

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/143197/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Caffyn, Alison 2021. Contesting countryside smells: the power of intensive livestock odours. *Journal of Rural Studies* 86 , pp. 554-565. 10.1016/j.jrurstud.2021.07.021

Publishers page: <https://doi.org/10.1016/j.jrurstud.2021.07.021>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



**This is a pre-copy-editing, author-produced PDF of an article accepted following peer review for publication in *Journal of Rural Studies***

## **Contesting countryside smells: the power of intensive livestock odours**

**Alison Caffyn. Cardiff University**

### **Abstract**

Agricultural smells permeate many rural areas and yet are little researched. Following scent trails can reveal much about rural relations and contestations. This research explored how smell emerged as one of the most controversial subjects during planning consultations over proposed intensive poultry units in the UK counties of Herefordshire and Shropshire. It considers how sensory knowledge is constructed within a planning context, comparing technical odour modelling reports submitted as planning evidence with the lay knowledge and experience of local residents and businesses. The mixed methods deployed included walking interviews and solo walks which gathered evidence of how smells from intensive livestock operations are experienced on the ground. The farming sector tends to normalise agricultural smells while many local residents experience an increasingly dissonant smellscape which affects their wellbeing in multiple ways. Focusing on one sensory dimension reveals contrasting understandings of the rural and how relations of power are contested in the rural planning arena.

**Key words:** Odour, intensive livestock farming, contested knowledge, experiential

### **1. Introduction**

*'Stand up against the stink of chicken sheds' (Hereford Times 7.10.14)*

In the mid-late 2010s headlines such as this were a regular feature in the pages of the Hereford Times and Shropshire Star newspapers, the main media outlets in these two UK counties.

Controversy had been sparked by the increasing numbers of intensive poultry units (IPUs) being built

across both counties. The letters to the papers were mirrored in the high number of objections lodged against IPU planning applications during public consultation periods. Smell emerged as the most contested issue in many of the cases.

*'Smell worry over chicken farm bid' (Shropshire Star 10.2.18)*

Local residents and businesses were concerned about unpleasant smells affecting their lives and livelihoods. However, they came up against counter-arguments from the farming sector that normalised smells as simply part of the countryside and positioned those complaining about agricultural smells as outsiders. The local authorities have to make decisions about each IPU planning application and officers usually require applicants to commission an odour report. The reports present the results of theoretical modelling of the smells the proposed IPU will generate and officers and politicians use this evidence to make their decisions. But many local people have come to distrust the odour modelling evidence and the decision-making process as a whole.

This article draws on research exploring the controversies over the proliferation of IPUs in Herefordshire and Shropshire and focuses on the issues and concerns around smell and how it is contested as an application passes through the planning process. In particular, it contrasts the different constructions of knowledge about smell and investigates how smells from IPUs are actually experienced in the countryside. It then goes on to reflect on what the disputes over smells reveal about the situation and the power relations in these rural localities. Smell by its nature is difficult to research and report upon and is under-researched in rural UK contexts. This study provides new perspectives, focusing on the impacts of the modern, large-scale intensive livestock facilities supplying birds to major meat processing companies. As such it explores shifting relations entangled in the ongoing, gradual transformation of rural space and sensory experience.

This article first contextualises the UK poultry industry, then discusses the limited literature on rural agricultural smells linking that to how sensory knowledge is constructed within a planning context. The mixed research methods are presented before key aspects are discussed including people's concerns about IPU odour, the odour modelling process and how odours are addressed once an IPU is built. The research breaks new ground by also exploring how smells from intensive livestock operations are experienced in reality from people's accounts and during walking interviews. The article concludes by reflecting what the findings reveal about rural planning contestations and relations.

## 2. Intensive poultry: the context

Herefordshire and Shropshire are the two UK counties with the highest numbers of intensively farmed poultry (Figure 1). This author (2021) estimated there are approximately 18 million birds at any one time in Herefordshire and 17 million in Shropshire.

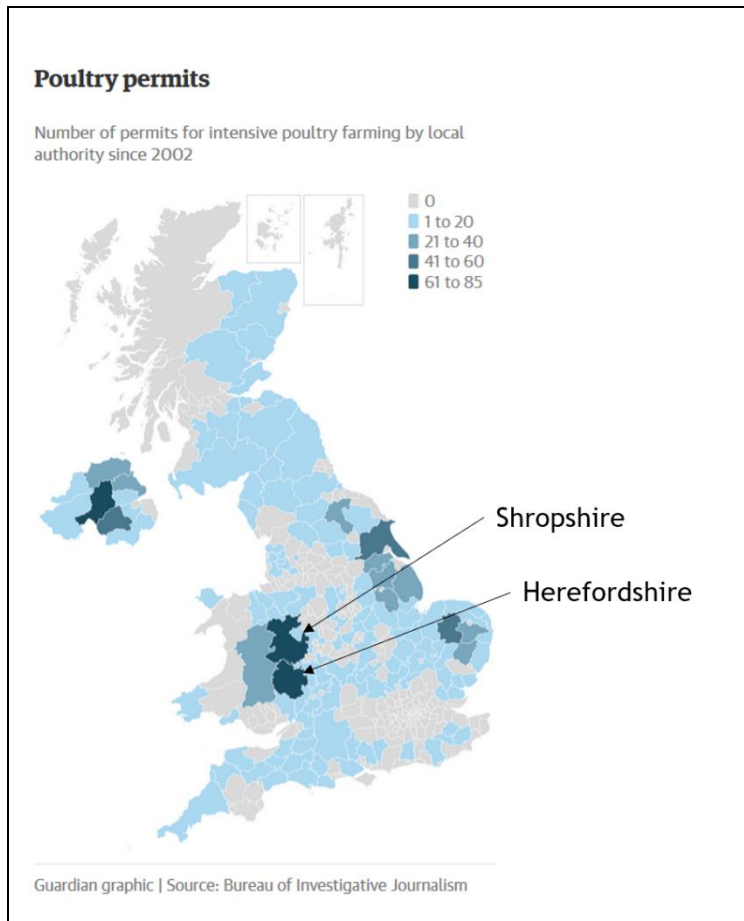


Figure 1 UK poultry unit permits by county (Wasley et al., 2017)

The UK poultry industry developed in the 1950s and 1960s and has expanded steadily since then in several parts of the country. The original local companies in Shropshire and Herefordshire were bought out by multinational corporations. In Shropshire, Unilever relocated its processing factory to another part of the country in 1990. In Herefordshire the American based multinational Cargill<sup>1</sup> has continued to invest and expand its operations at its processing plants in Hereford, its nearby feed mill and the IPU's it owns directly. As Cargill's processing capacity has increased, to over 2 million chickens a week, so IPU's in Herefordshire and southern Shropshire have proliferated (this author, 2021). IPU's across the area, and especially in north Shropshire, also supply other poultry processing (and egg) companies to the north and east.

<sup>1</sup> In 2018 this subsidiary formed a new joint venture Avara, with another poultry company Faccenda.

The recent increases in IPU have been driven by continued rises in consumption but also by supermarkets and fast food chains wanting to source more meat domestically. Chicken consumption in the UK has grown from around 1kg per head a year in the 1950s to 36kg now (AHDB 2018). The country is now 75% self-sufficient in chicken meat and 85% in eggs (AHDB 2018). The number of IPU across the two counties has increased at least four-fold. 'Chicken sheds' are also now twice the size of those built 30 years ago. Figure 2 shows a recent eight shed IPU close to an old four shed site (bottom left). The newer sheds are 113m long and 25m wide and have a large attenuation pond to the right, to collect dirty water, and an anaerobic digester (AD) unit, generating electricity, on the left.

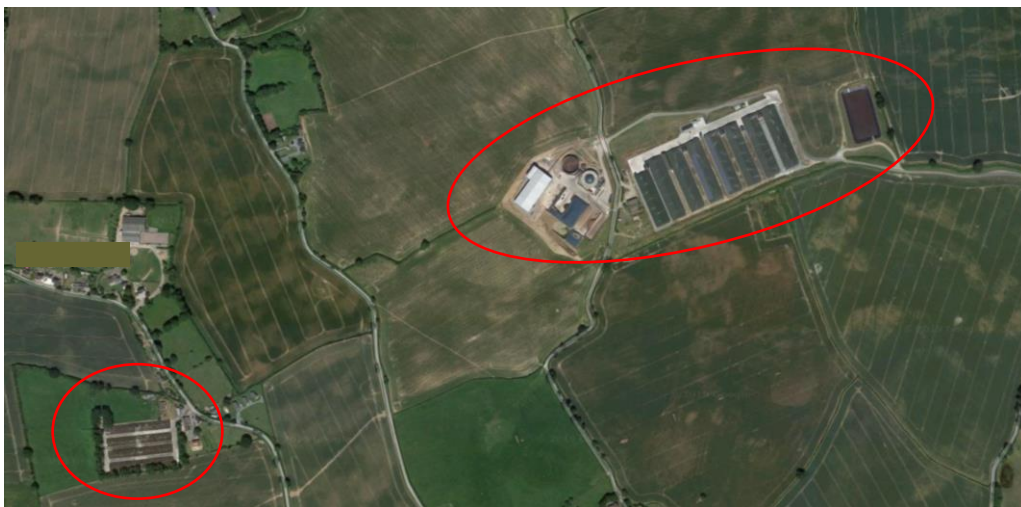


Figure 2 Poultry sites North Shropshire (Google Earth 2019)

Broiler sheds contain 40-55,000 chickens for around six weeks, after which the birds are taken for slaughter and the accumulated litter, manure and other debris is cleared out before the next crop. It is largely the ammonia in the birds' faeces and urine which creates the smell. Hens in egg units live around one year and their manure is normally removed by a belt system, creating less intense odour peaks. Smells may also come from dead birds (5% of broilers die within the six weeks), manure storage and transportation and attenuation ponds. A new four shed IPU with 200,000 broilers (such as that in Figure 3) would generate approximately 3,600 tonnes of manure a year. Poultry manure is usually applied to fields as fertiliser, in the normal practice of 'muck spreading', which generates further odour until the manure is ploughed in. Where farms do not have enough land to accept the volumes of manure, it is supplied to AD units or sold on elsewhere<sup>2</sup>. The concentrated digestate from AD units is also used as fertiliser.

---

<sup>2</sup> Discussions at the River Wye Nutrient Management Board in 2021 suggest farmers are now having to pay waste companies to remove the manure as volumes have exceeded land capacity in the catchment.



*Figure 3 Recently built IPU in South Shropshire 2018*

### **3. Sensory knowledge and power in the planning system**

Contestations over rural planning often prioritise the visual impact of the proposed development. Sight is often thought of as humans' primary sense and planning processes are dominated by plans, maps, photographs and visual assessments of what the new buildings will look like. Abram (2003) argued that although planning decisions are dominated by the visual, the 'rural gaze' is not independent of other senses. The two-dimensional focus on paper-based evidence distances local authority planners from the ground level senses of rural residents. Similarly, the visual sense has tended to dominate motivations for rural leisure visits; often thought of as 'sight-seeing'. Many authors have challenged this dominance of the visual (Crouch 2000; Edensor 2000; Howes 2005; Pink 2007 and 2015) and as concepts of embodiment and performativity became more prevalent in geography and sociology there was a move from representational to non-representational theoretical approaches. This links to the literature on phenomenology and post-phenomenology, drawing on work by Merleau-Ponty, and focusing on embodied experience of place and space (Macnaghten and Urry 2001; Rose and Wylie 2006; Ash and Simpson 2016). Concepts such as the rural idyll (Bell, 2006; Mingay, 1989; Short, 2006) and tourist gaze (Urry, 1990) remain important, but they need to be linked to all the senses and actual bodily experiences moving through and participating in a landscape (Wylie 2007).

Developing an approach to research contestations over potential smells from proposed developments brings three literatures into conversation: phenomenological literature on multisensory perspectives; planning literature on the construction and deployment of knowledge in the planning process; and Science and Technology Studies (STS). How technical assessments such as odour reports are understood, interpreted and either accepted or rejected by actors is a key element of the IPU contestations. Technical reports produced by consultants for applicants are presented as expert, objective and factual. STS authors have criticised the types of scientific rationality this tends to involve and how such scientific 'facts' are socially constructed and insensitive to the variability and uncertainty of many situations (Wynne 1992). Models aim to address the risks and reassure the

decision makers and concerned public with their scientific expertise (Irwin and Michael 2003). However, the use of such 'black-box' modelling processes in planning applications is a way of closing down discussion and disputes (Rydin 2012; Rydin *et al.* 2018a). Lay knowledge and how people experience IPU in reality are excluded. Such scientific modelling of sensory phenomena loses transparency and results in a singular outcome or label appearing to prove something is 'acceptable' and no longer subject to scrutiny. This research aimed to unpick these processes and also contrast them with the reality of experiencing intensive livestock smells once IPU have been built.

The planning process is also an arena where rural power relations are enacted. I used a blended pragmatic and relational theoretical approach to explore the power dynamics between actors, their competing value systems and whose voices are heard or not heard (Bridge 2020; Jones 2020, 2008). Both Foucauldian and pragmatist conceptions of power recognise the significance of knowledge and how sometimes a concerned public can form and disrupt existing power relations (Allen 2008; Marres 2007; Wills and Lake 2020). The contestations over how smell is experienced, how odour evidence is judged and which values dominate the decision making reveal the relations between the poultry industry and those trying to resist its further growth and the consequent spatial effects. These controversies reveal clashes between competing rural value systems; how rural space should be governed and differing views about what the countryside is for. Examining these relations through smell, which is a fundamental element of how people relate to familiar and unfamiliar places, highlights whose values, knowledge and experience count when it comes to spatial decision making.

#### **4. Intensive livestock smells**

Rural, agricultural smells have been little studied in the UK. There have been explorations of how animals were historically more enmeshed in urban communities and how smell has been one reason for livestock being, over time, banished to the countryside (Philo 1995). In some parts of the world animal smells continue to generate contestations in urban spaces (Chan 2020). In contrast, smells from livestock and manure are perhaps taken for granted as part of the countryside or are not considered a productive topic for research by (urban) academics. An exception was Porteous, in his classic 1985 article on smellscapes, who mentioned smells from factory farms having become a major source of rural pollution in the UK. Porteous highlighted habituation to smell; that local people become more accustomed to smell over time whereas non-residents or 'outsiders' will notice smell more. Also, he asserted that unfamiliar smells are more likely to be experienced as unpleasant. He described how both these factors would help explain the imbalance in opinions about smell between farmers and others: '*This is a common experience of outsiders, such as tourists, inner-city visitors to farms, and urban newcomers to country living.*' (Porteous 1985:358).

Porteous emphasised how smells can generate strong (positive and negative) reactions: *'one is immersed in smellscape; it is immediately evocative, emotional and meaningful.'* (p360). In contrast to the way one can visually frame a view, an individual has less control over how they experience a smell, as smells are usually invisible. Odour may be difficult to escape: individuals ingest smells taking air particles into their bodies willingly or unwillingly (Dennis, 2015); actively and passively. Hoover (2009) argued that how people experience smell also relates to how they interpret and experience space and place. She explained how people respond emotionally and physiologically to odour instinctively. Unlike other sensory experiences, smell goes directly to the limbic system and cerebrum, without being processed intellectually by the thalamus. Foul smells have also been interpreted as nature's way of warning of danger; a substance that could be poisonous, infected or otherwise bad for human health (Corbin 1986).

Smell and memory are closely linked. Porteous quoted a passage in a novel in which the smell from a tannery reminded the narrator of the animal terror and pain involved. This suggests that odours can convey other meanings such as animal suffering, which may be the case for some people smelling IPU's. Porteous introduced an additional, financial angle when he made reference to unpleasant industrial odours *'smelling of money'*, harking back to the traditional Yorkshire saying *'where's there's muck there's brass'* (Porteous 1985:359).

The North American literature on intensive livestock units has multiple references to neighbours objecting to the smell of hog and poultry farms. Constance and Tuinstra (2005) identified smell as one of four main areas of conflict between poultry CAFOs (confined animal feeding operations) and their neighbours in Texas and linked smell to two of the other issues; health impacts and property prices<sup>3</sup>. They described four basic characteristics of odour: frequency, intensity, duration and offensiveness, but acknowledged that smell is subjective and individuals' perceptions vary. One of the main findings of the research was the disconnect between the attitudes of the farmers and neighbours. Farmers acknowledged occasional days with bad smells but denied all other impacts. Neighbours found it hard to prove the levels of smell nuisance, impacts on their health or property values.

One study that focused solely on smell impacts was Carolan's work on intensive hog farms in Iowa. Carolan commented that: *'the literature is surprisingly silent when it comes to providing a contextual understanding of how agricultural odors are negotiated 'on the ground'.'* (2008:1235). He argued that odour can only be properly understood within a socio-historical context; that odour perception is a social process. Perceptions are influenced by whether one considers the smell to be 'in place' or not.

---

<sup>3</sup> The other being water quality



Agricultural smells are less unacceptable to farmers than to others. He argued livestock smells, because of the changes in the way they are farmed, are increasingly 'out of place' in the countryside. One of his respondents said:

*"it's unrealistic to say we shouldn't have to smell it [manure] at all. I mean, manure and odors are a part of agriculture. But, honestly, how natural is having thousands of animals confined in a building. (...) That's not what agriculture should be about". (Carolan 2008:1239).*

Another 'transgression' is when people can smell CAFOs from inside their houses. Many of Carolan's respondents accepted the odours when outdoors but said the smell and accompanying flies became a problem when experienced lying in bed or at the dinner table. Carolan also found residents' attitudes to the smells were affected by their social networks. When people are well integrated into the farming community they are less likely to perceive problems with the smells or complain about them (a finding backed up by Sharp and Tucker (2005) in Ohio). Those people who experienced serious problems with smell from the CAFOs often felt a sense of powerlessness. This revolved around the ineffectiveness of complaints and their inability to escape the smells or move away from the area. Carolan commented that as smell is invisible it is easily deniable. He concluded that the controversies over smells may essentially be over differing definitions of what nature or rural life should be, involving socio-historical factors around industrial farming, rural vitality, environmental sustainability and animal welfare.

Unpleasant odours, then, and the type of responses they receive, may reveal relations of power in rural localities. How people react to smells may depend not only upon their own sensory perceptions but also upon their place in the rural society and economy. Dennis (2015) discussed power relations around urban smokefree zones and how local authorities control the smells from cigarette smoke and may take action against those who transgress the rules. This rural situation, conversely, may reveal how seriously complaints about countryside smells are taken and whether local authorities take action to research, monitor, address or prevent smell pollution from intensive livestock operations. The scent trail may reveal further understandings of the disparate networks of actors and vested interests:

*'air tells us about difference. In the testimony of pollutants and choking effluvium, an analysis of air reveals who belongs and who does not, who is deserving and who is not' (Adey 2013:291)*

## **5. Methods**

This research gathered data about IPU's and the contested planning applications, used qualitative interviews and also ethnographic methods (this author 2020 gives a full account). I incorporated a

multisensory, experiential approach integrating phenomenological topics and methods to enrich the research and engage more materially and emotionally with the landscape (Haldrup and Larsen 2006; Lee Vergunst 2008). I was interested in how people familiar with a locality may have their experience and feelings about that place and their quality of life disrupted by a new IPU development. I was also keen to explore how non-local people (visitors) experience such rural localities. They may be less sensitive to changes over time but may still respond to sight, sound and smell. Focusing on experiential aspects may lead not only to a better understanding of why people may object so strongly to developments but also help identify ways of enriching the information and evidence considered during the planning process.

Controversial planning applications were identified through the number of objections each case attracted and through an analysis of local newspaper coverage. Planning documents, including odour modelling reports, planning officer assessments and public comments were analysed. The research involved observations of 28 meetings including planning committees (4), parish councils (2), campaign groups (10) and various meetings and workshops held by environmental bodies (12). Most of these were public meetings and the campaign group invited me having heard about my research through a mutual contact. In addition, I organised 48 interviews with 59 individuals including: farmers and farming bodies (9); local authority staff and decision makers (13); staff at environmental bodies (10); planning consultants and agricultural land agents (6); objectors and campaign groups (11); plus other local businesses and organisations (10). Some interviews involved several officers at one time or spouses or friends who were interviewed together. Interviews took place in people's homes, place of work or public venues such as cafes, according to the interviewee's preference.

Seven of the interviews included walking past and through IPU sites (or in one case a prospective site) on public rights of way to collect data on how the IPUs are physically experienced in real time. In addition, numerous reconnaissance visits and solo walks were made at sites throughout the two counties. Edensor (2000) contrasted the reflexive body of the walker with the labouring body of the farmer. He felt the experience of walking was a means to enact the romantic gaze and collect sights but also a way to experience nature using all the senses. This suggests walkers may be more sensitive to sensory impacts than farmers working in the landscape. People often walk seeking 'fresh air' and an auditory peacefulness which will enable self-reflection and give health benefits. The materiality of walking across varied terrain and habitats makes most walkers more alert to the particularities and qualities of the landscape (Olwig 2008; Lee Vergunst 2008). Walking pace gives time for all one's senses to be used. All methods and subsequent data coding and analysis paid particular attention to sensory information about visual, noise and odour impacts.

## 6. Odour concerns and narratives

Each IPU planning case varied, with certain issues being more contested depending on the details of the development, its location, ownership, operation and proximity of sensitive communities, habitats and landscapes. In some cases noise, night-time traffic or the visual setting of the IPU generated most concern. Indeed a similar article could be written about the noise impacts of intensive livestock operations. However, smell was one of the most mentioned concerns about proposed poultry units. A more detailed analysis of three representative applications with a total of 290 objections found 148, or just over 50%, of the objections included smell as one of the main concerns. Smell was mentioned in most newspaper articles and discussed by most interviewees.

Most local residents were concerned about experiencing strong, unpleasant odours in their homes, gardens and the local area generally and how it would reduce their quality of life. There were also many businesses, such as tourism, hospitality and leisure businesses that felt bad smells would impact their customers. One written objection argued:

*'Corvedale is popular with walkers, ramblers and tourists and the proposal creates a clear conflict with existing tourism businesses in the area. Who will want to sit in the local pub gardens on a warm summer's day with the smell of intensively farmed chickens wafting above their locally brewed ale?'*

Some local people were concerned that regular smell problems would impact on the value of their property and whether they would be able to sell it.

Odour was at times conflated with concerns about air pollution and health impacts. Ammonia, which is normally invisible, damages local habitats and causes health problems for those with respiratory illnesses. It can combine with nitrogen oxides, sulphur dioxides to create dangerous fine particulate matter (DEFRA, 2019). The dust and other particulate matter in IPU emissions can be a serious health risk as they may contain bioaerosols, chemicals, micro-organisms, bacteria, fungi, spores, viruses, antibiotics and aero-allergens from the plant and animal matter in poultry units such as feed, bedding, pests and the chickens themselves (EA 2008). Some people linked smell with flies and the annoyance, noise and disease risks associated with flies and other insects. Other interviewees linked smell and air pollution to impacts on local people's mental health, from the annoyance, distress and anger they may feel on a regular basis.

In contrast, most farming sector actors claimed smells were of limited intensity and duration and some said they didn't find the smell offensive. One told me: *'Well that's part of the country isn't it? People have to get real about what the countryside is'*. At one planning committee a councillor commented: *'I believe if you live in the countryside you should take the odour and lump it.'* The

argument was that the countryside has always been full of agricultural smells. There were commonly heard narratives about incomers who had chosen to live in the countryside who then complain about normal agricultural smells spoiling their imaginary rural idyll. The documentary analysis and interviews also identified several arguments regularly used to normalise the smell impacts from IPUs and the increasing volumes of manure being generated from proliferating IPUs. These included that the environmental permit, required by IPUs with over 40,000 birds, will control any smell pollution and the Environment Agency (EA), which oversees the permitting process, will address any complaints once the IPU is built. Newer IPUs were said to smell less than those of older design. Agricultural actors stressed that manure is a valuable fertiliser and argued that the extra amounts produced are simply substituting for manure or artificial fertiliser previously bought in from elsewhere. They claimed that smells are minimised by responsible manure transportation, storage and prompt ploughing in. Most of these points were in turn qualified or contested by objectors.

## **7. Odour modelling in the planning process**

Odour is by its nature difficult to measure. It is relatively subjective and some people have a stronger sense or are more sensitive to smell than others. An applicant has to submit evidence in the form of an odour report to convince the planning officer and planning committee that the IPU will not exceed the odour thresholds set by the Environment Agency. The EA itself also checks that the IPU buildings and equipment design meets 'Best Available Technologies' standards as part of the environmental permitting process. Exploring the odour reports clarified how smell has been treated in the planning process.

The EA classifies odours from intensive livestock rearing as 'moderately offensive' and has set a benchmark of 3 odour-units exposure or 3.0 ouE/m<sup>3</sup> (Environment Agency, 2011). The odour modelling process assesses 98th percentile hourly mean odour-units over a one year period<sup>4</sup>. The 'Atmospheric Dispersion Modelling System' normally used includes technical information about the proposed buildings and ventilation, dispersion variables including wind data and topography and models how many odour-units sensitive receptors, such as nearby houses, will receive.

Figure 4 shows a typical map modelling predicted odour around four proposed broiler sheds at a site in Shropshire, with the sensitive receptors numbered in pink boxes. These include residential properties but also a holiday home park to the west of the proposed site. The existing eight poultry

---

<sup>4</sup> The 98<sup>th</sup> percentile refers to 98% of the time – i.e. the model would allow for about seven days a year when the odour would exceed the 3 odour units level. The benchmark for the 'most offensive odours' is 1.5 ouE/m<sup>3</sup>. This categorisation appears to be a continuum with intensive livestock odours just below the threshold of 'most offensive' odours.

sheds belonging to the same farm can be seen in the bottom left corner of the map and have been omitted from the modelling exercise, a common deficiency in the odour reports.

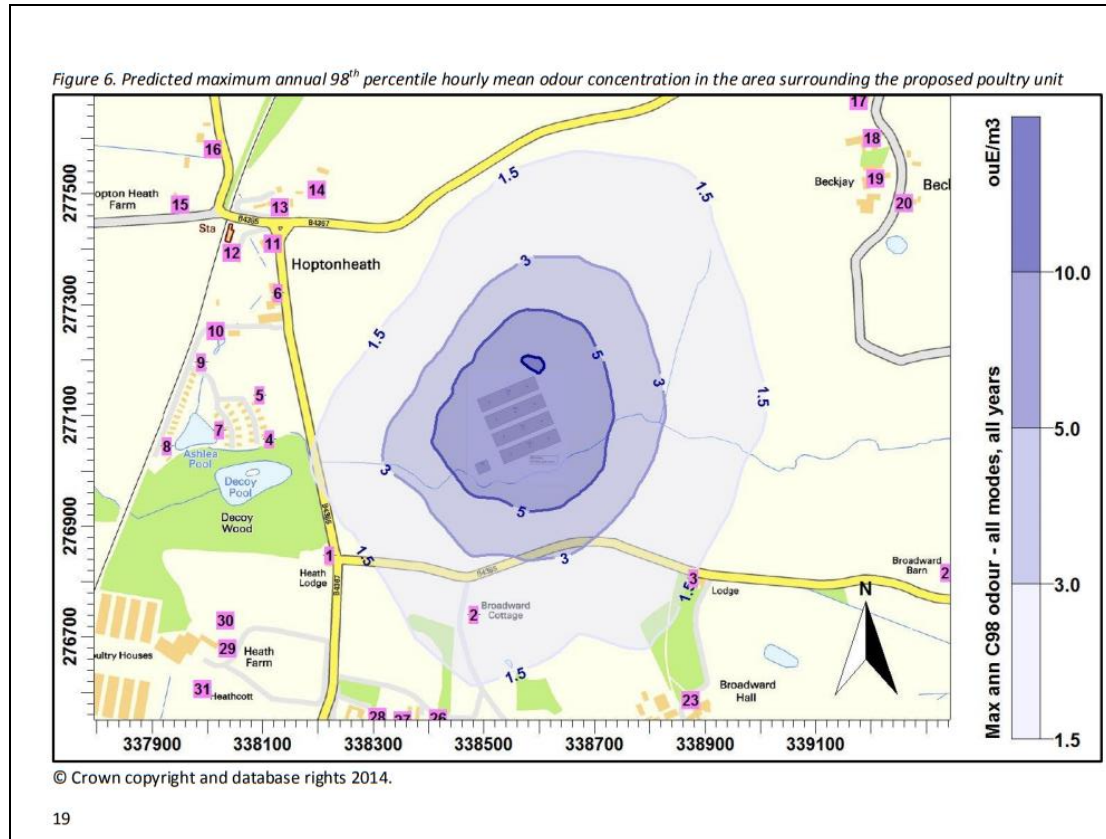


Figure 4 Odour modelling for a four shed IPU on the Shropshire-Herefordshire border (Smith, 2014)

Only in a few recent cases have modelling exercises attempted to present the cumulative impacts from several IPUs within close proximity (Figure 5).

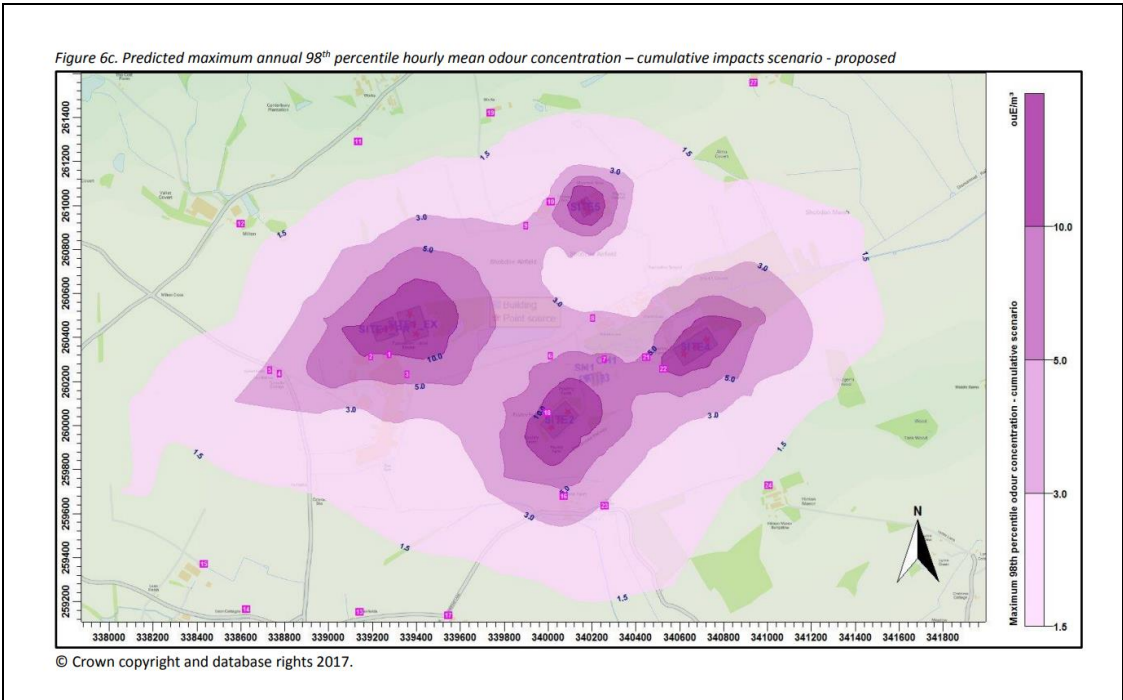


Figure 5 Odour modelling for an IPU close to other existing IPUs near Shobdon Herefordshire (Edgington, 2017)

Odour reports claim to assess odour frequency, intensity, duration, offensiveness and receptor sensitivity (or FIDOR) (EA 2011). Whilst many of the variables are identified and quantified, the actual model is in effect a ‘black-box’. Objectors can challenge details such as the distance of a receptor to the units but there is little scope to challenge the results. In practice the odour reports often go through multiple versions as errors are corrected and omissions addressed and yet the overall results tend to remain below the benchmark. Several planning officers expressed doubts about odour report results:

*‘you’re thinking, I’m not sure that’s far enough away. Why is that all right? (...) my experience is if they were that close to somebody, we’d be expecting a problem and they say, it’s not going to be’*

Officers check the variables and increasingly have commissioned comparator modelling exercises to test the results. The problem is that there is just one odour modelling consultant who dominates the sector in the UK. One officer described difficulties trying to source an alternative consultant to review an odour report as others have been taught by or worked with the leading consultant:

*‘there’s one consultant who has found a niche, cornered the market (...) when we were trying to commission people to do a peer review of his assessment (...) they said “well*

*you've got to be careful he's industry leading on this and it's his model – we all use variants of that.”.*'

The peer review reports usually suggest only minor adjustments. Another planning officer described how councillors on the planning committee were becoming cynical about the modelling reports:

*‘when they read the reports you can almost hear the eye rolling (...) “Oh another report which says cumulative effect just below 3 odour units per metre cubed, 98th percentile” – “Oh another one which just comes in under the WHO<sup>5</sup> noise,(...)” – just skirting the bounds of acceptability, but always just falling in the applicant’s favour.’*

Environment Agency officers also expressed doubts about odour modelling reports describing them as generic and inaccurate, for example using weather data from some distance away. One EA officer said: *‘it's all a bit of a black art’*. They have dealt with numerous sites where odour reports have predicted no odour problems but which have then had multiple complaints when built.

Despite the doubts held by some planning officers and councillors, the odour modelling reports are treated as definitive planning evidence. On rare occasions when an application was refused due to smell concerns applicants have appealed and planning inspectors have used the model's findings as proof of no harm and dismissed residents' concerns saying that periodic smell from IPUs is acceptable. In one such case the local authority had to pay substantial legal costs, which has reinforced officers' and councillors' caution about challenging odour reports.

The planning process has been failing to acknowledge the uncertainties. A review of odour modelling commissioned by the EA (Pullen and Vawda, 2007) found uncertainties associated with each step on the odour assessment process. It also pointed out that the Environmental Protection Act 1990 *‘contains no technical definitions of nuisance, such as maximum concentrations, frequencies or durations of odour in air.’*(pvi) and urged that this needs to be addressed. Government guidance on odour management states that there are *‘greater uncertainties associated with odour modelling than with modelling other pollutants’* (Environment Agency 2011:31). The guidance goes on to suggest that if the local population is already *‘sensitised’* to high odours *‘it may be prudent to reduce the benchmark by say 0.5. If there are short or infrequent episodes of very high odours that are averaged out by the modelling, they would need to be considered separately.’*(p32). Yet I have found no odour models of IPUs where the benchmark was lowered. Invariably, the periods of emptying and cleaning the sheds (when smells are at their worst) are omitted, rather than given separate consideration. A number of such inadequacies in odour reports appeared obvious to the objectors I interviewed and yet were overlooked by planning actors.

---

<sup>5</sup> World Health Organisation

Industry guidance on air quality management (Bull, 2018) calls into question the assumptions made in most odour reports. The guidance states that intermittent smells are difficult to model and that in these situations more than one method should be used to assess impacts. Thus instead of omitting the periods when poultry sheds are emptied and cleaned and the odour from transporting, storing and spreading the manure, models should instead be applying additional methods to assess these periods of high odour. With broiler sheds these periods are likely to occur around 25 days a year (clear out happens eight times a year and may last 7 days of which half may generate considerable smell) or double this if there are two sets of sheds operating on different schedules. Currently the modelled 98<sup>th</sup> percentile equates to about 7 days a year when odour would be expected to be above the benchmark. When added to the unmodelled clear-out periods this would total over a month of the year. Odour reports often state that it may be possible to time the clearing out of sheds for when wind direction is favourable, but there is no way of ensuring this would happen. It is in fact unlikely that an IPU could delay emptying sheds when the process is timed for when the processor is expecting a particular crop of birds.

Another failing is around receptor sensitivity - the R of FIDOR. IPU odour reports usually only examine receptor location, mapping nearby houses. However, the industry guidance recommends different levels of receptor sensitivity should be addressed (Bull, 2018). The guidance sets out that receptor sensitivity is highest at properties which are residential, schools, health facilities or tourism/cultural locations where good amenity is expected for long durations. Sensitivity is lowest at commercial or industrial properties, farms, roads and paths. The guidance suggested relevant receptor characteristics could include people's perceptions, health and whether they have an economic relation to the odour source, such as farm workers. While odour modelling reports often identify residential property owned by the farm, few of these other factors are normally addressed.

Campaigners have been increasingly challenging odour modelling reports and processes, on occasion commissioning opinions from air quality experts (Bull, 2019; Dickerson, 2015). The hilly topography in this area is often not factored in, to address weather conditions where wind funnels along valleys and where regular temperature inversions trap odours near the ground. Most models also omit periods of calm when winds are extremely light and odours at their worst (Bull 2018). Most odour reports simply aim to identify whether an IPU can be operated without exceeding the 3 odour units exposure benchmark at most receptors. They fail to identify and assess 'effects' resulting from the exposure levels and their significance.

In 2019 Bull was commissioned by campaigners to review evidence in a long-running contested case in Shropshire. He highlighted that the model used the same optimistic assumptions which had been proved erroneous in at least two IPU locations (in Somerset and Gloucestershire) where official sniff



testing has identified significant odour problems and one IPU has been partially closed down. Bull recommended that odour modelling should use pessimistic assumptions to avoid underestimating impacts due to the uncertainties of modelling. He stressed that modelling uncertainties are not small and could amount to plus or minus 100%. Bull (2018:14) advised that reports need to discuss the uncertainties of individual situations. This industry guidance is not currently a statutory requirement for IPU odour modelling but given the deficiencies and uncertainties, local authorities should perhaps consider requiring that reports should apply this guidance in future.

## 8. IPU odour complaints

In Herefordshire and Shropshire odour model predictions have not been tested once a poultry unit has been built. Local authorities do not have resources to commission *post hoc* testing, which in any case might create awkward situations if impacts were found to be higher than predicted. Odour complaints are usually dealt with by the EA under the permitting process,<sup>6</sup> so planning officers rarely hear about complaints unless there's an application to extend a site. Even then, there are mixed stories about how complaints are dealt with and the technology used to test odours. Checking odour complaints is time-consuming and relatively subjective.

Some residents make smell complaints using the Environment Agency standard reporting procedure. It was interesting to hear several EA staff discuss this and explain how, from their perspective, smell becomes visible and audible as they receive the complaints. One said:

*'People have a voice - they are the sensitive receptors; so when you've got odour you can hear it - you can see where people are shouting about it. And that's very vocal - people get quite emotive about that as well; so out of all of them [impacts] it's probably the odour that's the biggest.'*

EA officers and others agreed that some IPU sites generated more smells and smell complaints than others. They attributed this variously to the age and ventilation technology used in the units, management regimes, the quality of the feed given to birds and the stage in the crop cycle. Sites on higher ground also tend to have smells dispersed by stronger winds. Farmers need to have a protocol for monitoring smells and for responding to direct complaints. The problem is that they are desensitised to the smells and less likely to detect them and/or underestimate the intensity (Environment Agency, 2011).

Farming sector interviewees spoke of vexatious complainants and neighbours with a grudge. I heard several accounts from farmers of people complaining about smells from IPUs when in fact the sheds

---

<sup>6</sup> Complaints about smaller units, below the 40,000 bird permitting threshold, would be dealt with by the local authority's environmental health department.

were empty and of people confusing the smell from the sheds with the smell of muck spreading<sup>7</sup>. Narratives cast such complainants as emotional and naïve, perhaps having only recently moved to the countryside. Several people spoke of how areas of new housing had extended into the countryside bringing residents closer to some farms.

On the opposing side of the argument, campaigners stressed how difficult it is to make complaints about regular odour problems. There is no way to measure or prove the smell other than through smell diaries or ensuring the EA logs complaints to establish the pattern of nuisance experienced. They also pointed out that some people don't object because they're obligated to the landowner in some way and that many people just give up complaining, when it appears to achieve little.

## 9. IPU smells experienced

So how do people experience the smells from intensive poultry units? One objector described to me how frequently they smelt IPUs:

*'I think it's very difficult to go anywhere in Herefordshire without being aware of these broiler units. You can smell them - I can pick them up quite easily. Even if I can't see them I know I am passing one.'*

On most drives around the area a familiar whiff arrives through the car ventilation system. For someone living close to a poultry unit, smell is probably the most persistent and frequent impact. One interviewee said they were affected by smell five or six times a month (not just on clear-out and cleaning days). This equates to 60-70 days a year which could have quite an impact on people's quality of life.

What affects people the most is the nature of the smell. During my first reconnaissance visit to an IPU I described the odour as: *'A sweetish, yeasty or malty, sick type smell. Not totally unpleasant. Not obviously shitty; but not very pleasant either.'* (field notes, 22.10.17). I found the odour got worse, the longer one is smelling it. I came to find it very unpleasant and began to mildly dread encountering the smell on my solo walks as it made me feel slightly sick. Various interviewees described the smell as *'extremely offensive'*, *'overwhelming'*, a *'putrid stench'*. An objector explained:

*'chicken smell is nothing like any other type of smell (...) I can stand cow muck, I can stand sheep, I can stand anything, but I can't... chickens are a different ball game altogether.'*

The way many people discussed the types of farming smells made it clear they didn't want to be perceived as stereotypical incomers complaining about normal farming smells, noises and activities.

A local business owner tried to explain:

---

<sup>7</sup> A moot point as the judgement in a recent case taken by campaigners to the Royal Court of Justice stated that planning should include impacts from spreading of the poultry manure.

*'Chicken muck is beyond the pale...! Because you can't breathe. The smell of cow manure is the countryside. But chicken muck is rotting carcasses and really thick dust and flies, it's awful...'*

Numerous interviewees said that encountering poultry smells on a walk or cycle ride would be unpleasant but if it didn't last for long might soon be forgotten. They tended to be more concerned about people who live near a unit, or where manure is regularly spread. Also visitors staying in accommodation close by, who would find it more difficult to escape the smell. One person recounted a holiday when muck was spread in a field across from their accommodation:

*'It stank! So for the last four days of the holiday we had to keep the windows shut because of the flies and the smell and we couldn't really make use of the garden either because it was just too stinky.'*

Despite it being a regular holiday location for them they never went back. A tourism actor described a location in Herefordshire where they used to live:

*'the absolutely putrid smells from the units, we lived within half a mile of it, at certain times were appalling (...) if the wind direction was right, you couldn't sit outside because it was that putrid, it made you feel sick.'*

Weather conditions and the local topography can accentuate smell. It is often worst on still, calm days and evenings; when people are most likely to want to sit or eat outside.

Some people complained about the smell from muck-spreading while for others it was the smell of the units themselves either ongoing or at clear-out time which was the problem. For some it was all of these. Muck-spreading is usually well understood as a normal farming activity, but people complained about the muck not being ploughed in quickly<sup>8</sup> or that muck spreading was happening more often than once a year which had been normal in the past. There is concern that land is being over-manured, spread multiple times a year and that nutrients will wash off into watercourses causing eutrophication. People described farmers just spreading muck when they have a surplus rather than timing it to the growing cycle of the crops (Monbiot 2020), also making it less easy to predict when it will happen. A business owner commented:

*'the thing I really hate about them is this terrible, terrible smell (...) It's just sickening and cloying. And it never seems to get ploughed in very quickly it's left there to rot (...) you're faced with having to keep all the windows shut. As soon as you go outside the smell actually hits you like a wall.'*

Typical impacts on people's lives (or holidays) are having to retreat indoors to avoid the smell or not being able to dry washing on outdoor lines.

Several people reported health impacts from the smell, how it makes them feel physically unwell. For some it's a feeling of nausea or sickness, for others it may relate to breathing difficulties. One written

---

<sup>8</sup> Official advice is that it should be ploughed in within a maximum of two days

objection described the smells as *'choking'*, another person claimed: *'it burns your nostrils'*. I heard accounts of it triggering nausea, headaches and exacerbating respiratory diseases such as asthma and emphysema. Here I am conflating smell with the invisible air pollution, particulates and possible toxins in the air, but this is how people experience it. Several people described how offensive smells can trigger negative emotions and mental health conditions such as anxiety and depression. People experience feelings of vulnerability and powerlessness. Carolan (2008) found older people and women especially were most likely to talk about feeling powerless to take action about smells from nearby CAFOs. Their lack of social or economic capital affected their understanding of the odours. One interviewee made the point that having to keep windows shut and not going outside can make people feel more socially isolated. There are likely to be a range of interrelated negative sensory, health and wellbeing factors triggered by smell which are experienced by residents living close to poultry units which would merit more in-depth research.

In terms of smell impacts on visitors and tourism/leisure businesses I heard numerous complaints:

*'I used to play golf at Madley and the smell from those chicken sheds is abhorrent – some people have actually packed up playing and gone in and said oh we can't stand this!'*

One neighbour to a new unit said the farmer had originally agreed not to clear out the sheds at weekends when the holiday cottages nearby were occupied but that agreement was breached within six months of operation. The holiday accommodation owner described how it impacted their visitors and how those unlucky enough to be there when the smell was bad. They appreciated that visitors may be much more sensitive to poultry smells than those living locally. This is a significant point: farmers may think people are over-reacting to the smell because they personally are not as sensitive or don't find it as offensive, having been more exposed to it longer term. One poultry farmer I visited asked whether I noticed any smell as I arrived. In fact it smelt quite strongly as I drove the last mile to the site. The farmer seemed surprised when I said this. The smells are weaker and less out of place for farmers and, as the financial beneficiaries from IPUs, they are less likely to find it offensive. Despite this, there were several references made by interviewees about IPUs being increasingly located at some distance from where the farmer or landowner themselves live, away from the farmstead, which was seen as a form of acknowledgement of the unpleasantness of the smells, even if the farmer would not state this publicly.

Another bad smell emanated from Cargill's poultry processing plants in Hereford which impact city residents and visitors. One local government interviewee described a typical situation:

*'I went to a friend's (...) we went out in the garden and the smell was atrocious and she said oh my god we can't sit out here, let's go back in the house. (...) I said have you complained? and she said no what's the point complaining? (...) people don't complain'*

*because they think nothing's going to be done about it (...) So you don't complain; you just put up with it.'*

Knowing that Cargill was the largest private sector employer in the county and that the local authority strongly supports the company's role in the local economy means the public is less likely to bother complaining. In more rural locations too, people felt nervous or self-conscious complaining about poultry smells. Several interviewees were conscious that they might sound like the stereotypical townie incomer complaining about country smells; a view so often repeated by farming actors. They may suppress their views, aware that complaining may make it more difficult to integrate socially. Many people are reluctant to complain, finding it stressful. Thus complaints are suppressed, which means fewer complaints are heard and they are then easier to dismiss or deny.

Solo walks and walking interviews identified unpleasant smells at all the IPU's visited, although not all were particularly strong. Walking with an interviewee past or through an IPU enabled the experience to be untangled further. Smell emerged as the most significant issue on one particular walk in Shropshire. Beforehand, the tourism actor had expressed scepticism about whether IPU's would impact people walking nearby but their views changed as the experience unfolded. On the first 'whiff' of the site they described the smell as '*a little bit like damp bread, fresh bread, not quite cooked*'; not quite what they'd expected. As we spent about twenty minutes walking along a bridleway beside the site (which was probably mid production cycle) and back again they said they would soon tire of the smell. As time went on their comments became stronger:

*'Oooh... actually no – the smell thing is really starting to bother me. It's not any stronger than it was, it's just... all you can smell. (...) I'm starting to get a bit of a headache!'*

As we returned to the car later, I asked what had affected them the most:

*'The smell. It wasn't initially unpleasant but became repugnant over time. And I'm separating in my mind the context i.e. I'm pretending that I don't know that that's a chicken shed. That there are... (...) 200,000 chickens there, wow. Wow!... Yeah I think it would put me off. To be fair. I wouldn't choose to walk up there unless I had to. I can still taste it... (...) You know you can put up with it for a couple of minutes but longer-term exposure gives you a massive headache. I think because it's quite sweet – it's a cloying smell. (...) Well as you know, I came in sceptical but I hadn't appreciated the smell! I can still taste that... on my lips.'*

And as we drove away a little later they went on:

*'Oh I think I can smell it on my clothes... I feel I want something to drink to get rid of that taste. It's not the view; it's the smell. Imagine if you were here for a week and every day you were driving past that. I think that would have an impact on people's enjoyment. You'd be going; wind up the windows we're getting near the smelly bit... (...) I'm trying not to lick my lips cos I can still taste the bloody thing!'*

This shows how an individual's views altered significantly over the course of about an hour. It demonstrates how smell works, becoming more unpleasant with prolonged exposure and triggering other responses such as a headache. The interviewee felt they could actually taste the smell,

presumably particles in the air, bringing further sensory impacts. Back at their office they talked of needing to wash their hands: bringing in the sense of touch as well. This walk involved all five senses interwoven in an increasingly unpleasant experience. The interviewee reacted to the sight and noise of the unit and to the number of chickens inside, but it was the smell that impacted them most.

## 10. Discussion

Researching the multidimensionality of the issues around smell contestations has emphasised how black-box odour modelling not only omits parameters which could be modelled but also neglects many more intangible aspects of how smell is manifested and experienced. This research identified the wide zones of ignorance and uncertainty within the apparently certain evidence presented during planning applications (Callon *et al.* 2001). Such uncertainty and missing knowledge fuels the contestation (Rydin *et al.* 2018). It is clear that evidence could be gathered to address some of these omissions but is not called for.

Technical reports are used to close down the debate by using language which implies certainty about predictions and deters challenge; a form of '*boundary work*' (Jasanoff 1990). The language minimises potential impacts and emphasises averages. This is the sort of tactic Beck (1986) critiqued when discussing whether acceptable levels of pollution exist and how such processes require an inverted burden of proof. Beck suggested there has been a loss of '*social thinking*', whereby industrial pollution and loss of nature are viewed in technical and scientific ways with little consideration given to impacts on people's health and social life. The assertions of certainty are rooted in the scientific biases of neoliberal agriculture and biotechnology (Thompson 1995; Hencke 2008). Odour models are treated as scientific, objective and not to be argued with. Specificities of locality and context are treated as irrelevant, even if local residents are sceptical of modelling results (Callon *et al.* 2001; Wynne 2001; Whatmore and Landström 2011). Standard agricultural narratives are used to assert the rationality and objectivity of technical reports, sidestep uncertainties and undermine criticism.

My research findings tie in with Porteous's work on smellscape (1985). There was evidence that those enmeshed in the farming industry (and benefitting from it financially) are more habituated to IPU smells and therefore perceive the smell as weaker and less unpleasant than non-farmers and visitors. They consider that livestock smells are normal countryside smells which have been ever-present in agricultural rural areas. Some poultry farmers feel under attack by what they perceive as outsiders who do not understand farming and they perceive the increasingly intensive operations as evidence of progress rather than a problem. But the fact that farmers don't perceive IPU smells

strongly because of their biological habituation and socio-political position, does not mean the odours don't exist.

Many strong negative reactions to smell were reported and experienced during the fieldwork. I found, like Constance and Tuinstra (2005), that whilst almost everyone found poultry smells offensive, individual perceptions vary depending on frequency, intensity and duration. Part of the experience was the relative inescapability of smell (Dennis, 2015); one can only distance oneself from invisible odours by walking some distance away. If it invades your house, holiday cottage or garden it impacts on wellbeing and quality of life. This is what Carolan (2008) termed a 'transgression'; a smell 'out of place'. The bad aroma invading personal space, possibly while people are eating, relaxing or sleeping was seriously unpleasant for most people. People experienced the smell clinging to clothes, prolonging the effects.

If smells are accompanied by flies the impacts are considerably intensified by the noise, annoyance and fear of disease (Doron 2021). A tourism business recounted serious problems with flies from a newly built IPU close by, which distressed guests and triggered concerns about the future viability of the business. This is an example of how smell interacts with other factors; for example economic impacts such as tourism visits and property prices, both of which are likely to be negatively impacted by regular offensive smells (Constance and Tuinstra 2005; Hoover 2009). There could be potential for a distinctive unpleasant smell to impact on the place-marketing of rural areas such as Herefordshire and Shropshire (Henshaw et al. 2016).

Unpleasant smells can impact on people's social lives; if they cannot enjoy sharing their garden, sitting in a pub beer garden or decide to leave their holiday accommodation early. One couple who live near an IPU revealed that a close relative found the smell so unpleasant that they had stopped visiting. I also identified how some people experience bad smells in an interlinked way with knowledge of what was generating the smell: the incarcerated chickens. The smell is a sensory prompt about what is inside the sheds and this knowledge makes the olfactory experience worse for some people. The mind is perhaps merging the information and intensifying both.

Smell is so much more than the predictions of scientific models. Carolan argued that:

*'agricultural odor conflicts are in part products of deeper controversies and broader organizational shifts. Such controversies may be over, for example, what industrialized agriculture fundamentally means for individuals in terms of rural community vitality, environmental sustainability, and/or animal welfare. They may be over differing definitions of what 'nature' or 'rural life' should be.'* (Carolan 2008:1246).

This research similarly found smell is interwoven with other negative impacts and contributes to feelings of exposure and vulnerability that have emerged in local people's responses. These may be

more strongly experienced (and/or articulated) by newcomers and by women (Alaimo 2016). Rather than a simple value of 'odour units per metre squared at the 98<sup>th</sup> percentile', the smells are olfactory alerts to the multifarious risks, threats and harm that IPU's engender to actors in their vicinity and produce a powerful sensate regime (McSorley 2020). People experience a visceral response which also connects to the politics running through the situation and the underlying intensive food production system (Hayes-Conroy and Hayes-Conroy 2008). In this case actors' responses to the actual or potential smells from existing or planned IPU's reflect the rural power relations and how farming voices are heard more frequently and loudly. There are more people beginning to speak out, to challenge planning evidence and to construct new knowledge to counter industry narratives. There are signs that campaigners are gaining some purchase by identifying weaknesses in evidence and challenging the decision-making process through judicial review<sup>9</sup>. The agri-business lobby which had previously been able to exert power to suppress objections and ensure most IPU's were approved is now finding its hegemonic arguments are less convincing, as effects such as noxious smells affect more people more regularly.

## 11. Conclusions

Intensive livestock developments are one of the more extreme current disruptions taking place in UK rural environments. The research has demonstrated a growing dissonance between people's idyllic expectations of the Herefordshire and Shropshire countryside and the reality when encountered (Short 2006; Somerville *et al.* 2015). People experience a dissonant smellscape as well as landscape. The dissonance or 'violence' is not just the visual disruption, surveillance and increased noise an IPU introduces to a valued landscape but involves the associated unpleasant smells. The combination creates a different atmosphere from more traditional livestock or modern arable agricultural landscapes.

The planning system gives a false sense of certainty to the deliberations over IPU's, through the use of expert knowledge and technical planning documentation (Allmendinger 2016; Wills and Lake 2020). These experiential research findings produce a better understanding of the multidimensionality of IPU impacts moving well beyond the two dimensional to explore more situated knowledges and ways of experiencing (Haraway 1991; Pink 2015). My 'wayfaring' (Ingold 2010) alone and with others has clarified the limitations of the knowledge presented in support of IPU planning applications and how black-box modelling and paper-based evidence fail to capture what Olwig described as the: '*touched*,

---

<sup>9</sup> In the UK there is no third party right of appeal against a planning decision. Objectors can only request a judicial review of the process.



*smelled and heard proximate material world ... woven into the walker's sensory field'* (Olwig 2008:84).

Smell pollution is one of the most powerful and yet elusive impacts of intensive livestock farming. Yet the planning system does not handle experiential evidence well. Each sense is addressed in isolation: through the compartmentalised planning process. Little of this comes close to grasping the reality and variability of experiential impacts on local people and visitors. Models fail to capture how IPUs disrupt people's multisensory landscapes and wellbeing. Experiences vary substantially between people, places and conditions and are thus open to being contested and denied. Situated sensory knowledge is heavily contested by the farming lobby, through familiar narratives. IPUs are normalised within the agricultural community and accepted as part of the countryside. Farmers are habituated to the structures, the noises and smells so that they notice them much less vividly than others (Porteous 1985; Wheeler 2017). For those in the agricultural sector it is a working landscape rather than a domestic or leisure landscape; these are contrasting types of rural gaze and senses (Abram 2003). Local people not enmeshed within the farming hegemony perceive things differently. They are more likely to question whether something must be a certain way and less likely to see large developments as agricultural but instead industrial. They perceive the dissonance between the IPU and its setting more starkly. The sudden disruption and industrialisation of a valued landscape and environment is shocking and distressing to many, particularly when they perceive it is for the private profit of landowners and multinational processing companies. The smells they have to put up with are a reminder that others can mobilise power more successfully to win the planning arguments.

This research has followed multiple scent trails. The smells come from the chickens, which remain largely invisible throughout all these debates and throughout their lives. The chemical compounds in the chicken manure both generate the unpleasant odours but also flag the danger of both air and water pollution that is caused by the ammonia, nitrates and phosphates. But this research has revealed other 'stinks'. Objectors have been successfully creating a stink to open up the situation to more scrutiny, exposing the power relations at play and ineffective governance. There have also been whiffs of suspicion of undue influence and the possible stink of corruption around some planning processes and associated politics. As one objector told me: *'The whole thing stinks from beginning to end.'* Importantly smell has also been shown to play a key role in the entangled sensory and emotional impacts of IPUs. The increasingly frequent reek of ammonia wafting across Herefordshire and Shropshire is redolent of the multiple impacts from the poultry industry on local communities and environments. Focusing on pollution overflows from the IPUs such as smell, has demonstrated that far from the simple technical knowledge presented in odour reports, smell

impacts are multiple and intertwined with other dimensions and meanings of the rural.

Acknowledging and addressing variability, subjectivity and uncertainty in odour reports may facilitate more balanced, transparent and ethical decision-making.

**Funding:** This work was supported by the Economic and Social Research Council through a Wales Doctoral Centre PhD Studentship (grant reference C110866K).

**Acknowledgements:** The author would like to acknowledge the advice and support of Professor Mara Miele and Dr Chris Bear, Cardiff University, plus the helpful comments of three reviewers.

## References

Abram, S., 2003. The rural gaze, in: Cloke, P. (Ed.), *Country Visions*. Pearson, Harlow, pp. 31–48.

Adey, P., 2013. Air/Atmospheres of the Megacity. *Theory, Cult. Soc.* 30, 291–308.

AHDB Agricultural and Horticultural Development Board, 2018. *Poultry pocketbook - 2018*. Kenilworth.

Alaimo, S., 2016. *Exposed*. University of Minnesota Press, Minneapolis.

Allen, J., 2008. Pragmatism and power, or the power to make a difference in a radically contingent world. *Geoforum* 39, 1613–1624.

Allmendinger, P., 2016. *Neoliberal spatial governance*. Routledge, Abingdon.

Ash, J., Simpson, P., 2016. Geography and post-phenomenology. *Prog. Hum. Geogr.* 40, 48–66.

Bell, D., 2006. Variations on the rural idyll, in: Cloke, P., Marsden, T., Mooney, P. (Eds.), *Handbook of Rural Studies*. SAGE, London, pp. 149–160.

Bridge, G., 2020. On pragmatism, assemblage and ANT: assembling reason. *Prog. Hum. Geogr.* 1–19.  
<https://doi.org/10.1177/0309132520924710>

Bull, M., 2019. *Footbridge Farm - odour/emissions - application reference 17/01033EIA Letter Ove Arup and Partners to Shropshire Council*.

Bull, M., 2018. *Guidance on the assessment of odour for planning - Institute of Air Quality Management, IAQM (Institute of Air Quality Management)*.

Callon, M., Lascoumes, P., Barthe, Y., 2001. *Acting in an uncertain world: an essay on technical democracy*. MIT Press, Cambridge MA.

Carolan, M.S., 2008. *When good smells go bad: a sociohistorical understanding of agricultural odor pollution*.

- Environ. Plan. A 40, 1235–1249.
- Chan, K.W., 2020. Politics of smell: Constructing animal waste governmentality and good farming subjectivities in colonial Hong Kong. *Environ. Plan. C Polit. Sp.* 38, 1055–1074.  
<https://doi.org/10.1177/2399654420914320>
- Constance, D.H., Tuinstra, R., 2005. Corporate chickens and community conflict in East Texas. *Cult. Agric.* 27, 45–60.
- Corbin, A., 1986. *The foul and the fragrant*. Berg, Leamington Spa.
- Crouch, D., 2000. Places around us: embodied lay geographies in leisure and tourism. *Leis. Stud.* 19, 63–76.
- DEFRA, 2019. *Clean air strategy 2019*.
- Dennis, S., 2015. Explicating the Air: The new Smokefree (and beyond). *Aust. J. Anthropol.* 26, 196–210.
- Dickerson, D., 2015. Review of odour and dust chapters of Environmental Statement for proposed poultry unit, Bage Court Farm, Dorstone, Herefordshire, HR3 5SU for Golden Valley Action Group by Environmental Pollution Management Ltd.
- Doron, A., 2021. Stench and sensibilities: On living with waste, animals and microbes in India. *Aust. J. Anthropol.* 32, 23–41. <https://doi.org/10.1111/taja.12380>
- Edensor, T., 2000. Walking in the British countryside: reflexivity, embodied practices and ways to escape. *Body Soc.* 6, 81–106.
- Edgington, P., 2017. A dispersion modelling study of the impact of odour from proposed broiler chicken rearing houses at a knowledge transfer & training centre by Shobdon Airfield, Pembridge, near Leominster, Herefordshire, AS Modelling & Data Ltd .
- Environment Agency, 2011. *H4 odour management: how to comply with your environmental permit*. Bristol.
- Environment Agency, 2008. *PPC bioaerosols (dust and particulates) potentially emanating from intensive agriculture and potential effects on human health*. Bristol.
- Haldrup, M., Larsen, J., 2006. *Material Cultures of Tourism*. *Leis. Stud.* 25, 275–289.
- Haraway, D.J., 1991. *Simians, cyborgs and women: the reinvention of nature*. Free Association, London.
- Hayes-Conroy, A., Hayes-Conroy, J., 2008. Taking back taste: Feminism, food and visceral politics. *Gender, Place Cult.* 15, 461–473. <https://doi.org/10.1080/09663690802300803>
- Hencke, C., 2008. *Cultivating science, harvesting power: science and industrial agriculture in California*. MIT Press, Cambridge MA.
- Henshaw, V., Medway, D., Warnaby, G., Perkins, C., 2016. Marketing the ‘city of smells.’ *Mark. Theory* 16, 153–170. <https://doi.org/10.1177/1470593115619970>

- Hoover, K.C., 2009. The Geography of Smell. *Cartogr. Int. J. Geogr. Inf. Geovisualization* 44, 237–239.  
<https://doi.org/10.3138/carto.44.4.237>
- Howes, D., 2005. *Empire of the senses: the sensual culture reader*. Berg, Oxford.
- Ingold, T., 2010. *Being alive*. Routledge, London.
- Irwin, A., Michael, M., 2003. *Science, social theory and public knowledge*. Open University Press, Maidenhead.
- Jasanoff, S., 1990. *The fifth branch: science advisers as policymakers*. Harvard University Press, Cambridge MA.
- Jones, O., 2020. Pragmatism, anti-representational theory, and local methods for critical-creative ecological action, in: Wills, J., Lake, R. (Eds.), *The Power of Pragmatism: Knowledge Production and Social Inquiry*. Manchester University Press, Manchester, pp. 210–227.
- Jones, O., 2008. Stepping from the wreckage: geography, pragmatism and anti-representational theory. *Geoforum* 39, 1600–1612.
- Lee Vergunst, J., 2008. Taking a trip and taking care in everyday life, in: Ingold, T., Lee Vergunst, J. (Eds.), *Ways of Walking: Ethnography and Practice on Foot*. Routledge, London, pp. 105–121.
- Macnaghten, P., Urry, J., 2001. *Bodies of nature*. SAGE, London.
- Marres, N., 2007. The issues deserve more credit: pragmatist contributions to the study of public involvement in controversy. *Soc. Stud. Sci.* 37, 759–780.
- McSorley, K., 2020. Sensate regimes of war: Smell, tracing and violence. *Secur. Dialogue* 51, 155–173.  
<https://doi.org/10.1177/0967010619893231>
- Mingay, G., 1989. *The rural idyll*. Routledge, London.
- Monbiot, G., 2020. The government is looking the other way while Britain's rivers die before our eyes. *Guard*.
- Olwig, K., 2008. Performing on the landscape versus doing landscape: perambulatory practice, sight and the sense of belonging, in: Ingold, T., Lee Vergunst, J. (Eds.), *Ways of Walking: Ethnography and Practice on Foot*,. Routledge, London, pp. 81–91.
- Philo, C., 1995. Animals, geography, and the city: notes on inclusions and exclusions. *Environ. Plan. D Soc. Sp.* 13, 655–681.
- Pink, S., 2015. *Doing sensory ethnography*, 2nd ed. SAGE, Los Angeles.
- Pink, S., 2007. Sensing Cittàslow: slow living and the constitution of the sensory city. *Senses Soc.* 2, 59–77.
- Porteous, J.D., 1985. Smellscape. *Prog. Hum. Geogr.* 9, 356–378.
- Pullen, J., Vawda, Y., 2007. Review of dispersion modelling for odour predictions, UK Environment Agency.
- Rose, M., Wylie, J., 2006. Animating landscape: editorial. *Environ. Plan. D* 24, 475–9.

- Rydin, Y., 2012. Using Actor Network Theory to understand planning practice: exploring relationships between actants in regulating low-carbon commercial development. *Plan. Theory* 12, 23–45.
- Rydin, Y., Natarajan, L., Lee, M., Lock, S., 2018. Black-boxing the evidence: planning regulation and major renewable energy infrastructure projects in England and Wales. *Plan. Theory Pract.* 19, 218–234.
- Sharp, J.S., Tucker, M., 2005. Awareness and concern about large-scale livestock and poultry: results from a statewide survey of Ohioans. *Rural Sociol.* 70, 208–228.
- Short, B., 2006. Idyllic ruralities, in: Cloke, P., Marsden, T., Mooney, P. (Eds.), *Handbook of Rural Studies*. SAGE, London, pp. 133–148.
- Smith, S., 2014. A dispersion modelling study of the impact of odour from the proposed poultry unit at land south-east of Hopton Heath in Shropshire, AS Modelling & Data.
- Somerville, P., Smith, R., McElwee, G., 2015. The dark side of the rural idyll: Stories of illegal/illicit economic activity in the UK countryside. *J. Rural Stud.* 39, 219–228.
- Thompson, P., 1995. *The spirit of the soil: agriculture and environmental ethics*. Routledge, London.
- Urry, J., 1990. *The tourist gaze: leisure and travel in contemporary societies*. SAGE, London.
- Wasley, A., Harvey, F., Davies, M., Child, D., 2017. UK has nearly 800 livestock mega farms, investigation reveals. *Guard*.
- Whatmore, S.J., Landström, C., 2011. Flood apprentices: an exercise in making things public. *Econ. Soc.* 40, 582–610.
- Wheeler, R., 2017. Reconciling windfarms with rural place identity: exploring residents' attitudes to existing sites. *Sociol. Ruralis* 57, 110–132.
- Wills, J., Lake, R., 2020. *The power of pragmatism: knowledge production and social inquiry*. Manchester University Press, Manchester.
- Wylie, J., 2007. *Landscape*. Routledge, Abingdon.
- Wynne, B., 2001. Creating public alienation: expert cultures of risk and ethics on GMOs. *Sci. Cult. (Lond)*. 10, 445–481.
- Wynne, B., 1992. Misunderstood misunderstanding: social identities and public uptake of science. *Public Underst. Sci.* 1281–304.