European Union Network for the Implementation and Enforcement of Environmental Law

SWETE, Phase 5 - Landspreading Waste Materials Conference Report

Cranfield University

College Road, Cranfield, Bedfordshire MK43 0AL

3- 4th March 2020

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Introduction to IMPEL

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA countries. The association is registered in Belgium and its legal seat is in Brussels, Belgium.

IMPEL was set up in 1992 as an informal Network of European regulators and authorities concerned with the implementation and enforcement of environmental law. The Network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on implementation, enforcement and international enforcement collaboration as well as promoting and supporting the practicability and enforceability of European environmental legislation.

During the previous years IMPEL has developed into a considerable, widely known organisation, being mentioned in a number of EU legislative and policy documents, e.g. the 7th Environment Action Programme and the Recommendation on Minimum Criteria for Environmental Inspections.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on both technical and regulatory aspects of EU environmental legislation.

Information on the IMPEL Network is also available through its website at: www.impel.eu

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Executive Summary

This is the report for the IMPEL 'Landspreading Waste materials' conference held at Cranfield University on the 3rd and 4th March 2020. These notes supplement the presentation slides and should be read in conjunction with them.

The aim of the conference was to gain a better understanding between IMPEL Members of environmental issues around the landspreading of waste and sludge to land and how they are regulated in different countries. Also, to explore possible synergies and co-operation in tackling the environmental impacts of these activities.

Conference speakers represented Regulatory Authorities, industry and academia. The conference included opportunities for group discussions.

On the second day attendees were given a tour of Cranfield University's waste water treatment facility, laboratories and agrifood glasshouse and growth room facilities.

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Conference Report

Introduction

This is the report for the IMPEL 'Landspreading Waste materials' conference held at Cranfield University on the 3rd and 4th March 2020. These notes supplement the presentation slides and should be read in conjunction with them.

Outcome required:

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in different countries. Also to explore possible synergies and co-operation in tackling the environmental impacts of these activities.

Tuesday 3rd March

11:00 **Welcome, Introductions and purpose of the meeting**

Barry Sheppard (EA)

BS welcomed all to the meeting and to Cranfield University. The purpose of the conference was to get a better understanding of the environmental issues arising from the landspreading of waste materials and sewage sludge and how these activities were regulated in the different countries represented at the conference. Also what are the synergies between countries and how can these be built on to better manage the spreading of sludge and waste to land.

BS explained that the regulations that govern this in England are 30 years old and because of this the Environment Agency in England has created a sludge strategy to bring these to a more modern footing. The agenda included discussion sessions where we can get an understanding of the different approaches to this taken in different countries.

11:15 **Impel Water and land projects 2020**

Marco Falconi (ISPRA)

MF introduced himself and his roles in working on contaminated site and as the expert team lead. He explained that IMPEL was a network of regulators that goes beyond European Union and has 55 member organisations. MF explained IMPEL's mission statement, structure, objectives and how IMPEL can help member organisations and countries. He went on to explain IMPELS strategic and the focus of the various expert teams and the key priorities for the next 5 years. To finish MF set out the benefits of membership.

MF's second presentation was on the water and land expert team proposals for 2020. There 11 projects set out in the appended slides. All meetings are being delayed until June because of coronavirus. The Water and Land conference with be early October with the venue to be decided.

11:30 **The Environment Agencies sludge strategy – why is it required and what does it aim to do?**

Barry Sheppard & Mat Davis (EA)

BS reiterated that England's sludge regulations are 30 years old and needed to be fitted into a more modern regulatory framework. EA has spent last 2 years working with water industry, government (Defra) and other stakeholders to develop a strategy which is to be published shortly. (N.B. Post the meeting the strategy has

been published at https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use

This work is needed to ensure the safe and sustainable use of sludge in agriculture. It is also important for its role in protecting and enhancing soil health. The sludge can supply beneficial amounts of nutrients and organic matter to soil. However, it also has the potential to add harmful hazards to the soil. The strategy is designed to protect against this damage.

MD explained that he would be talking about the spreading of sewage sludge. There are benefits if this is done well, but done badly it can put all of these benefits at risk. MD gave some examples and provided pictures of bad examples e.g. sewage screenings and septic tank sludge deposited on land. It's examples like these that have led to the EA sludge strategy.

MD set out the legislation that contributes to the regulation of sludge. The reasons for change are that the Sludge Use in Agriculture Regulations (SUIAR) are 30 years old and there are also inconsistencies across the regulatory landscape; for example, sludge treatment and use is regulated differently to other bio-resources.

The strategy has 3 priorities:

1) Modernise and clarify the regulatory framework. The complexity of the supply chain had increased which meant the regulations were no longer fit for purpose.
2) This complexity drove the second priority which is to develop a consistent approach across the wide variety of waste spread to land.
3) Identify and assess emerging risks – chemicals, anti-microbial resistance and microplastics. The current regulations don't take all chemicals into account and concentrated on metals.

MD explained that UK Water Industry Chemicals Investigations Programme investigations are helping us make decisions on managing sludge taking into account these risks.

The sludge strategy identified four options for change.

1) Do nothing
2) Revise the existing regulations. The Environment Agency can't do this as only DEFRA can change regulations.
3) Utilise Environmental Permitting Regulations (EPR) tools such as mobile plant permits. These are 10 years old so would benefit from a review.
4) Evolve the EPR together with use of earned recognition through an assurance scheme. This has many advantages and MD explained some of these, alongside a smaller number of disadvantages.

Option 4 had been proposed by the EA as the best way forward..

This will be delivered by working with stakeholders including water companies, government (Defra), waste industry, biowaste sector and others such as the National Union of Farmers. This will include developing an

assurance scheme and a charging strategy for example. Particular difficulties have been found engaging with the septic tank sector which we are still trying to address.

12:15 **The potential transfer and uptake of contaminants into food arising from the use of recycled waste in agriculture**

Alan Dowding (Food Standards Agency)

AD explained the work done to investigate the transfer of contaminants in waste materials to the food chain. A number of studies had been completed; for example controlled feeding study for dairy cows with contaminated feed and bedding. This showed increased concentrations of contaminants in milk. Similarly a study of chickens and contaminated bedding resulted in eggs with an increased range of contaminants.

These studies showed that the tolerable daily intakes could be exceeded for dioxins, PCBs , PFAS etc.

The conclusion was that waste material spread to land could result in contamination of food and increased risk of causing exceedances of the dietary limits for many of these chemicals. These were very much worst case scenarios because, for example, we wouldn't normally expect cows to be exposed to 5% bio-solids in their diet if spreading was done properly. However, there is clear evidence that contaminants (including POPs) can transfer from waste materials to livestock by grazing on fields that had been landspread.

12:45 Group discussion – the European perspective

MF asked about risk assessment – such as GW proximity. How do we assess where spreading can take place? MD explained that there are various zones close to drinking water sources where spreading is not permitted. In other zones we have risk assessments to determine suitability for spreading.

MF said that the Po valley near Rome is heavily contaminated with Lindane. Food crops are not grown in this area. Could this approach be used to prevent contamination of animals. AD said that we do get atmospheric deposition so contamination can occur in areas that haven't had material spread.

RS – asked question about whether organics are included in the SUIAR? MD explained that it was only metals that are specifically listed in these regulations. But the regulation do require that use of sludge must not impair the quality of the soil and of the surface and ground water. All hazards which could cause such impairment must be considered, including organics. The fertiliser regulations also have organics and metals values. Industry want to know which values to use and how to use them and the sludge strategy is designed to help answer this, using EPR as the framework.

There was a discussion around waste water treatment and that to meet effluent discharge limits hazards may be moved and so concentrated in the sludge. This is a topic being considered by the Chemical Investigation Programme (CIP3).Need to innovate and gain both value and confidence from the use on land of sludge. Risk is sludge will instead require incineration. This will result in a loss of its many beneficial properties and the creation of ash that will need to be disposed of.

There was a discussion about the benefits of source control to prevent chemicals entering sludge and other wastes. It was felt that source control was the most effective, but most difficult way to minimise the contamination of both crops and livestock by landspreading activities

13:15 Lunch

14:15 **AGUA: waste landspreading in Umbria – the Environmental Database of Umbria**

Andrea Sconocchia (ARPA U)

AS explained that the agronomic use of sludge is allowed by decree in 1992. Olive oil waste is also allowed to be spread.

There are various criteria for using sludge. It must be treated, suitable to be used as a fertiliser or useful for agriculture in other ways, it must not contain toxic or harmful substances or exceed threshold concentrations of particular heavy metals.

Agronomical use of zootechnical waste also have criteria.

The most important consideration is protecting water that could be contaminated via the soil.

There is a database used to characterise the agricultural pressures in UMBRIA. Also have authorisations for spreading other wastes such as fish farming and oil and wine waste. All of this information is brought together to evaluate the pressure in the geographical database to see if sludge can be used. It is used to evaluate the nitrogen pressure on groundwater. It could also be adapted for other contaminants.

Umbria has similar problems to England. The legislation is old and it doesn't control emerging pollutants.

Risks to avoid – bioaccumulation of toxic substances in soil, degradative effects on soil, disturbance to population because of odour.

14:30 **Ensuring Sludge Quality – the UK Water Industries Biosolids Assurance Scheme**

Simon Black (Anglian Water)

SB explained the background and value of recycling to agricultural land.

The assurance scheme was set up to provide reassurance that bio-solids were being managed properly. It brings together regulations and best practice into a single transparent standard. It sets a minimum standard which protest the environment and creates a level playing field.

Its scope includes:

- Source material risk assessment e.g. trade effluent controls.
- Treatment of the sludge to recognised standards

- Field storage – is this being done safely.
- Application – what are the return frequencies?

Use a multiple barrier approach based on log reductions of E.coli, max conc of E.coli and appropriate harvest intervals.

15:00 **Innovative Technology for valorising sewage waste**

Andrew Swift (CEO FERA)

AS asked the question why use insects to process bio-wastes?

There are a number of reasons. Insects have high proteins and fat and very digestible protein. Chitin has chemical properties of interest and can also be developed as a plastic replacement. FERA have investigated two flies - the Black soldier fly and housefly.

AS explained that there were many regulations that cover this activity and it is difficult to understand how they apply to this. A lot of research is being done into this promising area and outlets being investigated for the insects that are generated by processing biowaste. There is still a remaining residue after the insects have been bred using the biowaste which will need to be landspread – however the volume is very much less

15-30 Coffee break

15:45 **Carbon utilisation and resource optimisation technology to convert wastes (carbon dioxide, ammonia and organic matter) into a fertiliser**

Pawel Kisielewski (CEO CCM technologies)

CCM was set up in 2013 as a carbon capture business. Its approach is to maximise resource, process and product efficiency through utilisation of CO2. They are looking at more beneficial uses of waste water in the future and want to recover more effectively resources contained within them. This will also have the benefit of reducing haulage costs as the resulting fertilizer will led to a lessening of greenhouse gas emissions both in manufacture and usage.

Tightening permit standards are leading to greater bio-solids generation. There is more production, more anaerobic digestion facilities and, at the same time, closure of incinerators. Microplastics are a threat and there are a number of other issues such as high haulage costs etc.

PK explained that resource value can be gained through NH4, P and bio-solids recovery. CCM can make a certified and tested product.

Fertiliser production in UK produces 20mt CO2 and this is increased by delivery practices. Phosphorus is also a finite resource. But there is lots of resources available in terms of N and P from human waste.

CCM's process captures carbon and produces useful products but with an improved carbon footprint.

This starts with a cellulose drawn from sludge. CO2 is drawn through this through this which reacts with ammonia on the fibre. They can then add additional nutrients which are locked together by converting carbonates to calcium carbonate and ammonium nitrate. The fertilizer produced by this process can compete on commercial grounds with existing materials.

CCM have looked at a wide range of organic wastes to produce fertiliser. – includes digestate from anaerobic digestion and using insect faeces (frass). They have been working on this for 6 years and the first commercial pilot sites are being considered now.

There is a demonstration plant in Swindon that can make 20 tonnes of product a day. This captures 2 tonnes of CO2 per day.

There is also a pilot plant being built by Severn Trent Water. Ammonia is sourced from liquid waste and CO2 is obtained from biogas clean up. This process monitors inputs and outputs so it is possible to trace what is applied to the fields. The fertiliser that is produced goes back to the growers who supply the plant.

CCM have investigated field trials for 5 years. The yields are as good as conventional products.

This process also generates significant revenue.

16:15 **Group Discussion**

BS asked if the English experience and need for a sludge strategy was recognised by others.

Delegates confirmed that they had similar issues to England. There were also issues with shortage of suitable sites and regional autonomy.

BS asked if others other countries are developing an equivalent of the English Sludge Strategy. Andrew Lee said that it would be good to get an IMPEL perspective and he was interested to see

which countries spreads sludge to land. CCM representatives said that France were moving to incineration but there were technical and logistical issues with this.

DSR explained that in Slovenia spreading to land was not popular. Sludge went to incineration plants mainly in Hungary but also to landfill and old mining sites. Hungary closed borders to waste last year and Slovenia doesn't have enough places to send sludge. Landspreading is a possibility.

CCM said Germany is moving to incineration and had approached CCM about the possibility of producing pellets as a better more standard source of material for incinerators.

MF said Italy use landspreading, incineration, fertiliser production and anaerobic digestion to produce methane. In some cases spreading was restricted – for example for some cheese production sludge can't be spread under producer organisation rules. In the Po valley landspreading was used widely but there were problems with odour control resulting in many complaints. BS said this was the same situation in the UK with odour being one of the main public objections to landspreading

MB – In PCColand it is possible to spread sludge to land. There are three minimum criteria for this and if these are achieved it can be spread on food crops or used for non-food crops such as corn for feeding birds. There are lots of complaints due to odours. Sludge has to be mixed to land immediately but often this didn't happen. Legislation was recently changed and wastewater companies now have to keep records and ensure it was used properly.

17:00 Summary of the day

BH summarised the very interesting presentations that had been provided throughout the day. The overall view was that the landspreading of waste materials, especially sludge, presented the same sort of problems in many countries. The issues, and perhaps potential solutions, are the same. There seemed to be a lack of effective regulatory controls and it was felt that a sharing of best practise and a review of the issues and problems in IMPEL countries would be a useful piece of work.

Wednesday 4th March

09:00 **Welcome and introductions by Prof Paul Leinster**

PL explained he had worked with IMPEL since 1996 and had good memories of working on projects. In 1990 he was working for SmithKline Beecham making penicillin. The fermenters used for this process produced sludge which was pumped out to sea. There were lots of questions about whether this was good practice and what was the best practicable environmental option to deal with this. No-one uses best practicable environmental option now but it was a good approach that examined the risks and benefits of a particular activity. The conclusion was that, after suitable treatment, it would it be a good option to spread the fermentation waste to land.

PL pointed out that public perception was important. If people don't accept the spreading of sludge then the supply chain will collapse. Getting the public on-board is essential and to do this you can't just rely on the science.

There must be a benefit to spreading and we need to demonstrate that there is truly an agricultural benefit. We need to be aware of sham recovery.

PL explained he is also working on natural capital and ecosystem services. This requires us to take an integrated approach and understand all the issues that we need to take into account to achieve this. In his opinion we need to get back to using the best practicable environmental option.

09:10 **New approaches to valorise biosolids as fertiliser for crop production**

Dr Ruben Sakrabani (Cranfield University)

RS explained that lots of data sets had been used to develop maps that showed how suitable land is to receive bio-solids. Growing crops place a demand in the soil and soil organic matter is important as

crops draw on this and growers need to supplement production with fertiliser. The question was how can bio-solids help with this? The build-up of organic matter is slow but its usage is quick, for example if an arable crop is planted after a grass ley. P is also a finite resource – how can we optimise where land should receive material?

Three test locations to produce nutrient use efficiency maps in conjunction with various constraints identified by engaging with stakeholders. There is now a portal to trial this with users with the constraints added to the map.

The project team would like to improve the tool but data are sensitive so it is difficult to get the information needed to do this.

09:30 **Manufacturing biosolids – consistent and pre-selected product quality**

Dr Yadira Bajon Fernandez (Cranfield University)

YBF explained that she was interested in making sure biosolids products are safe. Her work is focussed on understanding the process better and being able to control it to ensure quality and the right type of product.

YBF explained that we need to understand process enough to be able to control it. For example, can we produce a bio-solid that is low on metals or high in organic matter?

She outlined a number of projects that are underway to understand how we can engineer bio-solids quality.

For example metals are concentrated by thermal hydrolysis, but reduction in mass doesn't explain all of the increase. There is also an impact on partitioning between the solid and liquid phases. We need to understand how metals fractionate and how we can control this to prevent metals getting into bio-solids.

YBF had worked on a decision support tool to look at the impact of trade waste on bio-solids production. This showed for example that zinc improves production to a point and then disrupts it.

This presentation generated lots of questions about partitioning and trade control and the importance of source control.

09:50 Tour of facilities at Cranfield University

The remainder of the morning was taken up with an interesting tour of the facilities that Cranfield University have lead by YB and RS. These included the waste water treatment facility, laboratories and agrifood glasshouse and growth room facilities at Cranfield University. Cranfield University has a particular interest in soil health and quality and, by implication, the issues and problems around landspreading of waste. The facilities tours gave a good insight into this work. The Cranfield University staff (Yadira and Ruben) expressed an interest in working with IMPEL on landspreading related issues in the future.


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Annexes

Annex I. Attendees

Evita	Janevica	EJ	The State Environmental Service of the Republic of Latvia, Zemgale Regional Environmental Board
Marco	Falconi	MF	ISPRA
Darja	Stanič Racman	DSR	Inspectorate for the environment and spatial planning
Jeroen	November	JN	Department of Environment & Spatial Development
Andrea	Sconocchia	AS	ARPA Umbria (ASSOARPA)
Cristina	Correia	CC	General Inspection of Agriculture, Environment and Spatial Planning (IGAMAOT)
Malgorzata Monika	Budzynska	MB	Chief Inspectorate of Environmental Protection
Giovanni	Perillo	GP	University of Naples Parthenope
Roberto	Crosti	RS	ISPRA
Anabela	Rebelo	AR	Portuguese Environment Agency (APA)
Barry	Sheppard	BS	Environment Agency, England
Mat	Davis	MD	Environment Agency, England
Tim	Besien	TB	Environment Agency, England
Barrie	Howe	BH	Environment Agency, England
Paul	Leinster	PL	Cranfield University
Rubin	Sakrabani	RS	Cranfield University
Fredric	Coulon	FC	Cranfield University
Yardira	Fernandez	YF	Cranfield University
Alan	Dowding	AD	Food Standards Agency
Peter	Hammond	PH	CCM Technologies
Pawel	Kisielewski	PK	CCM Technologies
Rachael	Benstead	AB	FERA
Adrian	Charlton	AC	FERA
Simon	Black	AW	Anglian Water
Andrew	Lee	AL	Seven Trent Water
Ed	Ruswa	ER	Seven Trent Water