Costa Brava Water Agency’s sludge use programme

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Workshop on Knowledge and Practices of Using Treated Sewage Sludge on Land
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Pembroke College, Cambridge University, UK
Water agency formed in 1971 by 27 municipalities of the coastal area of Girona’s province, in NE Spain (highly touristic area)

Deals with the whole water cycle:
* Wholesale purveyor of drinking water to 14 municipalities (3 external to CCB) - 19 million m³/year
* Biological wastewater treatment to 28 municipalities (1 external to CCB) in 18 WWTP - 30-35 million m³/year
* Reclamation and reuse of treated wastewater for non-potable purposes since 1989 - 5.5 million m³/year (2007)
* Monitoring of ecological status of coastal streams since 2003
* Applied research on reclaimed water quality and efficiency of treatments, specially disinfection
Wastewater treatment in the Costa Brava area

- First WWTP built in 1972
- WWTP in operation (2008):
  - Conventional activated sludge: 7 facilities
  - Extended aeration: 10 facilities
  - Waste stabilization ponds: 1 facility
- Facilities dimensioned to treat wastewater produced in peak touristic season (summer)
- Negligible industrial contribution
- Flows between 50,000 and 6,500,000 m³/year (total 2007 = 30.1 million m³)
- Average energy consumption: 0.46 kWh/m³
- Biosolids production: approx. 38,000 tons/year (fresh). Compliance with all the heavy metal limits for land application of biosolids
Historical evolution of biosolids management

- Lack of regulations
- Biosolids applied to the soil without any previous calculation of doses
- Transported to agricultural land managed by non-professional farmers – yield and quality of crop was not so important
- Biosolids were transported in containers and dumped on the side of the fields. Difficulties for the farmers to spread them. Conclusion: biosolids were treated as a waste and soil a landfill.
- Severe limitations arose when biosolids production increased with the construction of new WWTP
- European regulations for the application of biosolids to agricultural soils passed in Spain in 1990 (RD 1310/90).
Historical evolution of biosolids management

- Diagnose report by Rafael Mujeriego and Maria Carbó (UPC) in 1994 that provided the clues for a change in the management practices.
- Key factors identified for a transition to a successful management:
  * To build a trustful and lasting relationship with the professional agricultural sector of the area –specially the growers of cereals- and to explore the potential symbiosis between them and the CCB
  * To calculate and apply agronomical doses, adapted for each crop and each field
  * To include the spreading of the biosolids among the tasks under the responsibility of the operators of the WWTP
  * To professionalise this service by hiring someone who could provide the link between the farmers and the operators of the WWTP and to coordinate the supply service.
  * To arrange experimental plots where the appropriateness of the biosolids as organic fertilizers for cereal crops could be tested under controlled conditions and in a scientific way – Mas Badia Experimental Station (http://www.irta.es/indexfr.asp?doc=/cat/qui/centres/09.asp)
  * Divulgation of results among farmers
Images

Sludge recollection in old sludge drying beds (no longer in use) and two examples of inadequate application of biosolids in the fields from the late 80’s

First workshop with farmers (1996), initial spreading tractor (1996) and present day truck used for biosolids application to the fields
Historical evolution of biosolids management

Today’s management

* Contact with farmers, search for adequate fields for application of biosolids (several criteria to be matched), soil sampling and analysis, and request of an application permit to be issued by Agència Catalana de Residus (Catalan Waste Agency)

* Calculation of doses according to the type of crop, biosolids’ composition, and previous applications

* Biosolids are transported and spread on the field at no cost for the farmer – the proper management of biosolids is perceived as essential for an effective pollution prevention in wastewater treatment. Once spread, farmers are required to cover the biosolids as quick as possible, to prevent nuisances (odours, insects, etc.)

* Agronomic information provided to the farmers, such as nutrient contributions and recommendations of the amount of potassium required for a proper fertilization
Fate of biosolids (2006)

FATE OF BIOSOLIDS FROM COSTA BRAVA WWTP IN 2006

- 38% External composting facilities
- 28% Blanes composting facility
- 18% Landfill
- 16% Agriculture
Advantages of the use of biosolids as organic fertilizers in cereal crops

- Symbiosis with the professional agricultural sector
- Biosolids applied prior to planting and covered immediately – never in contact with crop
- Nutrient recycling – fertilizer savings
- Landfill deposition is avoided – longer life of this kind of utilities
- Option of the lowest economic cost (20-25 €/ton fresh matter, one third of composting and one fourth of landfill deposition) and greatest sustainability
Critical review of present situation

- Problem #1 – Lack of synchrony between production times and application times
  - Production does not match demand (small WWTP & big fields)
  - Difficulties when application is not possible (rainy periods, late spring when winter fields are yet to be harvested and corn is already planted)
  - Need for storage
Problem #2 – Changes in regulations: biosolids would possibly require some kind of pathogen removal before soil application

* Catalan Waste Agency does not allow biosolids from WWTP without digestion (i.e., many extended aeration plants built over the last decade) to be applied to soils anymore
* Only three anaerobic digestors in the Costa Brava WWTP
* The biosolids from all of CCB’s extended aeration plants have to be taken to external composting facilities
The use of biosolids as organic fertilizers in cereal crops is still perceived as the best solution. Investments are needed in order to keep with this practice:

* Several new anaerobic digestors are very likely to be built; termophilic aerobic digestion (batch, 55ºC, 20 h) will also be considered
* One or two composting facilities will also be constructed, so they can provide additional treatment and storage to biosolids that either would not match new criteria or that cannot be applied

Legalise compost as fertilizer (Spanish legislation RD 824/2005) to simplify management and reduce costs

Biosolids from smaller plants will be transported to larger plants with any of these kind of treatments within the Costa Brava facilities
Future options

FATE OF BIOSOLIDS IN THE FUTURE IF THE PROJECTED PLANS ARE IMPLEMENTED

- 81% Agriculture
- 19% Other composting facilities
- 0% Blanes composting facility
- 0% Landfill
Experimental plots in Mas Badia
http://mediambient.gencat.net/aca/documents/ca/jornadatecnica003/15_salvia.pdf

  * Tests: Control (no fertilizer addition), chemical fertilizer and biosolids

  * Tests: Chemical fertilizer, biosolids fertilization (whole dose applied pre-sown) and combined fertilization (biosolids applied pre-sown + chemical fertilization applied at dressing)
Experimental plots in Mas Badia
http://mediambient.gencat.net/aca/documents/ca/jornadatecnica003/15_salvia.pdf

- After 13 years of application of biosolids in agronomic doses in experimental plots, the main conclusions are:
  - Yields are similar or even sometimes slightly greater than those obtained with chemical fertilizers
  - The rate of mineralization of organic nitrogen in the soil and the remains of previous years’ applications have to be taken into account in the calculation of doses
  - If doses are calculated to cover the crop’s nitrogen demands, in the mid term phosphorus concentration will markedly increase in the soil
  - No statistically significant variation has been observed in the concentrations of heavy metals in the soils that have received repeated applications of biosolids

- Essential information in order to provide sound advice to the farmers, from the way that doses had to be varied to how the nutrients have to be balanced, or what the farmers should expect in terms of yield and the quality of the crop.
Conclusions

- Biosolids produced in the Costa Brava WWTP have always been used as organic fertilizers in the area.
- Management practices have evolved over the years in order to adapt to the existing regulations, to the environmental requirements and to the professional farmers’ needs.
- Satisfaction in the farming sector guarantees a continuity in the use of biosolids as organic fertilizer in the future, but important investments in further treatment and in storage are needed.
- Experimental plots and divulgation of the results have also been a key factor for the whole process.
Thank you for your attention!