



Satellite Monitoring as a Legal Compliance Tool in the Environment Sector

European Union: Waste Report

(Ref: AHRC Report 7).

| WASTE | | | |
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| | European Legislation | Objective and Legal Requirement | Possible Application of Satellite Monitoring |
| 1. | Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils | <p>This Directive aims to promote the safe collection and disposal of waste oils (mineral-based lubrication or industrial oils).</p> <p>Directive deals with how waste oils need regulating and is generally linked with waste management licensing (where conditions relating to waste oils will be included).</p> <p>Member States must ensure that waste oils are collected and disposed of (by processing, destruction, storage or tipping above or under ground). A system of permits is required. The following are prohibited: any discharge into inland surface water, ground water, territorial sea water and drainage systems; any deposit and/or discharge harmful to the soil and any uncontrolled discharge of</p> | <p>Potential application to monitor prohibited discharge of large quantities of waste oils into surface waters or possibly surface of soil. Cannot monitor waste oil discharge into ground water or drainage system nor can satellites be used to monitor safe collection or disposal of waste oils. Wavelength of waste oil contamination would need to be known in order to monitor for waste oil contamination.</p> <p>Waste oils can be monitored for surface soil and water contamination by mapping the extent of area of contamination and the change in area over time. The change in area over time could possible indicate the point source of contamination and be linked to responsible party who illegally discharged the waste oil.</p> |

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| | | <p>residues resulting from the processing of waste oils; any processing causing air pollution which exceeds the level prescribed by existing provisions.</p> <p>The Directives do not authorise the mixing of waste oils PCBs and PCTs</p> <p>The Directive has been amended a number of times.</p> | <p>A variety of satellites sensors could be used to monitor waste oil discharge into surface soil and water at different spatial resolutions. If there are large volumes of discharge, MODIS can be used at low resolution, Landsat and Spot can be used at medium resolution, and Ikonos, Quickbird and Spot can be used at high resolutions. Radar backscatter data from Envisat ASAR or Radarsat can also be used for water surface monitoring. If waste oil is discharged in small quantities, high resolution satellite data could be used to monitor discharge into soil and water.</p> |
| 2. | Directive 75/442/EEC on waste | <p>The EU has a framework for coordinating waste management within the Community in order to limit the generation of waste.</p> <p>This Directive provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste.</p> <p>The Directive requires all Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health or causing harm to the environment and includes permitting, registration and inspection requirements.</p> <p>The Directive also requires Member States to take</p> | <p>No potential for monitoring with satellites because satellites could not be used to monitor the collection, transport, recovery and disposal of sewage sludge. However, GPS data could be used to monitor sludge transport if transport if the vehicles used were fitted with GPS transponders.</p> |

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| | | <p>appropriate measures to encourage firstly, the prevention or reduction of waste production and its harmfulness and secondly the recovery of waste by means of recycling, re-use or reclamation or any other process with a view to extracting secondary raw materials, or the use of waste as a source of energy.</p> <p>Lays down general principles such as the setting up of licensing and inspection systems to ensure that the management of waste does not harm human health and the environment.</p> <p>Determines whether or not something is a waste and whether it is discarded. Annex I sets out 16 categories of waste. Annex II lists 15 disposal operations.</p> <p>It imposes a duty that waste is only handled by authorised operators; it provides for the licensing of waste disposal and waste recovery operations; and provides for the keeping of records for the nature of waste, its transport and its treatment.</p> <p>Amended by Directive 91/156/EEC.</p> <p>Will be repealed by Directive 2006/12/EC.</p> | |
| 3. | Directive 86/278/EEC of 12 June 1986 on the | This controls the disposal, management and reduction of sewage sludge waste in agriculture in such a way as | Very limited application for potentially mapping areas of sludge, but most likely not applicable to monitoring |

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| | <p>protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture</p> | <p>to prevent harmful effects on soil, vegetation, animals and man. Sewage sludge may be used in agriculture, provided that the Member State concerned regulates its use.</p> <p>The Directive lays down limit values for concentrations of heavy metals in the soil (Annex IA), in sludge (Annex IB) and for the maximum annual quantities of heavy metals which may be introduced into the soil (Annex IC).</p> <p>The use of sewage sludge is prohibited if the concentration of one or more heavy metals in the soil exceeds the limit values laid down in accordance with Annex IA. The Member States must take the measures necessary to ensure that these limit values are not exceeded through the use of sludge. Sludge must be treated before being used in agriculture but the Member States may authorise the use of untreated sludge if it is injected or worked into the soil.</p> <p>The use of sludge is prohibited: on grassland or forage crops if the grassland is to be grazed or the forage crops to be harvested before a certain period has elapsed (this period, fixed by the Member States, may not be less than three weeks); soil in which fruit and vegetable crops are growing, with the</p> | <p>different concentrations of heavy metals in the soil, sludge and for determining whether the maximum threshold of heavy metals in sludge has been exceeded. Also, not possible to differentiate whether sludge is from the sewer. There is the potential to identify fields that have had sludge applied by using Spot or Ikonos to analyse soil reflectance changes.</p> |
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| | | <p>exception of fruit trees; ground intended for the cultivation of fruit and vegetable crops which are normally in direct contact with the soil and normally eaten raw, for a period of ten months preceding the harvest of the crops and during the harvest itself.</p> <p>Sludge and soil on which it is used must be sampled and analysed. Member States must keep records of quantities; composition and properties of the sludge; the type of treatment carried out; and the names and addresses of the recipients of the sludge and the places where the sludge is to be used.</p> | |
| 4. | <p>Council Directive 91/157/EEC of 18 March 1991 on batteries and accumulators containing certain dangerous substances</p> | <p>This legislation targets the recovery and controlled disposal of spent batteries and accumulators containing dangerous substances in the Community.</p> <p>The Directive as amended prohibits the marketing of batteries and accumulators containing more than 0.0005% of mercury by weight. The same applies to appliances incorporating such batteries and accumulators.</p> <p>Member States must draw up programmes aimed primarily at reducing the heavy-metal content of batteries and accumulators. Under these programmes, Member States must encourage the separate</p> | <p>No potential application to monitor the disposal of individual spent batteries and could not monitor the mercury in batteries by weight.</p> |

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| | | <p>collection of batteries and accumulators with a view to their recovery or ultimate disposal. The batteries and accumulators, or the appliances in which they are incorporated, must be marked in such a way as to indicate separate collection and recycling requirements and heavy-metal content.</p> <p>Will be repealed in 2008 by Directive 2006/66/EC</p> | |
| 5. | <p>Directive 91/689/EEC of 12 December 1991 on hazardous waste</p> | <p>This lays down a framework for the management, recovery and disposal of waste considered to be hazardous.</p> <p>This Directive seeks to define hazardous waste and the annexes set out the properties to which bring the wastes within the definition of hazardous. It also provides additional controls on its tracking, movement and management</p> <p>This controls the disposal, management and reduction of hazardous waste (through the setting up of licensing and inspection systems). Any establishment or undertaking that carries out disposal operations must obtain a permit. This also applies in the case of some recovery.</p> <p>Establishments or undertakings carrying out disposal operations or operations that may lead to the recovery of hazardous waste and producers of such waste are subject to periodic</p> | <p>No direct application to monitor disposal and management of hazardous waste. There is a potential application to monitor the area of hazardous waste contamination, if contamination occurs in surface water and if monitoring for contamination is required by the directive. GPS coordinates could be obtained tracking transport of waste, if the transport is completed with surface shipment by a truck, ship, or train. High resolution imagery such as Ikonos can be used to examine whether a specific location did or did not have a large vessel present at the defined time.</p> |

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| | | <p>inspections covering in particular the origin and destination of the waste. Transporters, producers, establishments and undertakings are to keep a record of their activities and make this information available to the competent authorities designated by each Member State.</p> | |
| 6. | <p>Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community</p> | <p>This is meant to control the transfrontier movement of dangerous and toxic waste.</p> <p>This Regulation sets environmental criteria for waste shipments within, into and outside the European Union. It covers shipments of practically all types of waste by all types of means, including vehicles, trains, ships and planes.</p> <p>The Regulation subjects the transfer of all waste to a system of prior informed consent of regulatory agencies in the two respective countries. It prohibits the export of hazardous waste from OECD countries to non-OECD countries.</p> <p>Waste which is transported for disposal must comply with the Basel Convention.</p> <p>Waste transported for recovery is more complicated. The Regulation adopts a classification for all wastes which divides waste into three lists: Green, Amber and Red. The categories are exclusive in the sense that</p> | <p>No direct application for satellite monitoring. There is a potential application to monitor movement of dangerous and toxic waste, if the shipment of waste is completed by a truck, boat or rail. High resolution imagery such as Ikonos can be used to examine whether a specific location did or did not have a large vessel present at the defined time. For large vessels, high resolution imagery can be used to estimate the type of ship (container vessel, oil tanker, bulk carrier) to assist with vessel identification.</p> |

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| | | <p>any waste not on the list is treated as being unassigned and Red list waste.</p> <p>The Green list can be found in Annex II to the EC Regulation. Shipments of such waste need to be accompanied to basic info such as description, quantity, name and address of the person to whom the waste is consigned and a description of the recovery operation. The only other requirement is that waste should be shipped to a facility licensed in accordance with the waste framework directive.</p> <p>Amber list wastes can be found in Annex III to the Regulation. They are subject to pre-notification procedures. They can be shipped under a general notification procedure (and do not have to obtain approval on each occasion).</p> <p>Red list wastes are subject to the greatest level of control. The regulatory authority in the exporting country must give notification to the importing regulatory authority prior to export and there is no provision for general approval as with amber wastes.</p> <p>Exports of waste intended for disposal are prohibited, except to EFTA (European Free Trade Association) countries which are parties to the Basle Convention. Exports of hazardous waste</p> | |
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| | <p>intended for recovery are prohibited, except those directed to OECD (Organisation for Economic Cooperation and Development) countries, third countries which are party to the Basel Convention or countries which have concluded a bilateral agreement with the Community (or, before 6 May 1994, with a Member State).</p> <p>All exports of waste covered by the measures to ACP (African, Caribbean and Pacific) States are prohibited. Imports into the Community of waste for disposal are prohibited except imports from countries which are parties to the Basle Convention or countries with which the Community (or a Member State) has concluded bilateral agreements.</p> <p>Imports from a non-EFTA country are permitted only on the basis of an application from the exporting country stating that it does not have the capacity to dispose of the waste in an environmentally sound manner.</p> <p>Imports of waste for recovery into the Community are prohibited except those from countries to which the OECD decision applies, countries which are parties to the Basle Convention or countries with which the Community (or a Member</p> | |
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| | | <p>State) has concluded bilateral agreements.</p> <p>In the case of transit through the Community of waste originating outside the Community and for disposal or recovery outside the Community, the transit must be notified to the last competent authority of transit within the Community.</p> <p>In the case of transit of waste for recovery from a country to which the OECD decision applies and to such a country, the notification must be sent to all of the competent authorities of transit in the Member State(s) concerned.</p> <p>Member States must take the necessary steps to inspect, sample and monitor waste shipments.</p> | |
| 7. | Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste | Repealed end of 2005 by Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste. | No potential application for monitoring with satellites. |
| 8. | Directive 94/62/EC of 20 December 1994 on packaging and packaging waste (as amended by Directive 2004/12/EC) | <p>This Directive aims to harmonise national measures concerning the management of packaging and packaging waste to provide a high level of environmental protection and to ensure the functioning of the internal market.</p> <p>Promotes waste reduction amongst producers.</p> | No potential application for monitoring with satellites. |

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| | | Requires producers to recover, reuse and recycle a significant proportion of packaging waste handled. | |
| 9. | Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) | <p>Objective is the controlled disposal of PCBs, the decontamination or disposal of equipment containing PCBs and/or the disposal of used PCBs in order to eliminate them completely.</p> <p>Member States must take the necessary measures to ensure that used PCBs are disposed of; PCBs and equipment containing PCBs are decontaminated or disposed of.</p> <p>Inventories must be compiled of equipment with PCB volumes of more than 5 dm³, which Member States must send to the Commission by September 1999 at the latest. The equipment and PCBs contained in the inventories must be decontaminated or disposed of by 2010 at the latest.</p> | No potential application for monitoring with satellites. |
| 10. | Directive 1999/31/EC of 26 April 1999 on the landfill of waste | <p>The objective of this law is to prevent or reduce as far as possible negative effects on the environment from the landfilling of waste, by introducing stringent technical requirements for waste and landfills and setting targets for the reduction of biodegradable municipal waste going to landfill.</p> <p>It defines the different categories of waste (municipal waste, hazardous</p> | No direct application for monitoring with satellites because satellites can not be used to monitor whether waste has been treated or whether specific hazardous waste has been disposed of in non-hazardous landfills. However, remote sensing can be used to monitor the extent to which landfill sites are being used. When vegetation grows on former landfill sites, remote sensing can be used to identify vegetation characteristics that may be |

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| | | <p>waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land.</p> <p>Landfills are divided into three classes: landfills for hazardous waste; landfills for non-hazardous waste; landfills for inert waste.</p> <p>A standard waste acceptance procedure is laid down so as to avoid any risks: waste must be treated before being landfilled; hazardous waste within the meaning of the Directive must be assigned to a hazardous waste landfill; landfills for non-hazardous waste must be used for municipal waste and for non-hazardous waste; landfill sites for inert waste must be used only for inert waste.</p> <p>The following wastes may not be accepted in a landfill: liquid waste; flammable waste; explosive or oxidising waste; hospital and other clinical waste which is infectious; used tyres, with certain exceptions; any other type of waste which does not meet the acceptance criteria laid down in Annex II.</p> <p>The Directive sets up a system of operating permits for landfill sites.</p> | <p>linked to the chemical deposited in the landfill.</p> |
| 11. | Directive 2000/53/EC of 18 September 2000 on end-of life vehicles (as | This Directive aims to prevent waste from end-of-life vehicles and promote the collection, re-use and recycling of their | No direct application for monitoring with satellites. Very high resolution imagery from the next generation of Ikonos satellites will have a |

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| | <p>amended)</p> | <p>components to protect the environment.</p> <p>To this end, it stipulates that vehicle manufacturers and material and equipment manufacturers must:</p> <ul style="list-style-type: none"> endeavour to reduce the use of hazardous substances when designing vehicles; design and produce vehicles which facilitate the dismantling, re-use, recovery and recycling of end-of-life vehicles; increase the use of recycled materials in vehicle manufacture; ensure that components of vehicles do not contain mercury, hexavalent chromium, cadmium or lead. <p>Also introduces provisions on the collection of all end-of-life vehicles. Member States must set up collection systems for end-of-life vehicles and for waste used parts. They must also ensure that all vehicles are transferred to authorised treatment facilities, and must set up a system of deregistration upon presentation of a certificate of destruction. .</p> <p>The storage and treatment of end-of-life vehicles is also subject to strict control. Establishments or undertakings carrying out treatment operations must strip end-of-life vehicles before treatment and recover all environmentally hazardous components. Priority must be given to the re-use and recycling of</p> | <p>best spatial resolution of 0.41m. This will allow the identification of waste sites where dumped cars are present.</p> |
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| | | <p>vehicle components (batteries, tyres, oil).</p> <p>The aim of this Directive is to increase the rate of re-use and recovery, and to increase the rate of re-use and recycling.</p> | |
| 12. | <p>Directive 2000/59/EC of the Council of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues</p> | <p>This directive enhances the availability and use of port reception facilities for ship-generated waste and cargo residues.</p> <p>The Directive targets: all ships, whatever their flag, including fishing vessels and recreational craft, putting in at a Member State port, apart from warships.</p> <p>A waste reception and handling plan must be drawn up in each port. These plans must be checked and assessed by the Member States and approved by them at least every three years.</p> <p>Captains of ships are required to notify certain information, in particular the date and the last port in which ship-generated waste was delivered and the quantity of waste remaining on board.</p> <p>Unless exempted, all ships are required to deliver their ship-generated waste before leaving a Community port, unless the captain can prove that his vessel has adequate storage capacity. Ships which do not deliver their waste without providing valid reasons for exemption</p> | <p>There is no direct application for monitoring with satellites. There is a possible application for using GPS coordinates for monitoring transport of ship-generated waste and cargo residues.</p> |

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| | | <p>are not allowed to leave the port until such delivery has taken place.</p> <p>Ports must establish cost recovery systems to encourage the delivery of waste on land and discourage dumping at sea.</p> <p>Ships may be inspected. Since not all ships can be checked, the choice of those to be inspected will focus mainly on ships which have not complied with the notification requirement and those suspected of not having delivered their waste.</p> <p>Where it is proven that a ship has put to sea without having delivered its waste and without benefiting from an exemption, the next port of call is alerted. The ship will not be authorised to load or unload its cargo nor to take on passengers without undergoing a detailed inspection</p> | |
| 13. | Directive 2000/76/EC of 4 December 2000 on the incineration of waste | <p>The aim of this Directive is to minimise the impact of negative environmental effects on the environment and human health resulting from emissions to air, soil, surface and ground water from the incineration and co-incineration.</p> <p>It covers virtually all waste incineration and co-incineration plants. A plant will only be an incineration plant or co-incineration plant if it burns waste as defined in the Waste</p> | No direct application to monitor with satellites, because directive aims at tightly regulating incinerators. Satellite monitoring can be used to determine background levels of some atmospheric pollution. |

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| | | <p>Framework Directive. Such wastes will include municipal waste, clinical waste, hazardous waste, general waste and waste derived fuels.</p> <p>It is not concerned with the place of incineration in waste management strategies, but with ensuring that incinerators continue to be tightly regulated.</p> <p>Permit requirements including: operating conditions, including temperatures and residence times; emission limit values for a range of substance to air and water including dioxins; emission monitoring requirements (reporting of dioxins, dioxin like PCBs PAHs).</p> | |
| 14. | <p>Directive 2002/96/EC of 27 January 2003 on waste electrical and electronic equipment</p> | <p>This Directive aims to prevent waste from electronic and electrical equipment and promote collection, re-use and recycling of WEEE. It also aims to improve the environmental performance of all operators involved in the life cycle of WEEE.</p> <p>This Directive applies to the following categories of electrical and electronic equipment: large and small household appliances; IT and telecommunications equipment; consumer equipment; lighting equipment; electrical and electronic tools (with the exception of large-scale stationary industrial tools); toys, leisure and sports</p> | <p>No potential application for monitoring with satellites.</p> |

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| | | <p>equipment; medical devices (with the exception of implanted and infected products); monitoring and control instruments; automatic dispensers.</p> <p>Member States are to encourage the design and production of electrical and electronic equipment which take into account and facilitate dismantling and recovery, in particular the reuse and recycling of WEEE.</p> <p>Member States are to minimise the disposal of WEEE as unsorted municipal waste and are to set up separate collection systems. Producers must make provision for the collection of waste that is not from private households. Member States must ensure that all waste electrical and electronic equipment is transported to authorised treatment facilities.</p> <p>Producers of electrical and electronic equipment must apply the best available treatment, recovery and recycling techniques. Such treatment is to include the removal of fluids and selective treatment in accordance with Annex II to the Directive.</p> <p>Waste treatment and storage must be in conformity with Annex III to the Directive. Establishments responsible for treatment operations must obtain a permit from</p> | |
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| | | <p>the competent authorities. Producers must set up systems for the recovery of waste electrical and electronic equipment collected separately.</p> | |
| 15. | <p>Directive 2006/12/EC of 5 April 2006 on waste.</p> | <p>This will be the new framework directive on waste. This Directive consolidates and replaces Directive 75/442/EEC as subsequently amended. The aim of this consolidation is to clarify and rationalise the legislation on waste but it does not change the content of the applicable rules.</p> <p>Member States must prohibit the abandonment, dumping or uncontrolled disposal of waste. They shall promote waste prevention, recycling and processing for reuse.</p> <p>The measures provide for cooperation between the Member States with a view to establishing an integrated and adequate network of disposal installations (taking account of the best available technologies). This network should enable waste to be disposed of in one of the nearest appropriate installations that guarantee a high level of environmental protection.</p> <p>Member States must ensure that any holder of waste has it handled by a private or public waste collector or a disposal undertaking, or disposes of the waste himself in compliance with these measures.</p> | <p>There is potential for monitoring large-scale waste contamination from dumping, abandonment and uncontrolled disposal of waste. As Member States have a responsibility to prohibit the abandonment, dumping or uncontrolled disposal of waste, they have to have information about (1) the use of existing waste disposal sites and (2) the creation of unauthorised dumping sites. Satellite remote sensing data with pixel sizes smaller than 10m can assist in mapping both categories of sites. Can use GPS to obtained coordinates to track shipment of waste as long as the transport vehicle is fitted with a GPS transponder. Geographic Information System (GIS) can be used to plan the most efficient network for carrying waste to disposal sites.</p> |

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| | | <p>Undertakings or establishments treating, storing or tipping waste on behalf of third parties must obtain a permit from the competent authority relating, in particular, to the types and quantities of waste to be treated, the general technical requirements and the precautions to be taken. The competent authorities may periodically check that the conditions of the permit are being complied with. They also monitor undertakings which transport, collect, store, tip or treat their own waste or third parties' waste.</p> <p>Recovery centres and undertakings disposing of their own waste also require a permit.</p> <p>In accordance with the "polluter pays" principle, the cost of disposing of waste must be borne by the holder who has waste handled by a waste collector or an undertaking and/or by previous holders or the producer of the product giving rise to the waste.</p> <p>The competent authorities designated by the Member States for the implementation of these measures are required to draw up one or more management plans relating, in particular, to the types, quantities and origins of the wastes to be recovered or disposed of, the general technical requirements, any special arrangements for particular wastes, and</p> | |
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| | | suitable disposal sites and installations. | |
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