1. **PURPOSE**

The purpose of this procedure is to describe methods for sampling and testing of surfaces for soluble salt contamination.

1. **SCOPE**

This procedure is intended for field use, and is aimed predominantly at the testing of freshly cleaned surfaces, and cured painted surfaces.

**3.0 BACKGROUND INFORMATION**

**3.1 General**

This test procedure is based on AS3894.6-2002. This procedure corrects errors and anomalies in the current standard, and differs in that the units resulting from the test are µg/cm2 of chloride ion, rather than the mg/m2 mandated in AS3894.6.

The sample location used for this procedure must be representative of the freshly cleaned surface. Method 1 is especially suited to horizontal surfaces, while Method 2 can be used in all orientations.

**3.2 Frequency of Testing**

The frequency of testing will be based on the source of chloride contamination and the exposure location. Where dry abrasive blasting has been carried out, a single test session after cleaning is all that is required, provided that the steel is painted within 4 hours.

Where cleaning processes using water are utilised, the frequency of testing will be based on the likelihood of re-contamination prior to coating application. Surface salt can accumulate over long periods of time even at significant distances from salt water. In these instances, a single test session will be sufficient to determine the pre-washing and post washing chloride levels. No subsequent washing will be required.

Where the structure is located in an area where re-contamination is possible, such as in marine exposures close to the sea, retesting will be required.

The recommended base frequencies of testing are as shown in Table TP916-1. However, the table represents a preliminary testing frequency only. Where repeat testing shows that shorter or longer intervals will provide clear indication of the likelihood of re-contamination, the test frequency shall be so modified.

The initial sampling and testing frequency for specific projects shall be incorporated into the Inspection and Test Plan.

Table TP916-

|  |  |  |  |
| --- | --- | --- | --- |
| Distance from Sea | Conditions | | Test Frequency |
| Wind speed | Wave Action |
| < 200m | Strong or greater | Breaking waves | Start of each day |
| Rolling swell or calm |
| Moderate | Breaking waves |
| Rolling swell or calm | 48 hours |
| Low | Breaking waves | Start of each day |
| Rolling swell or calm | 48 hours |
| 200m to 1km | Strong or greater | Breaking waves | Start of each day |
| Rolling swell or calm | 48 hours |
| Moderate | Breaking waves |
| Rolling swell or calm | Initial only |
| Low | Breaking waves |
| Rolling swell or calm |
| > 1km | All conditions | | Initial only |

**3.3 Levels of Salt Contamination**

For the purposes of this procedure, all surface contamination is reported as µg/cm2 of chloride ion.

The limits nominated under this test procedure are as shown in Table TP916-2.

Table TP916-

|  |  |  |
| --- | --- | --- |
| Coating System Type | Exposure | Maximum µg/cm2 of Cl- |
| All liquid coating systems | Atmospheric | 10 |
| Immersion | 5 |
| Buried | 5 |
| All tape coating systems | All exposures | 50 |

The above are nominal values and, where specified, manufacturer values take precedence.

To obtain equivalent values in other units, the multiplication factors are as shown in Table TP916-3.

Table TP916-

|  |  |  |
| --- | --- | --- |
| To Convert | To | Multiply by |
| µg/cm2 Cl- | µg/cm2 NaCl | 1.65 |
| µg/cm2 Cl- | mg/m2 Cl- | 10 |
| µg/cm2 Cl- | mg/m2 NaCl | 16.5 |

**3.4 Wash Water**

The level of dissolved salts in the wash water will have a direct effect on the contamination which will remain on the surface after washing. Table TP916-4 shows the relationship between the thickness of a drying water layer and the concentration of chloride ions in the water, and how they relate to the level of surface contamination which will be present after the water evaporates.

Table TP916-

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Conductivity, µS/cm | Cl-, ppm | µg Cl- in … mm thick water layer(=µg/cm2) | | | | |
| 1.5 | 1 | 0.5 | 0.25 | 0.1 |
| 65 | 30 | 8 | 5 | 3 | 1 | 1 |
| 130 | 61 | 15 | 10 | 5 | 3 | 1 |
| 195 | 91 | 23 | 15 | 8 | 4 | 2 |
| 260 | 121 | 30 | 20 | 10 | 5 | 2 |
| 325 | 152 | 38 | 25 | 13 | 6 | 3 |
| 390 | 182 | 45 | 30 | 15 | 8 | 3 |
| 455 | 212 | 53 | 35 | 18 | 9 | 4 |
| 520 | 243 | 60 | 40 | 20 | 10 | 4 |
| 585 | 273 | 68 | 45 | 23 | 11 | 5 |
| 650 | 303 | 75 | 50 | 25 | 13 | 5 |

The data shown is based on conductivity testing of solutions of known concentration of analytical grade sodium chloride in deionised water.

The best quality of wash water available shall be used at all times. Wash water shall be tested for conductivity before use. The conductivity shall be a maximum of:

1. 130µS/cm for liquid coating systems.
2. 400µS/cm for tape systems.

**4.0 TEST MATERIALS AND EQUIPMENT**

**Method 1**

* Plastic or glass beaker, nominal 250mL capacity
* Measuring cylinder or pipette, 50mL capacity
* Quantab chloride titrator strips, 30-600ppm
* Cotton Balls
* Deionised water
* Tweezers or latex gloves

**Method 2**

* Bresle patches or similar
* Syringe, nominally 2mL capacity, with fine needle
* Pipette, 2mL capacity
* Plastic or glass beaker, nominal 20mL capacity
* Quantab chloride titrator strips, 30-600ppm
* Deionised water

**5.0 PROCEDURE**

**5.1 Method 1 - Swabbing**

1. Measure out 50mL of deionised water into the beaker.
2. Using latex gloves, or tweezers, place 2 cotton balls into the water, swirl the cotton balls in the water and squeeze against the sides of the beaker. Allow to stand for approximately 1 minute.
3. Place a quantab test strip in the water, and allow the water to wick up and saturate the test strip. Saturation may take a few minutes, and is achieved when the yellow strip across the top of the column turns dark blue.
4. Read the scale number at the top edge of the white column and obtain the Cl concentration from the calibration chart. Record the result as the blank.
5. Rinse the beaker with distilled water, then, measure out 50mL of deionised water into the beaker.
6. Using latex gloves, or tweezers, place a cotton ball into the water, swirl the cotton ball in the water and squeeze against the sides of the beaker.
7. Mask out an area of the surface to be tested, so that an area of 150mm × 150mm is visible. The masking can be carried out using duct tape or similar.
8. Swab the test area by repeatedly dabbing with the cotton ball, and return to the beaker each time to rinse.
9. After swabbing, swirl the cotton ball in the water and squeeze it against the sides of the beaker. Leave the cotton ball in the water.
10. Use a fresh cotton ball to dry off the surface, and add to the beaker.
11. Stir the contents of the beaker, using the gloved finger, and allow to stand for approximately 1 minute.
12. Place a quantab test strip in the water, and allow the water to wick up and saturate the test strip. Saturation may take a few minutes, and is achieved when the yellow strip across the top of the column turns dark blue.
13. Read the scale number at the top edge of the white column and obtain the Cl concentration from the calibration chart. Record the result.
14. Repeat steps 5) to 13) on another 2 test areas.
15. Calculate the µg of Cl by multiplying the ppm values by 50 (the volume of water).
16. Divide the result from 15) by 225 (area swabbed) to give µg/cm2.

**5.2 Method 2 – Bresle Patch**

1. Place 2mL of deionised water in the beaker.
2. Place a quantab test strip in the water, and allow the water to wick up and saturate the test strip. Saturation may take a few minutes, and is achieved when the yellow strip across the top of the column turns dark blue.
3. Read the scale number at the top edge of the white column and obtain the Cl concentration from the calibration chart. Record the result as the blank.
4. Apply the patch to the test surface.
5. Inject approximately 2mL of deionised water into the patch using the syringe, ensuring that no air is trapped between the latex film of the patch and the test surface.
6. Rub the patch to ensure that the test surface is fully wetted, then allow to stand for approximately 20 seconds.
7. Extract the water using the syringe, then reinject back into the patch. Repeat a further 2 times, then extract the fluid and place in the beaker.
8. Place a quantab test strip in the water, and allow the water to wick up and saturate the test strip. Saturation may take a few minutes, and is achieved when the yellow strip across the top of the column turns dark blue.
9. Read the scale number at the top edge of the white column and obtain the Cl concentration from the calibration chart. Record the result.
10. Repeat steps 4) to 9) on 2 additional test areas.
11. Calculate the µg of Cl by multiplying the ppm values by 2 (the volume of water).
12. Divide the result from 11) by the Bresle test area to give µg/cm2.

**6.0 UNCERTAINTY OF MEASUREMENT**

The uncertainty of measurement has not as yet been determined.

**7.0 DOCUMENTATION**

Complete Form TP916-1

**TP916 Surface Salt Contamination**

|  |  |
| --- | --- |
| PROJECT DESCRIPTION | |
| Project |  |
| Sample Location |  |
| Date Sampled |  |

|  |  |
| --- | --- |
| TEST METHODOLOGY | |
| Test Method | Method 1 Swab / Method 2 Bresle Patch |
| Test Strip Identifier | Quantab Chloride Titrator, Low range 30-600ppm |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| RESULTS | | | | | |
| Test No. | Cl- Concentration | | | |  |
| ppm | µg | Area, cm2 | µg/cm2 | µg/cm2 less blank |
| Blank |  |  |  |  |  |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| Average | | | | |  |

Tested By: ……………………………………………Title: ……………………………………………

Form TP916-1