

Hydrocarbon Odour Management Protocol for Upstream Oil and Gas Point Source Venting and Fugitive Emissions

June 2014

Alberta Energy Regulator

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Introduction

Each year, the AER receives more complaints about off-lease emissions and odours. A large number of these complaints originate in areas of the province where dense petroleum development and unique operating, topographical, and other conditions increase levels of emissions. To address public concerns with hydrocarbon odours at existing producing facilities and in reducing emissions or hydrocarbon odours to reasonable levels, inspection staff at the Alberta Energy Regulator (AER) use the protocol set out in this document to guide them during an investigation.¹

This protocol is designed for upstream oil and gas single or multipoint source venting and fugitive emissions. For example, it includes casing gas vents, open or closed thief hatches, dehydrator still column vents, and truck loading and unloading operations. It was developed in response to new provisions in the April 2014 edition of *Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting* that prohibit unreasonable off-lease hydrocarbon odours (see section 8.2[3] of *Directive 060*). These provisions authorize the AER to respond to concerns with off-lease nonhydrogen sulphide (H₂S), hydrocarbon-based emissions. They also align with existing odour requirements for processing plants in section 9.050(6)(b) and (c) of the *Oil and Gas Conservation Rules (OGCR)*.

This protocol does not aim to eliminate emissions or hydrocarbon odours entirely. Nonhydrocarbon odours (e.g., SO₂) and odorous emissions from on-route transportation (e.g., trucking, rail), diesel engines, and area sources (e.g., mines, pits) have not been addressed. Odorous emissions from combusted gases are buoyant and can travel great distances. These sources have not been addressed because they would involve lengthy analysis, dispersion modelling, and ambient monitoring stations.

One Step Further—Preventing Hydrocarbon Odours

The AER may also be proactive in preventing hydrocarbon odours from negatively affecting the public through the AER's

- solution gas conservation escalation process and
- play-based regulatory initiative (formerly known as the AER's Unconventional Regulatory Framework [URF]).

For more information visit the AER's website at www.aer.ca.

¹ A hydrocarbon odour is defined as an odour with a distinctive smell that can be described as oil-like, asphalt-like, gasoline-like, natural gas-like, or chemical-like. Hydrocarbon odours are attributed to emissions from the production, processing, transportation, or disposal of crude oil, crude bitumen, sludge, slop oil, condensate, or natural gas.

Regulatory Requirements

The following acts, rules, and regulations pertain to odour management in the upstream oil and gas industry.

- *Oil and Gas Conservation Rules (OGCR)*

Section 7.035

The licensee, in the case of a well or facility, the operator, in the case of a facility that is exempted from the requirement to obtain a licence or approval, and the approval holder, in the case of an oilfield waste management facility, must comply with the requirements of *Directive 060* and *Directive 039*.

Section 8.050(1)

When oil, water or unrefined product is spilled or released from a break or leak in a wellhead, tank, separator, treater or process vessel, the licensee of the well or operator of the facility from which the spill or release occurred shall immediately take reasonable steps to contain and clean up the spill or release and shall ensure that the spilled or released material is processed in the operator's facilities, if appropriate, or is treated or disposed of, or both, in accordance with *Directive 058*.

Section 9.050(6) (b) and (c)

The operator of a processing plant shall conduct operations in such a manner as to

- (b) control the emission of unburned hydrocarbon vapors to the satisfaction of the Regulator and the Department of Environment and Sustainable Resource Development,
 - (c) control the emission of odourous materials to the satisfaction of the Regulator and the Department of Environment and Sustainable Resource Development
- *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*

Section 11.6(3)

Provisions to control odours during receiving, processing, treating, and disposing of waste materials. If the facility is approved to handle sour fluids, extra precautions must be in place to ensure that odours are controlled.

- *Environmental Protection and Enhancement Act (EPEA)*

Section 116(1) and (3)

- (1) Where the Director is of the opinion that a substance or thing is causing or has caused an offensive odour, the Director may issue an environmental protection order to the person responsible for the substance or thing.
- (3) An environmental protection order under this section may order the person to whom it is directed to take any or all of the following measures:
 - (a) investigate the situation;
 - (b) take any action specified by the Director to prevent the offensive odour;
 - (c) minimize or remedy the effects of the offensive odour;
 - (d) monitor, measure, contain, remove, store, destroy or otherwise dispose of the substance or thing causing the offensive odour or lessen or prevent the offensive odour;

- (e) install, replace or alter any equipment or thing in order to control or eliminate the offensive odour;
- (f) construct, improve, extend or enlarge a plant, structure or thing if that is necessary to control or eliminate the offensive odour;
- (g) take any other action the Director considers to be necessary;
- (h) report on any matter ordered to be done in accordance with directions set out in the order.

- *Directive 060* (April 2014 edition)

Section 8.2(3)

Venting and/or fugitive emissions must not result in any H₂S odours outside the lease boundary. Venting and/or fugitive emissions must not result in any offensive hydrocarbon odours outside the lease boundary that, in the opinion of the AER, are unreasonable either because of their frequency, their proximity to surface improvements and surface development (as defined in *Directive 056*), their duration, or their strength.

For the purposes of *Directive 060* and this protocol, the AER has defined surface developments and surface improvements in *Directive 056*, as follows:

- Surface improvement: a railway, pipeline, canal or other right-of-way; a road allowance; a surveyed roadway; a dwelling; an industrial plant; an aircraft runway or taxiway; a building used for military purposes; a permanent farm building; a school; or a church.
- Surface development: an occupied dwelling (full or part time); a publicly used development; a public facility (campgrounds, places of business); or any other surface development where the public may gather on a regular basis. This includes residences immediately next to an emergency planning zone (EPZ) and those from which dwellers are required to egress through the EPZ.

Overview

The AER's protocol for managing concerns with hydrocarbon odours (see figure 1)

- requires the gathering of evidence and the justification of the situation before a decision on whether to enforce can be made,
- can function independent of a specific policy on hydrocarbon odours from the Government of Alberta (GoA),
- can be adapted or used to complement future policies or rules adopted by the GoA and will develop over time. In the future, the protocol may also address education, prevention, mitigation, and enforcement.

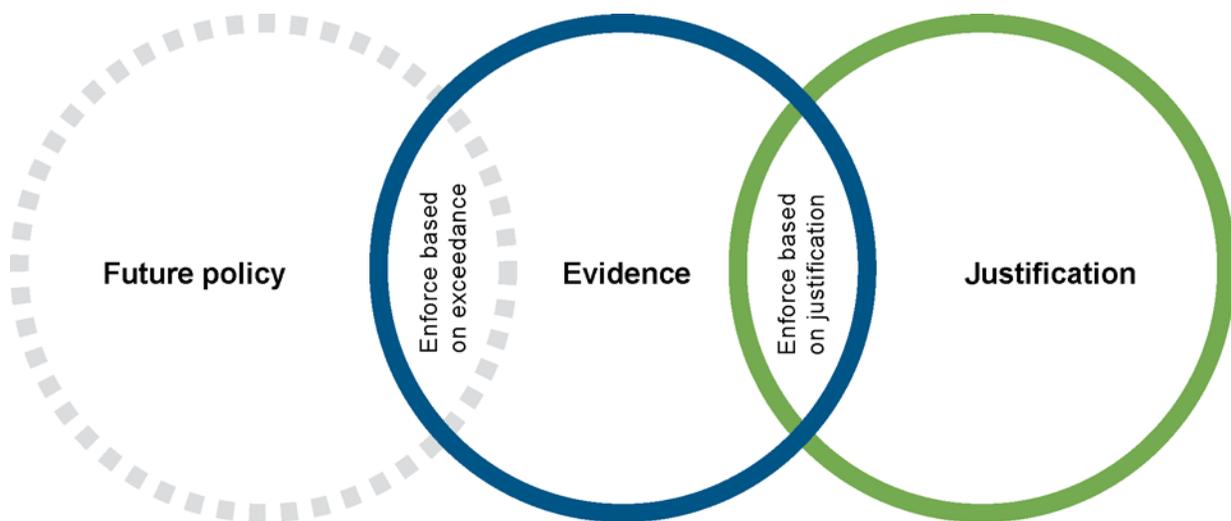


Figure 1. Hydrocarbon odour protocol

Current legislation gives the AER considerable discretion in determining how AER staff conducts an investigation into a hydrocarbon odour and makes the decision on whether to enforce. Enforcement against an offensive hydrocarbon odour is currently at the discretion of AER field staff (i.e., an inspector or compliance officer). AER staff must always act in accordance with the rules of natural justice and procedural fairness in all inspection and enforcement activities.

To ensure that this protocol is used consistently across the province, the AER will assign a select number of inspectors to investigate concerns and complaints about hydrocarbon odours. AER inspectors must conduct any investigation into a hydrocarbon odour in conjunction with the AER's existing procedures for inspections.

Initiating a Response

The decision on whether to initiate a response to a hydrocarbon odour lies with the AER field inspector. In deciding whether to initiate a response to a hydrocarbon odour, consider whether the odour is being emitted off site and is

- worse than what it would be during regular operation (e.g., due to a fugitive emission or process upset),
- worse than those odours being emitted at other batteries in that field or area, or
- causing a problem.

Since most batteries emit at least some hydrocarbon odours, use your best judgement when making the decision to initiate a response to a concern or complaint. This response into a hydrocarbon odour may be initiated because of a complaint or a routine inspection. Odour complaints are recorded and may be used as evidence when considering whether to issue an enforcement action.

Evidence

Collecting Evidence

If the response is due to a complaint, start by collecting evidence at the nearest site upwind from where the complainant was at the time the odour was detected. This is typically a residence. During the response, collect enough information to establish that it is more likely than not that the unreasonable hydrocarbon odour originated from the facility in question (see figure 2).

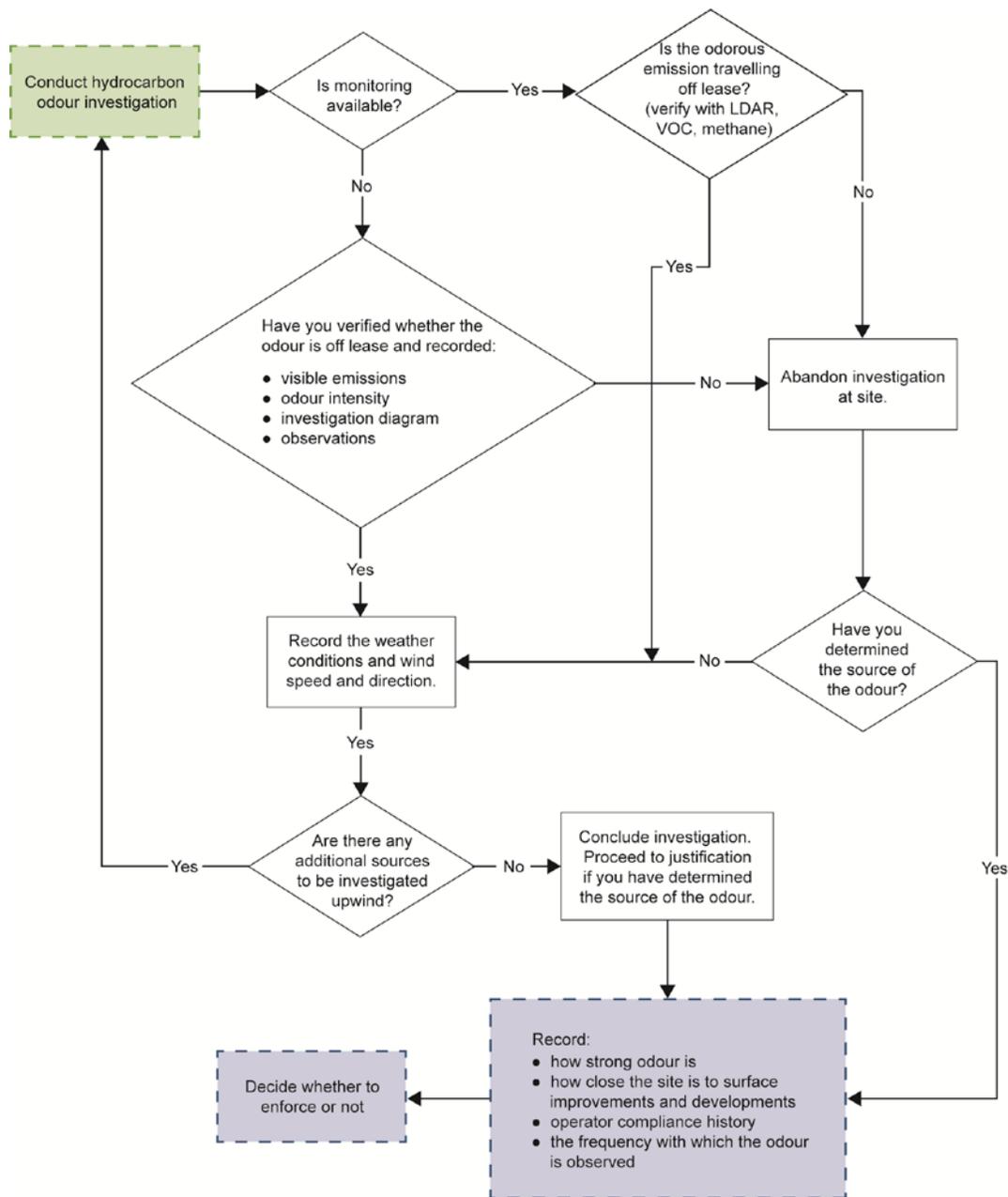


Figure 2. Process for managing hydrocarbon odours

The offensive hydrocarbon odour must be present at the time of inspection. If you cannot detect or verify that an odour is present at the site in question, you can either decide to investigate further to eliminate potential sources upwind or abandon the inspection. If you can verify where the offensive hydrocarbon odour is coming from (i.e., site), begin determining if you have sufficient justification for enforcement and documenting such information (see Justification and Enforcement).

Before you begin your investigation, review the evidence collection process with the operator. Use your best judgement when engaging the operator on site.

Recording observations

The inspector must record observations about and characteristics of the odour (e.g., strength of the odour, metered total hydrocarbon content (THC) or methane content) both on and off lease. The inspector needs to verify that the odour in question originated on lease and must confirm that it is moving off lease.

Record details on and observations made during the investigation on an investigation sheet and on an observation diagram (see appendix 1 and 2). Such information may include

- wind direction;
- the strength of the hydrocarbon odour;
- where the odour was detected;
- visible emissions;
- the reference numbers (e.g., tank numbers) of any equipment that may be having problems (e.g., malfunctioning, inoperative);
- readings from measurement devices, including where they were made (e.g., tank temperatures);
- the content of processing equipment/tanks (i.e., oil, condensate, or gas);
- a second inspector's observations;
- the operator's comments/odour verification;
- operational issues; or
- a video recording of fugitive emissions (e.g., FLIR camera).

Record the date and time of each observation. Take a photograph of the layout of the site when it can be done safely and without interrupting operations. You may wish to also have the operator sign the investigation sheet once it has been completed.

Collection methods

To either determine the source of the odour or strengthen evidence you may have already gathered, you may need to

- record public complaints,
- use human senses (sight, smell, and sound),

- use measurement or detection devices, THC detectors, methane detectors, or thermal cameras), or
- rule out other potential sources of the odour.

About using measurement or detection devices:

- Follow existing procedures for the device you are using (e.g., instruction manual for portable methane detectors and calibration requirements).
- Because methane is odourless and will inevitably be present with odorous compounds, it may be useful as an indicator or marker to determine which equipment may be causing the odours and to verify where the odorous compounds are coming from.
- If using a THC or methane detector, establish baseline readings to validate the strength of the odour. These baseline readings can be compared to readings at other sites to prove that offensive odours are stronger than normal. For example, an inspector conducting an investigation into odours being emitted at site A detects an offensive odour and methane concentrations of 30 ppm. The inspector then visits multiple sites surrounding site A and detects a mild odour and methane concentrations of 10 ppm. With this evidence, the inspector now has support that site A is emitting odours that are stronger than the normal. Create a baseline reading map (appendix 3) when visiting multiple sites in a given area.
- If a thermal camera is not used, wind must be present during the investigation. If it is a calm day, odorous compounds can accumulate and it may not be possible to determine the plume trajectory or that the odour is originating on site.

Level of detail

The objective of an investigation into a hydrocarbon odour is to determine the site or sites emitting the offensive hydrocarbon odour and to rule out other possible sources of the odour. The level of detail gathered ensures that enforcement is consistent, effective, and can withstand scrutiny in any subsequent appeal. At any point during an investigation, you can choose to issue an enforcement action, even with minimal evidence. However, if an operator chooses to appeal an enforcement action, it may be overturned if the evidence collected to support the enforcement is inconclusive or insufficient. As a result, always take every reasonable step to ensure you have properly established and articulated the applicable noncompliance and have collected and thoroughly documented the inspection procedures you followed and the information and evidence you collected to support any enforcement action.

- **The operator is present during the inspection.** Many oil and gas producers try to ensure that their operations do not adversely affect area residents and the AER wants to encourage open and honest discussion to help solve the problem. Attempt to maintain a positive, open relationship with an operator and use your best judgment when engaging an operator on site. However, if an operator is

present and claims that he/she cannot smell the odour, you may need to go above and beyond normal protocol to verify the odour, either by having an additional inspector or witness confirm that the odour is present or by using measurement equipment to prove that there are fugitive emissions or elevated hydrocarbon concentrations in the atmosphere.

If an operator confirms that there is an offensive odour emanating from its facilities, that confirmation (verbal or written) can be used to support the evidence collected. Have the operator sign a witnessed statement of this confirmation to avoid a later dispute. However, this may not be practical or encourage an open and honest discussion. Unfortunately, not all operators are cooperative and would likely dispute any AER request and have the option of disputing any enforcement action taken against them (see section 5 of *Directive 019: Compliance Assurance*).

- **The inspection is in response to a complaint.** If an inspector is responding to a hydrocarbon odour complaint, they should first consider verifying the odour at the location of the complainant as this is recorded and can be used as evidence. Some consideration should also be given to the response time of the inspector as odours can be transient, strong yet short lived, or the wind can change direction at any time.
- **The operational complexity and density of the site.** If the operation or the area is complex enough to cast doubt on the findings (i.e., high density of operations at multiple leases by numerous operators), conduct a more comprehensive investigation. Multiple sites can contribute to the odour being detected. Consider investigating into any operators of neighbouring sites both to demonstrate procedural fairness and to rule out other sources. Use monitoring tools or equipment to narrow your search or strengthen your evidence and use deductive reasoning to determine the source of the emission. You do not need to find the *exact* source; however, you do need to collect enough evidence to ensure that enforcement is supported and justified.

All sites in question are subject to justification and enforcement action if sufficient evidence is collected. Create an investigation report for each site investigated.

When faced with evidence that may cast doubt on evidence collected, field inspectors should take additional steps to verify and confirm the presence of an odour before proceeding to justification.

Field inspectors must do everything within their power to confirm that there is an odour.

Measurement devices are not always required. However, evidence is less likely to be challenged if one is used. Field inspectors should always use their best judgment when collecting evidence.

Justification for Enforcement

One of the AER's goals is to ensure compliance with its regulatory requirements. To do this, the AER uses a variety of compliance tools. Each tool that the AER uses to obtain compliance is chosen on a case-

by-case basis. Before deciding whether to enforce, justify your reasons for doing so based on any one or a combination of the following:

- **How strong the hydrocarbon odour is.** All oil batteries emit some hydrocarbon odour. Only sites emitting strong and offensive hydrocarbon odours should be considered for enforcement. Strong and offensive hydrocarbon odours can be described as strong, pungent, intoxicating, overwhelming, or in some cases as strong enough to cause a negative sensation such as nausea and should be detected both on and off lease (just outside the facility boundary) to justify issuing an enforcement action. Sites that emit strong and offensive hydrocarbon odours are more likely to negatively affect a surface improvement or development.

You will be determining the trajectory of the odorous plume both on and off lease—not at the point of impingement (e.g., location of the complainant). The odorous plume will typically disperse and may lose its strength when it reaches nearby surface improvements or developments.

Strong and offensive hydrocarbon odours are easier to detect consistently. Mild odours are more subjective and ambiguous when determined without odour measurement equipment. Do not issue an enforcement action if an odour is mild or weak enough to cast doubt.

- **How close the site is to surface improvements and developments.** The decision to issue an enforcement action depends on whether an offensive odour is adversely affecting people within a surface improvement or surface development. If the site emitting the offensive odour is located in an unpopulated area, issuing an enforcement action may not be warranted. There is no minimum distance to a surface development or improvement and you must use your best judgement when determining what is reasonable.

Example:

It would be difficult for a field inspector to justify issuing an enforcement action against the operator of a battery located 50 kilometres away from a complainant. This is because of the possibility of there being other sources causing or contributing to the odour and uncertainty in determining plume dispersion. However, if the field inspector believes the odour is coming from that battery and is affecting residents, he or she should investigate the situation more thoroughly. If the complainant were only 10 km downwind from the battery, the field inspector should consider issuing an enforcement action provided there is sufficient basis to do so.

(Note that an on-duty inspector is not considered a receptor when determining how close the source of the odorous emissions is to surface developments or improvements.)

- **The frequency with which a hydrocarbon odour is “observed.”** You can determine the observation frequency of an odour by doing any one or more of the following:

- *Evaluating* the site’s operating performance history regarding odorous emissions, such as fugitive emission problems, upsets, unique operational issues, or uncommon equipment failure.
- *Considering* the historical number of complaints and complainants in the area.

If a complaint is the first, the situation may not warrant enforcement action unless the odour is severe. If a complaint is not the first (e.g., two or more complaints have been received from the same resident in the same year about similar problems) and odours are detected around the lease boundary, issuing an enforcement action may be appropriate provided there is sufficient basis to do so.

- *Considering* the licensee’s operational compliance record and its efforts to reduce emissions or address complaints regarding its operations.

Taking the time to meet the operator to explain the requirements and, where warranted, issuing a notice of noncompliance (rather than an enforcement action) may assist in mitigating any assertions that the AER did not act with procedural fairness. All related odour investigations and meetings with operators in connection with odour investigations must be documented. If the issue is a reoccurring operational problem, take enforcement action.

- **How long the odour lasts at a given time.** The duration of an odour can be either continuous (e.g., the result of constant fugitive emissions or intentional casing gas venting) or transient (e.g., odours emitted during temporary operations such as truck loading or an equipment outage). Transient hydrocarbon odours may be difficult to prove. As noted above, an odour must be present during the investigation to warrant issuing an enforcement action.

Issuing an Enforcement Action

Before deciding to issue an enforcement action, consider

- the strength of your evidence,
- whether the decision would be consistent with other actions taken by the AER in similar situations,
- procedural fairness principles (all parties’ right to be heard and judged impartially),
- how far away the odour source is from existing and future receptors; and
- the receptors (e.g., complainants and persons who may be potentially affected by the odours).

Some examples of when to enforce based on the justification of the situation are shown in table 1.

Table 1. Sample enforcement decisions

Scenario	Evidence collected	Odour strength	Justification	Decision
1) An inspector arrives at an isolated battery that is emitting hydrocarbon odours.	The inspector verifies that the odour is coming from the site using his/her sense of smell and deductive reasoning.	Strong and offensive	A public roadway is 3 km away. There are no historical complaints or operational or compliance issues with the facility (i.e., there are no receptors in relation to the odours).	Do not issue an enforcement action.
2) An inspector is responding to complaints of odours in an area where there is a high density of oil batteries.	The inspector verifies that the odour is coming from the site using his/her sense of smell and a methane detector. The inspector investigates neighbouring facilities and is able to rule out other sources.	Strong and offensive	A public roadway is 3 km away. There are many historical complaints and operational and compliance issues with the facility. The closest residents are located 15 km away (i.e., there are receptors in relation to the odours)	Issue an enforcement action.
3) An inspector is responding to odour complaints in an area where there is a high density of oil batteries.	The inspector verifies that the odour is coming from the site using his/her sense of smell and a methane detector. The inspector investigates neighbouring facilities and is able to rule out other sources.	Mild	A public roadway is 1 km away. There are many historical complaints and operational and compliance issues with the facility. The closest residents are located 10 km away (i.e., there are receptors in relation to the odours).	Do not issue enforcement action.
4) An inspector is responding to odour complaints in an area where there is a high density of oil batteries.	The inspector verifies that the odour is coming from the site using his/her sense of smell, a methane detector, and a thermal camera. The inspector investigates neighbouring facilities and determines that multiple sites are contributing to the odour.	Strong and offensive	A public roadway is 10 km away. There are many historical complaints and operational and compliance issues with the facility. The closest residents are located 20 km away from the farthest facility (i.e., there are receptors in relation to the odours).	Issue an enforcement action against all licensees of the batteries emitting an offensive odour.

Try to avoid showing or being perceived as showing bias, emotion, or dislike, and avoid taking into account any irrelevant consideration.

See the case studies available in appendix 4 and use them to guide you in making consistent enforcement action decisions. Use the Post-Site Investigation Sheet (Justification of Enforcement) to record your decision on whether to issue an enforcement action and your reasons for the decision (see appendix 5).

APPENDIX 1 Odour Investigation Sheet

Odour Investigation Sheet



Inspector name(s):	Location:
Date:	Time:

Collection Methods (check all that apply)					
<input type="checkbox"/> visual	<input type="checkbox"/> total hydrocarbon detector	<input type="checkbox"/> sound	<input type="checkbox"/> methane detector	<input type="checkbox"/> smell	<input type="checkbox"/> FLIR camera
Other:					

Investigation Details	
Was the investigation in response to an odour complaint? If yes, attach the record of the complaint (if available).	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are there operational issues on site? (e.g., fugitive emissions, PVRV open, excessive tank temperatures, VRU failure)	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes, provide details: _____	

Are the hydrocarbon odours originating from the site in question considered "strong and offensive"?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If no, abandon the investigation.	
Was the operator on site during the investigation?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Representative's name: _____	
Operator's comments: _____	

NOTE: if operator agrees with odour, there is no need to justify the evidence.	
Has the operator taken any immediate voluntary action as a result of the investigation?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes, provide details (e.g., shut in production, reduce tank temperatures): _____	

Continued on next page

Observation Diagram
Notes: _____ _____ _____ _____ _____ _____

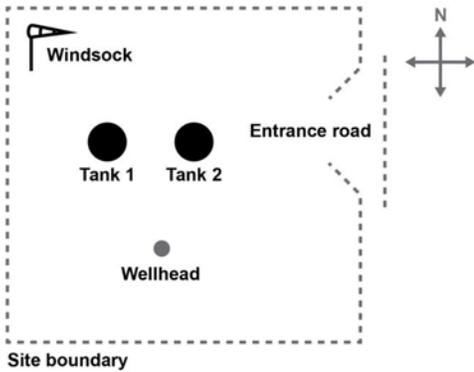
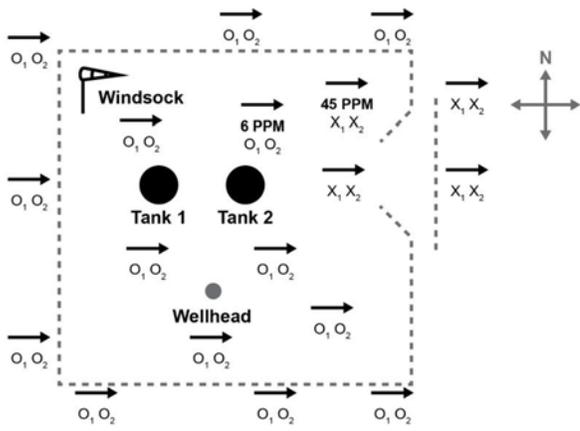
Conclusion
<p>Is the offensive hydrocarbon odour originating from the site in question? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If yes, complete the Post-Site Investigation Sheet (Justification of Enforcement).</p> <p>If no, abandon the investigation or investigate sites upwind.</p> <p>Comments: _____ _____ _____</p>

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APPENDIX 2 Drafting an Observation Diagram



Drafting an Observation Diagram

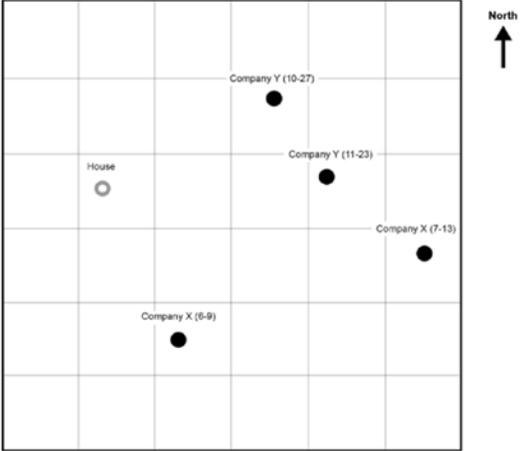
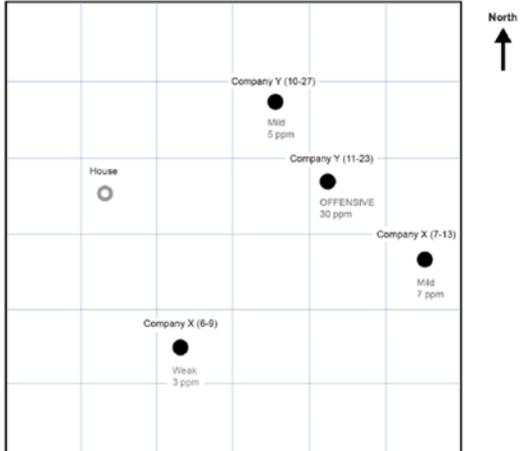
What to Record	Examples
<p>Draw a bird's eye view of the major equipment on site. Include tanks, buildings, wellhead, approximate boundary, windsock etc. Does not have to be drawn to scale.</p> <p>Include geographic direction (i.e., north).</p>	 <p>The diagram shows a dashed-line site boundary. Inside, there is a windsock in the top left, two black circles representing Tank 1 and Tank 2, and a grey dot representing a Wellhead. An entrance road is shown on the right side. A north arrow is located in the top right corner.</p>
<p>Walk around the site and record observations (e.g., no odour, odour, total methane concentration in ppm, visual indication of leaks or sounds).</p> <p>At each observation point, record the wind direction.</p> <p>Your objective is to determine the plume trajectory. Record your observations on site and off site. Include notes if necessary. Use the legend below.</p> <p>Legend O_1, O_2 – no hydrocarbon odour detected X_1, X_2 – strong hydrocarbon odour \rightarrow – wind direction n – use for multiple field</p>	 <p>The diagram shows the same site layout as above but with arrows indicating wind directions. Arrows pointing towards the tanks are labeled O_1, O_2. Arrows pointing away from the tanks are labeled X_1, X_2. Specific odour levels are noted: '6 PPM' near Tank 2 and '45 PPM' further to the right. A north arrow is in the top right corner.</p> <p>Notes: Total methane detector was used. Tank 2 temperatures are elevated. Can see vapour exiting the Tank 2 hatch. Elevated methane detected when strong odour observed. Site confirmed as the odour source.</p>

OdourManagementInvestigationHowTo-1a-20140109

APPENDIX 3 Drafting a Baseline Map



Drafting a Baseline Map

What to Record	Examples
<p>Draw a bird's eye view of the investigation area. Identify the location of the sites visited and the location of complaint or residence. If the map is not to scale, write "NTS". Include the geographic location (i.e., north).</p>	 <p style="text-align: center;">82-20W5M</p>
<p>Record the maximum observed strength and measurement device reading at each site.</p>	 <p style="text-align: center;">82-20W5M</p>

OdourManagementInvestigationHowTo-NewFigures-20140513

APPENDIX 4 Case Studies

Case Study 1

Situation:

Numerous operators are producing cold heavy oil in a densely populated area. The closest residents are located about 8 km west of the operating area and there is a history of complaints of odours from them. Two sites were investigated, sites 1 and 2.

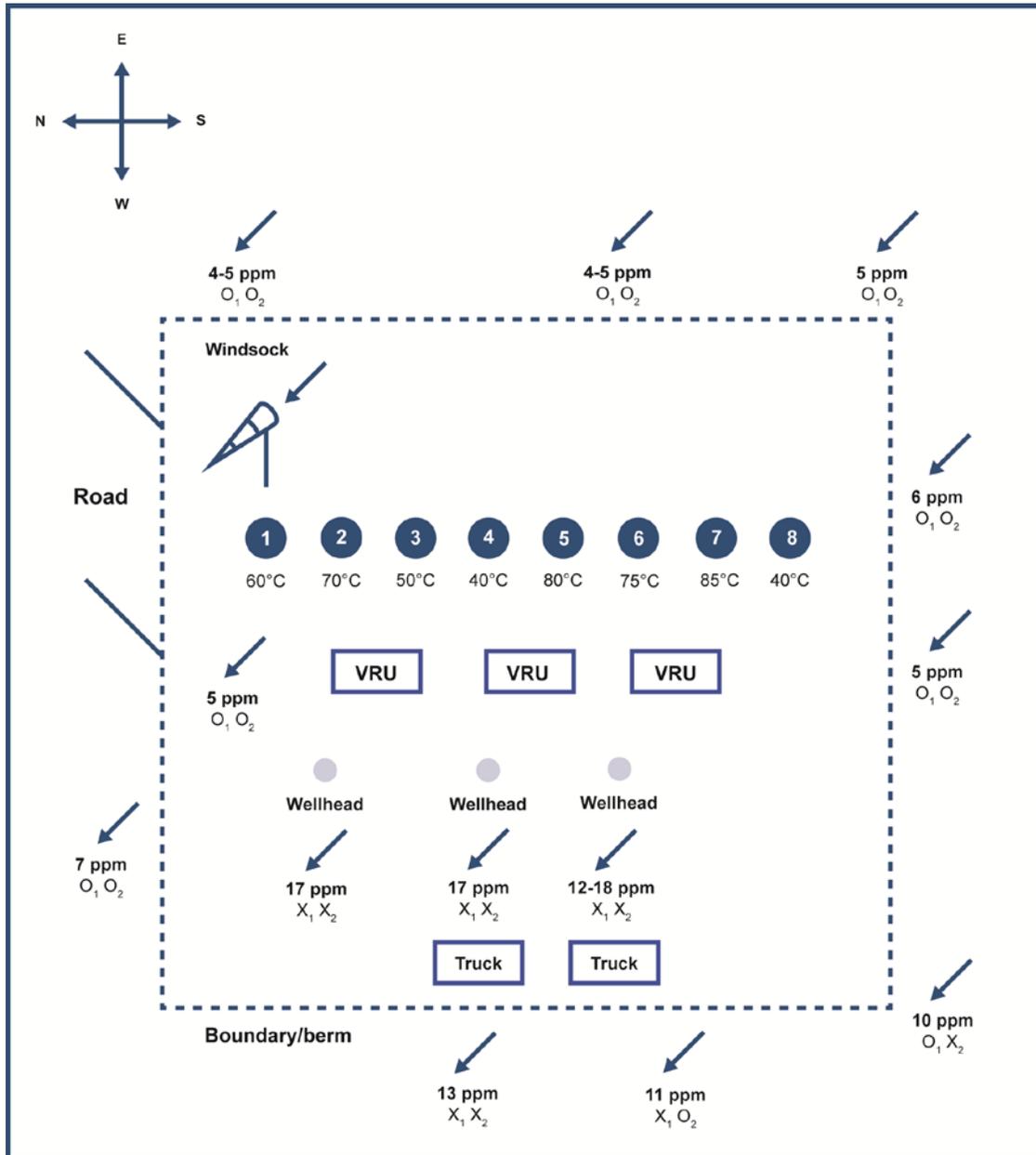
Due to the high density of producing batteries, the inspector must investigate sites upwind and examine a variety of facilities that are operated by different companies. All operators in the area have made attempts to eliminate odorous emissions by conserving solution gas using vapour recovery units. Reportable venting has been eliminated. However, complaints continue to occur due to fugitive emissions.

Company X (Site 1)

Evidence: Two AER inspectors conducted the investigation and were equipped with a total hydrocarbon detector. The operator was not present during the investigation. The following figure illustrates the evidence collected. The inspectors could smell a hydrocarbon odour downwind of equipment both on and off lease (verified by the total hydrocarbon detector). The inspectors concluded that a hydrocarbon odour is coming from site 1.

Justification and Decision: Both AER inspectors verified the presence of the odour. However, the inspectors debated its strength and whether or not it was strong and offensive. After inspecting numerous sites in the area, the inspectors determined that the odour is comparable to those emitted from nearby batteries and the site is not emitting more odours than other facilities in the area. The sensation when smelling the odour on site can be described as present and annoying but not overwhelming, pungent, or nauseating. Therefore, the odour strength is considered mild and enforcement action will not be issued.

Observation Diagram for Company X (Site 1)



Legend:

- X_n - offensive odour
- O_n - no odour
- n = 1 - inspector 1
- n = 2 - inspector 2
- ↙ - wind direction

Company Y (Site 2)

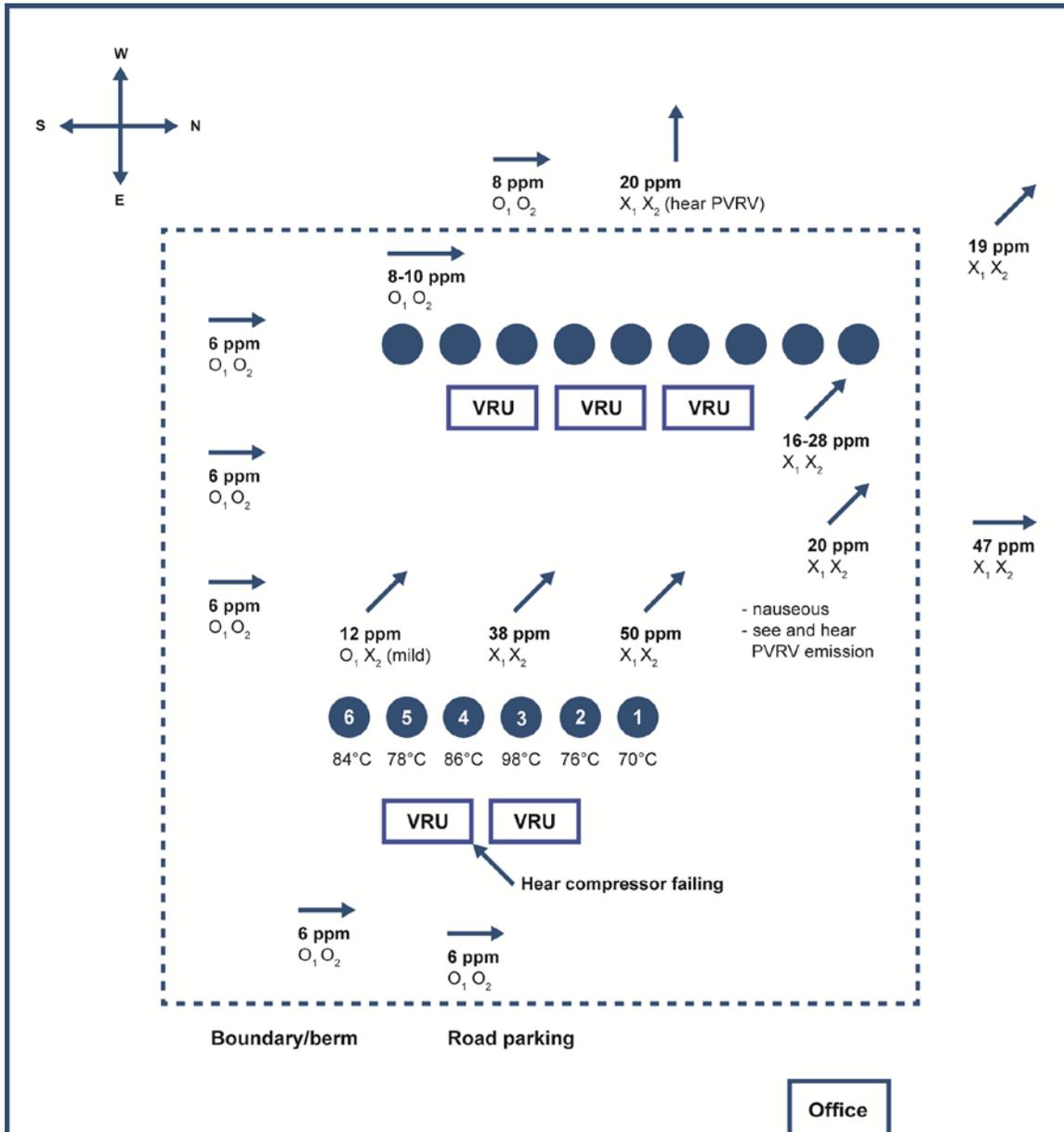
Evidence: Two AER inspectors conducted the investigation and were equipped with a total hydrocarbon detector and a thermal camera. Both inspectors could smell hydrocarbon odours from the road approaching the facility. The operator was present during the investigation. The operator is known to claim that staff can't smell anything, which is why the inspector needs to use the thermal camera to gather evidence. The following figure illustrates the evidence collected. The inspectors could smell hydrocarbon odours downwind of the equipment both on and off lease (verified by the total hydrocarbon detector). The inspectors could visually see fugitive emissions from tanks with or without the thermal camera and could hear that a compressor was experiencing operational problems. Tank 3 was operating at excessive temperatures and may be the cause of the excessive fugitive emissions. The inspectors concluded that a hydrocarbon odour is coming from site 2.

Justification and Decision: Both inspectors claim that the odour is significantly stronger than those emitted from other batteries in the area. The sensation they experienced when smelling the odour can be described as overwhelming, pungent, and nauseating. Therefore, the strength of the odour is considered strong and offensive.

Over the years, the operator has made several attempts to eliminate odours by installing vapour recovery units and replacing thief hatches with proprietary technology. There are several documented instances where the AER has identified fugitive emissions coming from storage tanks using a thermal camera. The site has a documented history of being the source of offensive odours. The operator is known to elevate storage tank temperatures, which is the suspected cause of the excessive fugitive emissions. The operator voluntarily shut down production for the inspection.

The AER has held several meetings with the operator to discuss previous operational concerns. Although the operator has made improvements, strong and offensive odours are still present. Therefore, enforcement action will be issued.

Observation Diagram for Company Y (Site 2)



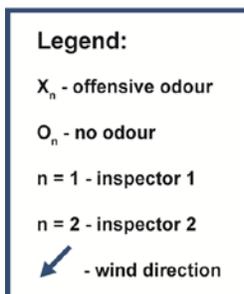
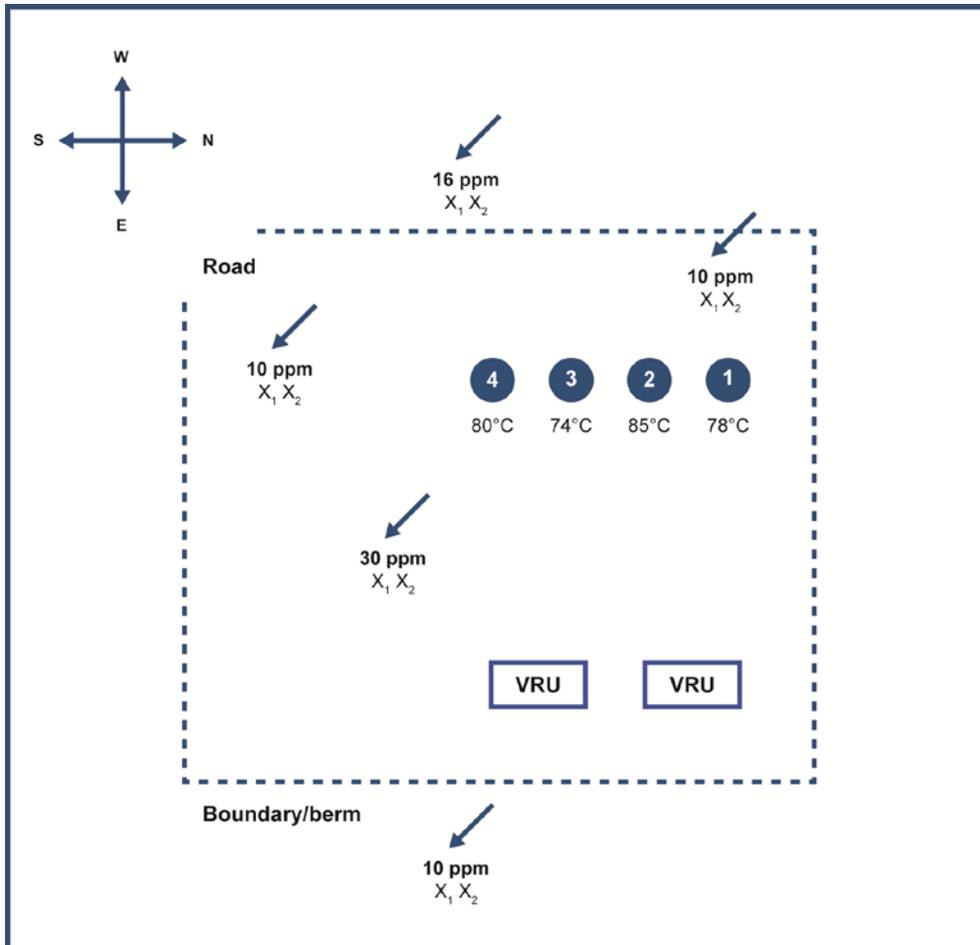
Legend:

- X_n - offensive odour
- O_n - no odour
- n = 1 - inspector 1
- n = 2 - inspector 2
- - wind direction

Case Study 2: Sample inconclusive investigation

Inconclusive evidence was collected from an investigation (see below observation diagram). Odours were detected both upwind and downwind of the facility, making it impossible to conclude that the site is the source of the odour. The inspector should either investigate sites upwind or return to the site with a thermal camera.

Observation Diagram



APPENDIX 5 Post-Site Investigation Sheet (Justification of Enforcement)

**Post-Site Investigation Sheet
(Justification of Enforcement)**



Site History	
Does the site have a history of operational issues or a record of noncompliances?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If no, consider issuing a notice of noncompliance.	
If yes, provide details: _____ _____	
Is there a history of odour complaints about the site?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If no, consider issuing a notice of noncompliance.	
If yes, provide details: _____ _____	
If yes, has the operator made attempts to manage odours?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes, provide details: _____ _____	
Is the site close to a surface development or surface improvement?	
If no, do not enforce.	
If yes, provide details on or include a labeled map of the area and any nearby surface developments or improvements. (e.g., house located 1.2 km NW of facility)	
Enforcement Decision	
Is the odour, at a minimum:	
• a strong, offensive hydrocarbon odour that is originating from the site in question	<input type="checkbox"/> Yes <input type="checkbox"/> No
• near any surface developments or surface improvements	<input type="checkbox"/> Yes <input type="checkbox"/> No
Inspector name(s):	
Decision to enforce:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Justification for enforcement: _____ _____ _____	

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