



Prevention engineering for workplace health – Dust

Contents

Introduction
Section One 03

XD1+ Function
Section Two 18

Device Operation
Section Three 22

Wearable Safety Analytics
Section Four 27

In Summary
Section Five 30



Introduction

01



Lung disease prevention

By collaborating with Trolex, a pioneering dust particulate monitor supplier, Ideagen Wearable Safety are able to bring dust monitoring data into a single analytics platform of multiple workplace risks – the Wearable Safety Analytics.

The result, a more convenient and accessible way to monitor and more effectively control exposure to occupational dust. Go beyond basic compliance and gain the peace of mind that your controls are effective in keeping your workers safe.



How can dust harm health?

Not all dusts are the same, some are more harmful than others. Excessive exposure to some types of dust has been linked to the development of particular health problems, such as lung cancer or asthma



Inhaling

Inhaling dust can create breathing problems. The health effects of breathing in dust can take many years to develop. Inhalable dust is visible, whereas is
Respirable dust is invisible to the naked eye



Swallowing

Inhaled dusts can get into the digestive tract and bloodstream, where they can cause local effects such as gastrointestinal tract irritation.



Eye contact

Dust particles produced during the cutting, grinding and drilling of materials can cause eye damage or irritation.



Skin contact

Some dust can cause ulceration of the skin and irritation. Skin can be harmed by dusts such as epoxy resins, rubber processing chemicals, wood dust and fibreglass and can lead to dermatitis.

Dust in the body

Illnesses and diseases resulting from the effects of dust

<100 μm , (most harmful <10 μm)

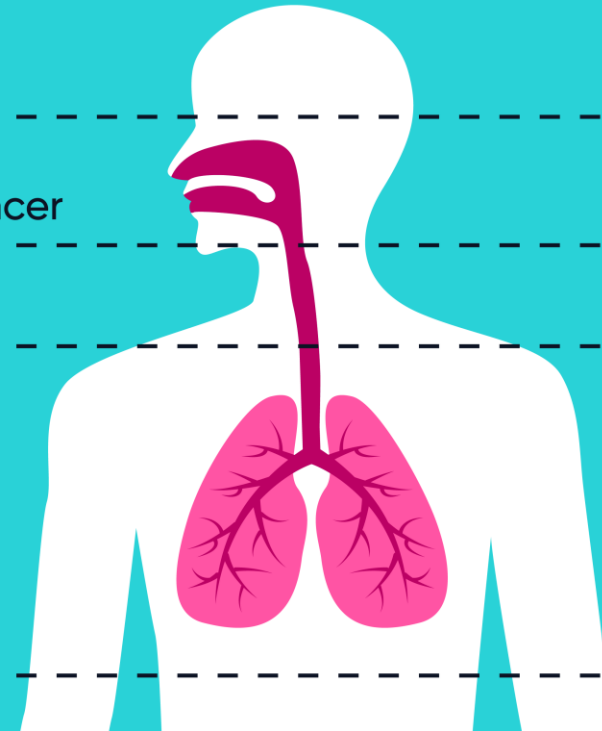
Inhalable dust:
Wood dust

Inhalable dust diseases:
Acne, Dermatitis, Skin Cancer

<4 μm

Respirable dust:
Welding fumes
Silica dust
Asbestos

Respirable dust diseases:
Asthma,
Asbestosis,
Cancer,
COPD,
Silicosis



Dust sizes

What does it mean

Dust is considered particles of 100µm and less. Anything more is typically too heavy to remain air borne



µm = The unit of measure for the dust particle diameter

µg/m³ & mg/m³ = Volume of dust per cubic metre

Measuring the volume of dust for each particulate diameter

Inhalable dust – PM₁₀
visible to naked eye

Respirable dust – PM_{4.25}
Invisible to naked eye

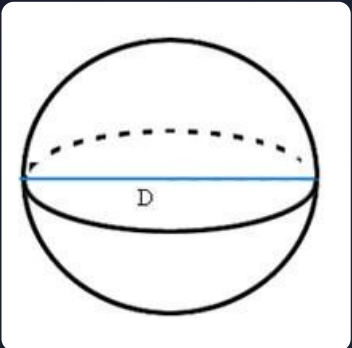
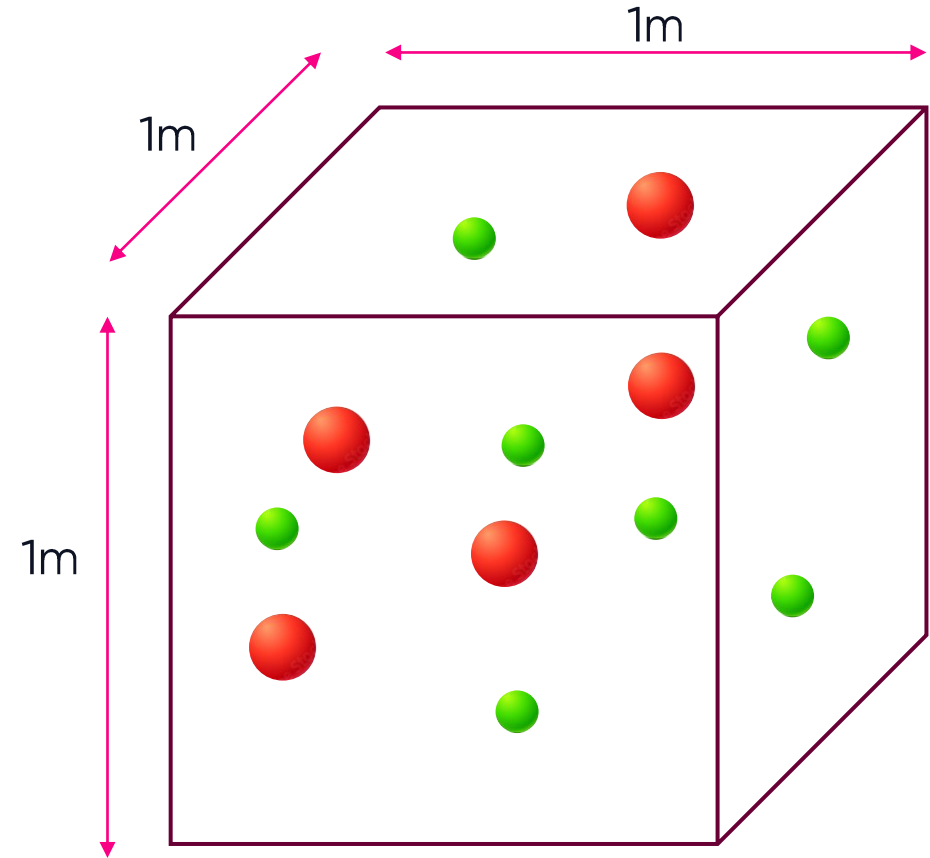
Dust size of particle vs volume of Dust

Inhalable dust – PM10

- visible to naked eye.
- Dust with a diameter $< 10\ \mu\text{m}$
- $\text{mm} = 1,000^{\text{th}}$ of a m
- $\mu\text{m} = 1,000^{\text{th}}$ of a mm

Respirable dust – PM4.25

- Invisible to naked eye
- Dust with a diameter $< 4.25\ \mu\text{m}$



Dust / Particulate monitoring terminology

Unit	Full name	Explanation
μm	Micron	Unit of measurement for an individual particle.
PM	Particulate Matter	A sum of solid and liquids droplets suspended in the air, many of which can be harmful in high concentration
$\mu\text{g}/\text{m}^3$	Micrograms per cubic metre	Measurement of particulate matter present in a given amount of cubic air. Measurement frequently used by legislative bodies
mg/m^3	Milligrams per cubic metre	Measurement of particulate matter present in a given amount of cubic air. Alternative reference measurement frequently used
WEL	Workplace Exposure Limit	Under the Control of Substances Hazardous to Health Regulations 2002 (COSHH) regulations, workplace exposure limits (WELs) are assigned to a large number of hazardous substances, which must not be exceeded.
STEL	Short Term Exposure Limit	Short term exposure limit (or STEL for short) is the limit of particulate concentration that you can be continuously exposed to for a 15-minute time frame. The figure will vary depending on particulate
TWA	Time Weighted Average	This is the average allowable amount of particulate exposure during an eight-hour shift period

Types of dust

Dust could be categorized either by Type (composition) or by high-risk Industries (origin). Here are the main types of occupational dusts encountered in various industries:

Mineral dusts

- **Silica Dust** – Common in construction, mining, and quarrying activities.
- **Coal Dust** – Found in coal mining
- **Asbestos Dust** – Historically, used in construction and insulation

Metallic dusts

- **Lead Dust** – Found in battery manufacturing, welding, & painting
- **Beryllium Dust** – Used in aerospace & electronics
- **Aluminium Dust** – Found in metal processing & manufacturing

Organic dusts

- **Wood Dust** – Produced in woodworking and carpentry
- **Grain Dust** – Common in agriculture and milling
- **Cotton Dust** – Found in textile industries

Synthetic dusts

- **Plastic Dust** – Produced in manufacturing and processing of plastics
- **Fibreglass Dust** – Found in insulation and manufacturing industries

Miscellaneous dusts

- **Talc Dust** – Used in cosmetics, ceramics, and pharmaceuticals
- **Carbon Black Dust** – Found in rubber and tire manufacturing

Construction dust

This is a general term used to describe different dusts that you may find on a construction site.

There are three main types:



Silica dust – created when working on silica containing materials like concrete, mortar and sandstone (also known as respirable crystalline silica or RCS);



Wood dust – created when working on softwood, hardwood and wood-based products like MDF and plywood;

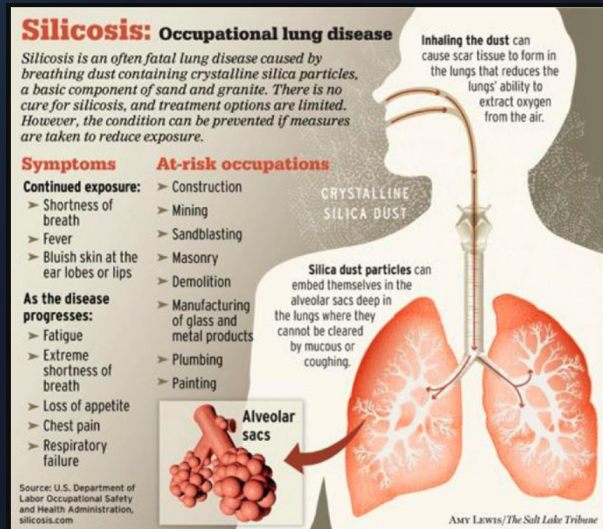


Other 'general' dust – created when working on other materials containing very little or no silica. The most common include gypsum (e.g. in plasterboard), limestone, marble and dolomite.

Silicosis

Linked to lung cancer, increased risk of COPD, TB, kidney disease and arthritis.

Sufferers may find it difficult or impossible to walk even short distances or up stairs. The effect continues to develop after exposure has stopped and is irreversible.



Type of Stone	Percentage of Silica
sandstone, gritstone, quartzite	more than 70%
concrete, mortar	25% to 70%
shale	40% to 60%
china stone	up to 50%
slate	up to 40%
brick	up to 30%
granite	up to 30%
ironstone	up to 15%
basalt, dolerite	up to 5%
limestone, chalk, marble	up to 2% (but these can contain silica layers)

Dust statistics around the world: Great Britain

99% of 13,000 occupational deaths were attributable to disease, primarily the result of lung disease & cancer attributable to past exposure to chemicals and dust

Occupation lung disease

12,000

Lung disease deaths each year estimated to be linked to past exposures at work

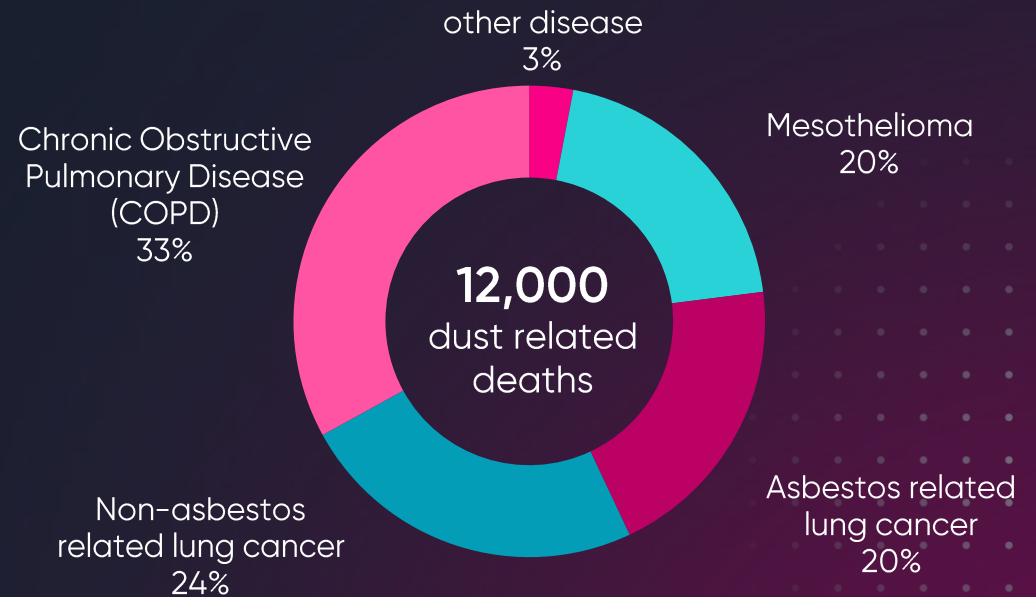
Death certificates and Attributal Fraction Estimates

17,000

Estimated annual new cases of self-reported breathing or lung problems caused or made worse by work

Labour Force Survey (LFS)

Lung disease contributing to estimated current annual deaths



Dust statistics from around the world

Canada

Approx. 900,000 Canadians are occupationally exposed to Silica on a regular basis. Most at risk are construction & mining workers, heavy equipment operators & plasterers or drywallers.

Australia

Silica Dust

Approx. 600,000 workers are exposed to silica dust

USA

General Dust

365,000 cases of work-related respiratory illness were reported in 2022

Silica Dust

Approx. 2.3 million workers are exposed to silica dust

Legal obligations

If dust falls within the definition of a 'substance hazardous to health' then the requirements of COSHH will apply, including the need to assess the risk to workers and to ensure exposure is prevented or adequately controlled. Dust will be a 'substance hazardous to health' for the purposes of COSHH if it is a substance:

- which is listed in Table 3.2 of part 3 of Annex VI of the CLP Regulation; and
- for which an indication of danger specified for the substance is very toxic, toxic, harmful, corrosive or irritant; or
- if it is a substance to which a workplace exposure limit (WEL) applies.

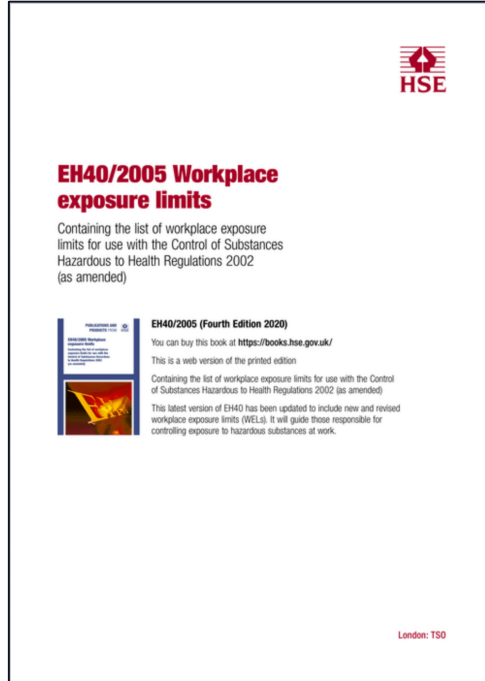
Assess the risk to workers and ensure exposure is prevented or adequately controlled

- A compliant assessment generally requires an occupational hygienist with a gravimetric sampler and laboratory analysis. The only way to understand the chemistry of the risk
- NOT a way to understand that the risk is being managed as impractical to do frequently enough

Work exposure limits

Each dust and particulate type is harmful at different concentration levels

The EH40 provides the threshold levels for the most harmful substances under COSHH



Substance	CAS number	Workplace exposure limit				Comments
		Long-term exposure limit (8-hr TWA reference period)		Short-term exposure limit (15-minute reference period)		The Carc, Sen and Sk notations are not exhaustive.
		ppm	mg.m ⁻³	ppm	mg.m ⁻³	
Resorcinol	108-46-3	10	46	20	92	Sk
Rhodium (as Rh) metal fume and dust soluble salts		- -	0.1 0.001	- -	0.3 0.003	
Rosin-based solder flux fume	8050-09-7	-	0.05	-	0.15	Sen
Rotenone (ISO)	83-79-4	-	5	-	10	
Rouge total inhalable respirable	1309-37-1	- -	10 4	- -	- -	
Rubber fume	See paras 31–36	-	0.6	-	-	Carc, limit relates to cyclohexane soluble material
Rubber process dust	See paras 31–36	-	6	-	-	Carc
Selenium and compounds, except		-	0.1	-	-	

Hierarchy of controls for dust

Most
Effective



Least
Effective

Elimination

**Remove
the hazard**

Adopt production processes that generate less dust (any wet method is likely to generate less dust than a dry one).

Substitution

**Replace
the hazard**

Substitute with a less hazardous substance, such as the use of pellets rather than powders, or replace sand with garnet as abrasive blasting agent

**Engineering
Controls**

**Isolate the
hazard**

Suppress dust by using water sprays on stockpiles and roads, and when using machinery and cutting equipment. Use additive in water sprays to suppress dust and adjust the droplet size of the spray according to dust particle size

**Administrative
Controls**

**Change the way
people work**

Provide training and information to workers on the hazards, risks and controls of dusty tasks, as well as supervision for workers

PPE

**Personal protective
equipment**

Select the most appropriate respiratory protection for the task (e.g. P1 or P2, full face, half face, powdered air, purifying).

The XD1+

02



Simple and effective



170g: Personal, portable or mountable



No pumps, filters, sampling heads, tubes, impactors or any other consumable parts



Virtually zero maintenance



User configurable audio visual alarms to provide instant warnings to workers who exceed the thresholds



Battery operated, rechargeable



Data available on the Analytics Platform and on RASOR



Simple and effective



0.1 μm to 10 μm particulate detection



Real-time alerts



Vibration alerts



RFID tag



BLE enabled



Robust alligator clip



Simple and effective



Self-test on every power up, or whenever you choose



No change-out of pumps, filters, impactors or sensing heads



No annual return to base



Compliance check takes less than 1 minute per test



Compliance Pack⁺ includes compliance base and hood and 4 calibrated compliance samples



3-month automated reminder to perform your compliance check



Device operation

03



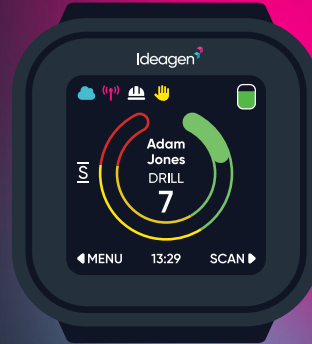
Key components



XD One unit

Simple, real-time dust monitor available to every worker who needs it

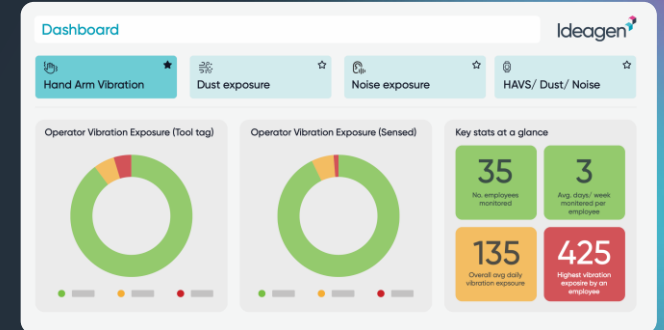
Collects Dust data for different particulate matter (PM1, PM2.5, PM4.25 and PM10), enabling detailed concentration profiling



Wearable safety watch

Assign personal dust monitor to specific workers

Use R LINK watch to assign XD-One+ to the workers and gain access to their dust data



Wearable safety analytics

Analytics delivers dust data from individual workers allowing you to determine where highest concentration of dust exists so you can manage better.

Connecting the XD1+ to the wearable safety ecosystem



Personal R-link with dust association

Assign R-Link to a worker and pair the watch with their XD1+

Workers will be able to conveniently view the dust data on their watch

Dust data is available in the Analytics when R-Link is within range of a Gateway and on signing out a watch



Personal RASOR with dust allocation

Assign RASOR to a single worker and pair the device with their XD1+ dust monitor

The worker can access their dust data live within a menu of RASOR

Live and GPS tracked dust data will be sent to the Analytics



RASOR in hub (one to many)

A powered RASOR remains at a fixed location in 'Hub Mode'

RASOR can allocate many XD1+ dust monitors to individual workers

Dust data is transmitted to the Analytics via RASOR once the XD1+ is returned and unpaired

Alert/Alarm warnings and calculations



Short-term exposure limit (STEL) alert

- Default STEL period in Wearable safety Analytics is 15 minutes
- STEL alert warning threshold – Default set in Wearable Safety Analytics at $1000 \mu\text{g}/\text{m}^3$

Time-weighted average (TWA) alarm

- Default TWA period in Wearable Safety Analytics is 8 hours
- TWA alarm warning threshold – Default set in Wearable Safety Analytics at $1000 \mu\text{g}/\text{m}^3$

Always refer to local guidelines and legislation to ensure that alert & alarm warning thresholds are set at appropriate and permissible values for the intended operating environment.

Video training

WEARABLE SAFETY DUST MONITORING CAPABILITY



Data management via Wearable Safety Analytics

04

Workforce Incursions

Name	Days	Contact time (mins)		Contact			Last seen
		Total	Avg.	Short	Moderate	Sustained	
	22	561.1	25.5	4	40	5	
	6	59.2	9.9		4	2	
	8	307	38.4	4	4	2	
	7	80	11.4	5	3	1	
	8	237.3	29.7	2	7	1	
	3	3.1	1		3		
	3	0.9	0.3	3			

Add intervention

Category

Detail

Date

Signature

Wearable safety analytics functionality



Connecting tasks, workers and risk monitoring to improve H&S processes and employee behaviour.

A single system incorporating powerful analytics to manage aggregated risk data from a suite of personal monitors.

A system that can grow with you. Add third party monitoring

Wearable safety analytics functionality

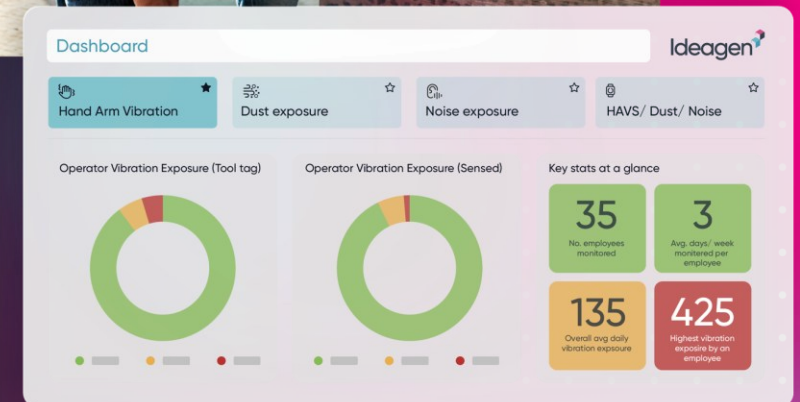
01 Easily Share with all stakeholders with readily accessible on-line and auto e-mailed reports and alerts

02 Granular detail on daily exposure

03 Clear and pertinent information to prioritise efforts on the hierarchy of controls

04 Assign exposure record to an individual and a process

05 Secure access to intuitive analytics hosted on a robust and GDPR compliant scalable cloud platform



Evidence your prevention engineering



Record & Monitor Control Measure Success

Log applied control measures and track their effectiveness against monitored risk data.

The screenshot displays the 'Operator Exposure Action' form. At the top, there's a filter bar and a 'Download PDF' button. The main section features a table with columns: 'Date', 'Time', 'Task Name', 'Manufacturer', 'Trigger Time (min)', 'Exposure Points', 'Early Points', 'Significant', and 'Intervention'. The table lists several exposure events, including '07/03/2017' and '04/03/2017'. Below the table, there's a section for 'Intervention' with a text area for notes and a 'Sign' button. The form also includes a 'Date Implemented' field and a 'Status' dropdown.

Log & Authenticate Interventions

Log intervention notes allocated to individual employees and electronically sign to acknowledge.

Ideagen Wearable Safety



History and credentials

Clients +900

Employees protected +75,000

Tool records +20M

Software users +9,000

Balfour Beatty

LAING O'ROURKE

CATERPILLAR



BAE SYSTEMS

>100 local authorities

2001 Established from Edinburgh University.

2008 Launched a tool mounted HAV monitor.

2014 Introduced cloud based secure analytics & auto data management

2016 Launched a wrist worn industrial wearable

2019 IoT gateway for live data and location tracking

2022 Internationally scalable ecosystem for HAVs noise, dust, MSD



**Microsoft
Partner**

Application Development
Application Integration