mix·uk·limited

Suite 'C', St. Mary's Studios, St. Mary's Road, Bowdon Cheshire, WA14 2PL
Tel: 0044 (0) 161 332512 Fax: 0044 (0) 161 3321932 email: info@mixuk.com website: www.mixuk.com

MIX UK STERLING CORROSION INHIBITOR CALCIUM NITRITE SPECIAL (SCI-S)

Technical Data Sheet

DESCRIPTION:

STERLING CORROSION INHIBITOR – S (SCI-S) is a chloride free, ready to use aqueous solution of Calcium Nitrite exhibiting a neutral concrete setting time. It complies with ASTM G109 and C494 requirements for type C admixtures. While having corrosion inhibiting properties, **SCI-S** will perform with-out the accelerating effect associated with normal Calcium Nitrite.

U. K. Mix has formulated a chemical treatment for concrete which provides an effective barrier for chloride induced corrosion on reinforcing steel in concrete structures.

SCI-S is specifically designed for use in climatic conditions such as that found in the Gulf Region.

Calcium Nitrite inhibits corrosion by reacting with ferrous ions at rebar level to form a stable passive film of ferric oxide (Fe_2O_3) on the reinforcement steel, around the anode according to the following:

$$2FE^{++} + 2OH^{-} + 2NO_2 \rightarrow 2NO + FE_2O_3 + H_2O$$

Calcium Nitrite promotes the stabilization of the passivating layer of oxide normally found on the reinforcing steel in concrete. Its protective mechanism works through repairing the defects that usually occur in the oxide structure, thus preventing chloride ions from penetrating the pure ion of metal. The induced barrier is insoluble and after determining the chloride content, the Structural Engineer can specify the appropriate amount of **SCI-S** which should be added to ensure the structural integrity of concrete.

SCI-S is fully compatible with the full range of Superplasticizers, Retarders, Air Entraining Agents and other concrete admixtures. All admixtures should be dispensed separately to obtain the desired results.

The water cement ratio should be adjusted taking into consideration the water available in **SCI-S** in order to maintain the desired water cement ratio.

The water added at the batching plant should be reduced to compensate for the addition of **SCI-S** by 0.85 of a litre for water per litre of Calcium Nitrite added.

SCI-S is compatible with all types of portland cements and Pozzolanic cements. There are however significant variations and standards between cements even within the same type, so differences in reaction to any concrete additive may occur with different cements. Special attention should be given to mix designs containing ground granulated blast furnace slag.

SCI-S ADVANTAGES:

- Provides Protection for reinforcing steel.
- Exhibits neutral setting time for the concrete.
- Easy to use.
- Increases compressive strength
- For use in prestressed and post-tensioned concrete in vertical and horizontal members.

Specification: Calcium Nitrite content not less than 30% by weight.

SCI-S complies to the requirements of ASTM G109.

Specific Gravity: 1.30 ± 0.03

Predicted Chloride Content	Required Addition Rate of SCI-S Solution
KG/m³	**L/m³**
1	2.5
2	5.0
3	7.5
4	10.0
5	12.5
7	17.5
8	20.0
10	25.0

PACKAGING: 210 ltr. drums

STORAGE: SCI-S has a shelf life exceeding 12 months if stored in original sealed containers.

Freezes at approx. - 5°C

TECHNICAL ADVICE:

The Technical Department is available to assist you in the correct use of our products and its resources are at your disposal entirely without obligation.

Refer to the Technical Department when considering the use of SCI-S with GGBS.

SAFETY PRECAUTIONS

Information contained in this data sheet is based on knowledge considered to be true and correct and is offered for the user's consideration, investigation and verification, but we do not warrant the results to be obtained. No statement, recommendation or suggestion is intended for any use which will infringe any patent or copyright.

Mix UK Sterling Corrosion Inhibitor Calcium Nitrite Special (SCIS) is marketed in the Gulf Region by:

GULF CONCRETING PRODUCTS
P.O. Box 43010 Abu Dhabi ; 50012 Fujairah, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: info@gcpuae.ae | Website: www.gcpuae.com

CROWN CONCRETING PRODUCTS LLC
P.O. Box 43010 Abu Dhabi, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: crown@gcpuae.ae

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MIX UK STERLING CORROSION INHIBITOR CALCIUM NITRITE SPECIAL (SCI-S)

Material Safety Data Sheet

1. INGREDIENTS

Product Name	:	Mix UK Sterling Corrosion Inhibitor Calcium Nitrite Special (SCIS)
Manufacturer	:	MIX UK Ltd.
Material	:	Calcium nitrite
CAS#	:	13780-06-8
%	:	28-32

2. PHYSICAL DATA

Appearance	:	Physical state: Yellow Liquid
Odour	:	None
pH	:	7.0 ± 0.5
Boiling point	:	NA
Melt point	:	NA
Specific Gravity	:	1.30 ± 0.03
Bulk density	:	NA
% Solubility (H2O)	:	Complete
% Volatile by weight	:	NA
Vapour density	:	NA
Vapour pressure	:	NA

3. FIRE AND EXPLOSION HAZARD DATA

Flash point and method	:	None
Flammable limits	:	LEL: none ; UEL: None
Extinguishing media	:	None
Special fire fighting procedures	:	None
Unusual fire and explosion hazards:		Do not allow to dry. Product will act as an oxidizer.

4. PHYSIOLOGICAL EFFECTS

LD50 oral (ingestion)	:	NE
LD50 dermal (skin contact)	:	NE
LC50 (inhalation)	:	NE
Primary route of exposure	:	Inhalation, Eye and Skin
Effects of overexposure		
Inhalation	:	Irritating to mucous membrane and upper respiratory tract
Eye	:	May cause irritation
Skin	:	May cause mild irritation
Ingestion	:	May cause G.I. irritation, nausea and cramps. Large amounts may be toxic and may cause CNS effects.

5. EMERGENCY AND FIRST AID PROCEDURES

Inhalation	:	Move to fresh air. If illness or irritation occurs, call a physician or poison control centre.
Eye	:	Irrigate eye for 15 minutes. If pain, irrigation or burning persists, seek medical attention.
Skin	:	Wash area thoroughly with soap and water. If pain, irritation or burning persists, call physician or poison control centre.
Ingestion	:	Call a physician or poison control centre immediately.

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6. SPECIAL PROTECTION INFORMATION

Ventilation	:	Adequate fresh air
Respiratory	:	None
Eye protection	:	Yes
Protection gloves	:	Yes (rubberized)

Note: All chemicals should be handled so as to prevent eye contact and excessive or repeated skin contact. Appropriate eye and skin protection should be employed. Inhalation of dusts and vapors should be avoided

7. CHEMICAL REACTIVITY

Conditions causing instability	:	None
Incompatibility (materials to avoid):		Add separately to concrete mix.
Hazardous decomposition products:		May yield nitrogen oxide fume if heated and burned.
Special sensitivity	:	None

8. STORAGE

Precautions to be taken in handling and storing: Keep from freezing. Do not contaminate with other chemicals otherwise the material will agglomerate and clog equipment.

9. SPILLS, LEAK, AND DISPOSAL INFORMATION

Steps to be taken in case material is spilled or released: Small spills up to 2 gallons, soak up with absorbent and dispose of in landfill. Wash area. Consult local sewer authority for effect on sewage treatment facility.

Vendor assumes no responsibility for injury to the vendee or third persons caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

To the best of our knowledge, the information contained herein is accurate. However, we cannot assume any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards which exist.

Mix UK Sterling Corrosion Inhibitor Calcium Nitrite Special (SCIS) is marketed in the Gulf Region by:

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Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: crown@gcpuae.ae

PROJECT : .....
LOCATION : .....
CONSULTANT : .....
CONTRACTOR : .....
READY MIXED CONCRETE SUPPLIER : .....
DATE OF CASTING : .....
LOCATION OF CONCRETE IN BUILDING : .....
CONCRETE MIX : .....

CAL/NITRITE TEST RESULTS

LOADING TIME	CASTING TIME	TICKET NO.	TRUCK NO.	TESTING TIME	M^3	RESULT M^3

HACH METHOD OF TESTING OF CALCIUM NITRITE IN FRESH CONCRETE

This is a quick and easy test to perform on site.

1. **Take one kilogram of fresh concrete and place in 20 ltrs. of water.**
2. **Stir agressively for 2 minutes.**
3. **Allow to settle for 5 minutes.**
4. **Take 100 ml of the clearing water and pour in 1.4 litrs. of water (use an empty bottle of mineral water and allow little clearance for shaking).**
5. **Shake for one minute.**
6. **Fill the plastic vial to mark on the side.**
7. **Open one reagent package and add to the sample in the vial, shake for one minute.**
8. **Wait 5 minutes for the colour development.**
9. **Match the colour of the sample to the closest colour on the test tube.**
10. **Read Calcium Nitrite content in litre of SCI per M^3 of concrete.**

Note: that mg/ltr. to multipy by 10 to obtain ltr./M^3.

<u>Receptacles required on site:</u>

- **Weigh mechanism for 1 kg of concrete.**
- **Small container capacity 1 kg of fresh concrete.**
- **One bucket capacity 20 ltrs.**
- **A beaker capable to measure 100 ml.**
- **One empty bottle 1.5 ltr.**

PARTICULAR SPECIFICATIONS
DURABILITY OF CONCRETE - CALCIUM NITRITE ADMIXTURE

1. GENERAL

To prevent the embedded steel from corroding and to ensure a long life for the reinforced concrete works. A Calcium Nitrite corrosion inhibiting admixture shall be added to the concrete mix at the time of mixing at the rate of 10 litres per cubic meter of concrete.

2. MATERIAL

The Calcium Nitrite corrosion inhibiting admixture shall be added as an aqueous solution which contains a minimum of 30% of Calcium Nitrite by weight, such as Sterling Corrosion Inhibitor Special, S.C.I.S. the material should comply to the requirements of ASTM G109.

3. EXECUTION

The water content of the Calcium Nitrite corrosion inhibiting admixture shall be counted as mixing water for the purpose of determining the water / cement ratio of the concrete I.E. ten litres of Calcium Nitrite equals eight and a half litres of water.

The Calcium Nitrite corrosion inhibiting admixture must be added to the mix immediately after other admixtures (water - reducing etc.) have been introduced to the mix.

The incorporation of Calcium Nitrite shall be clearly documented on the delivery ticket from the ready mix producer.

As for all concrete, whether or not containing Calcium Nitrite, the concrete producer must make a trial mix to determine the amount of other admixtures (superplasticizer, retarder) if any, needed in order to deliver the required concrete mix to the job site.

4. TESTING

In addition to compressive strength tests and slump tests, the contractor shall provide at his own expenses 3 samples of hardened concrete per 100M3 or fraction thereof placed in a single days run or as deemed necessary by the engineer for the purpose of determining the Calcium Nitrite content of the concrete.

Testing shall be carried out in a laboratory approved by the engineer at the contractor's expense.

Concrete failing to contain Calcium Nitrite at the required concentration shall be rejected.

BILL OF QUANTITIES

All concrete must include a neutral set Calcium Nitrite corrosion inhibitor such as SCI-S or equivalent approved added to the mix at the batching plant or transit mixer at the rate of 10 litres per M^3 of concrete.

SPECIFICATION FOR CONCRETE

Add SCI'S neutral set Calcium Nitrite or equivalent approved to concrete at the prescribed rate of ten litres per M^3 at site or at the batching plant. To be added to all concrete works for piling, substructure and superstructure concrete. The Calcium Nitrite is to comply to the requirements of ASTM G109.

LIST OF SEVERAL PROJECTS SUPPLIED WITH MIX UK CALCIUM NITRITE SPECIAL

Country	Projects	Consultant	Client	Contractors	M3	Year of Project
U.A.E	*Asab infrastructure upgrade*	*A.C.G*	*ADCO*	*Al Habtoor*	*25,000*	*98*
U.A.E	*Al Noor hospital*	*Dar El Amara*	*Sheikh Mohd. Bin Butti*	*Al Hamed*	*2,500*	*97*
U.A.E	*Palaces Management Bldg.*	*H.H Sheikh Zayed private department*	*H.H Sheikh Zayed private department*	*Al littani Cont.co*	*3,000*	*2000*
U.A.E	*Commercial Bldg.*	*Handasat Al-Amaara Cons.*	*Khalifa Committee*	*Khamis Al Swadi*	*5,000*	*96*
U.A.E	*Tank Refurbishment Jebel Dana*	*AEC*	*ADCO*	*RMC Beton*	*20,000*	*2003*
Yanbu K.S.A	*P.T.A*	*Bechtel*	*Ibn Rashid*	*A.W.M*	*30,000*	*95*
U.A.E	*Al Farden tower*	*Golden Planner*	*Al Farden*	*Al Hamed*	*20,000*	*96*
U.A.E	*Commercial Bldg.*	*Esmat Khalil*	*Khalifa Committee*	*Fayrouz Cont Co*	*4,500*	*97*
U.A.E	*Bab infrastructure*	*A.C.G*	ADCO	*Arabtec*	*20,000*	*2000*
U.A.E	*Sub Station Sharjah*	*Halcrow*	*SEWA*	*TEAM*	*5,000*	*2000*
U.A.E	*Infrastructure upgrade Bu Hasa*		*ADCO*	*RMC Beton*	*1,000,000*	*2003*
U.A.E.	*Habsham*	*AEC*	*ADCO*	*Beton*	*400,000*	*2003*
U.A.E	*Turkmenistan Embassy*		*PDSZ*	*Unibeton*		*2003*
U.A.E	*Das Island*		*ADMA OPCO*	*Granite*		*2003*
Oman	*Fisherie Harbour*			*Al Futtaim Tarmac Oman*		*2003*

We also supplied for various other projects through ready mix companies in the U.A.E such as Ready Mix Beton, Twam Ready Mix, Tremix, Supermix, Redco Al Suweidi, National Ready Mix, RBC, Jamix Sharjah, Orimix , Unibeton Etc.

PROTECTIVE ABILITIES OF VARIOUS CORROSION INHIBITORS

MATERIALS OR METHODS	CHLORIDE INGRESS	INHERENT CHLORIDES IN CONCRETE	CARBONATION
Calcium Nitrites	Yes 	Yes 	Yes 
Cathodic Protection	Yes 	Yes 	No 
Concrete Surface Coating	Yes 	No 	Yes 

Sterling Calcium Nitrite and Sterling Calcium Nitrite Special provide an effective barrier against chloride induced corrosion on steel reinforcement in concrete structures.

Sterling Calcium Nitrite Special, assures optimal performance specifically in high chloride conditions and in hot climatic conditions.

Sterling Calcium Nitrite inhibits corrosion by reacting with ferrous ions at the rebar level to form a stable passive film of ferric oxide (Fe_2O_3) on the reinforcement steel, around the anode according to the following formula:

$$2Fe^{++} + 2OH + 2NO_2 \qquad 2NO + Fe_2O_3 + H_2O$$

Sterling Calcium Nitrite is fully compatible with the full range of concreting additives such as superplasticizers, retarders and air entraining agents. All admixtures should be dispensed separately to obtain the best results.

Sterling Calcium Nitrite is compatible with all types of cements including GGBS, Microsilica, Fly Ash, Ordinary Portland Cement and sulphate resistant cements.

REPORT OF TESTS

Description : Testing of Corrosion Inhibitor Special (SCIS)

Tested for : Gulf Concreting Products, PO Box 43010, Abu Dhabi, UAE

Lab Ref. No : WR01-18884A (Sheet 1 of 5) Lab Req. No. WQ00-07557

Date Received : 04.11.2000 Date Reported 23.10.2002

Client's Reference: Req. dt. 04.11.2000
Sample No. W00-007465
Sample ID Calcium Nitrite

1.0 Introduction

Further to instructions received via a requisition dated 04.11.2000 from Messrs IEMS, Abu Dhabi, Al Futtaim Tarmac Laboratories Division started a long term test on SCIS as per ASTM G109 to determine the effect of chemical admixture on the corrosion of steel reinforcement in concrete exposed to chloride environment.

2.0. Mix Design for Concrete

To make the test specimen following materials were used:-

Cement	:	Type I Cement ex National Cement Co, Dubai, U.A.E.
Aggregate	:	1 ½ " Aggregate ex RAK Rock Co.
Sand	:	0-5mm Sand ex Bartawi
Admixture (Air Entraining)	:	AE 316 ex Fosroc
Water	:	Dubai Main Supply
Additives	:	Calcium Nitrite ex IEMS
Steel Reinforcement Bar	:	14mm ex Qatar

3.0 Sample Preparation

Concrete was made in according with ASTM G109, Section 6.1 using the above materials with a minimum slump of 50mm.

The test specimens were casted with a 14mm rebar placed horizontally in the concrete. The outer portion of the steel was coated with an epoxy. The specimens were demoulded and kept in a thermostatically controlled room for 28 days at a room temperature of 20 ± 2°C with a relative humidity of 50±5%.

Test Method

The surfaces of the specimens were wire brushed and a pond was made using plastic with a measurement of 75mm x 150mm. The pond was filled with 3% sodium chloride solution (approximately 400ml) and the specimens were kept in a room temperature of 22 ± 2°C with a relative humidity of 50±5%. After two weeks, the solution was drained and dried the specimens for 2 weeks. This cycles were continued still the final stage. The sample's current was monitored every 4th week.

4.0 Results

The results in tabular and graphical formats are given on the attached sheets.

For Al Futtaim Tarmac (Pte) Ltd.
Laboratories Division

Tested by:VM/SKS

WR01-18884A (Sheet 3 of 5)

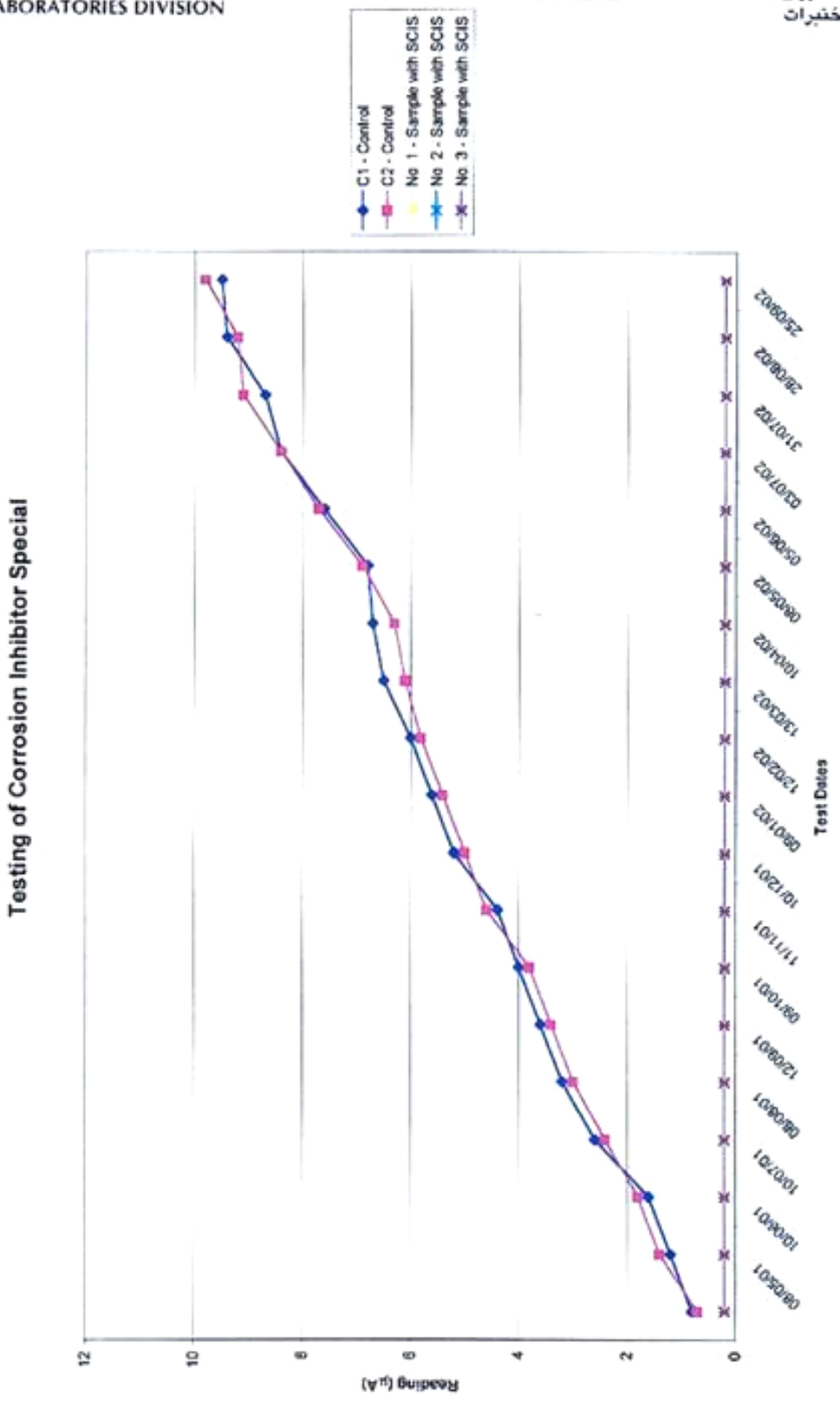
Reading date	Control Reading (µA)	Sample Reading With SCIS (µA)
08.05.2001	5.6	< 0.2
	5.4	< 0.2
	-	< 0.2
10.06.2001	6.0	< 0.2
	5.8	< 0.2
	-	< 0.2
10.07.2001	6.5	< 0.2
	6.1	< 0.2
	-	< 0.2
08.08.2001	6.7	< 0.2
	6.3	< 0.2
	-	< 0.2
12.09.2001	6.8	< 0.2
	6.9	< 0.2
	-	< 0.2
09.10.2001	7.6	< 0.2
	7.7	< 0.2
	-	< 0.2
11.11.2001	8.4	< 0.2
	8.4	< 0.2
	-	< 0.2
10.12.2001	8.7	< 0.2
	9.1	< 0.2
	-	< 0.2
09.01.2001	9.4	< 0.2
	9.2	< 0.2
	-	< 0.2
12.02.2002	5.6	< 0.2
	5.4	< 0.2
	-	< 0.2
13.03.2002	6.0	< 0.2
	5.8	< 0.2
	-	< 0.2

WR01-18884A (Sheet 4 of 5)

Reading date	Control Reading (µA)	Sample Reading With SCIS (µA)
10.04.02	6.5	< 0.2
	6.1	< 0.2
	-	< 0.2
08.05.02	6.7	< 0.2
	6.3	< 0.2
	-	< 0.2
05.06.02	6.8	< 0.2
	6.9	< 0.2
	-	< 0.2
03.07.02	7.6	< 0.2
	7.7	< 0.2
	-	< 0.2
31.07.03	8.4	< 0.2
	8.4	< 0.2
	-	< 0.2
28.08.02	8.7	< 0.2
	9.1	< 0.2
	-	< 0.2
25.09.02	9.4	< 0.2
	9.2	< 0.2
	-	< 0.2
23.10.02	9.5	< 0.2
	9.8	< 0.2
	-	< 0.2
27.11.02	9.7	< 0.2
	10.1	< 0.2
	-	< 0.2
25.12.02	10.0	< 0.2
	10.4	< 0.2
	-	< 0.2
29.01.03	10.3	< 0.2
	10.5	< 0.2
	-	< 0.2
26.05.03	10.7	< 0.2
	10.7	< 0.2
	-	< 0.2

Al-Futtaim Tarmac
LABORATORIES DIVISION

الفطيم تارماك
قسم المختبرات



Testing of Corrosion Inhibitor Special

REPORT OF TESTS

Description : One Sample of Calcium Nitrite

Tested for : IEMS , Post Box No. 43010, Abu Dhabi U.A.E.

Lab Ref. No : WR01-17189 Req. No. WQ01-07078

Date Received : 28.08.2001 Date Reported 03.09.2001

Client's ref. : IEMS/TD/F1347/2001, Req. dated 25.08.2001
AFTLD sample No. : W01-007078/01

1.0 INTRODUCTION

Further to instructions received in a test requisition dated 25.08.2001from Messrs IEMS, Abu Dhabi , Al Futtaim Tarmac Laboratories Division have carried out a chemical analysis on a sample of Calcium Nitrite

2.0 RESULTS

Tests		Results
Total Solids Content @ 180 ° C	% by Wt	34.80
Calcium Content	% by Wt	9.82
Nitrite Content (NO_2)	% by Wt	22.35
Calcium Nitrite as Ca $(NO_2)_2$	% by Wt	32.09
Chloride as Cl	% by Wt	0.01
pH Value at 25°C		7.01
Specific Gravity		1.306

Test method : Standard Wet Chemical Analysis Ref. A text book of quantitive inorganic analysis by I Vogal : BS 5075 Part 1 :1983

For Al Futtaim Tarmac (Pte) Ltd.
Laboratories Division
Tested by : ODS, Date tested: 30.08.2001 - 02.09.2001
Sampled by the client, certificate of sampling was not given.

REPORT OF TESTS

Description :	A sample of Calcium Nitrite (Sterling S-CIS)
Tested for :	I.E.M.S., PO Box 43010, Abu Dhabi, UAE
Lab Ref. No :	WR00-19545 (Sheet 1 of 3) Request No. WQ00-06189
Date Received :	14.09.2000 Date Reported 17.10.2000

Client's reference: IEMS/FC/F1287/2000 Req. dt. 13.9.2000
Sample No. WQ00-006085

1.0 Introduction

At the request of Messrs International Engineering Materials and Supplies Est (IEMS), two (2) number concrete trial mixes were carried out at the laboratory of Al Futtaim Tarmac Laboratories Division, Dubai on 19th September 2000.

The purpose of carrying out the trial mixes was to evaluate the relative performance of an admixture supplied by the client, identified as "Sterling S - CIS Calcium Nitrite" with respect to the compressive strength and setting time properties.

The mix design for the trial were provided by the client.

WR00-19545 (Sheet 2 of 3)

2.0 Materials

The individual materials used for the trials were from local sources, identified as follows.

Material	Source
20mm Crushed aggregate	Gulf Crushers
10mm Crushed aggregate	Gulf Crushers
5mm Natural, washed sand	Al Tawon
Dune sand	Al Ain
Cement	OPC, Sharjah
Water	DEWA
Admixture (Cormix SP6)	GRACE
Calcium Nitrite (S-CIS)	IEMS

3.0 Mix Proportion

The mix design was provided by the client, whilst the design process was conducted in accordance with the UK Department of the Environment "Design of Normal Concrete Mixes".

Material	Batch Weight per m³	
	Control Mix	Mix with Calcium Nitrite
Cement	350 kg	350 kg
20mm Aggregate	810 kg	810 kg
10mm Aggregate	290 kg	290 kg
5mm Sand	680 kg	680 kg
Dune sand	90 kg	90 kg
Admixture (Cormix SP6)	4.5 Ltr	4.5 Ltr
Calcium Nitrite	Nil	10.0 Ltr
Water (Free)	154	147

WR00-19545 (Sheet 3 of 3)

4.0 Tests

Following tests were carried out on the fresh and hardened concrete for each mix.

- Slump - BS 1881 : Part 102 : 1983
- Initial and final setting time - ASTM C403:1990
- Compressive strength - BS 1881 : Part 116 : 1983

5.0 Results

Item	Test		Control mix		Mix with Calcium Nitrite	
1	Slump		75		75	
2	Setting time					
	• Initial		6 hrs 45 min.		4 hrs 35 min.	
	• Final		8 hrs 45 min.		6 hrs 50 min.	
3	Compressive strength (N/mm^2)	3 days	41.0	Average	43.0	Average
			39.0	40.5	45.0	44.0
			41.5		44.0	
		7 days	50.0	51.0	53.0	53.5
			51.5		53.0	
			51.5		54.5	
		28 days	61.0	62.0	64.0	64.5
			62.0		66.0	
			62.5		63.0	

For Al Futtaim Tarmac (Pte) Ltd.
Laboratories Division

Tested by: SV