



### Head Office – The Netherlands

Sliedrecht

### Shipyards – The Netherlands

Hardinxveld-Giessendam  
Heusden  
Kinderdijk  
Krimpen aan den IJssel  
Sliedrecht

### Shipyards – P.R. of China

Dalian

### Shipyards – Serbia

Belgrade

### Sites – The Netherlands

Alblasserdam  
Apeldoorn  
Delfgauw  
Dordrecht  
Emmeloord  
Goes  
Hardinxveld-Giessendam  
Kinderdijk  
Sliedrecht

### Sites – Europe

Aberdeen - United Kingdom  
Blandford Forum – United Kingdom  
Komarno – Slovakia  
Riding Mill – United Kingdom  
Rijeka – Croatia  
Verberie - France

### Sites – USA

Houston, TX  
Wayne, NJ

### Sites – South Africa

Cape Town

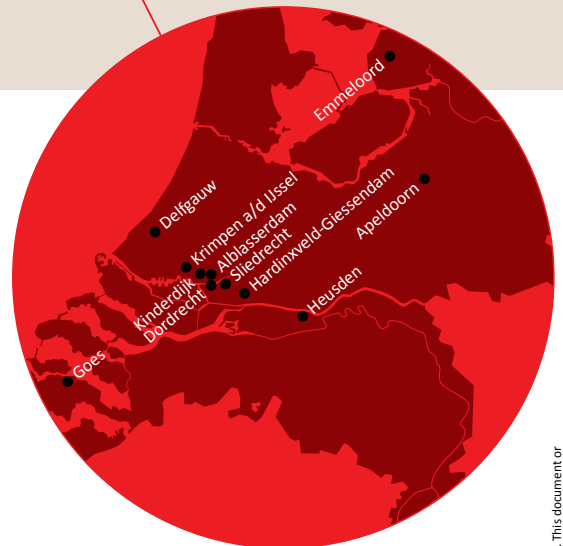
### Representative offices

Beijing – P.R. of China  
New Delhi – India  
St. Petersburg – Russia

### Regional IHC Organizations

#### worldwide

Dubai – United Arab Emirates  
Kinderdijk - The Netherlands  
Lagos – Nigeria  
Mumbai – India  
Singapore – Republic of Singapore  
Tianjin/Tanggu & Guangzhou – P.R. of China



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# IHC Systems

*Dedicated to Efficient Dredging*



## *Production measurement systems*



an IHC Merwede company

**The technology innovator.**

# Efficient Dredging...

'Efficient Dredging' helps contractors to make the most of their dredging equipment: to generate high economic and ecological benefits, achieve optimal utilisation rates, reduce dredging time, make the dredging process smoother, simplify fault diagnosis, reduce downtime and wear, prevent under- and over-dredging, and maximise crew satisfaction.

Even after a shipbuilder has built reliable and efficient equipment, and even after contractors have optimised equipment utilisation, the **Efficient Dredging** concept continues to make a significant contribution, providing dredgers with extra 'senses' and 'hands & feet'.

Relatively modest investments in instrumentation, automation, surveying and simulation techniques produce major improvements in efficiency and accuracy. Automation under dredge master supervision can enhance production by up to 30%.

IHC Systems draws on all kinds of conventional and innovative control, automation, communication and presentation technologies. We also make the most of the knowledge and resources of the entire IHC Merwede group.

The concept is honed in close alliances with contractors and worked out in specific products, systems and services for every category of dredger and in every field. The products can cope with all dredging and mining conditions.

Our knowledge, expertise and experience are dedicated to reducing over-dredging, spillage, energy consumption, emissions, turbidity, ecological side-effects and operational costs. They represent our contribution to a sustainable future for all our stakeholders.

**...our contribution to a sustainable future**



## Benefits

Measuring the production of trailing suction hopper dredgers (TSHD) or cutter/wheel suction dredgers (CSD) allows owners of dredging vessels:

- to support the dredge master's instincts and skills;
- to initiate manual or automatic control, improving the efficiency of the equipment while reducing the cost per cubic metre of dredged material;
- to prevent overloading a dredger's engines when discharging using long pipelines;
- to install automatic or manual pump control to prevent clogging in long pipelines;
- to produce reports documenting production figures for clients or authorities.

Production is calculated by multiplying the measured velocity and the density of the slurry in the pipeline. IHC production measurement systems, which can be used on all types of stationary and floating suction dredgers, produce vital information about what

is actually going on inside the suction tubes and in the delivery pipes. They are essential for cost-effective and safe dredging. Outputs are available for weight rate [tons of solids/sec] or [tons/hour] or for volume rate [m<sup>3</sup> of settled material/sec] or [m<sup>3</sup>/hr]. The systems can also calculate cumulative total figures.

IHC production measurements have been proven in practice all over the world for more than 40 years. More than 1250 units have been sold so far, and almost all of them are still in operation.

## Typical system arrangement

IHC Systems production measurement systems comprise:

- a radioactive mixture density transmitter;
- an electromagnetic mixture velocity transmitter;
- appropriate signal processing and presentation equipment depending on client requirements.



Production efficiency is vital in dredging jobs



... both on TSHDs ...



... and on CSDs

## Radioactive mixture density transmitter

The radioactive density transmitter uses the principle of radiation absorption. Gamma rays are directed across the dredge pipeline. They do not contaminate the mixture in any way; they simply pass through, or are absorbed by, soil particles, like light beams. The amount of gamma photons de-energized by the mixture is a logarithmic function of the mixture mass in the pipe. Absorbed photons are converted to harmless ions (= electrically loaded atoms) with very low energy levels; the rest activate the detector on the other side of the pipe. The remaining number of non-absorbed photons is a measure for the mixture density.

IHC Systems uses two kinds of sealed gamma sources: Caesium 137 for smaller diameters and Cobalt 60 for larger diameters. Two detection systems are available: the robust detector using the Geiger-Müller tube principle and the slightly more vulnerable, but highly sensitive,

scintillation-counter principle. The system selected depends on the required accuracy, measurement range, physical limitations and/or client preference.

The system is extremely safe: workers can – even though safety regulations stop them doing so – stay in the vicinity without being exposed in excess of the legal annual limits. Licensing from the authorities for possessing and using a system of this kind is a straightforward matter (see page 7).

There are three transmitter versions, each supplying their own operational and technical benefits – see the figures. The first is the ‘clamp-on density transmitter’: the steel-clad, lead-enveloped radiation transmitter unit and the receiver unit are mounted on heavy brackets that can be mounted on any dredge pipe. The second version is manufacturer-mounted on an independent pipe piece

with adapted flanges that can be installed in the dredger’s discharge pipeline. Finally, the integrated version is mounted on an electromagnetic mixture velocity transmitter, combining all the measurements needed for production calculation and providing the benefit of short building length. Of course, all the versions comply with mechanical standards and safety rules, hardening them for the rough dredging environment. ISO-9001-supported production ensures quality.



Clamp-on type density transmitter



Separate density and velocity transmitters

## Electromagnetic mixture velocity transmitter

The electromagnetic mixture flow transmitter works like an electric generator: the pipe is surrounded with an alternating electromagnetic field. In this magnetic field, the moving mixture acts like an electric conductor. So Faraday's law implies that this conductor generates an electric voltage that is proportional to the flow in the pipeline.

The first transmitter version is a stand-alone pipe piece with the same dimensions as the vessel's discharge pipeline and adapted flanges. It is installed in that discharge pipeline. The second, integrated, version also supports the equipment for radioactive density measurement described above. Both versions are produced in accordance with ISO 9001 Quality Management

procedures and they comply with the mechanical, electrical and safety standards for the shipbuilding and dredging industry.

## Liners for durability

The durability of the costly transmitters can be enhanced with liners. Liner material is selected depending on technical possibilities and limitations, as well as on customer preferences and standardisation strategies. The following options are available:

- no liner, the usual approach for clamp-on density transmitters;
- hardened steel liners for very abrasive mixtures and rock.

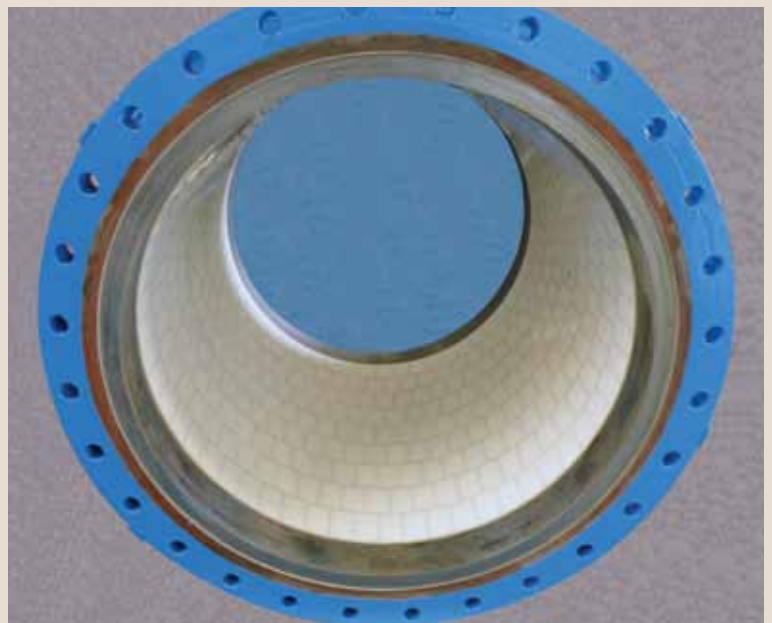
Limited by maximum permitted radioactive source activity in relation to diameter. Cannot be used in velocity transmitters;

- synthetic irathane liners, applicable in soil types without high levels of sharp sand or rock particles;
- extremely wear-resistant IHC Systems-patented liners of irathane-embedded aluminium oxide ( $Al_2O_3$ ) tiles, applicable in all soil types. These liners

can be of the fixed or the onboard replaceable type. For the latter type, optional mounting dismounting tools are available.



Integrated density and velocity transmitters



Extremely wear-resistant patented  $Al_2O_3$  liner

## Signal processing

There are two main solutions for signal processing, depending on operational requirements:

- The first principle involves converting the signals from the velocity and the density transmitters to standardised values and inputting them in an integrated dredger control system's PLC or SCADA computer. The PLC or SCADA software then calculates and presents the production figures on the operator

displays. This solution is generally chosen for larger and automated vessels, where the production signals are used not only for presentation but also for automation and/or reporting purposes. An integrated IHC Systems signal conditioner for both signals is available.

- The second principle involves integrating signal processing and presentation in a single system. This can be done

with IHC Systems' Production Calculator (PRC). In addition to signal conditioners, the PRC includes an LCD display with bar graphs for density, velocity, production rate in [tonnes/sec] and [m<sup>3</sup>/sec], and cumulative production figures. A keyboard is used for settings and calibration. Standardised analogue outputs have been included.

## Presentation

Dredge operators prefer density and velocity values to be presented on a cross needle indicator. This analogue instrument can be connected to both signal processing systems.

The advantage is that operators can see immediately the effect of both density and velocity on the production rate. It has now become customary to use a virtual cross-needle indicator on

SCADA screens or, for example, on the IBIS system used on IHC Beaver® dredgers.



IHC Systems Production calculator PRC

## Straightforward licensing

The industrial application of radioactivity is surrounded by myths resulting from misconceptions about the subject and the association with nuclear hazards, without in-depth knowledge. The truth is that the sealed radioactive sources used in IHC Systems density measurements are entirely safe and legally approved throughout the world. They can be used without precautions other than the standard measures common to

operational and safety precautions in industry.

Owners of density measurements become users of radioactive materials and they are therefore required by law to apply for a national licence for the application, possession, transport or handling of radioactive materials according to the standards of the IAEA (International Atomic Energy Association) in Vienna.



Example of SCADA presentation



IBIS production presentation

### IHC Systems offers extensive practical help with licensing procedures.

Immediately after order confirmation, IHC Systems places the following at the user's disposal:

- a short guide: How to apply for a licence (international);
- a Sealed Source Design Review (SSDR). This SSDR provides all the legal, physical, mechanical, visual, transportation and safety information on the sealed radioactive source;
- a certified radiation officer to help with the detailed completion of application forms supplied by the authorities.

IHC Systems also provides practical help in the shape of:

- an instruction manual accompanying every delivery, explaining installation, commissioning and operation;
- an optional introductory course to the principles of radiation and safety;
- 24/7 commissioning and Life Cycle Support services throughout the world on a cost declaration basis.

Licences guide owners through, among other things, the appointment of an appropriately trained, responsible person, the radiation officer. They also inform about the duty to register, to keep records and to inform the authorities about the location of radioactive material, the responsible transportation of the radioactive material and possible further specific licence-dependent requirements.