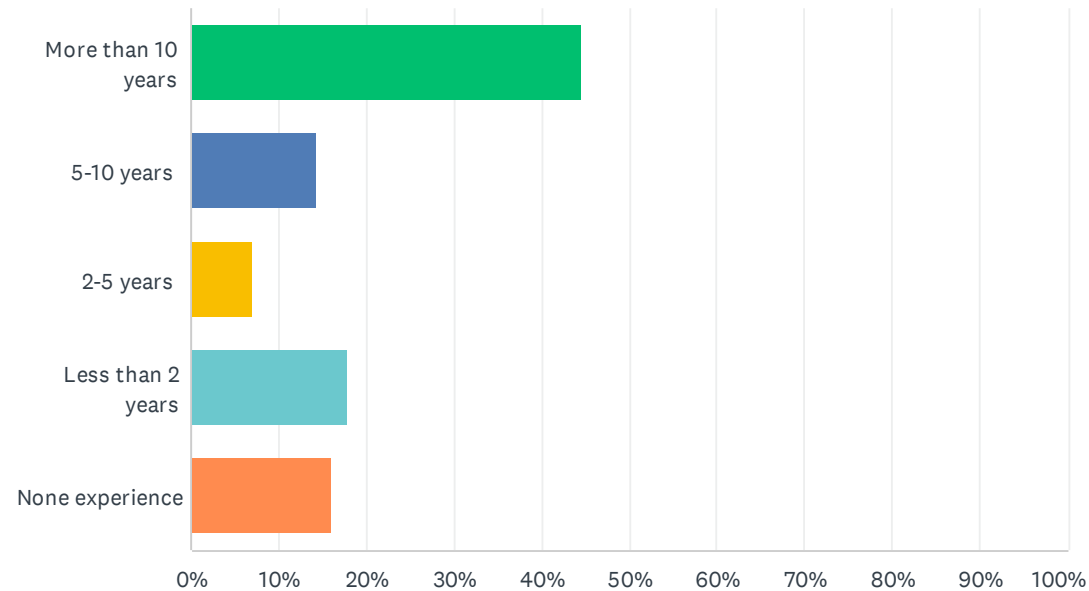
MORE: Next Generation Marine Materials (v2)

1	All	10/16/2024 10:57 AM
2	CEO	10/16/2024 10:20 AM
3	Service	10/9/2024 10:32 AM
4	Service	10/9/2024 9:38 AM
5	Scientist	10/7/2024 9:46 PM
6	Business Developement	9/12/2024 3:28 PM
7	sales	7/1/2024 10:11 AM
8	Technical/Business Development	6/3/2024 10:13 AM
9	Global director business development	6/2/2024 7:58 PM
10	Business Deveopment	6/1/2024 6:55 PM

### Q3 How long experience do you have within selection of material quality for tribo-corrosion applications?

Definition: Tribo-corrosion is a material degradation process that occurs due to the combined effects of corrosion and wear (in wet abrasive environment).

Answered: 56 Skipped: 0

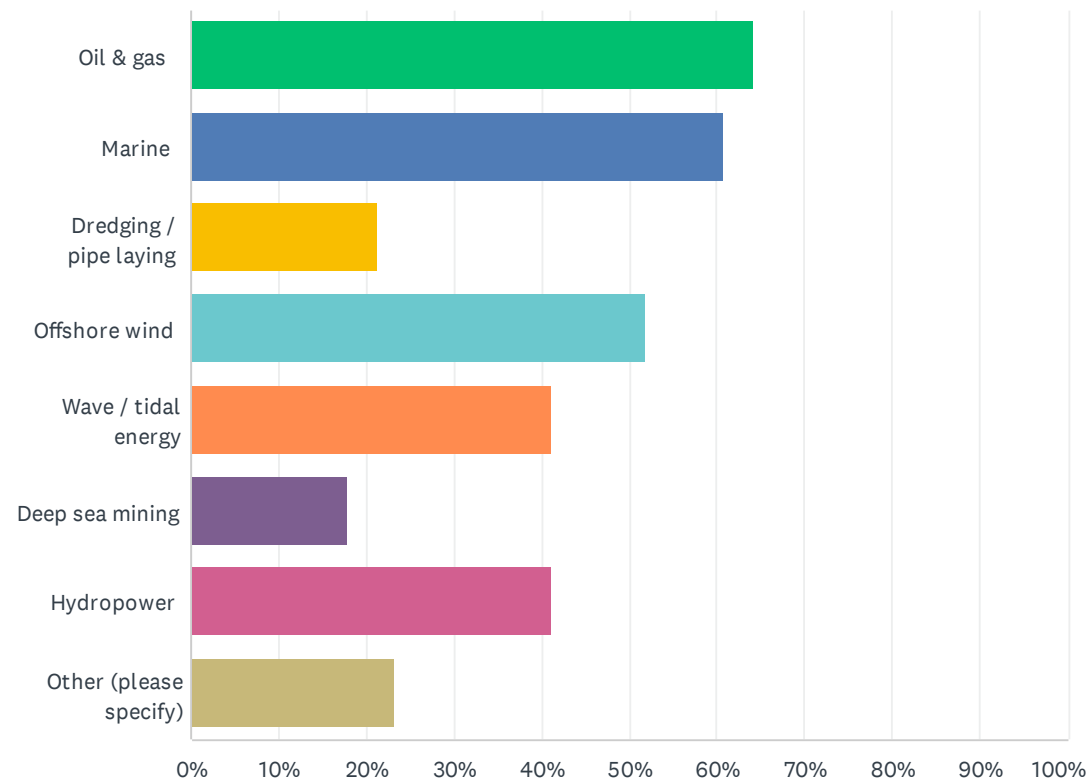


MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
More than 10 years	44.64%	25
5-10 years	14.29%	8
2-5 years	7.14%	4
Less than 2 years	17.86%	10
None experience	16.07%	9
TOTAL		56

## Q4 Which industries are you involved in?

Answered: 56 Skipped: 0



## MORE: Next Generation Marine Materials (v2)

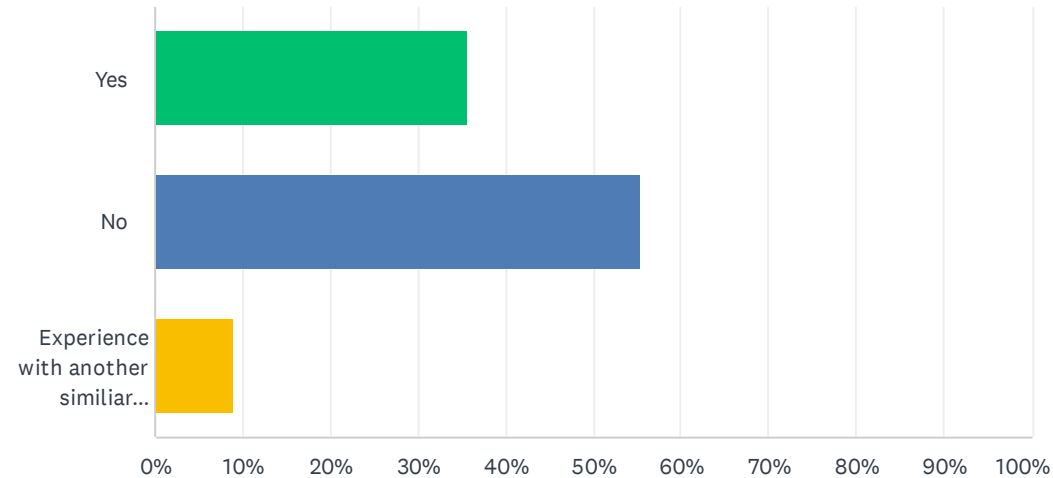
ANSWER CHOICES	RESPONSES
Oil & gas	64.29% 36
Marine	60.71% 34
Dredging / pipe laying	21.43% 12
Offshore wind	51.79% 29
Wave / tidal energy	41.07% 23
Deep sea mining	17.86% 10
Hydropower	41.07% 23
Other (please specify)	23.21% 13
Total Respondents: 56	

#	OTHER (PLEASE SPECIFY)	DATE
1	Steel	10/16/2024 10:53 AM
2	tribology	10/15/2024 12:38 PM
3	Research	10/14/2024 2:26 PM
4	Academia	10/7/2024 9:46 PM
5	Port Operations, Flood Barriers, Navigation locks	10/6/2024 2:17 PM
6	Surface coating (laser cladding and high-speed laser cladding)	9/30/2024 9:09 AM
7	material corrosion - general	9/19/2024 5:55 PM
8	Aerospace, Medical, Automotive, General Industry, Energy	9/12/2024 3:28 PM
9	traditional industry and agricultural industry	6/28/2024 1:50 PM
10	No specific	6/28/2024 12:20 PM
11	Pulp & paper	6/11/2024 7:08 AM
12	Landbased industries	6/10/2024 9:14 AM
13	Process, steel, pulp & paper, mining	6/4/2024 8:43 AM



Q5 Do you have any experience with using DNVs “Guideline for qualification of wear and corrosion protection surface materials for piston rods”?

Answered: 56 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		35.71%	20
No		55.36%	31
Experience with another similiar guideline.(Please specify guideline/document, and whether it includes combined wear and corrosion testing).		8.93%	5
TOTAL			56

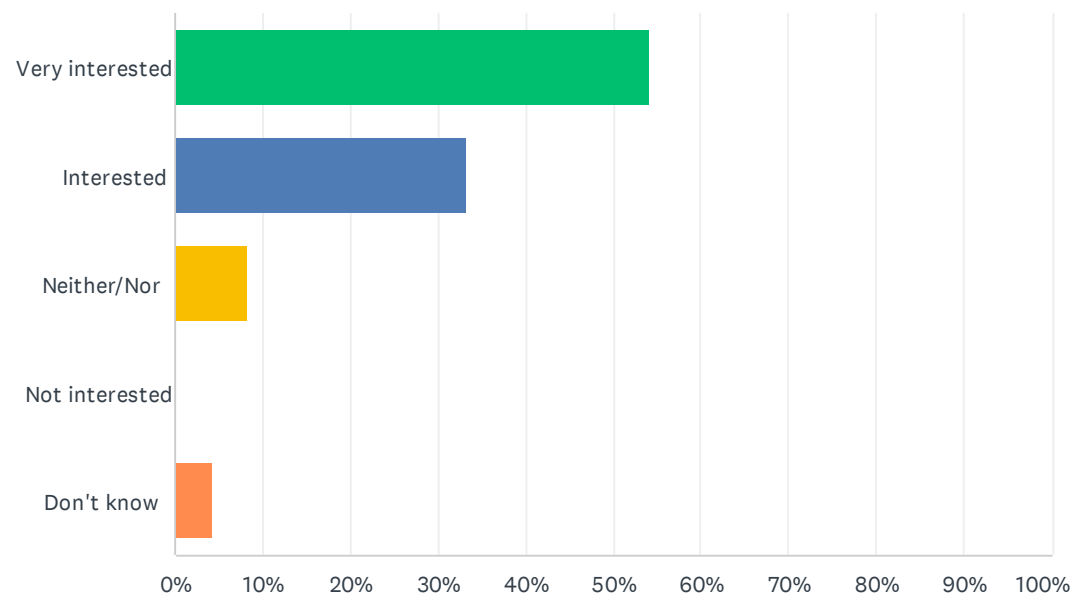
#	EXPERIENCE WITH ANOTHER SIMILIAR GUIDELINE.(PLEASE SPECIFY GUIDELINE/DOCUMENT, AND WHETHER IT INCLUDES COMBINED WEAR AND CORROSION TESTING).	DATE
1	I have worked with erosion, corrosion and erosion-corrosion inside offshore process equipment, a related challenge. However, no O2, but instead CO2. Carbon, austenitic and martensitic and duplex steels. Erosion caused by sand. This wasduring my time working for DNV over 20 years ago.	10/16/2024 10:57 AM

MORE: Next Generation Marine Materials (v2)

2	DNV has audited our German powder production plant for marine applicationapp	9/12/2024 3:28 PM
3	Astm	9/5/2024 11:06 PM
4	ISO 15614-7	8/23/2024 11:10 AM
5	DIN and ASTM	6/28/2024 12:20 PM

Q6 How interested would you be in a new improved guideline for ORE tribology and material qualification?

Answered: 24    Skipped: 32



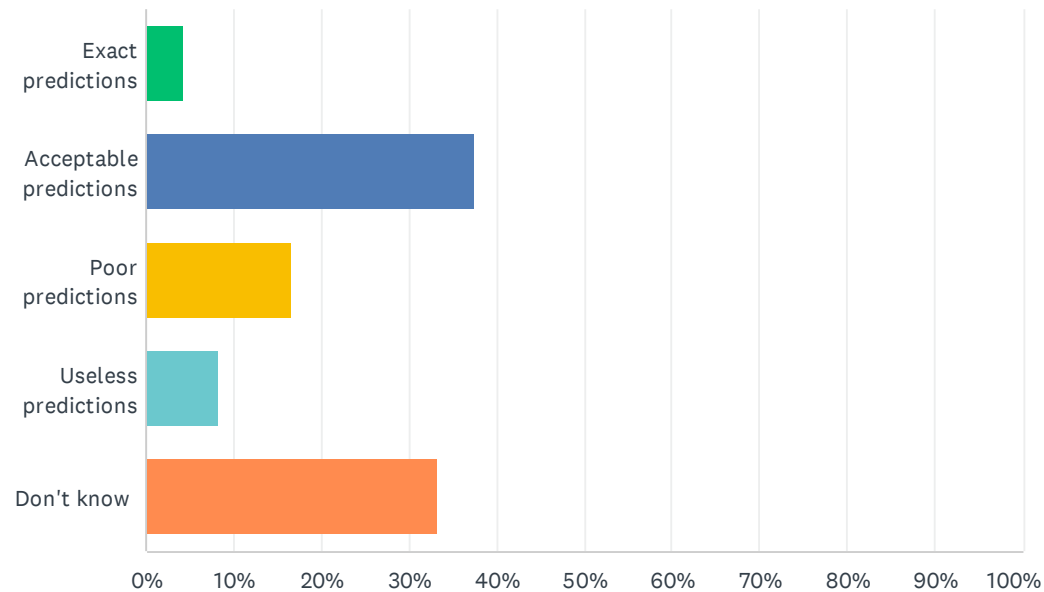
ANSWER CHOICES	RESPONSES	
Very interested	54.17%	13
Interested	33.33%	8
Neither/Nor	8.33%	2
Not interested	0.00%	0
Don't know	4.17%	1
TOTAL		24

MORE: Next Generation Marine Materials (v2)

#	PLEASE SPECIFY REASON	DATE
1	To be able to supply even better products and advise customers in a better way, imprvoing sustainability	10/6/2024 2:19 PM

Q7 What is your impression of the accuracy of service life prediction of current recommended qualification testing for materials/coatings exposed to harsh offshore conditions (simultaneous corrosion, wear and fatigue)?

Answered: 24 Skipped: 32

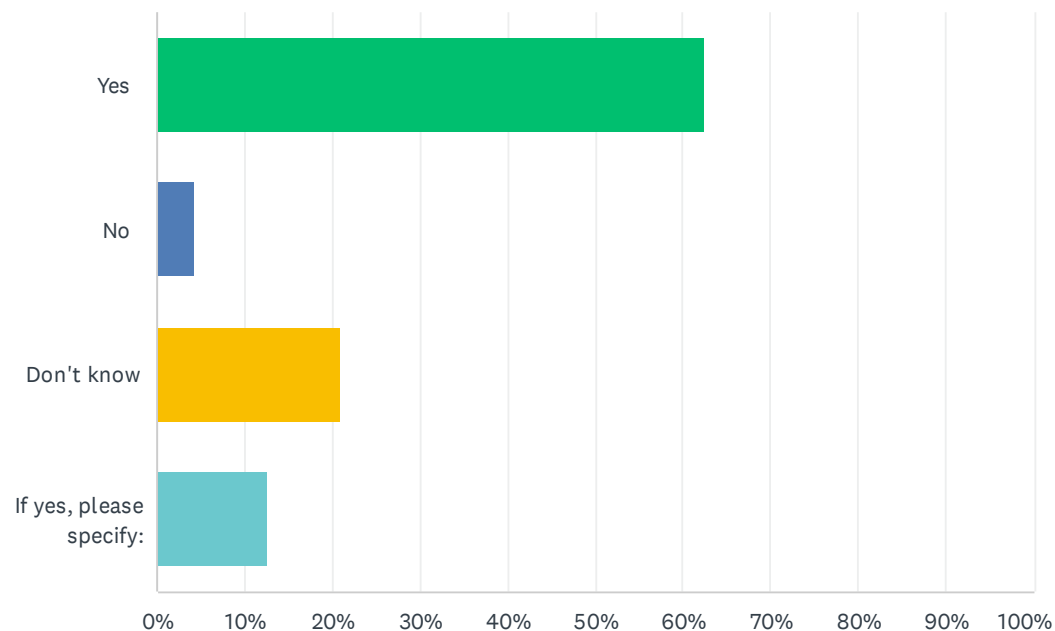


MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Exact predictions	4.17%	1
Acceptable predictions	37.50%	9
Poor predictions	16.67%	4
Useless predictions	8.33%	2
Don't know	33.33%	8
TOTAL		24

Q8 Do you support that such guidelines should be established as an official standard (e.g. EN, ISO, ANSI, ASTM) or recommended practice (e.g. industry cluster, research organisation, certification body)?

Answered: 24 Skipped: 32



MORE: Next Generation Marine Materials (v2)

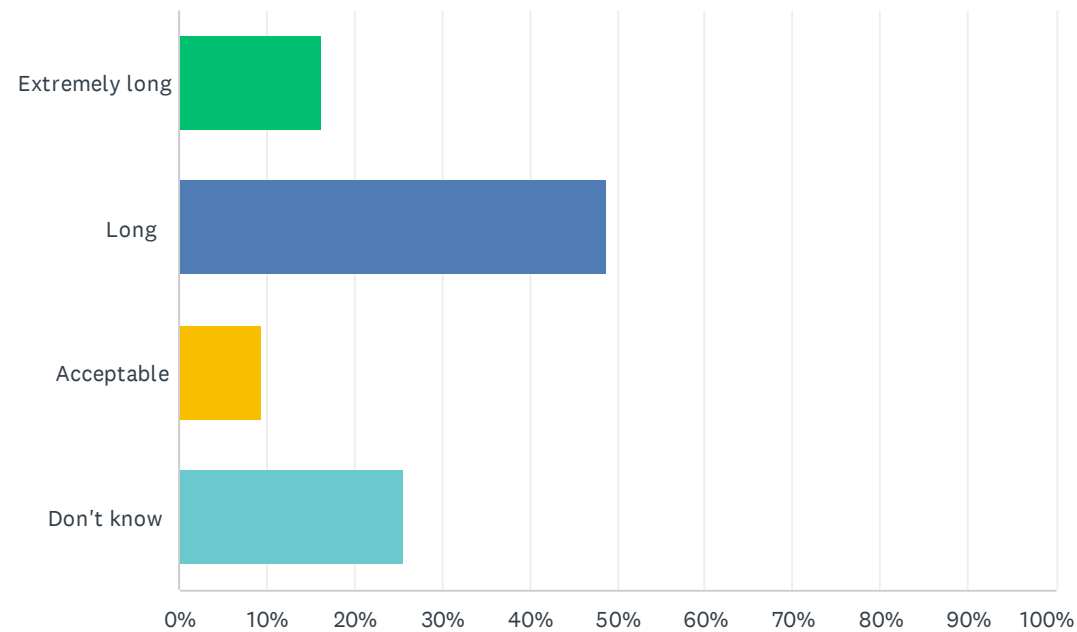
ANSWER CHOICES	RESPONSES	
Yes	62.50%	15
No	4.17%	1
Don't know	20.83%	5
If yes, please specify:	12.50%	3
TOTAL		24

#	IF YES, PLEASE SPECIFY:	DATE
1	Recommended practice. Much faster process than official standard. Can be converted to standard at a later stage.	10/16/2024 10:59 AM
2	Recommended practise would be very useful	10/16/2024 10:53 AM
3	Standard Requirements per sector	6/1/2024 6:59 PM



Q9 What is your impression on the time it takes to obtain test results for current qualification tests?

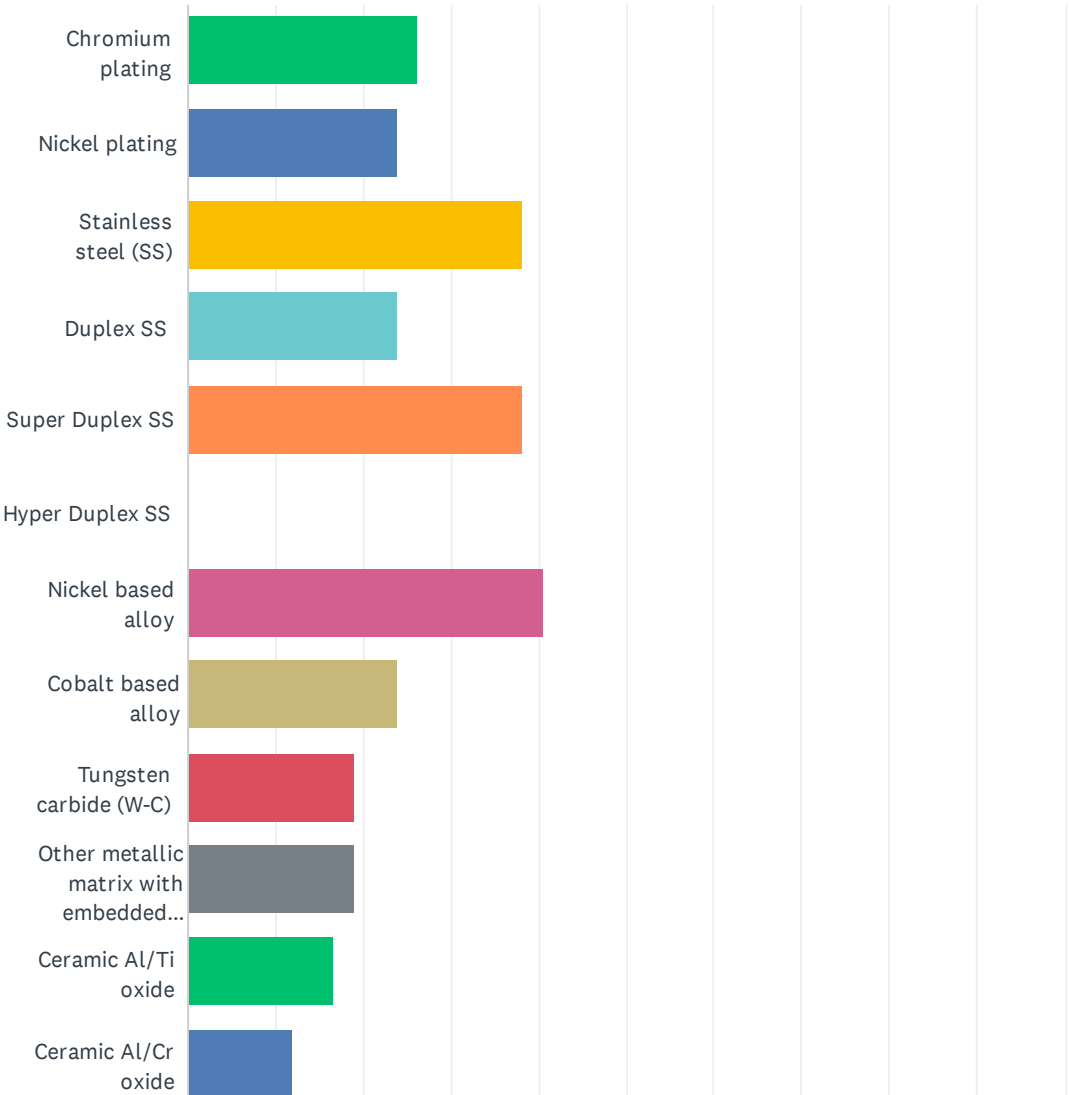
Answered: 43    Skipped: 13



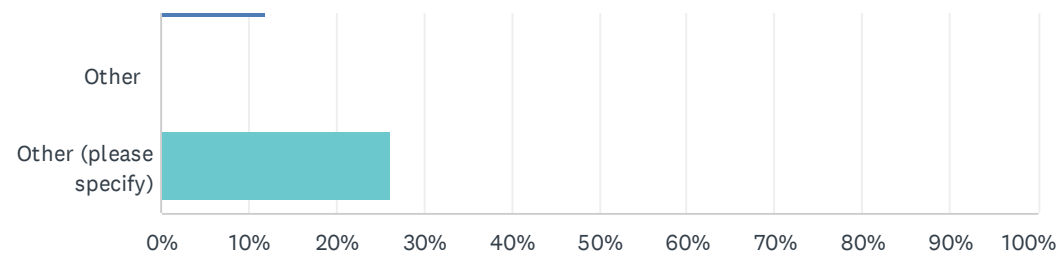
ANSWER CHOICES	RESPONSES	
Extremely long	16.28%	7
Long	48.84%	21
Acceptable	9.30%	4
Don't know	25.58%	11
TOTAL		43

Q10 Name the most common material selection you are using for harsh offshore tribo-corrosion applications today.

Answered: 42    Skipped: 14



MORE: Next Generation Marine Materials (v2)



ANSWER CHOICES	RESPONSES	
Chromium plating	26.19%	11
Nickel plating	23.81%	10
Stainless steel (SS)	38.10%	16
Duplex SS	23.81%	10
Super Duplex SS	38.10%	16
Hyper Duplex SS	0.00%	0
Nickel based alloy	40.48%	17
Cobalt based alloy	23.81%	10
Tungsten carbide (W-C)	19.05%	8
Other metallic matrix with embedded carbides	19.05%	8
Ceramic Al/Ti oxide	16.67%	7
Ceramic Al/Cr oxide	11.90%	5
Other	0.00%	0
Other (please specify)	26.19%	11
Total Respondents: 42		

#	OTHER (PLEASE SPECIFY)	DATE
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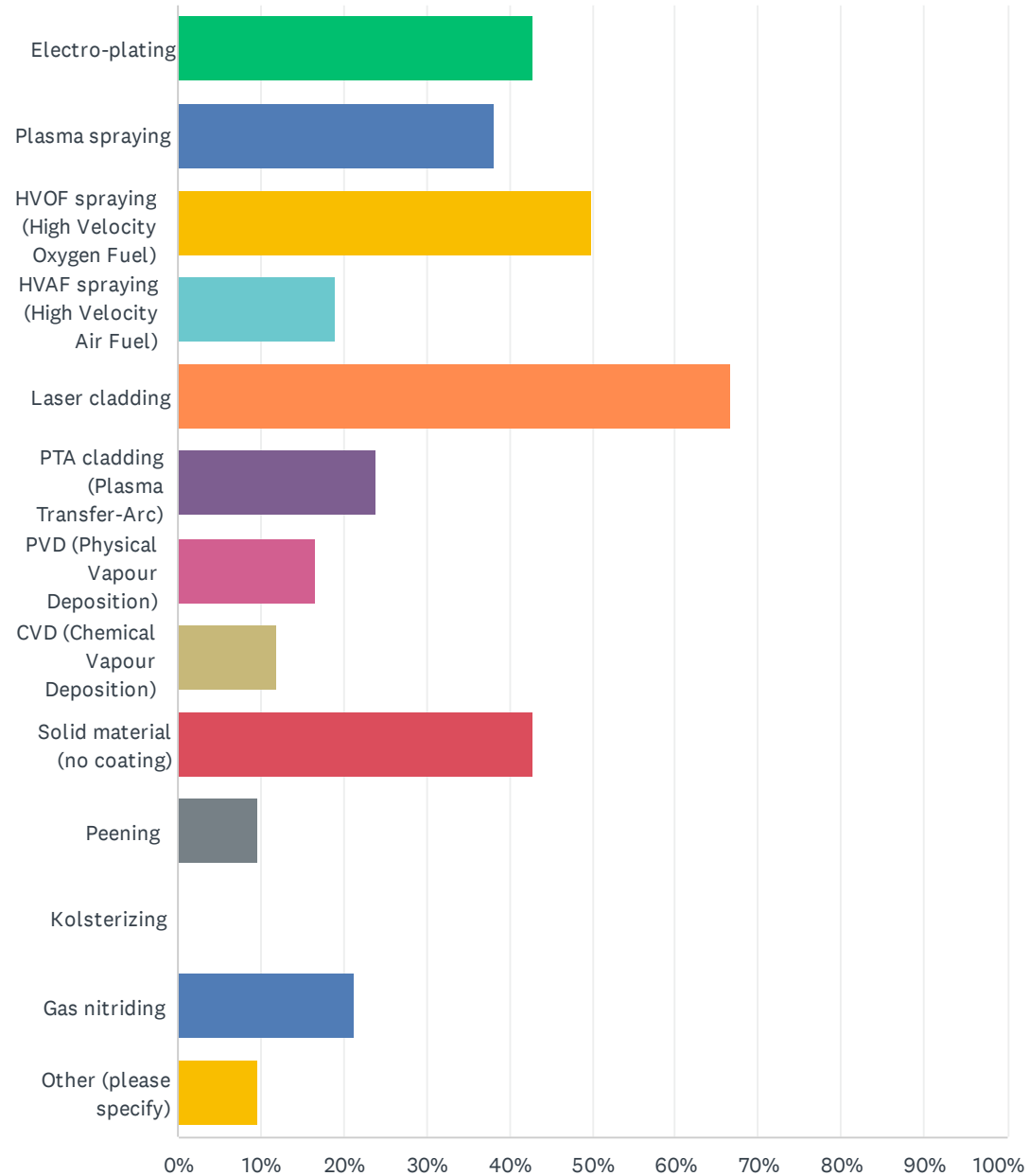
## MORE: Next Generation Marine Materials (v2)

1	NA	10/16/2024 11:03 AM
2	Plastics/composites	10/16/2024 11:00 AM
3	not applicable	10/14/2024 1:47 PM
4	not expert in this	10/14/2024 12:55 PM
5	ZrN, DLC	10/9/2024 4:31 PM
6	Welded	10/9/2024 10:43 AM
7	Inc625 cladding	10/6/2024 2:27 PM
8	S355	9/11/2024 12:40 PM
9	TCE316L, TCE625 and TCE625+	6/4/2024 2:20 PM
10	Polymer surfaces	6/3/2024 12:40 PM
11	Patented	6/1/2024 7:11 PM

Q11 Which coating application (surface treatment) methods do you have experience with?

Answered: 42   Skipped: 14

## MORE: Next Generation Marine Materials (v2)



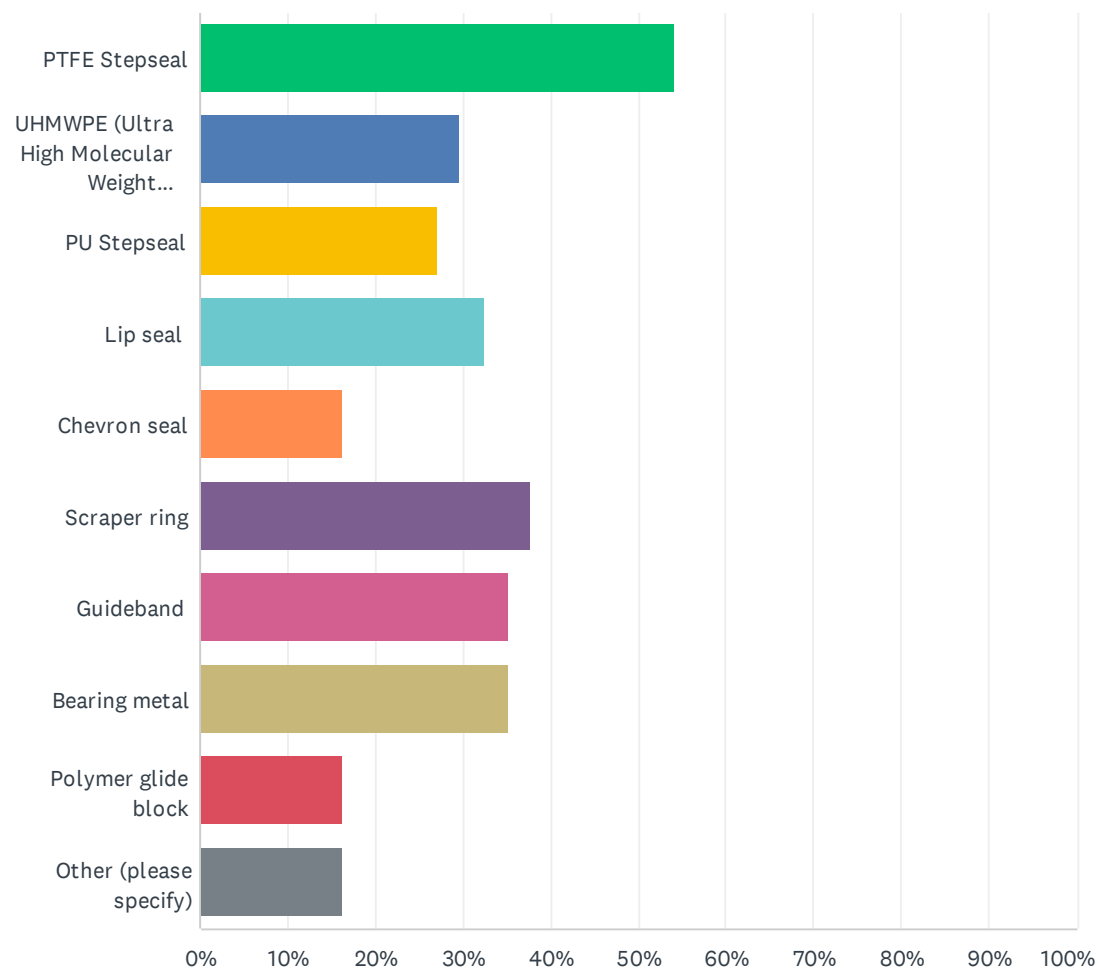
MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Electro-plating	42.86%	18
Plasma spraying	38.10%	16
HVOF spraying (High Velocity Oxygen Fuel)	50.00%	21
HVAF spraying (High Velocity Air Fuel)	19.05%	8
Laser cladding	66.67%	28
PTA cladding (Plasma Transfer-Arc)	23.81%	10
PVD (Physical Vapour Deposition)	16.67%	7
CVD (Chemical Vapour Deposition)	11.90%	5
Solid material (no coating)	42.86%	18
Peening	9.52%	4
Kolsterizing	0.00%	0
Gas nitriding	21.43%	9
Other (please specify)	9.52%	4
Total Respondents: 42		

#	OTHER (PLEASE SPECIFY)	DATE
1	QPQ	10/16/2024 11:05 AM
2	NA	10/16/2024 11:03 AM
3	none	10/16/2024 11:00 AM
4	Arc-spraying, Flame spraying	6/4/2024 9:01 AM

## Q12 Name the most common countermaterials (sealing or load support) you are using for harsh offshore tribo-corrosion applications today.

Answered: 37 Skipped: 19



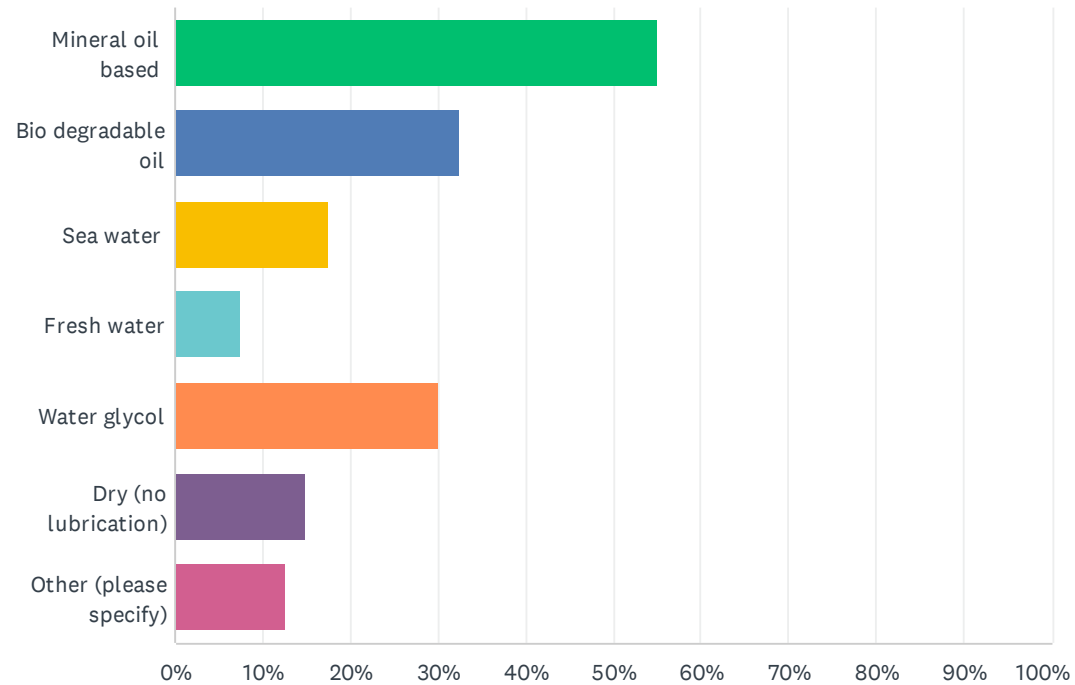


ANSWER CHOICES	RESPONSES	
PTFE Stepseal	54.05%	20
UHMWPE (Ultra High Molecular Weight PolyEthylene) Stepseal	29.73%	11
PU Stepseal	27.03%	10
Lip seal	32.43%	12
Chevron seal	16.22%	6
Scraper ring	37.84%	14
Guideband	35.14%	13
Bearing metal	35.14%	13
Polymer glide block	16.22%	6
Other (please specify)	16.22%	6
Total Respondents: 37		

#	OTHER (PLEASE SPECIFY)	DATE
1	NA	10/16/2024 11:03 AM
2	Polyurethane	10/16/2024 11:00 AM
3	not applicable	10/14/2024 1:47 PM
4	NA	9/12/2024 3:32 PM
5	our customers choice	6/4/2024 9:01 AM
6	Chevron for SS, polymer against polymer	6/3/2024 12:40 PM

## Q13 What kind of lubrication are you mostly using?

Answered: 40 Skipped: 16



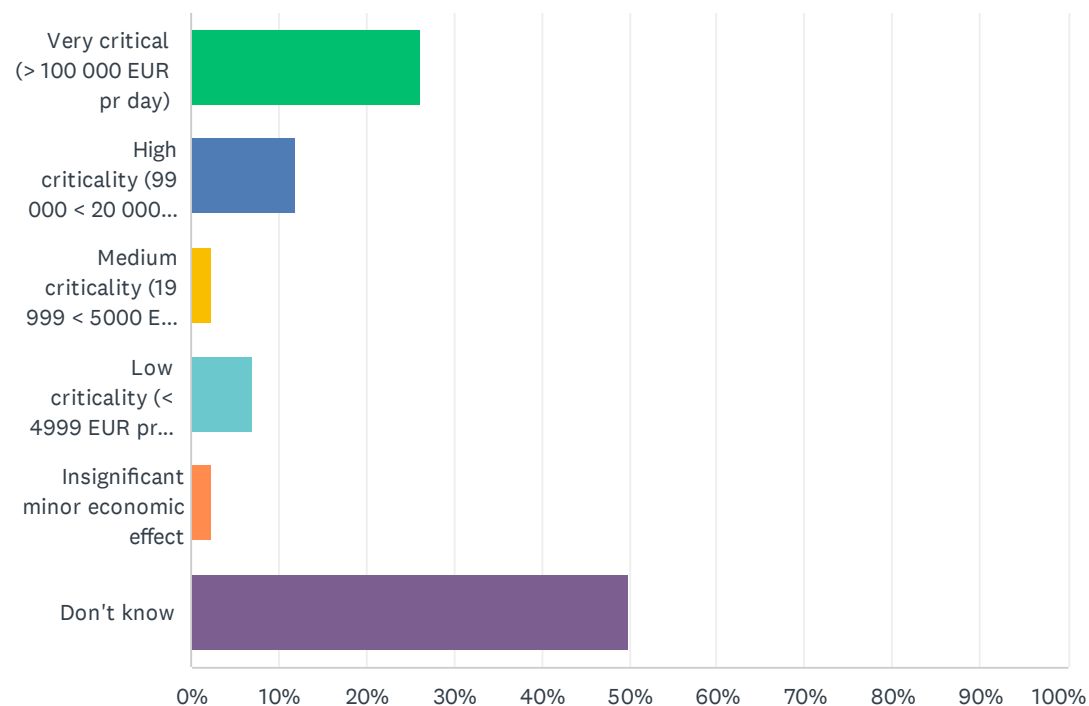
MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Mineral oil based	55.00%	22
Bio degradable oil	32.50%	13
Sea water	17.50%	7
Fresh water	7.50%	3
Water glycol	30.00%	12
Dry (no lubrication)	15.00%	6
Other (please specify)	12.50%	5
Total Respondents: 40		

#	OTHER (PLEASE SPECIFY)	DATE
1	NA	10/16/2024 11:03 AM
2	Solid lubrication	10/14/2024 1:47 PM
3	NA	9/12/2024 3:32 PM
4	our customers choice	6/4/2024 9:01 AM
5	have no details on lubrication	5/31/2024 4:00 PM

Q14 How critical is system down time due to Tribo-corrosion/ Multi-degradation damage (for your most critical application)? Multi-degradation: Simultaneous corrosion, wear and fatigue.

Answered: 42 Skipped: 14

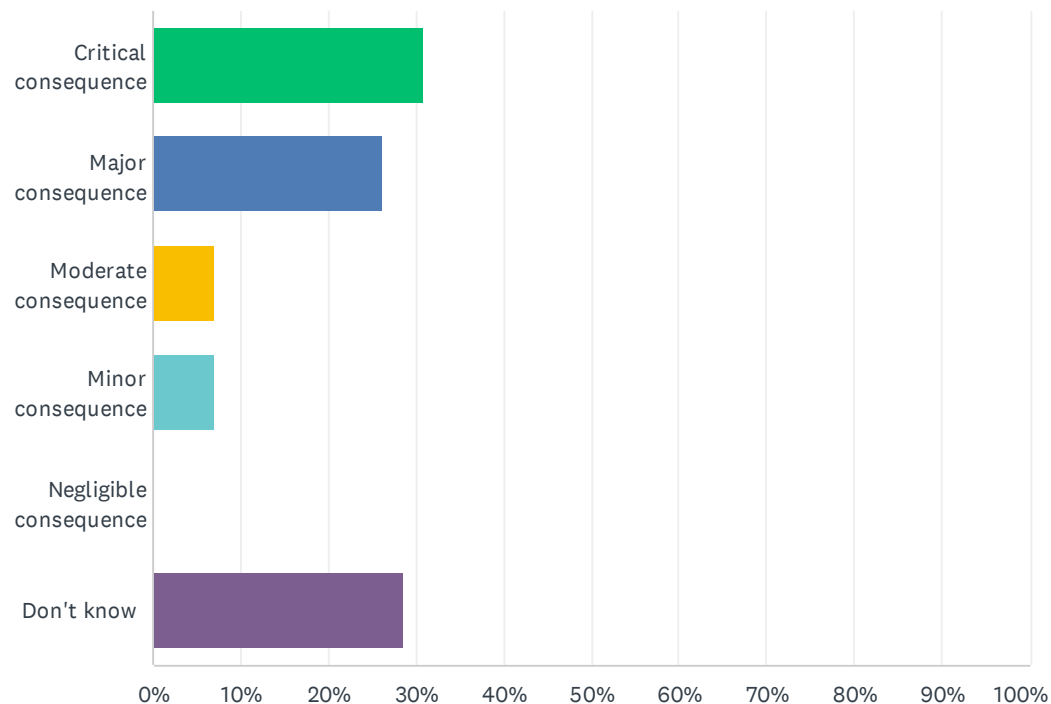


## MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Very critical (> 100 000 EUR pr day)	26.19%	11
High criticality (99 000 < 20 000 EUR pr day)	11.90%	5
Medium criticality (19 999 < 5000 EUR pr day)	2.38%	1
Low criticality (< 4999 EUR pr day)	7.14%	3
Insignificant minor economic effect	2.38%	1
Don't know	50.00%	21
TOTAL		42

## Q15 Which worst-case HSE consequence could result due to Tribo-corrosion/ Multi-degradation failure (for your most critical application)?

Answered: 42 Skipped: 14

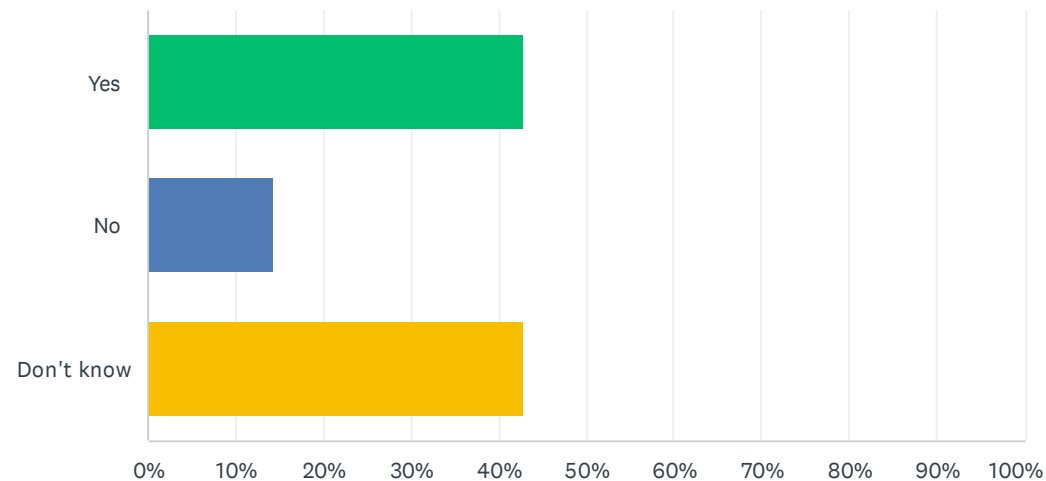


MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Critical consequence	30.95%	13
Major consequence	26.19%	11
Moderate consequence	7.14%	3
Minor consequence	7.14%	3
Negligible consequence	0.00%	0
Don't know	28.57%	12
TOTAL		42

Q16 Do you think your current material alternative provides acceptable quality / service life versus cost?

Answered: 42    Skipped: 14



ANSWER CHOICES	RESPONSES	
Yes	42.86%	18
No	14.29%	6
Don't know	42.86%	18
TOTAL		42

#	ANY COMMENTS ABOUT HISTORICAL MATERIAL SELECTIONS?	DATE
1	Our system is designed with redundancy and easy replacement of cylinders, this has a significant O&M cost impact.	10/16/2024 10:59 AM
2	Lasercladding, chrome- and nickel plating are really good surface coatings to apply for resistance against corrosion and wear diffrent environments or applications.	6/4/2024 2:20 PM
3	We use many different alloys as Ni-SF, Inconel 625/718, WC or CrC alloys. the importance to our experiance is materials in combination with the correct choosen application-technique for the purpose of the coating.	6/4/2024 9:01 AM

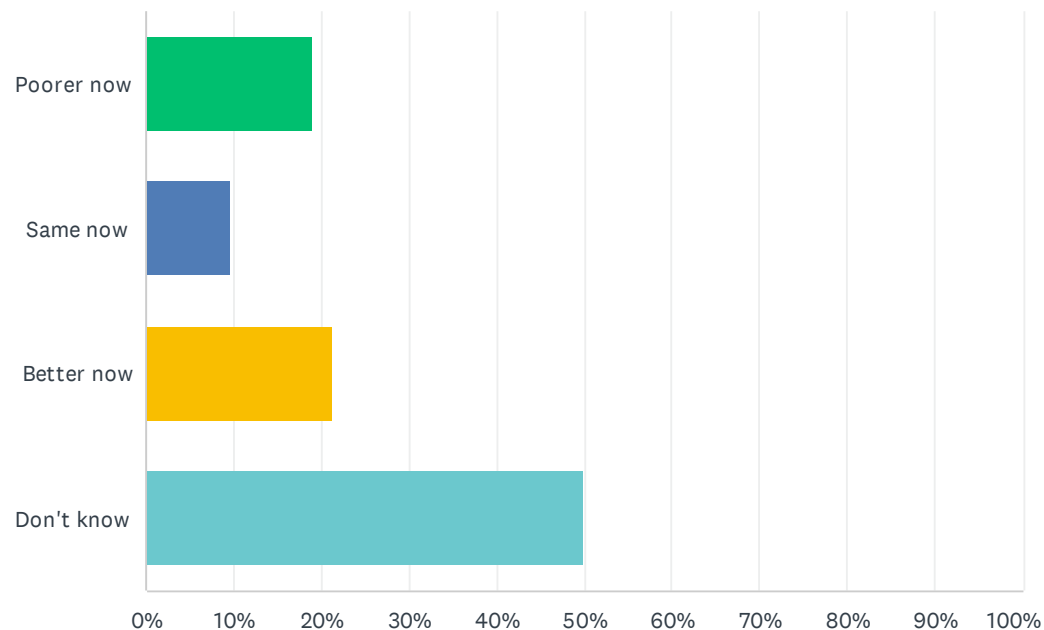


MORE: Next Generation Marine Materials (v2)

4	Yes, you can find a good material combination, but it is considered to expensive	5/31/2024 5:35 PM
5	Clients come to us when they need a better solution than the current solution. Based on the tribological situation, we suggest an improvement within the value of the problem.	5/31/2024 4:00 PM

Q17 What is your impression of total quality/service life of using the same material selection over time for the same application exposure? (E.g. service life of a Hard Chrome plated piston rod ordered in 2006 versus same ordered in 2018).

Answered: 42 Skipped: 14

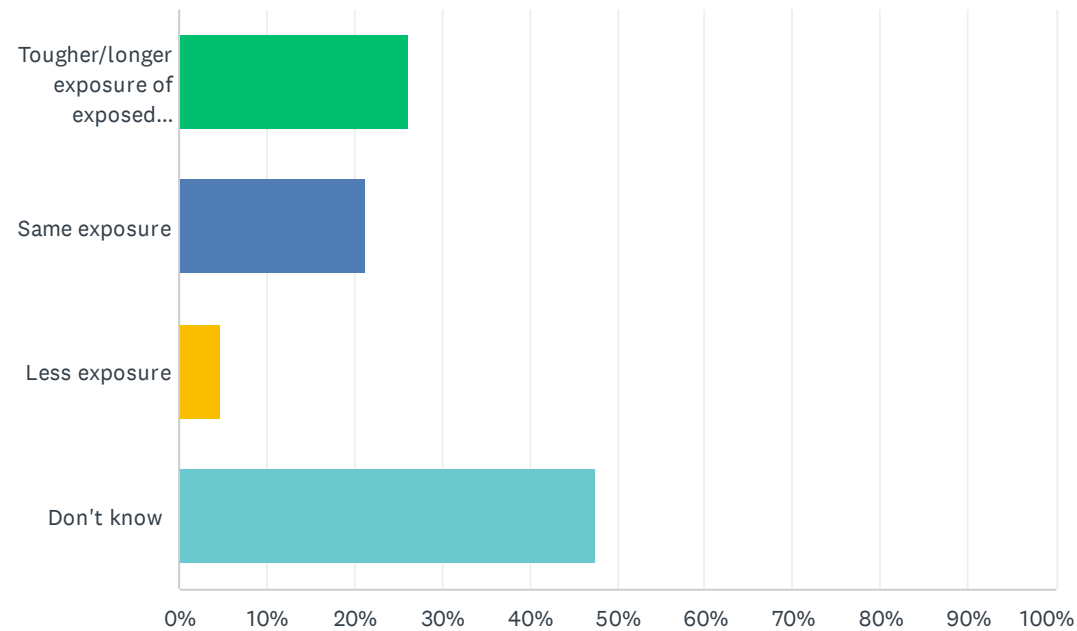


MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES	
Poorer now	19.05%	8
Same now	9.52%	4
Better now	21.43%	9
Don't know	50.00%	21
TOTAL		42

Q18 How have the usage and time of exposure for the component evolved during the last 5-10 years?

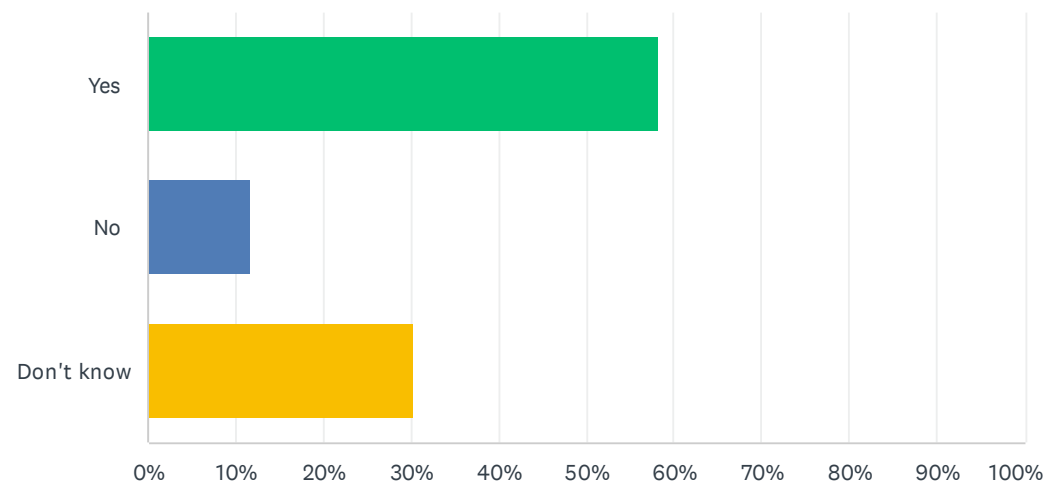
Answered: 42    Skipped: 14



ANSWER CHOICES	RESPONSES	
Tougher/longer exposure of exposed component area	26.19%	11
Same exposure	21.43%	9
Less exposure	4.76%	2
Don't know	47.62%	20
TOTAL		42

Q19 Are more material/coating selection options needed to meet your tribo-corrosion application needs?

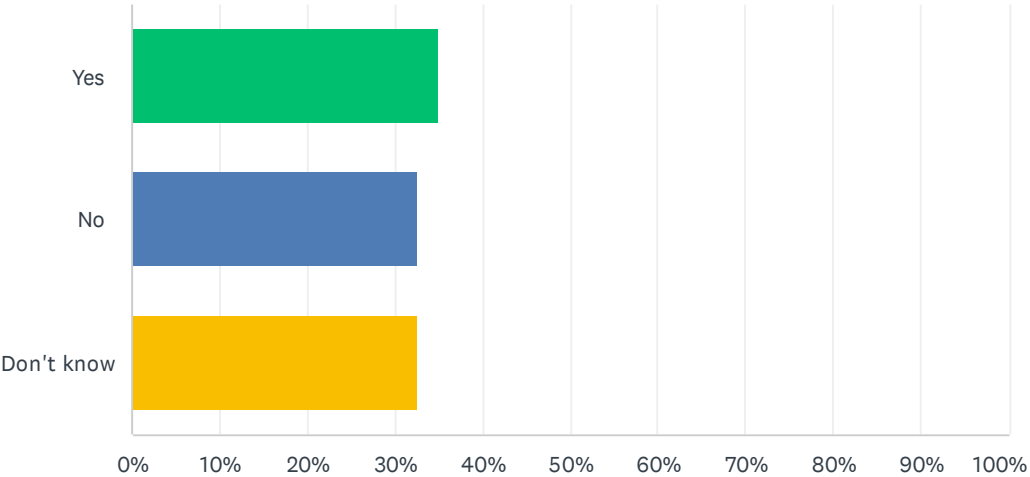
Answered: 43    Skipped: 13



ANSWER CHOICES	RESPONSES	
Yes	58.14%	25
No	11.63%	5
Don't know	30.23%	13
TOTAL		43

Q20 Is there a lack of available coating supplier options for your applications?

Answered: 43    Skipped: 13



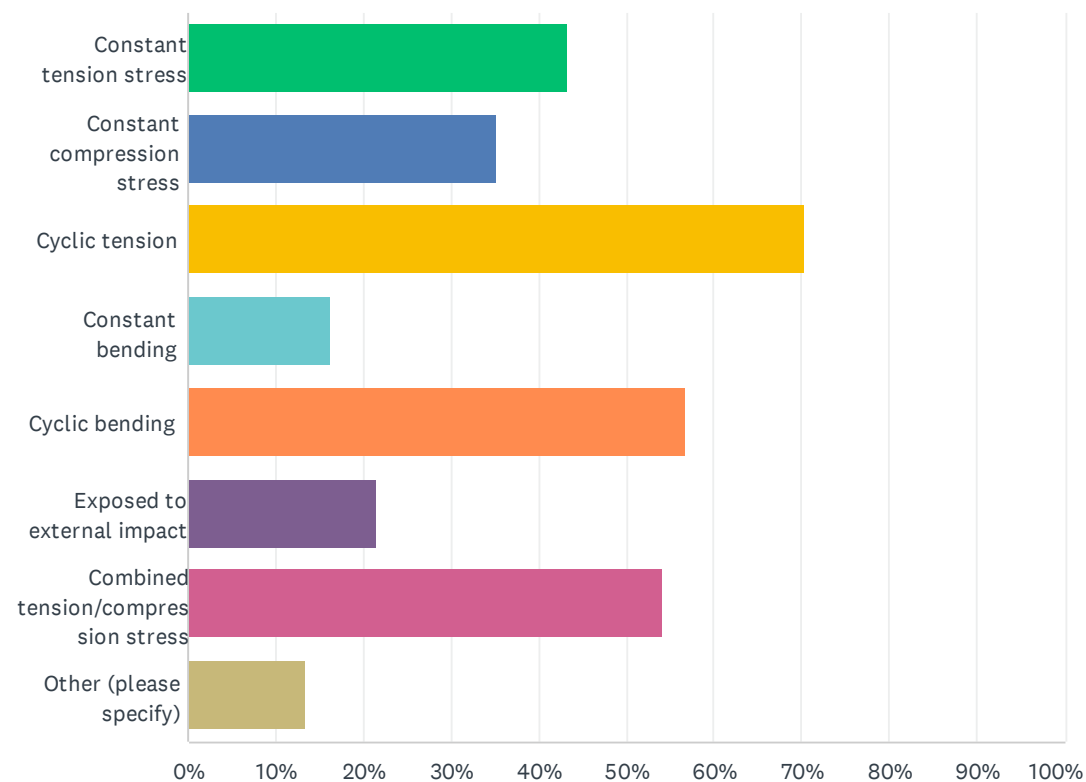
ANSWER CHOICES		RESPONSES	
Yes		34.88%	15
No		32.56%	14
Don't know		32.56%	14
TOTAL			43

#	PLEASE SPECIFY ANY NEW ALTERNATIVE COATINGS/MATERIALS	DATE
1	To far away	10/9/2024 10:43 AM
2	Laser Cladding has the option to use a lot of variety in their coatings. We are able to coat the layer with laser cladding what the application is asking for.	6/4/2024 2:20 PM
3	Within Thermal spraying HVOF is the technique we increase most due to its properties.	6/4/2024 9:01 AM



## Q21 What is the mechanical loading exposure of your tribo-corrosion application(s)? Tick all that are relevant.

Answered: 37 Skipped: 19





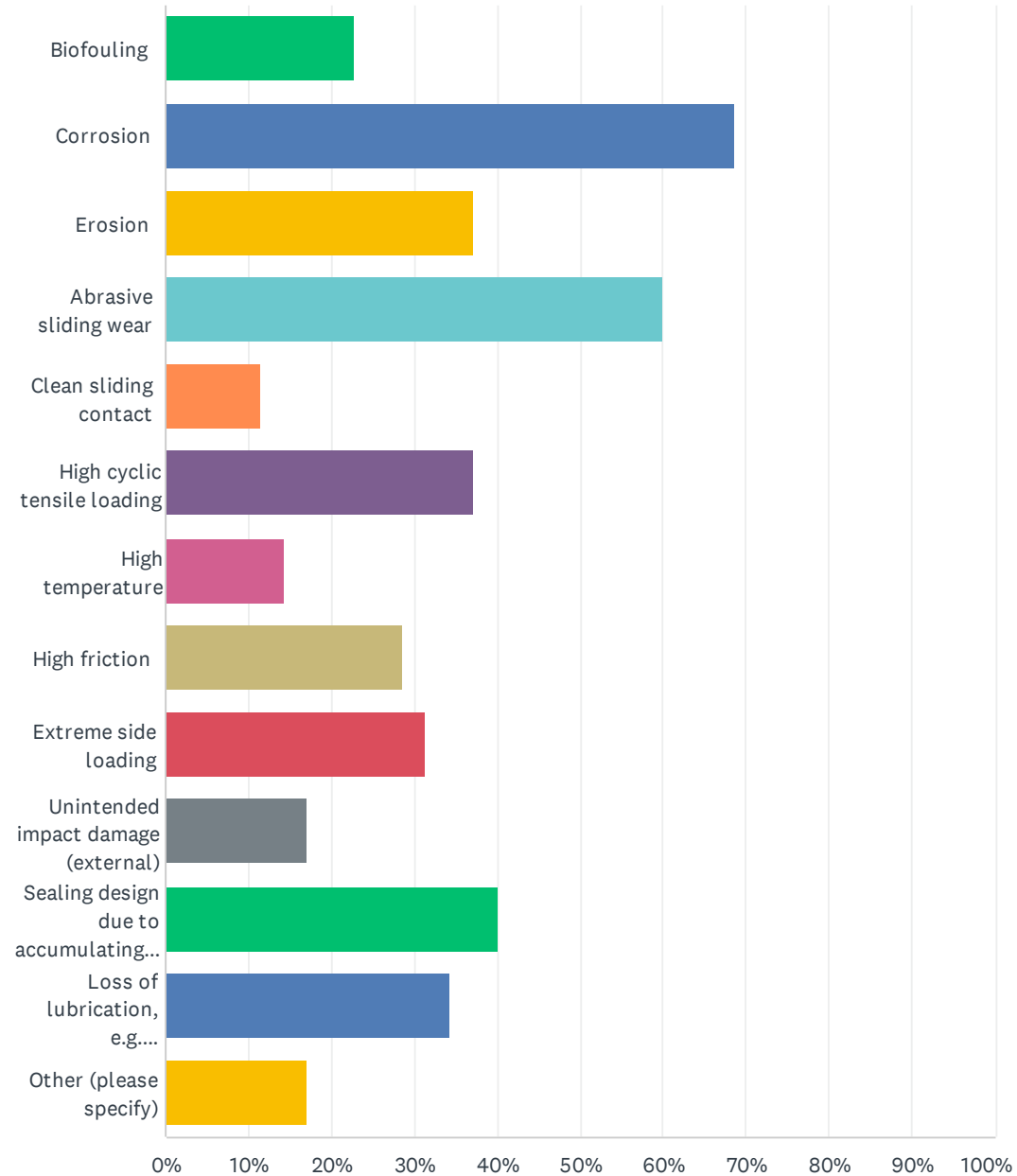
ANSWER CHOICES	RESPONSES	
Constant tension stress	43.24%	16
Constant compression stress	35.14%	13
Cyclic tension	70.27%	26
Constant bending	16.22%	6
Cyclic bending	56.76%	21
Exposed to external impact	21.62%	8
Combined tension/compression stress	54.05%	20
Other (please specify)	13.51%	5
Total Respondents: 37		

#	OTHER (PLEASE SPECIFY)	DATE
1	NA	10/16/2024 11:03 AM
2	not applicable	10/14/2024 1:47 PM
3	Reciprocating sliding	10/9/2024 4:31 PM
4	NA	9/12/2024 3:32 PM
5	Rolling contact fatigue	5/31/2024 5:35 PM

Q22 What is the main degradation mechanism or exposure that causes tribo-corrosion and multi-degradation problems for your marine (wet or submerged) applications? Tick all that are relevant.

Answered: 35   Skipped: 21

## MORE: Next Generation Marine Materials (v2)



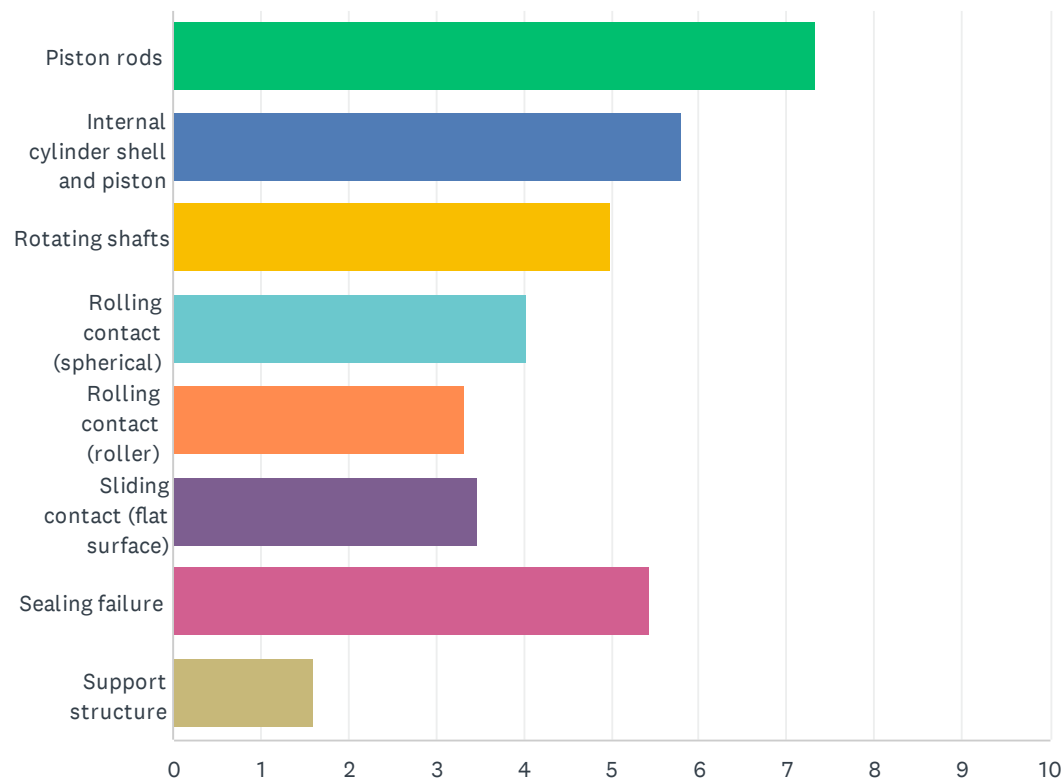
## MORE: Next Generation Marine Materials (v2)

ANSWER CHOICES	RESPONSES
Biofouling	22.86% 8
Corrosion	68.57% 24
Erosion	37.14% 13
Abrasive sliding wear	60.00% 21
Clean sliding contact	11.43% 4
High cyclic tensile loading	37.14% 13
High temperature	14.29% 5
High friction	28.57% 10
Extreme side loading	31.43% 11
Unintended impact damage (external)	17.14% 6
Sealing design due to accumulating wear particles	40.00% 14
Loss of lubrication, e.g. degradation of hydraulic fluid or lube oil	34.29% 12
Other (please specify)	17.14% 6
Total Respondents: 35	

#	OTHER (PLEASE SPECIFY)	DATE
1	NA	10/16/2024 11:03 AM
2	not applicable	10/14/2024 1:47 PM
3	not really an expert	10/14/2024 12:55 PM
4	NA	9/12/2024 3:32 PM
5	these are problems our customers applications facing, we only perform coatings.	6/4/2024 9:01 AM
6	Cavitation	5/31/2024 4:00 PM

## Q23 According to your experience, which tribo-corrosion and multi-degradation applications causes most service life problems ?

Answered: 30 Skipped: 26

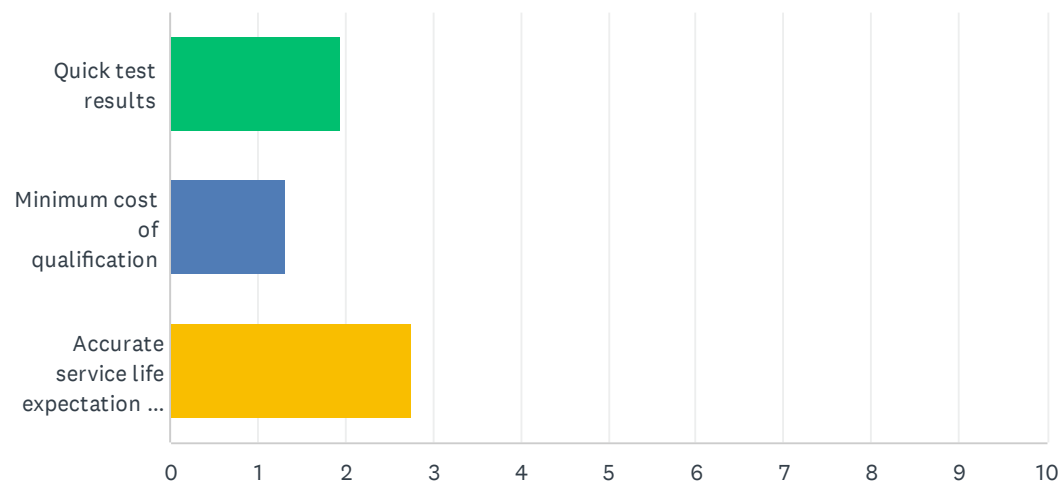


# MORE: Next Generation Marine Materials (v2)

	1	2	3	4	5	6	7	8	TOTAL	SCORE
Piston rods	70.00% 21	20.00% 6	0.00% 0	3.33% 1	3.33% 1	0.00% 0	0.00% 0	3.33% 1	30	7.33
Internal cylinder shell and piston	6.67% 2	40.00% 12	16.67% 5	16.67% 5	6.67% 2	10.00% 3	3.33% 1	0.00% 0	30	5.80
Rotating shafts	0.00% 0	6.67% 2	33.33% 10	30.00% 9	16.67% 5	10.00% 3	3.33% 1	0.00% 0	30	5.00
Rolling contact (spherical)	0.00% 0	6.67% 2	10.00% 3	20.00% 6	20.00% 6	30.00% 9	13.33% 4	0.00% 0	30	4.03
Rolling contact (roller)	0.00% 0	3.33% 1	3.33% 1	6.67% 2	30.00% 9	23.33% 7	33.33% 10	0.00% 0	30	3.33
Sliding contact (flat surface)	3.33% 1	3.33% 1	10.00% 3	10.00% 3	16.67% 5	20.00% 6	23.33% 7	13.33% 4	30	3.47
Sealing failure	20.00% 6	20.00% 6	23.33% 7	10.00% 3	0.00% 0	3.33% 1	20.00% 6	3.33% 1	30	5.43
Support structure	0.00% 0	0.00% 0	3.33% 1	3.33% 1	6.67% 2	3.33% 1	3.33% 1	80.00% 24	30	1.60

## Q24 What is, according to your experience, the most important aspect when qualifying materials?

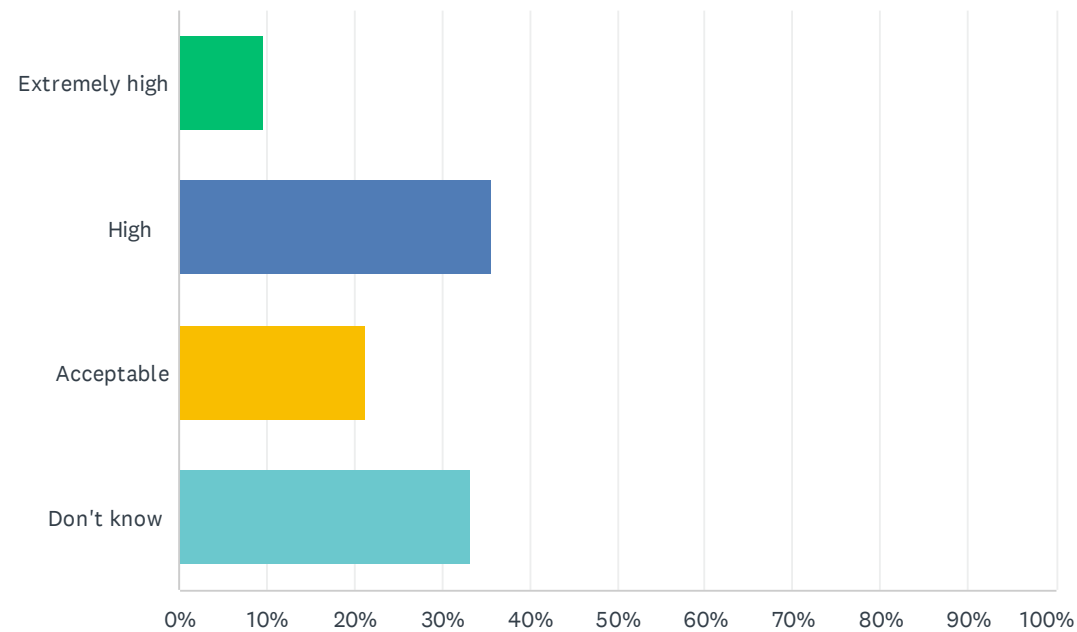
Answered: 34 Skipped: 22



	1	2	3	TOTAL	SCORE
Quick test results	14.71% 5	64.71% 22	20.59% 7	34	1.94
Minimum cost of qualification	5.88% 2	20.59% 7	73.53% 25	34	1.32
Accurate service life expectation (to achieve minimum life-cycle cost)	79.41% 27	14.71% 5	5.88% 2	34	2.74

Q25 What is your impression on cost for current qualification testing methodology?

Answered: 42    Skipped: 14



ANSWER CHOICES	RESPONSES	
Extremely high	9.52%	4
High	35.71%	15
Acceptable	21.43%	9
Don't know	33.33%	14
TOTAL		42