H2Obvious®

www.h2obvious.com

THE ONLY COMPLETE
AND GUARANTEED

GLOBAL SOLUTION

FOR

LEAK DETECTION

AND

CORROSION UNDER INSULATION - CUI

ALSO KNOWN AS

UNDER INSULATION CORROSION - UIC

H2Obvious®

www.h2obvious.com

TML®

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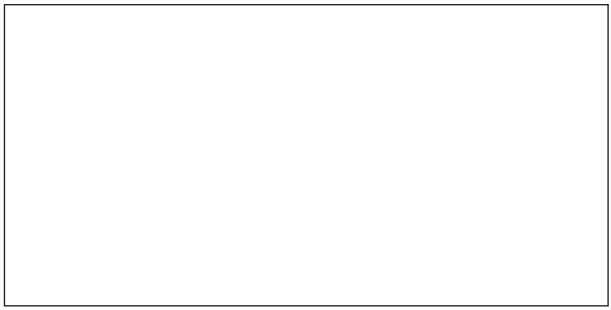

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Please direct all inquiries to:

info@h2obvious.com
www.h2obvious.com

SIYAKHULA QUALITY INSPECTIONS
CK No: 2007/016242/23
VAT No: 4770235457
16a Ashley Road, Hillcrest, 3610, KZN, South Africa
Tel: 0027 83 666 6638
Tel / Fax: 00027 31 765 6949
e-mail – kalbrecht@telkomsa.net

H_2Obvious
Taylor McLaren Limited
London
England

RE: REPORT OF H_2OBVIOUS

Dear Sir's

I am writing this report on my experiences with H_2Obvious, the device for Leak detection and CUI mitigation.

I have installed devices on many sites. They include the following industries:

- Oil and Petrochemical
- Food and Beverage
- Paper and Pulp
- Sugar Refining
- Chemical Storage

From my investigations and finding's, H_2Obvious is a beneficial device that helps identify and hinder the development of CUI and identify possible leaks that is suitable for all industries where there is a requirement for thermal insulation on process pipes and vessels.

The device is best suited being fitted on new installations however; I have recently installed devices retrospectively, where insulation media and cladding are currently in-situ.

When fitting the device recently on a fairly 'new' pipe (+/- 1 year old), I stripped the thermal insulation and found there was severe scabbing and pitting under the insulation media. Upon further stripping, it was found that there was a small leak in the pipe, which was not detected due to the product seepage being contained in the insulation media.

If H_2Obvious had been fitted when the above pipe was installed, the problem could and would have been avoided.

All the fitting and testing on site was carried out by myself, with no assistance, which clearly demonstrates, that they are very user friendly devices to fit.

I have carried out extensive and thorough testing with the unit, subjecting it to all conditions.

It is my conclusion that H_2Obvious does what it states and will be a beneficial investment to any industry, greatly improving the integrity of the fabric when used in conjunction with a regular inspection and maintenance programme.
I have done extensive testing with the unit, subjecting it to all conditions.
It is my conclusion that H_2Obvious does what it states and will be a beneficial investment to any industry.

Yours Faithfully

K. Albrecht

_____
Karyn Albrecht
NACE COATING INSPECTOR LEVEL 1 - Certified

H2OBVIOUS IS THE ONLY COMPLETE AND GUARANTEED SOLUTION FOR LEAK DETECTION, AND FOR MITIGATING AGAINST CORROSION UNDER INSULATION - CUI, ALSO KNOWN AS UNDER INSULATION CORROSION - UIC

H2Obvious devices can and should be installed in **any** process environment where thermal insulation could mask or accelerate corrosion or leakage. Each H2Obvious device can detect, indicate and identify the location of any fluid present either on the pipe surface, or within the insulation media.

Fluid, by its very nature, will flow to its lowest point and exit where it is able. The H2Obvious solution simply allows the fluid to exit into the detection and indication device, immediately alerting operatives to the potential for Corrosion Under Insulation, and to the Health and Safety issues surrounding leaking pipes.

Each self-contained, non-intrusive H2Obvious device will constantly and independently monitor, indicate and alert to the presence of fluids or hydrocarbons, remaining active for 24 hours a day, 7 days a week, 365 days per year

Yet perhaps the greatest advantage of the H2Obvious product is the simplicity of its installation. Each device can be installed in moments, both **dynamically**, when new insulation is being applied to pipes and vessels, and **retrospectively**, when insulation has already been applied.

H2Obvious technology is an innovative, globally patented and trademarked solution, suitable for **any** industry that uses thermal insulation, on **any** pipes or container vessels that may be susceptible to leaking or corrosion.

The following paragraphs describe the process in more detail.

Once fitted, each H2Obvious device functions as follows***:***

1 - By detecting **any** fluid that has either formed on, or leaked from, the pipe/vessel surface, or that has entered the insulation media - there are absolutely **no exceptions** to this.

Moisture and fluctuating temperatures eat through ANY protective painted pipe/vessel, causing rusting and corrosion eventually leading to weeping pipes/vessels. This fluid could be water/moisture that has entered the outer cladding through damaged insulation or damaged weather barrier cladding. (This could even be by way of deteriorated mastic jointing of the outer cladding). The H2Obvious device will detect this very quickly, as moisture travels either along the pipe surface or perforates through the insulation media. When this moisture enters the detection unit, via the collector funnel in this instance, the high intensity LED will flash and the highly visible float will raise - a double indication. The purpose of this is that if the battery is spent* before an inspector sees the flashing light, the float will remain raised and highly visible to the inspector. In this instance, when fitted and monitored correctly, **H2Obvious will mitigate Corrosion Under Insulation**.
A final point on this: if moisture/water enters the outer cladding at, say, the 'Six O'clock' position, as a result of damaged outer cladding or deteriorated mastic jointing, the moisture will actually perforate (wicking effect) up through the insulation and enter the collector funnel before it has a chance of reaching the pipe.

*The battery in the unit has a 5-year life. Battery replacement is very simple, requiring just the unscrewing/refitting of the collection vial, without disturbing the insulation. Even at the end of year 5, the LED will flash continuously for 7 days.

2 - If this fluid is 'Hydrocarbon' process product or in fact oil, there are a few things that the device will indicate:

Oil (Crude or otherwise):

Depending on the viscosity of this oil/product, it will flow along the pipe, down the collector funnel and enter the vial/unit. The float may or may not raise, dependent on viscosity. However, activity will be clear to an inspector, as the oil would be physically visible in the vial/unit. The uniqueness of the H2Obvious solution is that it will almost pinpoint this leakage, as if devices adjacent to the active unit are empty, the inspector will know exactly (within 2 meters) where the release is. Should a device adjacent to the active unit become active, this demonstrates the direction of the flow of fluid.

Hydrocarbons:

By their very nature some process products are not conductive (inert), and when entering the vial/unit, pure 'Hydrocarbon' will **not** activate the LED. However, it **will** raise the highly visible fluorescent float, pinpointing where the product release under insulation has occurred and determining the direction flow. Hence H2Obvious is also an under insulation leak detection solution, as this process product would have to have come from inside the pipe/vessel. Also note if there is **any** conductive fluid mixed with the 'Hydrocarbon', the LED will activate as well as the float raising.

In all the above instances of 'fluid' entering the H2Obvious vial/unit via the collector funnel, the vial itself can be unscrewed and the contents taken away for detailed analysis. The process of unscrewing the vial from the unit does not necessitate insulation removal. A replacement vial may be connected instantly to the collector funnel, whilst the escaped fluid is examined and possible remedial actions discussed.

To further clarify:

NO fluid of **any** kind can enter the vial/unit unless it has entered via the collector funnel located within the insulation media. The vial/indicator part of H2Obvious is fully watertight to the outside world.

H2Obvious is rated as intrinsically safe for **any** process environment, whether highly hazardous or not, being therefore suitable for both **onshore** and **offshore** use.

The H2Obvious collector funnel material (PPS) is specified and rated to +270 Celsius, although a device has been tested in situ on a pipe at a constant +310 Celsius for 3 weeks, with no adverse change in its structure or functionality.

The H2Obvious vial/unit itself, containing the electronics and float, is specified and rated to atmospheric (Ambient) temperatures –40 Celsius to +80 Celsius inclusive. (Ambient in this instance means outside the outer cladding of the insulation).

H2Obvious may be used with **any** insulation media and **any** outer cladding materials that are in general use in the processing business. There is only one exception to this. H2Obvious should **not** be used where the insulation media is 'glued' to the pipes or vessels, as the glue could inhibit the flow of fluid to and through the collector funnel. The market share for this type of insulation is small.

H2Obvious may be installed on **any** pipe diameter. Carbon steel is most susceptible to corrosion, however, stainless steel is also susceptible, as it pits and causes Stress Corrosion Cracking (SCC). H2Obvious may be utilised for **all** steels in general use.

In conclusion:

Fluid by its very nature, **will** flow and find its lowest point and exit where it is able. H2Obvious simply allows the fluid to exit into an indication device, thereby **FACILLITATING LEAK DETECTION, AND MITIGATING AGAINST CORROSION UNDER INSULATION.**

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info@h2obvious.com

H2Obvious For CUI Mitigation

When Does CUI Occur?

CUI predominantly occurs on carbon steels and 300 series stainless steels. On carbon steels it manifests as generalised or localised wall loss. With the stainless pipes it is often pitting and corrosion induced stress corrosion cracking (SCC). Though failure can occur in a broad band of temperatures, corrosion becomes a significant concern in steel at temperatures between 0 and 149 ºC (32 and 300 ºF) and is most severe at about 93 ºC (200 ºF). Corrosion and corrosion induced stress corrosion cracking rarely occur when operating temperatures are constantly above 149 ºC (300 ºF). Corrosion under insulation is caused by the ingress of water into the insulation, which traps the water like a sponge in contact with the metal surface. The water can come from rain, leakage, deluge systems, wash water, or sweating from cycling temperatures or low temperature operation such as refrigeration units.

Systems Benefiting from H2Obvious for CUI Mitigation.

API 570 specifies the following areas as susceptible to corrosion under insulation: areas exposed to mist overspray from cooling water towers; areas exposed to steam vents; areas exposed to deluge systems; areas subject to process spills, ingress of moisture, or acid vapors; areas exposed to sea spray; carbon steel piping systems, including those insulated for personnel protection, operating between -4 and +120 ºC (25 and 250 ºF). Corrosion under insulation is particularly aggressive where operating temperatures cause frequent condensation and re-evaporation of atmospheric moisture.

Other susceptible areas include: carbon steel piping systems that normally operate in-service above 120 ºC (250 ºF) but are in intermittent service; austenitic stainless steel piping systems that operate between 60 and 204 ºC (150 and 400 ºF), as these systems are susceptible to chloride stress corrosion cracking; vibrating piping systems that have a tendency to inflict damage to insulation jacketing, providing an entry point and path for water ingress; steam traced piping systems that may experience tracing leaks, especially at the tubing fittings, insulation media joints beneath the insulation; piping systems with deteriorated coatings and/or wrappings; locations where insulation plugs have been removed to permit thickness measurements on insulated piping should receive particular attention.

All equipment will be shut down at some time or other. The length of time and frequency of down time spent at ambient temperature may well contribute to the amount of corrosion under insulation that occurs in the fabric. It would be an overwhelming task to muster the resources needed to tackle this extensive list of piping and vessels with traditional inspection methods. This is where H2Obvious offers a real advantage. Once installed, early detection and identification of exactly where water is entering the system gives a ‘Heads-up’ approach to where CUI susceptibility lies.

In all cases H2Obvious may be fitted either to piping or vessels that are scheduled for re-insulating or by retrospectively fitting the devices to in-service piping and vessels without the necessity of stripping down the equipment.

Onshore Reference Site:

Coastal Refining Facility – United Kingdom

Situated on the North East Coast of the UK, this facility allows for cost-effective North Sea crude oil imports and product exports to European and world markets.

This Refining Facility can process over 245,000 barrels of crude oil per day into a range of products, from low-sulphur petrol and diesel to liquefied petroleum gas (LPG), heating oil and industrial feedstocks such as propylene.

H2Obvious Commissioned and Installed during May 2007

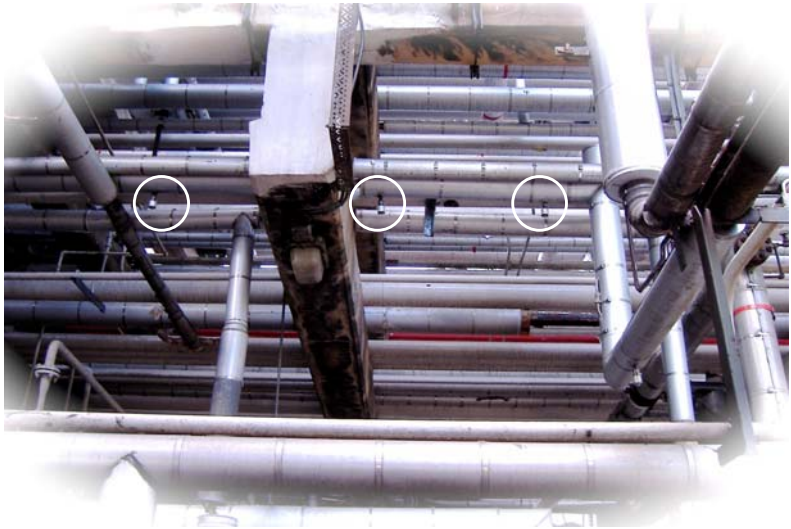
Fluid Monitoring for Leak Detection and CUI Mitigation as a Solution to Corrosion Under Insulation

H2Obvious installed at 1 metre (3 feet) intervals along the horizontal and at the base of the vertical

(Circled below)

"This pipe rack has a prolific history of corrosion under insulation (CUI)"

Re-insulated process lines utilising H2Obvious for fluid monitoring, installed at each insulation media joint



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Additional Benefits

H2Obvious has a primary function, to capture, indicate and identify fluid that exists on the surface of a pipe, the inner surface of the insulation or which may be saturated into the insulation media of an insulated pipe. In consequence that fluid fills a float chamber/vial within the device and, if conductive, starts an alarm with the flashing LED.

Analysis of the scene leads to one of two conclusions:

a) Float rises but no flashing light -probably Hydrocarbon
b) Float rises with flashing light -probably substantially water

The H2Obvious vial can then be unscrewed from the collector funnel, capped and taken to the lab for further analysis. From this sample, hydrocarbon or other process product (if any) can be identified and compared with that of the product inside the pipe. If analysis shows the same, there is undoubtedly a product release/leak nearby. If the sample shows differences, there is a product release somewhere else, moving either along the pipe or within the insulation media.

If water is found, it can be analysed for ph level, resistivity and other properties to identify the impurities it contains.

Assuming water ingress:

When at the time of the initial alarm and fault, the water is pretty clear; it can be assumed that little or no corrosion/deterioration has taken place and that the protective coating on the pipe is sound. It may be some time before the pipe needs attention. The rate at which deterioration will occur depends on many things including the ph level of the water, the cyclic temperature regime of the pipe, the amount of future ingress and the type and quality of coating used. The best time to repair and refurbish the fabric is difficult or nearly impossible to predict without further monitoring.

However, the device can then be flushed out and re-installed on the collector funnel, the incident logged and a monitoring regime instigated. The devices' electronic alarm may be spent but its float chamber will continue to attract fluid raising the visible float, which may be sampled as before at regular intervals, perhaps monthly. The analysis can be compared with those of previous samples and a prediction of the deterioration produced giving the most economic time for safe repair of the fault. If a sudden change in the sample is noticed such as high iron oxide content, the prediction can be revised and the repair date brought forward. Other monitoring methods can be applied just to the section of pipe identified as "At risk" These identified sections of pipe could be pulsed eddy current, ultrasonic, thermography, radiography or guided wave based methods which, while normally difficult to apply, may be beneficial in providing a quantitative analysis of pitting or wall thickness when you know just where to look.

If, subsequent to the initial alarm, the next adjacent device(s) alarm themselves, then it can be interpreted that the water is ingressing to the extent that the sheer volume is flowing past the first alarmed device, which may be full and that the damaged area is increasing. Again, this discovery may necessitate a change in plan to bring forward a limited 'strip and search' on the affected section.

Even so, the early warning, indication and monitoring process means that it is likely that such work can be aligned with a natural, planned shutdown or existing maintenance plan for that part of the facility.

Offshore Reference Site 1

Triton FPSO

The Triton is a double hulled floating processing tanker situated in block 21/30, North Sea 190 KM east of Aberdeen United Kingdom. Co-operatively owned and jointly operated by Amerada Hess, Shell and Petro-Canada.

The Triton has been in this location since 2000 and has a design life of 21 years. It's 800ft (244m) long and has a dead weight of 105,000 tons. This FPSO can store 630,000 barrels and will process 105,000 barrels/day of tanker-stabilised crude oil, using three stages of separation, with a dehydrator and a test separator for well testing.

February 2006, Taylor McLaren Ltd was invited to present H2Obvious "The Solution to CUI". This invitation was after a catalogue of unplanned shutdowns in Dec. 05 & Jan 06 as a direct result of severely corroded pipes under thermal insulation. CUI was discovered on the 2km gas line after a product release halted production, totalling 10 days during this period for remedial maintenance to be completed.

Present at the presentation were representatives from, Wood Group, Shell UK, Amerada Hess, Petro-Canada and Lloyds Registers. After the presentation, the round table consensus was that the installation of the H2Obvious solution would considerably contribute to resolving future CUI failures.

H2Obvious units were commissioned and installed in January 2007.

Technical Report and Analysis available under separate request from info@h2obvious.com.

Essential Health and Safety Requirement 1.0.6

Instructions specific to hazardous area installations

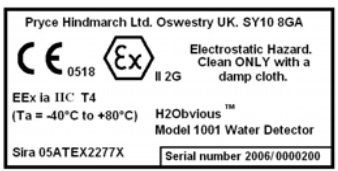
(reference European ATEX Directive 94/9/EC, Annex II, 1.0.6.)

The following instructions apply to this equipment, covered by certificate number Sira 05ATEX2277X :

1) The equipment may be located where flammable gases and vapours of groups IIA, IIB and IIC may be present. The equipment is only certified for use in ambient temperatures in the range –40°C to +80°C and should not be used outside this range.
2) The equipment has not been assessed as a safety-related device (as referred to by Directive 94/9/EC Annex II, clause 1.5).
3) Installation of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice (EN 60079-14 within Europe).
4) Repair of this equipment is not permitted. If faulty in any way, it must be replaced in its entirety. If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

Aggressive substances - e.g. acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.
Suitable precautions - e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

Certification Details



Specification

Application	Water Detector for thermally insulated pipes
Power source	Lithium Thionyl Chloride Battery
Maximum operational life	5 Years
Max. operation time after activation	7 days at 20°C
Operating Temperature Range	-40°C to +80°C
Max Pipe Temperature	+180°C
Certification details	See Certification section
Water resistance - Index of Protection	IP66
Minimum Pipe Outside Diameter	17mm combined with a minimum 15mm thickness of insulation
Insulation Thickness Range	10mm to 80mm
Max and Min protrusion from pipe surface	Max - 157mm Min - 125.4mm
Diameter	35.8mm (approx)
Weight	60 gm approx depending on funnel specification

Warranty

From the date of purchase and for five consecutive years H2Obvious® module is warranted to activate via led and visual float, where there is the presence of sufficient ingression of water or moisture in the device. This warranty is only valid if the module has been installed and maintained in accordance with these instructions.

Direct all enquiries to:
Taylor McLaren Limited, Fountain Court,2 Victoria Square
Victoria Street, St Albans, Hertfordshire, UK, AL2 2SA
Telephone: 00 44 (0) 870 351 2332
Email: info@taylormclaren.com H2obvious.com

H2Obvious®

User Instructions

Indication device for
Water Detection and Moisture Monitoring
on a Pipe Surface
Under Thermal Insulation.

TML®

INSTALLATION

1) Siting of Unit

H_2Obvious is designed to function correctly only when fitted at every joint of the thermal insulation on an insulated pipe. This can be done by fitting the unit tight up to the last section of thermal insulation prior to fitting the next section.

2**) Fixing to the pipe**

Take funnel and fit a flexible fixing strap guide, smooth side up with its slot co-incident with the slot in the strut. Thread a suitable fixing strap through the slot and loosely fix it round the pipe (Fig 1), ensuring that the strap lies between the raised features on the strap guide. Slide the assembly up to the edge of the insulation. The funnel must hang vertically with the threaded end facing down.

3) Final Adjustment of Funnel

The length of the assembly can be adjusted by pushing or pulling the funnel up and down relative to the strut. Friction has been designed in to allow fine adjustment of the funnel's position. Ensure that the threaded section and the 'o' ring seal are below and clear of the outer cladding (Fig 2). Do NOT remove the protective cap at this stage. Cut the thermal insulation away around the funnel to ensure a snug fit . Tighten the fixing strap to secure the assembly onto the pipe. Install the next piece of insulation tight onto the funnel. Cut it away around the funnel as before.

4) Seal Funnel exit from Outer Cladding

Different thermal insulation systems use different methods to provide environmental and mechanical protection. Whatever system is used, make sure that the point at which the funnel exits the outer cladding is fully sealed with silicon adhesive sealant (not supplied) after all protective layers and treatments have been applied to the thermal insulation (Fig 3).

COMMISSIONING

1) Conditions

Installation of the Electronic Modules and final commissioning can only take place in dry conditions. Ingress of rain or water spray into the uninstalled Electronic Modules may lead to false alarms.

2) Installation

After ensuring that all paints, adhesives and sealants are fully dry, remove each protective cap in turn and screw an Electronic Module onto the exposed thread. The module must be tightened sufficiently to engage the 'o' ring seal. Hand tightening is sufficient. Do NOT over-tighten. It may be necessary to support the funnel whilst tightening to prevent it from turning. A spanner can be fitted to flats found immediately above the 'o' ring.

NOTE:

Testing of the Electronic Module prior to Installation is not recommended. However if water is poured into the float chamber for that or any other purpose, it must be thoroughly dried out before final fixing.

IN USE

1) Regular Checks

The unit should be checked at regular intervals to see if either the bright red led is flashing, or if the float is visible. In either case, the cause is water under the insulation. Once triggered the unit will flash for 7 days before the battery is exhausted. In the case of either alarm condition, it is essential that the insulation in the vicinity of the unit is stripped backed to the source of the leak and the pipe examined for corrosion, taking corrective action where necessary. On re-instating the insulation, the unit MUST be replaced.

2) Service Life

H_2Obvious has a service life of 5 years after which it must be replaced. If the installation is still generally sound, it is possible to screw a new Electronics Module onto the original funnel.

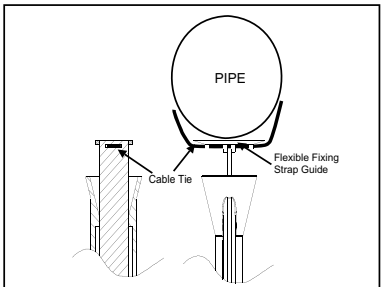


Fig 1

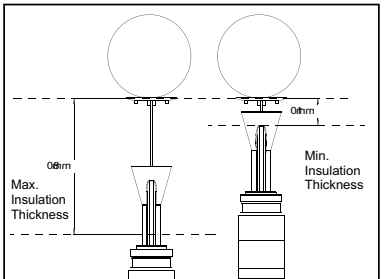


Fig 2

Fig 3

Installing H2Obvious Retrospectively, Where Insulation is Already In Place

The current "User Instructions" recommends that H2Obvious Model 1001 should be installed prior to the insulation media and outer cladding being applied for example new and re-instated stripped insulation, the H2Obvious model 1001 model and funnel arrangement can also be fitted Retrospectively, i.e. where insulation is already in place and is not currently in the schedule for strip, inspection and insulation replacement. This process can be utilised on the base of verticals and along the horizontals of pipes as well as at the 6 o'clock position of vessels, where the underside of the vessels and pipes are visible.

The simple installation process is as follows:

1, Drill a hole with a diameter of 30mm in the outer cladding on the under side of the insulation at the 6 o'clock position.

2, 'Core' out the insulation media to expose the pipe surface.

3, With the protection cap in place, take the black collector funnel only and extend the shaft to the maximum height. The white pipe mount may or may not be used in this process, when using the pipe mount simply mastic glue the support to the top of the extendable shaft.

4, Slowly insert and push the funnel into the drilled and 'Cored' hole until you feel resistance (The shaft has now touched the pipe surface) continue to push the funnel up until the funnel does not move further (This adjusts to the correct height of the funnel to the thickness of the insulation.

5, Using a standard (In-use) sealant or mastic, seal the funnel onto the outer cladding, ensuring there are no gaps or holes.

6, When the sealant is dry, remove the protective cap, gently replacing it with an H2Obvious detector vial/unit

7, Ensure you hold the base of the collector funnel with one hand whilst screwing on the H2Obvious vial/unit to the base of the funnel. Always make sure that the 'O' ring seal is engaged when screwing in place the H2Obvious vial/unit (You will feel resistance and a squeak when fully engaged)

H2Obvious is now fully fitted and in service

Bored Hole at the 6 O'clock position exposing bare pipe surface

Collector Funnel secured in place using a standard silicon sealant

Additional plate to secure the funnel, H2Obvious unit/phial screwed into place (Not essential)

H2Obvious detecting and activating the presence of fluid on the pipe surface under the insulation

This picture clearly shows fluid exiting the collector funnel from with in the insulated pipe

Major Business Benefits

REDUCTION IN BUSINESS INTERRUPTION & UNPLANNED SHUTDOWN

- **INCREASED HUMAN SAFETY**. (Reduction in work at heights, which reduces chances of falling objects and associated dangers)
- **ROUTE CAUSE OF HYDROCARBON RELEASE IDENTIFIED EARLY**
- **COST REDUCTION** of scaffolding. (Use of high rope access only for device replacement after 5 years)
- **ROOT CAUSE OF CUI** indicated before it starts.
- **MAINTENANCE FREE**.
- **INDICATES WHEN AND WHERE** water ingress or leakages are present.
- **INCREASED INTEGRITY**. (Reduces the chances of leakages)
- **EXTENDS LIFE OF INSULATION**.
- **CHANGED WITHOUT DISTURBING** insulation.
- **7 CONSECUTIVE DAYS** in electronic indication mode.
- **HIGHLY VISABLE** mechanical indication mode until removed.
- **NOT COMPROMISING INTEGRITY** of the insulation.
- **TESTED ON SITE** at any interval.
- **STOPS WATER PROGRESSION** further from the damage
- **COST REDUCTION** of repair and maintenance.
- **ELIMINATES** pipe replacement
- **ELIMINATES** visual strip and search
- **ELIMINATES** other corrosion detection methods (Outside Diameter only)
- **ERADICATES** most incidences **CUI**

24 X 7 X 365 FLUID MONITORING

H2Obvious™ **IS** A Solution to Leak Detection and CUI

1 **EC TYPE-EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 Certificate Number: Sira 05ATEX2277X

4 Equipment: H2Obvious™ Model 1001 Water Detector

5 Applicant: Pryce Hindmarch Limited

6 Address: Unit 8
Mile Oak Industrial Estate
Maesbury Road
Oswestry
Shropshire
SY10 8GA
UK

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number R52A13918A.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 50014:1997 + Amendments 1 and 2
EN 50020:2002

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

II 2 G
EEx ia IIC T4 (Tamb = -40°C to +80°C)

Project Number 52A13918
Date 12 January 2006
C. Index 12

C Ellaby
Certification Officer

Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England
Tel: +44 (0)1244 670900 Fax: +44 (0)1244 681330
Email: exhazard@sira.co.uk
Sira Certification Service is a service of Sira Test & Certification Ltd

SCHEDULE

EC TYPE-EXAMINATION CERTIFICATE Sira 05ATEX2277X

13 **DESCRIPTION OF EQUIPMENT**

The H2Obvious™ Model 1001 Water Detector is a battery powered instrument designed to indicate when water is present in the space between a process pipeline and its outer insulating cladding. The instrument comprises a single printed circuit board, an encapsulated fuse, a light emitting diode (LED), a single non-replaceable ½ AA size Lithium-thionyl chloride cell and two sensing contacts. These devices are all housed in a cylindrical enclosure that is connected to a funnel arrangement and has a strap for attaching the instrument to the process pipework. The H2Obvious™ Model 1001 Water Detector is intended to be located on the outside of the pipework cladding thus allowing the funnel arrangement to collect water from behind the cladding and deliver it to a pair of sensing contacts connected to the electronic sensing circuit. The circuit senses the presence of the water and switches on the LED that is visible through the outer enclosure.

14 **DESCRIPTIVE DOCUMENTS**

14.1

Drawing	Sheet	Rev.	Date	Description
H2O-007	1 of 2	3	19 Dec 05	Circuit diagram
H2O-007	2 of 2	4	19 Dec 05	Parts list
H2O-008	1 of 1	5	19 Dec 05	Internal wiring details
H2O-009	1 of 1	2	13 Dec 05	General assembly
H2O-010	1 of 1	2	19 Dec 05	Detector assembly details
H2O-012	1 of 1	2	19 Dec 05	Battery assembly
H2O-014	1 of 1	2	13 Dec 05	Label details
H2O-015	1 of 1	2	19 Dec 05	Enclosure details

14.2 Report number R52A13918A

15 **SPECIAL CONDITIONS FOR SAFE USE** (denoted by X after the certificate number)

15.1 The enclosure is non-conducting and may generate an ignition-capable level of electrosatic charges under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSRs)

The relevant EHSRs that are not addressed by the standards listed in this certificate have been identified and individually assessed in report number R52A13918A.

17 **CONDITIONS OF CERTIFICATION**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of Sira Certificates.

17.2 Holders of EC type-examination certificates are required to comply with the production control requirements defined in Article 8 of directive 94/9/EC.

17.3 This certificate relies on the following previously certified products. When used as part of the H2Obvious™ Model 1001 Water Detector, the key attributes listed in the table below shall still be maintained by their original certificate.

Description	Certificate no.	Key attributes
ISF001#/**/$$	Sira 05ATEX2274U	EEx ia II, Fuse rating: 125 mA at 30 V

17.4 The H2Obvious™ Model 1001 Water Detector shall only be fitted with a Saft type, LST14250-CNR, ½ AA size, Lithium-thionyl chloride cell.

Date 12 January 2006

Sira Certification Service
Rake Lane, Eccleston, Chester, CH4 9JN, England
Tel: +44 (0)1244 670900 Fax: +44 (0)1244 681330
Email: exhazard@sira.co.uk
Sira Certification Service is a service of Sira Test & Certification Ltd

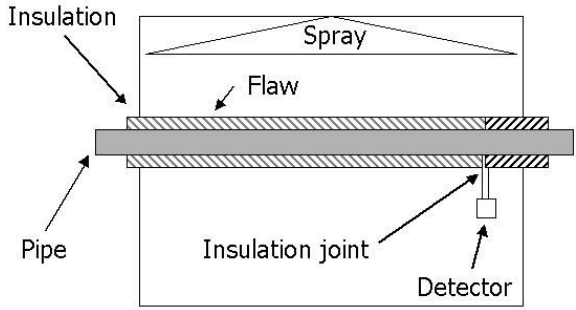
SUMMARY OF TEST SERIES 4: PIPE WITH CYCLIC HEATING

OUTLINE TEST METHOD

Tests were performed in parallel on 3" nominal bore carbon steel pipes with three insulation systems:

- System 2000
- Ultrashield
- Rockwool + metal cladding

The H2Obvious detector device was fitted at a joint in the insulation. Deliberate flaws were made through the top of the cladding at 0.8 m distance to the detector. Slits were cut in the System 2000 and Ultrashield. In the case of the metal cladding, one 25mm diameter hole was made in the sheath. The pipe was angled slightly with the detector at the low end.



Schematic diagram of test set-up

Artificial seawater (ASTM D1141) was used for spraying. Two air-mist nozzles produced a continuous fine spray, similar to a dense fog or fine drizzle. All surfaces, including those not in the direct line of spray, were wetted. The nominal spray rate was approximately 1.5 cm depth per 24 hours, and was measured daily by a collection funnel.

The pipes were heated internally. Internal pipe bore temperatures (equivalent to process fluid temperature) were measured by thermocouples and controlled by proportional temperature controllers. The external temperature in the chamber was 23-27°C.

Production model detectors were used in this test, whereas prototype devices were used in previous tests.

The extent of water penetration is largely a function of the deliberate flaws created in the coverings, and not indicative of the relative merits of the different insulation systems.

TEMPERATURE CYCLING

The internal pipe temperature was held at 180°C for 12 hours at the start of testing. Thereafter, the temperature was controlled according to the following cycle:

Step 1 Heat off for 12hrs
Step 2 120°C for 12hrs

After eighteen days, the cycle was changed to:

Step 1 Heat off for 48hrs
Step 2 120°C for 12hrs

The purpose of this change was to allow more time for water penetration to the pipe surface between the heating periods.

SUMMARY OF RESULTS

General

The condition of the detectors after testing was essentially identical to that before exposure, with no visible damage, for example from heat.

System 2000

The detector light activated after 16 days exposure. Water was visible inside the collection chamber, but not sufficient to lift the float.

Water had penetrated the outer sheath at the flaw, and possibly more generally. The inner sheath surface and outer side of the insulation was wet, and disbonded in parts. The sheath itself was beginning to wrinkle and open at some of the joins. Water had penetrated down to the steel pipe at the flaw and at a join in the insulation material, adjacent to the detector location, and hence reached the detector. There was no water penetration to the pipe surface at other points. There was no significant spread of water along the steel pipe surface, either from the flaw or from the joint location, presumably due to the heat.

Ultrashield clad pipe

The detector activated on the 45th day of the test. Moisture was visible inside the detector collection chamber, but not sufficient to lift the float.

The outside of the insulation and inside of the sheath was wetted, and there was some penetration through the rockwool towards the pipe, particularly at the joins. The pipe itself was entirely dry with no evidence of moisture having been present (for example, fresh corrosion).

The collector funnel, being set slightly off the pipe surface, collected water that had penetrated part-way through the insulation towards the pipe surface.

Stainless steel clad pipe

The detector did not activate up to 45 days testing, at which point the test was stopped, and the insulation removed to allow examination of the pipe.

The outside of the insulation, and inside of the sheath was wetted, and there was some penetration through the rockwool towards the pipe, particularly at the joins. The degree of penetration was less than in the case of the Ultrashield clad pipe. The pipe itself was entirely dry with no evidence of water having been present (for example, fresh corrosion).

CONCLUSIONS

The production model H2Obvious detectors survived exposure to pipe temperatures up to 180°C without apparent damage, and operated effectively after this exposure.

The H2Obvious detectors were able to detect the presence of water in a situation of fluctuating temperatures and cyclic vaporising and condensing within the insulation. Depending on the position of the collection funnel, the detector is able to detect water in the insulation which has not (yet) reached the pipe surface.

Product Warranty and Solution Guarantee

Effective 1st February 2007:
Warranty & Guarantee for H2Obvious Fluid Detector 1001.

Product Warranty:

From the date of purchase and for five (5) consecutive years, H2Obvious module/vial is warranted to activate via LED and visual float, where there is the presence of sufficient ingression of fluid in the device from either the pipe surface or with in the insulation media.

When fitted correctly, fluid will not enter the module/vial unless it has collected through the funnel.

This warranty is only valid when installed and maintained in accordance with the User Instructions.

Solution Guarantee:

When H2Obvious is fitted and monitored 'Strictly' in accordance with the User Instructions and all written recommendations Taylor McLaren Limited will guarantee against Corrosion Under Insulation (CUI) failures. Only where H2Obvious has been proven to be inactive, in both electronic and manual indication modes and where the presence of the undetected fluid has directly lead to the Corrosion Under Insulation (CUI) failures.

This guarantee is only valid when installed and maintained in accordance with the User Instructions.

H2Obvious
A Complete & Guaranteed Solution to:

Hydrocarbon Leak Detection
&
Corrosion Under Insulation (CUI)

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AND

CORROSION UNDER INSULATION - CUI

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