Regulation of Walleys Quarry landfill site

Plan to reduce hydrogen sulphide emissions

October 2021
Environment Agency: West Midlands Area

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Background

Walleys Quarry Ltd (WQL) is the operator of Walleys Quarry Landfill. Decomposition of previously deposited waste has led to elevated emissions of hydrogen sulphide ("H_2S") unacceptably affecting residents and businesses. The Environment Agency (EA) has been applying an increased level of regulatory scrutiny to the site operator for a number of years. Previous air quality monitoring showed no cause for health concerns see link for further information.

Air Quality Monitoring in 2021

Air Quality monitoring, which began in March 2021, found considerably elevated H_2S levels. This generated two urgent courses of action:

1. Further increased regulation of the site to understand the cause of the elevated levels and put measures in place to rectify this as quickly as possible;
2. The EA sought advice from the UK Health Security Agency (UKHSA) (formerly known as Public Health England or PHE) as well as Staffordshire County Council and Newcastle-under-Lyme Borough Council (Local Authorities with public and environmental health responsibilities respectively); partners who are best placed to provide expert advice on the risks to health.

Data from the four air quality mobile monitoring facilities (MMFs) around the site has been shared with partner organisations. Advice from UKHSA was that there should be a reduction in H_2S levels to meet:

- the World Health Organisation half-hour ***odour annoyance*** average of 5 parts per billion (ppb); and
- US EPA Reference concentration ***lifetime*** value of 1 ppb

The data showed a significant reduction since a recorded peak on 07/08 March 2021. In August 2021 UKHSA's monthly *Health Risk Assessment of air quality monitoring results* demonstrates that three out of the four monitoring locations (MMF9 being the exception) were below the long-term (lifetime) health-based guidance values. UKHSA advises all measures are taken to reduce the off-site odours from the landfill site, as early as possible, and reduce the concentrations in the local area to levels below those health-based guidance values used to assess long term exposure. The EA has therefore required WQL to continue to implement the measures identified as quickly as practicable.

Judicial Review

In the recent claim for judicial review regarding the EA's regulation of the site, the Court did not find the EA in breach of its legal obligations at present, but did identify additional work it considered was needed to meet them. The Judge declared that the EA must design and apply measures which will effectively achieve the levels of H_2S set out in UKHSA's advice as early as possible.

In this plan the EA has assessed the impact of the measures it has already required WQL to implement, and sets out the next steps WQL must take to continue to achieve the reduction in ambient hydrogen sulphide levels based on the recommendations of UKHSA.

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The strategy

The EA has re-evaluated its regulatory strategy in light of the outcome of the Judicial Review, taking into account the impact of the measures that it has already required WQL to undertake. EA specialists have considered what other actions WQL could, or should, be required to implement in order to reduce H_2S emissions from the site.

This plan is a live document kept under review to ensure it adapts to the latest evidence from site about the impact key measures have on landfill gas levels. It will evolve to take into account further investigatory work the EA is requiring WQL to carry out, as well as the impact of operational measures. WQL is currently co-operating, but the EA will use appropriate enforcement tools where necessary in order to achieve the required outcome.

Objectives

There are three objectives key underpinning this plan:

- ***contain*** landfill gas emissions from the site
- ***capture*** as much of that gas as possible
- ***destroy*** it by combustion through the gas utilisation plant (GUP)

This is with the aim of delivering:

- the reduction of off-site hydrogen sulphide concentrations in order to meet, as early as possible and thereafter, the World Health Organisation half-hour average
- the reduction of daily concentrations in the local area to a level below the US EPA Reference Value from January 2022 and thereafter

The EA believes this is the most effective strategy to ensure that escape of H_2S to the atmosphere is minimised and that as much of it as possible is collected and burnt. It will result in the lowering of total H_2S emissions from the site and therefore a lowering of the levels off site. The strategy has been successful at reducing odour complaints at other sites in the West Midlands Area and across the country.

Rejected measures

In designing measures, and reviewing the strategy, the EA has considered all regulatory options available. It has looked again at whether stopping waste acceptance, either by suspending or revoking the permit, would reduce H_2S levels any quicker than the measures identified in this plan. Neither measure would help to address the presence of elevated H_2S caused by previous waste deposits (that is before May 2021).

Should fresh evidence indicate that there is a problem associated with current waste inputs, the EA will immediately review these measures once again.

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Progress towards meeting objectives

Whilst ultimate success will deliver reduced H_2S concentrations, steps along the way will be measured by:

- increased areas of capping and reduction in the fugitive surface gas emissions proving that gases are being ***contained***
- increased volumes of gas ***captured*** and transferred to the GUP
- efficient and effective operations of the engines and flares to ***destroy*** these gases as validated by telemetry in the GUP and off-site monitoring data

Alongside this are measures related to the general management of the site, including waste acceptance. The EA will continue with its programme of announced and unannounced inspections, and off-site odour assessments to ensure effective delivery of the plan. In particular it will:

- undertake unannounced spot checks on waste deliveries to ensure implementation of waste acceptance procedures and WQL screens out gypsum-bearing waste to prevent its deposit on site
- audit waste producers who send waste to the site, such as waste transfer stations, to ensure accurate description of loads to prevent further gypsum-bearing waste being delivered to the site
- conduct investigations of waste loads rejected by WQL as notified by the company to tackle issues of misdescription at source, and reduce the risk of the waste going on to other landfills
- review WQL's environmental permit to determine if a variation is required to secure H_2S reductions, or add additional monitoring requirements to ensure the permit reflects what is now known about the site, and the measures needed to sustain the reduction in H_2S levels

To monitor and demonstrate that the ongoing and future measures under the ***contain***, ***capture***, ***destroy*** strategy are working as soon as possible, the EA will continue to:

- use its network of four mobile monitoring facilities to monitor ambient air quality, including levels of H_2S
- carry out off-site amenity impact assessments
- review site works

Timescales for the completion of each task have been set to be challenging, but reasonable for WQL to deliver. They make allowances for the work to be correctly planned and delivered safely. WQL has to undertake the work following the standards in published EA landfill sector technical guidance.

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Measures completed

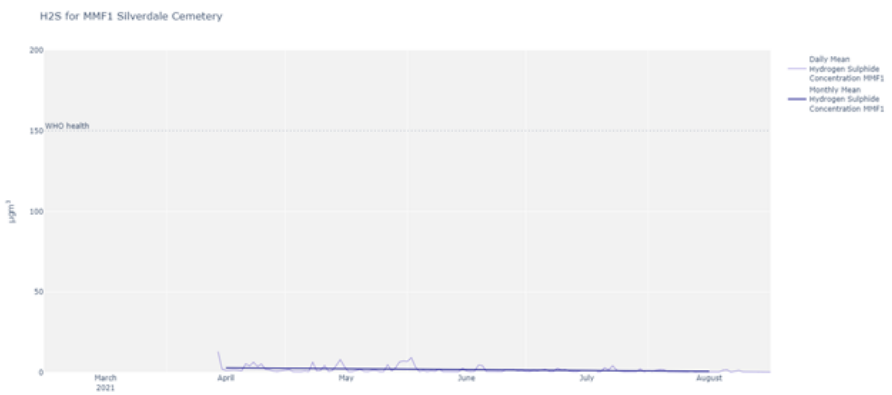
Measures taken on site by Walleys Quarry over this period have reduced the hydrogen sulphide to achieve the required intermediate-term public exposure concentration range at three of the four MMF by August 2021. Some of the measures employed to achieve this include:

		Key measures required of WQL	Timescale	Reasoning & impact
Contain	1	13,934 m² of cell 1 permanently capped 17,522 m² of cells 2 & 4 temporarily capped	April 2021	The EA served an Enforcement Notice requiring works to seal the site surface to specified standards to prevent fugitive emissions & make more gas available for capture
	2	Surface emissions survey identified 50 actions to address points of fugitive emission	June 2021	Surface emission surveys determine exactly where landfill gas, including H_2S, is escaping directly to atmosphere & allow immediate remedial works to be carried out
	3	Further temporary capping of steep flanks; WQL decided to install approximately 20,000m² of Posi-shell	October 2021	Further sealing to prevent fugitive emissions. WQL has carried out a surface emissions survey, which the EA is assessing
Capture	4	Installed 13 additional deep gas collection wells	February / March 2021	Increased availability of gas, arising from containment improvements, is collected by additional infrastructure & transferred to the GUP rather than being emitted passively
	5	Installed horizontal wells in the active tipping phase	June 2021	Increase in landfill gas capture of 100-130m³ per hour
	6	Installed pin wells	July 2021	Increase in landfill gas capture of 60m³ per hour
	7	Installed further sacrificial gas collection infrastructure	August 2021	Increased gas collection reduces likelihood & scale of fugitive emissions
Destroy	8	Installed a temporary flare	May 2021	Ensure additional flaring capacity available to maximise gas destruction
	9	Installed additional landfill gas pre-treatment infrastructure	June 2021	Previously, elevated H_2S levels had been quickly saturating the carbon scrubbing system meaning the engines could not operate properly. This work prevents gas engine damage & downtime
	10	Real-time telemetry equipment installed on the GUP by Landfill Gas Contractor	August 2021	The EA served an Information Notice requiring reporting of live monitoring of key performance indicators (gas flow, suction pressure & gas composition) & reassurance that the GUP is operating as it should
	11	Produced updated Waste Acceptance Procedures following EA advice & guidance	May 2021	To ensure inclusion of controls to prevent future inputs of gypsum-bearing wastes which can produce H_2S when they decompose

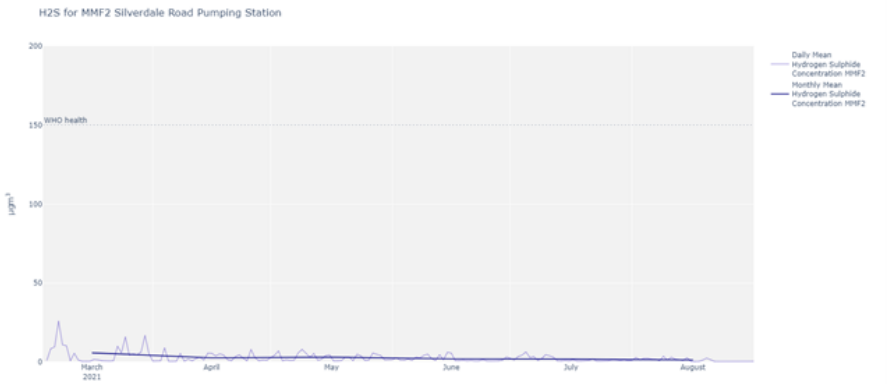
Evidence of progress to date

These charts show the H_2S monitoring results for the four MMF units for the period to August 2021. The UK HSA assessment of the results from March to August 2021 states: *hydrogen sulphide data up to the end of August 2021 shows continuing exposure to the population around the site, albeit concentrations in August continue to decrease compared to those seen from March to July. Additionally, at three of the monitoring sites concentrations are now below the long-term (lifetime) health-based guidance value.*

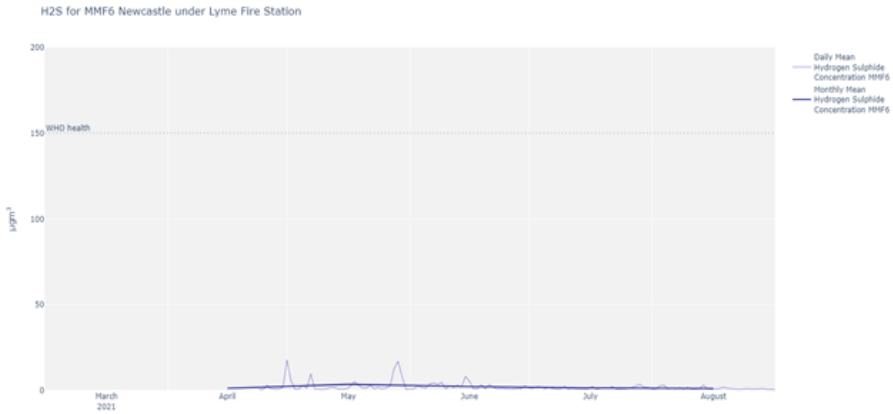
MMF1 Silverdale Cemetery H_2S Levels



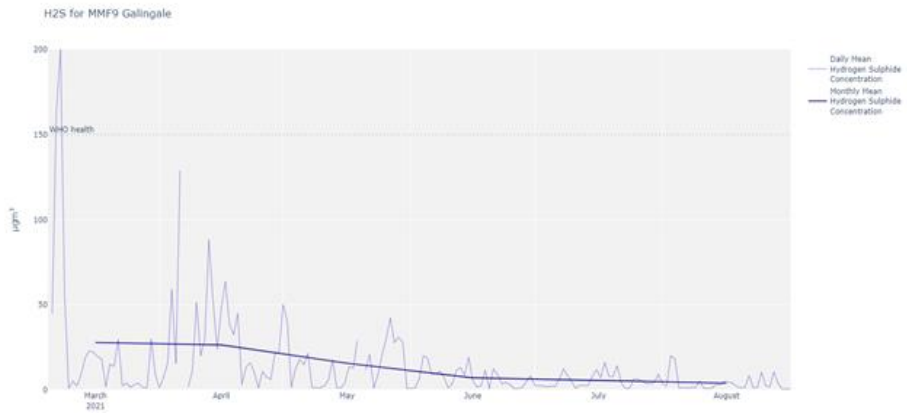
MMF2 Silverdale Road Pumping Station H_2S Levels



MMF6 Newcastle-under-Lyme Fire Station H_2S Levels



MMF9 Galingale View H_2S Levels



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Evidence of progress to date

Reductions in H_2S emissions outside the site boundary at Galingale View (MMF9) are shown in the blue line on the image below. This is the MMF which is the closest to the site boundary, and has had the highest readings to date.

More landfill gas is now being collected shown in the grey line on the image below, and treated by flares and/or engines – whereas previously it might have escaped into the atmosphere. Between April and July 2021 gas capture increased from 2,200 m³p/h to 2,700m³p/h. This has further increased to 3,091 m³p/h in October 2021.

Taken together, these findings validate the '***contain***, ***capture***, ***destroy***' strategy the EA has adopted.

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Next steps

Operational action

EA officers have identified the appropriate measures required building on the effect of the works already completed; implementing the advice of UK HSA. These are set out below, and remain centred around the EA's ***contain***, ***capture***, ***destroy*** strategy, but also takes into account the way the site is responding to measures implemented so far. This ensures that the evidence informs the design of the measures required – maximising the likelihood of a continued and sustained reduction in H_2S emissions.

The EA expects to see a reduction in fugitive emissions now more of the site is capped, and an increase in landfill gas collection as each well is connected. As gas collection efficiency increases across the site due to the increased density of gas wells, the gas collection rate will peak and stabilise. Some of this gas, containing H_2S, would previously have escaped into ambient air beyond the site boundary; and so the EA expects all of these measures to further reduce and/or sustain low levels at the four MMFs.

Modelling work

Gas generation, and atmospheric dispersion modelling is also important to assist WQL and the EA to predict likely future emissions and make sure the right measures are in place, including any changes to the GUP. This modelling will be used to inform short-term and long-term decision-making including revisions to WQL's Gas Management Plan so that is effective to adequately deal with the current situation and landfill gas in the longer-term.

Whilst the declaration made in the Judicial Review proceedings was concerned primarily with reductions in H_2S emissions in the short-term, the EA still has to regulate the emissions from this site in the longer-term. To ensure both the short and longer-term gas management system is effective in maximising gas capture for destruction, WQL must demonstrate that as much of the gas within the landfill as possible can be safely destroyed, any downtime is avoided, and sufficient flare capacity is available to manage longer-term gas production (as bulk gas generation increases).

Assuring what comes onto site

Waste acceptance audits for both WQL, and waste producers, form part of the assurance the EA requires to be satisfied that current and future inputs will not create additional issues with elevated H_2S.

Deadlines and review

This plan includes deadlines for further actions. At each of these points the EA expects to be able to assess completion and consider the effectiveness of each action, using all the data available. Data covering several weeks will be required before conclusions can be drawn; reflecting the nature of the objectives. The EA will take further action if the required outcomes are not achieved.

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Ongoing and future measures

		Key measures required of WQL (unless specified)	Timescale	Reasoning & impact
Contain	12	Submission of an updated phasing & capping plan	October 2021	The EA required a revised plan to reflect reduced waste tonnages being received at the site & identify any additional permanent or temporary capping required. The EA will review the plan and require WQL to carry out any necessary capping works as quickly as possible
	13	Submission of bi-monthly fugitive emission surveys & weekly gas field balancing data	From October 2021	The EA will review the submissions to assess the performance of the Posi-shell and other capping. If measures are not having the expected impact WQL will be required to take remedial steps
Capture	14	Installation of 28 new & replacement wells within the waste mass following approval of Construction & Quality Assurance (CQA) plans for the gas well design The current installation rate is approximately one well per day; installation process is complex & must be undertaken by specialist contractors. WQL must report progress on installation	September to October 2021	Eleven wells had been installed by 07 October 2021. Gas collection from these new wells was approximately 550m³p/h WQL proposed to install 8 full extent gas wells in August 2021. The EA required this to be increased to 28 as a matter of urgency to increase gas capture
	15	The new gas wells must be connected to the gas collection infrastructure as they are completed.		New gas collection infrastructure on site for the new wells allows the segregation of landfill gas with high H_2S concentration to be sent to a site flare for destruction

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Ongoing and future measures

		Key measures required of WQL (unless specified)	Timescale	Reasoning & impact
Destroy	16	Review of GUP back-up power supply	September 2021	To ensure uninterrupted gas treatment to minimise the impacts of any power outages at the site
	17	Produce updated gas generation modelling & a landfill gas risk assessment using the most recent H_2S concentration results from the gas field & surface emission survey data	October 2021	In July 2021 the EA identified WQL's gas generation modelling was under-reporting gas production volumes & needed updating along with the landfill gas risk assessment based on the same model The modelling for measures 17 & 18 is complex & the shortest practical deadline has been set for the completion of this work These updated modelling will be used to inform short-term & long-term decision-making including revisions to WQL's Gas Management Plan
	18	Update atmospheric dispersion modelling of existing & future gas flare & engine emissions & surface emissions to include assessments against WHO intermediate standard & US EPA Reference Value		
	19	Using the output of measures 17 & 18 submit detailed design proposals & timescales for action in a revised Landfill Gas Management Plan	October 2021	To ensure the design of both the short-term & the longer-term gas management system is effective to adequately deal with the current situation & landfill gas in the longer-term
	20	Review future permanent flare capacity requirements including considering replacement of the current temporary 1000 m^3/hr flare to increase capacity	December 2021	To ensure sufficient capacity in the GUP to destroy predicted volumes of landfill gas
	21	Weekly reporting of telemetry information by Landfill Gas Contractor	Ongoing until February 2022	The EA served an Information Notice requiring further reporting of live monitoring of key performance indicators (gas flow, suction pressure & gas composition) & reassurance that the GUP is operating as it should

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Adapting the plan

This plan sets out and explains the measures the EA has and will require WQL to implement, including deadlines for future measures. At each deadline the EA expects to be able to assess completion and consider the effectiveness of these measures using all available data. Data covering several weeks may be required before conclusions can be drawn; reflecting the nature of the objectives.

Unforeseeable future events may have an impact upon the on-site improvements (or the outcome they are designed to achieve). Sustained reduction in H_2S emissions requires a process of continual review and improvement. The plan remains adaptive and the EA will direct further action from WQL as quickly as possible if the required outcomes are not achieved.

Biochemical reactions, which produce H_2S, are subject to a range of environmental factors which will continually change the amount of gas produced. Factors such as atmospheric pressure above the landfill will have an impact on the emission rate from the surface, and the wind-speed/direction will affect levels recorded at the four EA MMFs.

Whilst it is not possible to precisely predict the effect that each individual step the EA has required WQL to take will have, or exactly how much an individual gas well will collect or H_2S production rates inside the site will change in the future, '***contain, capture, destroy***' remains the most effective strategy.

Expected improvements, building on those to date, will be attributable to a combination of all the measures implemented by WQL, rather than any single measure in isolation. Our experience as a landfill regulator nationally has shown that the implementation of these measures should be effective.

WQL can now accurately record and demonstrate the increased gas capture, associated with the improved containment and collection on site. The focus of the EA's regulatory work has, and will continue, to involve WQL making improvements to reduce levels of H_2S escaping from the site as early as possible. More of the surface of the landfill is now capped - estimated at 68.6% - and the gas abstraction rates have significantly increased.

Monitoring since April 2021, together with decreasing numbers of complaints, support the EA's view that the right measures have been designed, and are being applied to achieve the health-based guidance values advised by UKHSA. It is necessary to assess the monitoring results over an extended period before drawing firm conclusions. The EA will continue to make its monthly air quality reports publicly available on its Walleys Quarry web pages. This will include assessment against the World Health Organisation half-hour average (5 ppb) and the US EPA Reference Value (1 ppb).

The EA has every sympathy with the local community, who should not have to live with the distress caused by landfill gas being released from Walleys Quarry. The EA remains determined to use every necessary regulatory power to achieve the H_2S levels recommended by UKHSA and is committed to engage with the community.

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