Turning Environmental Challenges
into Operational Savings

A case study of odour management in the wastewater treatment industry

EnviroSuite

Contents

EnviroSuite for Odour Management

benefits of at least

$900,000 [(1)]

per year

payback period of

six months

or less.

[(1)] AUS Dollars

Our work implementing proactive environmental technologies at wastewater treatment plants has shown ongoing net financial benefits of at least $900,000 per year, with a payback period of six months or less.

The wastewater treatment industry is facing ever increasing challenges.

Encroachment

More Stringent Regulations

Too Much Data

As communities grow, ageing infrastructure built on the outskirts of communities has gradually moved within buffer distances designed for odour control. Facing regulations that continue to increase in stringency and communities that continually demand more from industry and regulators, businesses have increased expenditure on control and tracking of odour impacts.

Unfortunately most systems for environmental management focus on the collection, storage and only sometimes, the display of information. Although useful for reporting on issues that have happened in the past, analysis of data is time consuming and difficult for non-subject matter experts. At the end of a lengthy investigation, results are inconclusive, and the opportunities for operational improvement have passed.

At high risk sites, traditional ways of managing odour can no longer deliver performance that the community and customers are happy with. New ways of doing business need to be geared towards helping businesses avoid impacts or to improve operations, supported by high quality analysis that is delivered to the people that need it, when they need it.

Sewage treatment plant odours often result in lawsuits!

Plants that cause persistent nuisance are often the subject of legal action by residents, regulators or property developers. When successful, the costs to business can be many millions.

See some examples below.

Sewage treatment plant odours trigger lawsuit

Cities move forward with sewage stink lawsuit


Environmental management is
often seen as a cost to business,
but the costs of the traditional
methods for odour management
can be much higher.

Our work with sewage treatment plants has found seven areas of costs related to odour issues.

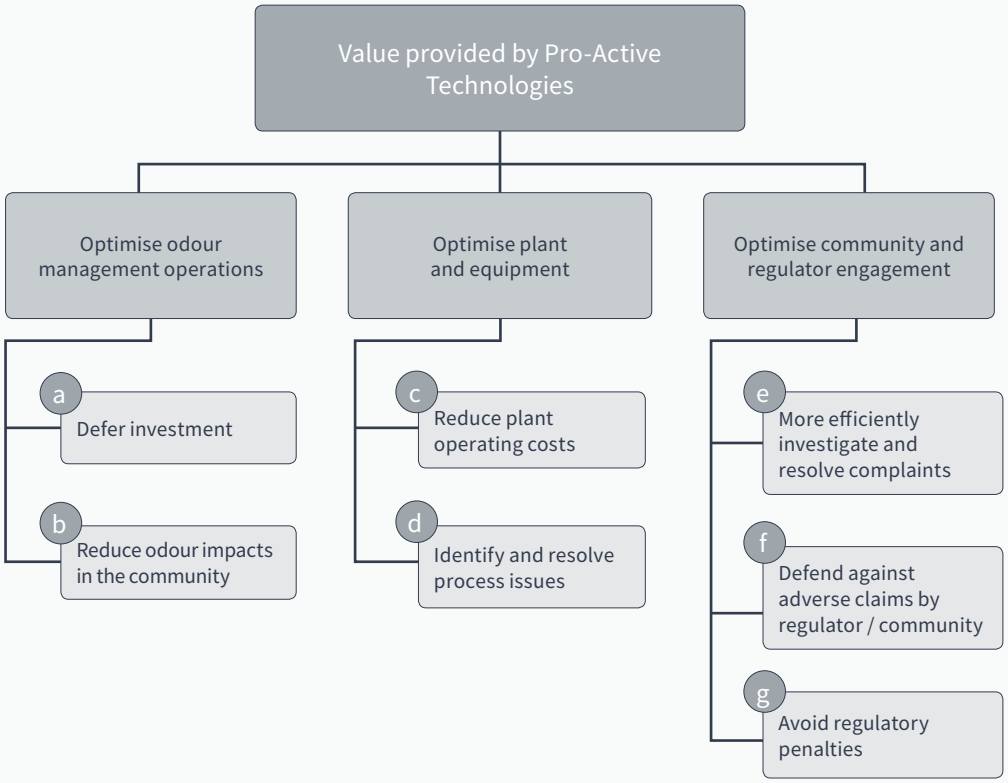
To avoid these costs businesses need to find new ways to improve odour management performance without increasing ongoing operating costs.

Pro-active technologies designed to avoid incidents, improve performance and reduce the number of odour complaints are ideal for delivering the genuine financial benefits that business needs.

1. Unnecessary investment in expensive control technologies.
2. Reduction in property values in nearby communities.
3. Higher operating costs associated with odour management.
4. Undiagnosed process upsets - odour can often be a symptom of a plant performing sub-optimally.
5. Management and resolution of complaints.
6. Lawsuits from regulators, community groups and developers.
7. Regulatory penalties related to odour management.

Pro-Active Technologies for Odour Management are designed to drive down the costs of odour management or increase the value to business by:

- Forecasting incidents before they happen, so that they can be avoided.
- Providing an early warning for incidents or process upsets that are in the early stages of development.
- Analysing rapidly the root cause of incidents so that an effective response can be deployed before the community is affected.
- Managing complaints automatically and effectively so that resources are only used on legitimate complaints.
- Automating reporting on performance so that management can spend time on driving improvements in performance as opposed to reporting on issues that have happened in the past.
- Improving performance without costly capital expenditure.



The key to delivering this value is technology that moves beyond the storage and display of information, to technology that delivers analysis and understanding in real-time, so that managers of the business can make the right decisions at the right times to avoid environmental incidents.

The key aspect of implementing a pro-active system for odour management include:

1. Stakeholder engagement.
2. Configuration of monitoring systems.
3. Configuration of modelling systems.
4. Configuration of reports and alerts.
5. Ongoing review and consultation.

Stakeholder engagement

Stakeholder engagement is critical. Pro-active systems are a new way of doing business and change management needs to be a focus of any implementation. The people that make the day-to-day decisions that affect plant performance are often different to those that make the decision to implement the system in the first place, so consultation and communication is critical. Everyone needs to understand why the change is happening and what the benefits to the business will be. Key questions during early consultation include:

- How complaints are currently managed at a site level. For example, what information is available to analyse complaints, how is it used, what information is reported internally and externally?
- How is monitoring of hydrogen sulphide (H2S) currently used to manage odour? What are the limitations of existing methods?
- What frequency of automated reporting would provide optimum response?
- Who should receive risk reports?
- How monitoring dashboards should be displayed and who should have access to them?
- Is there any information on what alert levels and format (e.g. SMS, email, what averaging period) would be useful for the site?
- What modelling is available that could be utilised in a real-time or forecast model for the site?
- What meteorological conditions typically lead to complaints?
- How is performance currently measured at each site and what level information is desired?
- How could a new system improve the way that odour risk is managed?
- What information is available on monitoring technologies currently in use?

What are the limitations of currently available technology?

Configuration of modelling systems

Modelling systems underpin the effectiveness of forecasting systems. Odour impacts are highly dependent on meteorology, so knowing what meteorology will do in advance can help you to avoid incidents. Even more importantly, knowing what the forecast means, and delivering the right information to the right person at the right time will determine whether change occurs.

- Understand what conditions cause the worst impacts. You may have this information already from previous work and an air quality specialist should be able to help you here.
- Use a model suited to the issue. Odour from wastewater conditions is typically worst under calm conditions or subject to complex meteorological patterns. Make sure that your meteorological model and dispersion model are suited to this.
- Test your model against real impacts. Understand the accuracy of your forecast and adjust it based on tests against actual impacts.
- Translate outputs - The people that use the information need to be able to understand what it means for their business. Any forecast that is generated needs to be presented in a way that decision makers understand.

Configuration of monitoring systems

A monitoring network can form the basis of a system for rapid response, compliance monitoring, or both. How fit for purpose is your monitor?

Accuracy is important but not everything. Some low-cost sensors are perfectly suitable for providing an early warning of incidents about to occur, but are not accurate enough to be used for regulatory reporting. The advantage of low-cost sensors is that you can have wider coverage around your facility, both as hotspot monitors and boundary monitors, and if they help you to avoid impacts in the community, then they have served their purpose. Low-cost sensors are also often low-energy, so can be mobile and/or solar powered, enabling you to be flexible as your priorities change. Of course, if your numbers might need to go to a regulator as part of formal reporting obligations, then a monitor higher up the cost-curve may be more appropriate.

Configuration of reports and alerts

An SMS or email alert is used when:

- You want to know something now. You want to know it now because you need to respond quickly to manage that particular issue well.
- You want to know every time something happens, not just when you are sitting at your pc or looking at the plant.
- Once you've made the decision that you need triggers and alerts, there are a few more decisions to make:

The type of trigger

Spot triggers or alerts linked to 'instantaneous' values are best when a rapid response is needed above all else. Real-time instruments can exhibit volatile short-term patterns and don't always accurately represent what is happening from an operational point of view. Basing alerts on short-term triggers can lead to some false alarms, but will guarantee that you respond quickly when action is needed.

For example, when monitoring H2S as a safety issue when conducting plant maintenance, applying spot triggers makes sense, as you want to know the second

that someone is in danger.

Fixed averages will smooth out short-term peaks but slow down response times. If you can wait some time before responding to an issue, or you don't know enough until after you have gathered more than one data point, a longer term average will reduce the number of false alarms linked to your monitoring. Fixed averages might be advisable when objectives of compliance requirements are based on fixed time periods (e.g. 24 hour or 8 hour averages).

In a similar category, moving or rolling averages give an indication of sustained trends. Because moving averages are based on the latest available information, they can facilitate a quicker response to emerging issues if very large jumps in monitored values occur. Moving averages provide a balance between rapid response and smoothing out short-term peaks.

For example, when using sensors close to the plant, you may want to see a persistent pattern before deploying resources to investigate a process issue, so a longer term or moving average makes sense.

Designing the alert

Setting the trigger form and level of the trigger will always depend on your own specific objectives and targets but I would advise that you are flexible when starting out. Be prepared to change trigger levels if they are not giving you the outcomes you need. Too many alerts and people can become annoyed, or worse, start to ignore them. Too few alerts and you might miss the events that you really don't want to miss.

One way to optimise the number of alerts that are being issued is through the use of filters. Filters define when alerts are, and are not, sent. Some examples of filters are:

- Alerts are turned off during certain wind directions, or when it is raining, or during the night.
- Alerts are based on the difference (or some other relationship) between two or more monitors.
- Alerts occur when something is forecast to happen, as well as when it happens.
- There are different levels of alert (e.g. red, orange, green) linked to different responses.

Think carefully about who should receive each alert and when they should receive it; focus on who needs to respond and who needs to know about it. It is probably not worth waking up the whole environment and management team at 2 am with an SMS when an email to operators will do.

Don't forget, a critical element in establishing your alert system is ensuring that you have an appropriate response already planned, whether this is to address the condition causing the alert, or simply observing the conditions that drove it. Alerts should align with the goals of your Environmental or Risk Management Systems, if not, you won't realise the full potential of your system.

Consequently, it is also important to make a decision about what exactly you want to be alerted to. There will be a different design depending on whether you are aiming to characterise:

- specific parts of the plant, or the whole facility
- compliance issues or production issues.

These criteria will feed back into the type of equipment you use and where exactly you place it, but that will be the topic of another post on another day.

Reports are traditionally used to summarise performance long after they have occurred. Monthly or quarterly reports are common. We

believe that improvement in performance is possible if key historical information is communicated more frequently. Automated daily reports of key performance indicators allow for decision makers to build a connection between their actions and their impacts. This gives the best opportunity for pro-active decisions that avoid impacts to occur. A report at the end of the month may be effective in describing impacts, but often doesn't lead to changes in daily decisions that can effect impacts.

Ongoing review and consultation

Be prepared to make changes to configuration early in the process, as decision makers may respond differently to the way you expect. We've found that some control rooms are often experiencing 'alert fatigue' and only want SMS/email alerts for very serious events, while others are happy to use the dashboards only. Every team is different and even the same team may turn out to want something different after the system is actually implemented. This iteration is normal and be sure to take the time to consult with users of the system soon after it has gone live.

Thames Water has implemented EnviroSuite at two sewage treatment plants as part of an ongoing commitment to improve odour management.

Thames Water is the UK's largest water and wastewater services company, with 15 million customers.

EnviroSuite is being used as a decision support tool to improve operational management and enables the facilities to more efficiently manage environmental issues by:

- Forecasting and early warning of high risk periods using EnviroSuite's modelling module
- Real-time analysis of odour impacts and alerting and diagnosis of process upsets using EnviroSuite's monitoring module
- Instant diagnosis of the source of a complaint and efficient management of complaint data using EnviroSuite's incident intelligence module

Ute Edar Lagares Vigo, Lagares, Spain

Spain’s largest biofiltration sewage treatment plant.

EnviroSuite is being used at the plant to forecast odour risk, provide a platform for real-time odour management and rapid response for odour impacts and efficiently and effectively analyse and manage odour impacts in the area.

Ute Edar Lagares Vigo, a joint venture of GS Inima Environment S.A., Obrascón Huarte Laín S.A., Corsan Corviam Construcción S.A. and Isolux Ingeniería S.A has recently completed the major upgrade of a wastewater treatment in Lagares, Spain, creating Spain’s largest biofiltration sewage treatment plant. The existing facility is being expanded and modernised to improve space utilisation and operational flexibility. With an initial capacity of 147,000 cubic meters a day, the plant now serves 800,000 people.

The scarce land available has required a high-performance design and with close proximity to the local community, efficient management systems are required.

The Future of Odour Management

Odour management is becoming a costly and complex issue. For businesses wanting to avoid significant costs associated with purchasing and operating control systems, pro-active systems for odour management can deliver ongoing benefits and lower costs of operation.

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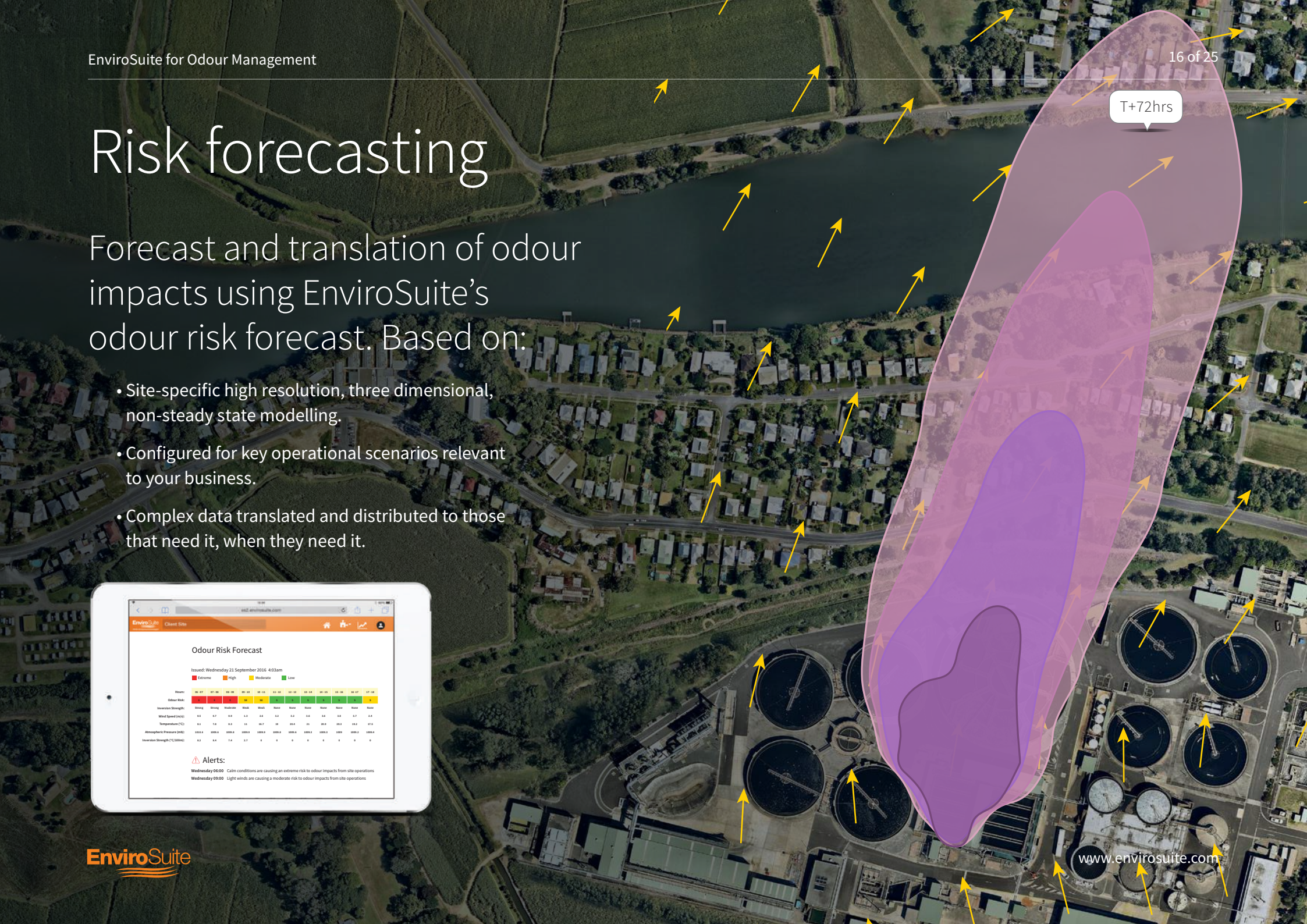
EnviroSuite for Odour Management

Risk forecasting

Forecast and translation of odour impacts using EnviroSuite's odour risk forecast. Based on:

- Site-specific high resolution, three dimensional, non-steady state modelling.
- Configured for key operational scenarios relevant to your business.
- Complex data translated and distributed to those that need it, when they need it.



Rapid response and Hotspot Analysis

EnviroSuite's monitoring module provides :

- A variety of dashboards and analysis tools to help you understand your impacts in real-time.
- Integrated with a flexible alerting and reporting system to deliver an early warning when incidents are imminent.
- Tools to help you diagnose the source of an issue before it has left the plant boundary.

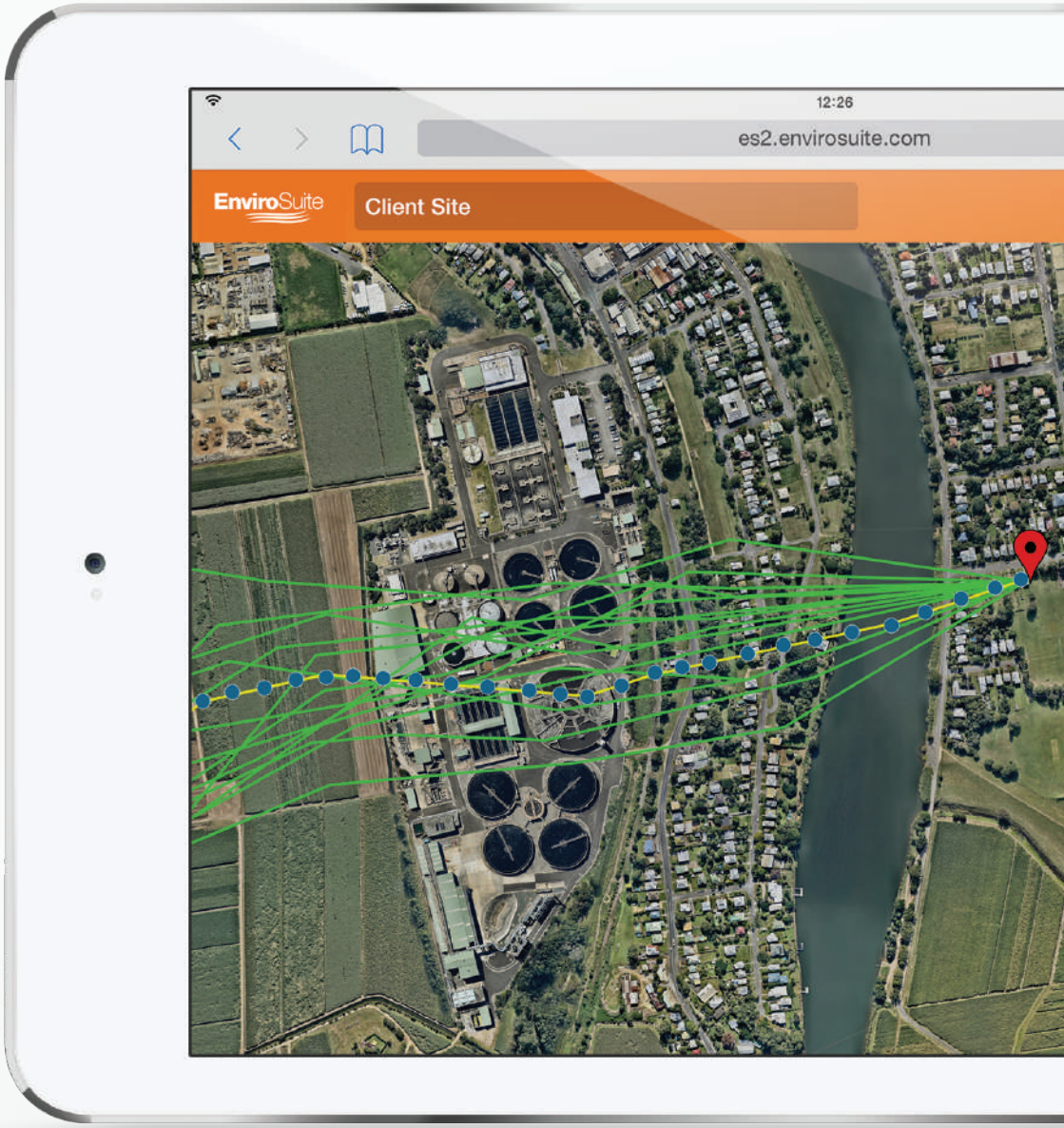
Backtracking

Identify the source of the issue with automatically generated reverse trajectory modelling.

Backtrack pathways are automatically generated when a complaint is received, so you can instantly identify the source of an air quality or odour issue. Backtrack pathways are attached to every ticket for easy reference.

Avoid unnecessary investigations

By identifying the source of the issue you can decide whether or not an investigation is required, avoiding many hours of wasted investigation time.



Complainant location

Most likely path of pollutant

Other potential paths of pollutant

Forward Tracking

Identify areas at risk before an incident occurs with ‘forward tracking’

Forewarn communities of potential issues.

Example work flow

1. An alert is generated from a monitoring location
2. Predicted forward trajectory pathway is automatically modeled
3. Pathway can be used to identify if off-site impacts are imminent
4. Issue forewarning and alert decision makers, if required.

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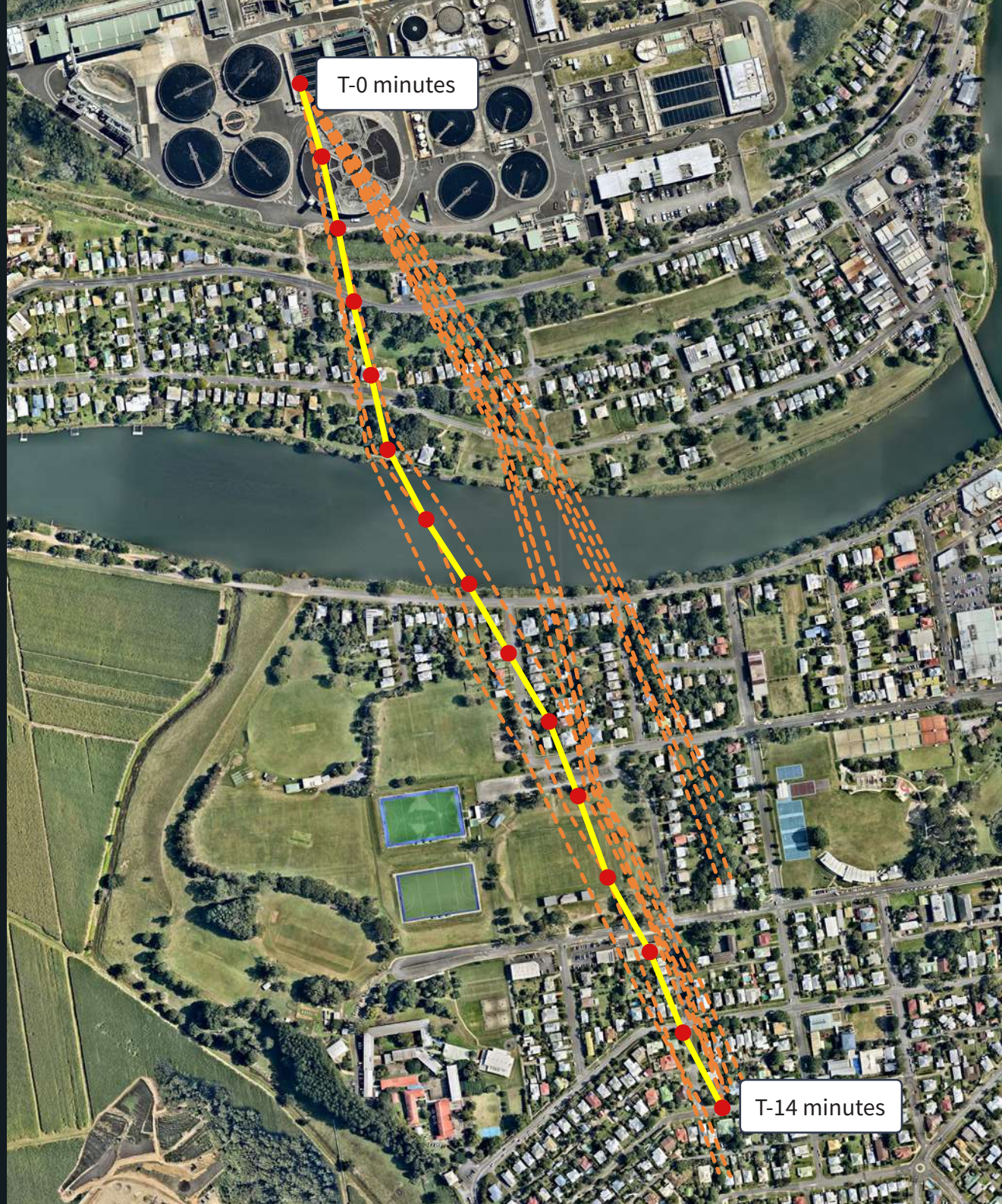


Incident Analysis and Management

Introduction

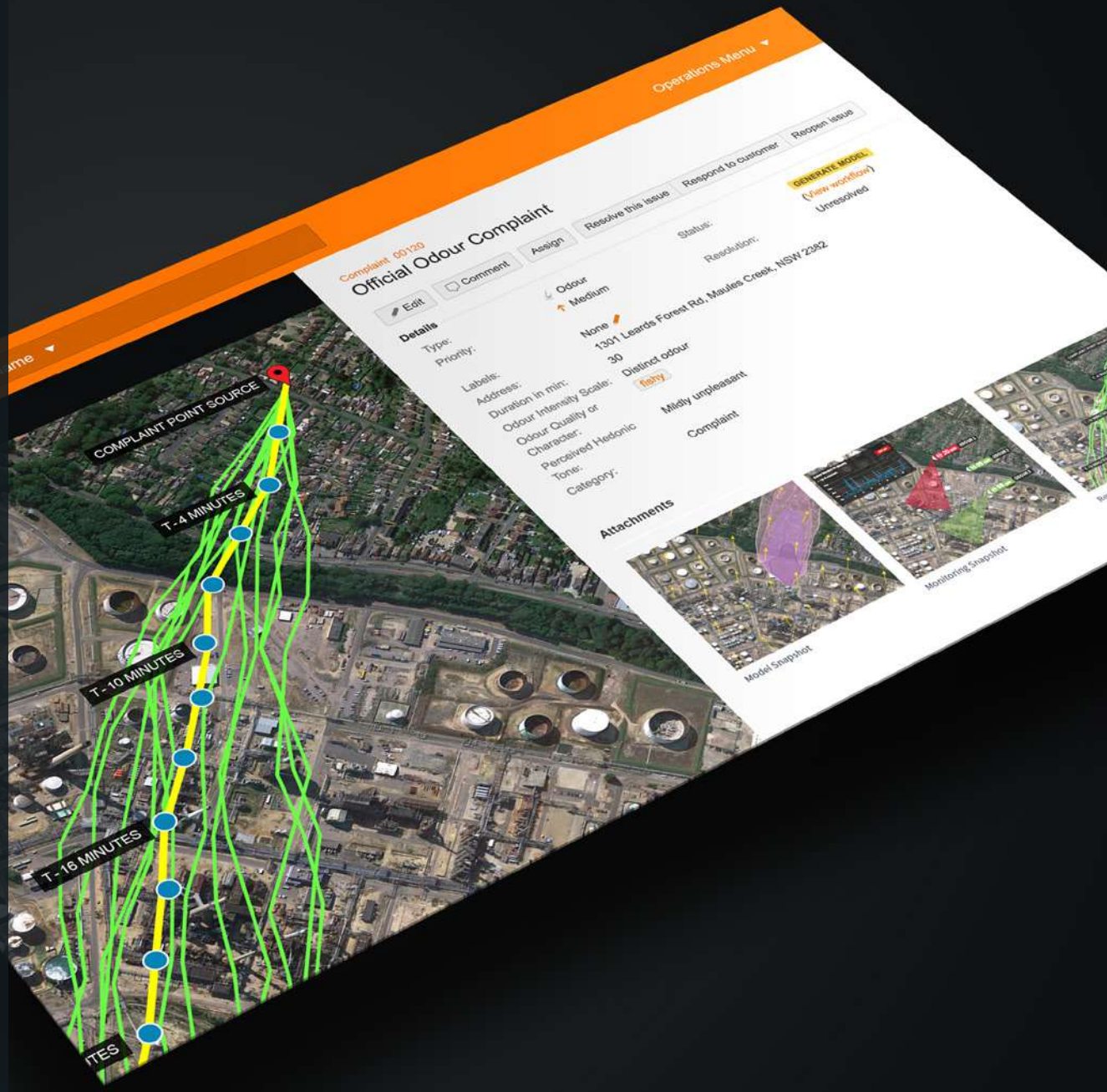
Simple incident management

EnviroSuite's incident intelligence platform makes it fast and simple to manage, investigate and even prevent complaints, giving you more time to focus on improving the performance of your business.

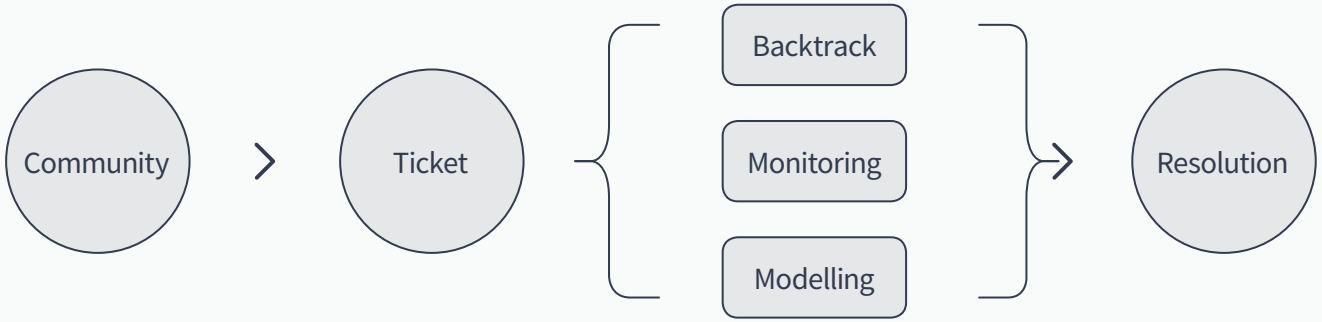
Organised intelligence

With all your intelligence in one place, the progress of an incident or complaint can be easily tracked, assigned and referenced at any time.

- Community portal for better engagement
- Business (administrator) portal for superior workflow management and response



Investigate complaints efficiently



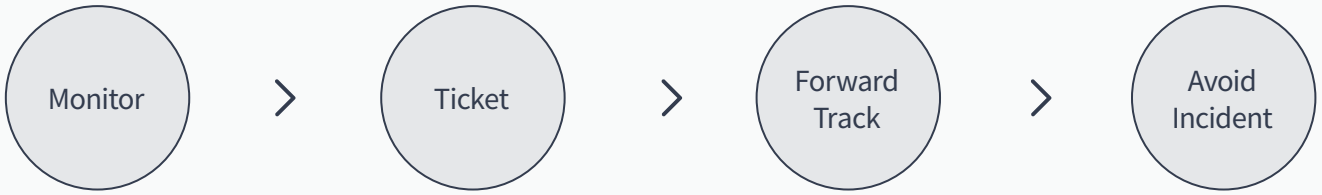
1. Complaint / observation is lodged via app

2. Automatically generated ticket and notification to appropriate staff

3. Automatically generate and store comprehensive analysis of the cause of the complaint

4. Evidence collected and used to reach a prompt and efficient resolution

Avoid incidents

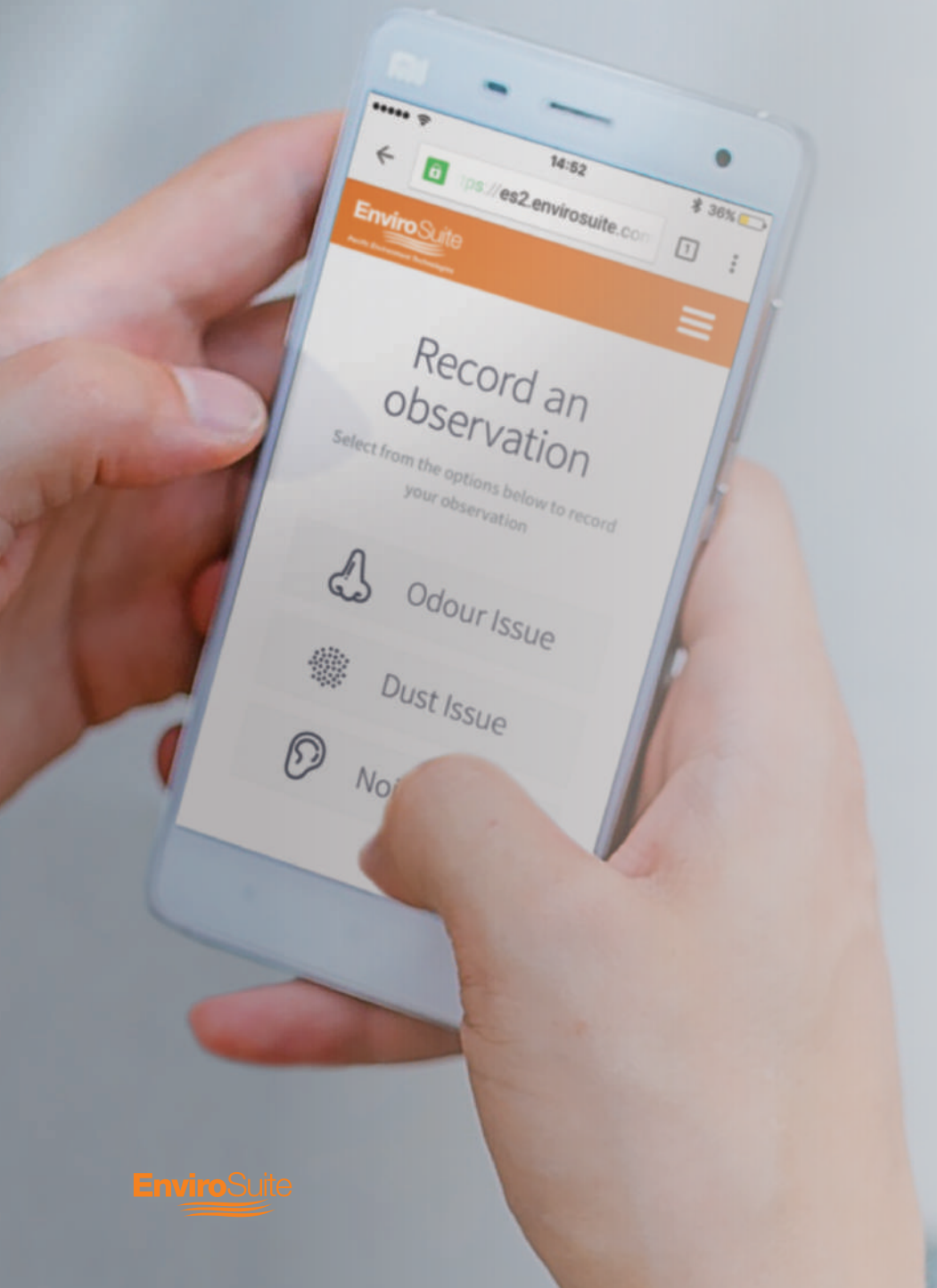


1. Data from one or more monitoring stations shows increasing pollutant concentrations

2. Automatically generated ticket and notification to appropriate staff

3. Modeling shows the pathway that pollution will travel, if current conditions continue, highlighting areas that may be impacted

4. Stakeholders are informed before an event occurs. Community may take evasive actions. Response teams can mobilise to control or contain a developing incident



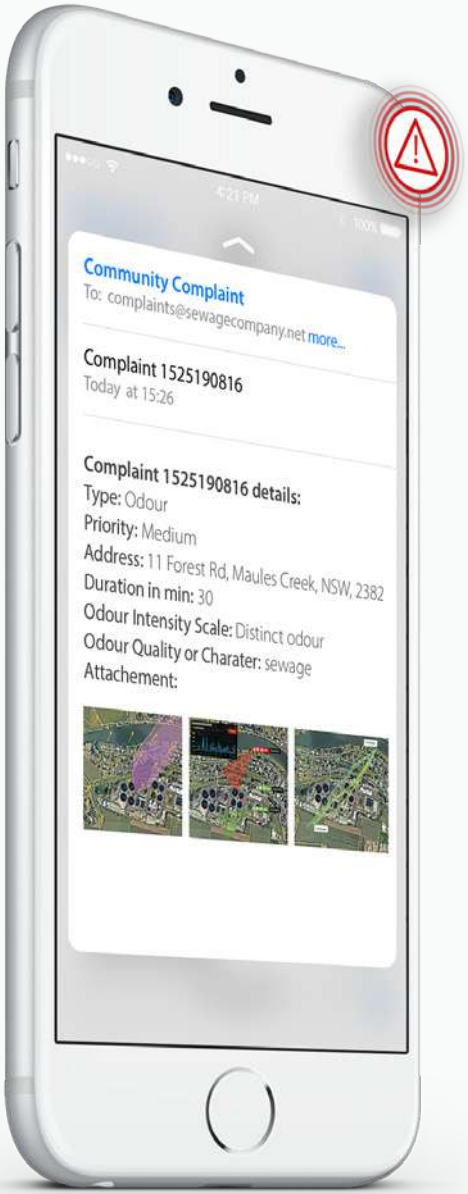
Community complaints portal

By providing the community with an easy-to-use complaint submission app, you will enhance relationships and build trust by addressing concerns quickly, effectively and consistently.

EnviroSuite's ticketing system allows complaints to be prioritised and addressed in record time. Public tickets are automatically generated in your private complaints management portal for instant analysis.

Features include:

- Secure portal.
- Saves significant time for data entry and management.
- Linked automatically to analysis tools, which only the business has access to.
- Ensures consistent recording of data in accordance with scientific standards.
- Accessible via tablet, smartphone, PC.



Community complaints analysis

Tickets, entered by the public or your own agents, are automatically linked to a suite of analytical tools based on leading science for complaints management.

With a confident diagnosis of the source of an issue, you can now identify legitimate complaints, focus quickly on causes and remedies, reduce community impacts and improve future performance.

Model Snapshot

Monitoring Snapshot

Reverse and forward trajectories