



REMTECH 2016, Italy, September 2016 Report of Session on: What will drive the EU nanoremediation market till 2025 – opportunities and challenges for the utilisation of nanoremediation.

Nanotechnologies could offer a step-change in remediation capabilities: treating persistent contaminants which have limited remediation alternatives, avoiding degradation-related intermediates and increasing the speed at which degradation or stabilisation can take place. However, adoption of nanoremediation has been slower, with fewer than 100 field scale applications, since the first field application in 2000. However, the recent emergence of nanoremediation as a commercially-deployed remediation technology in several EU countries, notably the Czech Republic and Germany indicates that it is now time to look at nanoremediation as a technology in the European market-place.

Since early 2013, the EU FP7 NanoRem project (www.nanorem.eu) has been carrying out an intensive development and optimisation programme for different nanoparticles (NPs), along with analysis and testing methods, investigations of fate and transport of the NPs and their environmental impact. NanoRem is a €14 million international collaborative project with 29 Partners from 13 EU countries, and an international Project Advisory Group (PAG) providing linkages to the USA and Asia. It is a major initiative, which will support the effective deployment of nanoremediation technologies in Europe.

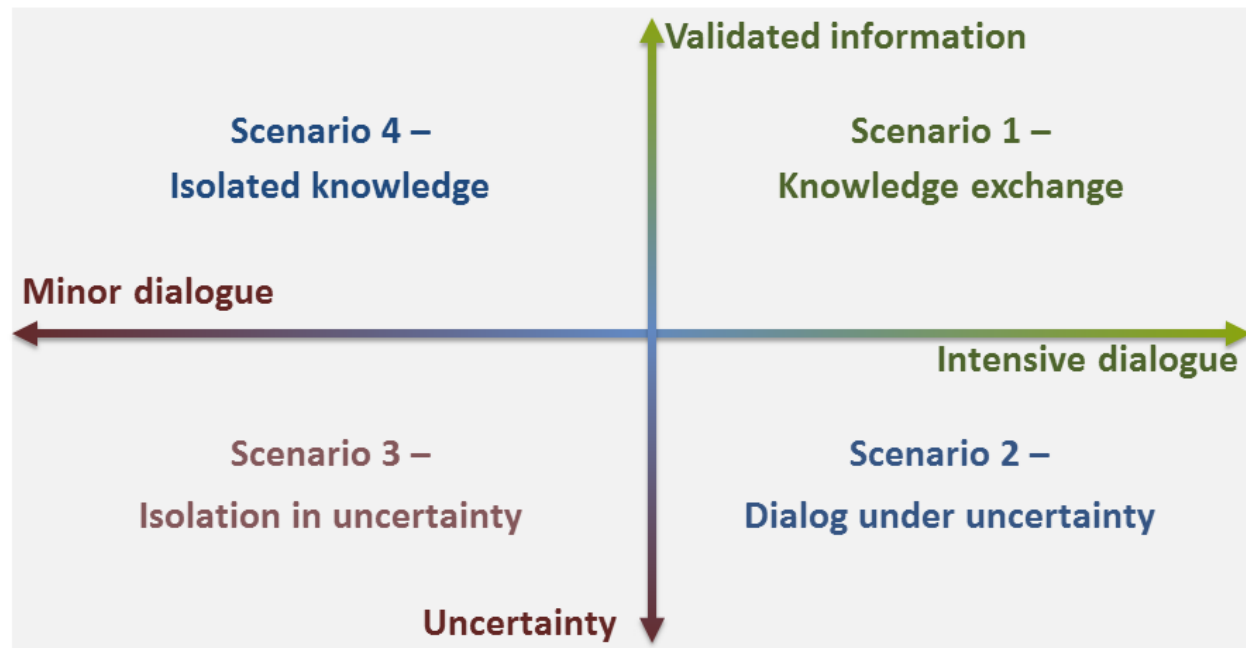
At RemTech 2016 NanoRem offered two sessions on September 21st 2016 to provide delegates with the practical, implementation, technical and market information to understand how nanoremediation might address contaminated sites and how they might deploy nanoremediation within their own organisations, whether they are a site manager, a service provider or a regulator.

The **first** session focused on providing a practical grounding in nanoremediation theory and practice with particular reference to applied examples in the field. The **second** session focused on discussing business and strategic intelligence for delegates with interests in using nanoremediation at their sites or developing nanoremediation activities at their organisations. This short paper reports the key findings of the **second** session.

Eight participants took part (two linked to NanoRem from Politecnico di Torino):

- Alessandro Mattiello, University of Udine, Italy
- Donata Visconti, University of Naples
- Federico Fuin, ARPAV – Environmental Protection Agency of Venice
- Varios, Politecnico di Torino
- Pietro Vaccari, Nanoverse consultancy
- Isabella Buttino, ISPRA (regulatory agency)

Overall the discussion endorsed the existing scenario analysis model summarised in the Figure below.



The following key points emerged from an open discussion.

1. Communication to the public and business is vital because many individuals fear nanotechnology, and they may have decision making influence. Additionally public confidence is very important for remediation markets in Italy because much of the investment comes from public agencies. While polluter pays principle exists in Italy, the remediation of orphan sites is paid for by public funds.
2. Understanding costs is vitally important, and ideally cost should be in the framing diagram as a "third dimension" in this plot because of its dominant effect on use. Costs relate to whole system costs, not just the nanomaterial cost element of a project. While there is great interest in nanoremediation, costs are perceived to be high and uncertain.
3. A comment from one participant was the "I came here today perceiving that nanoremediation was very expensive and very experimental. The presentations this morning [in the training session] were very convincing and show that the technology is actually more established than I thought.". This comment came from someone at a public agency who further commented that agency professionals have very little time to go out and seek information. Therefore if service providers want to succeed with a nanoremediation proposal, they need to bring high quality and validated information to the regulator to support their submission. Even information from other countries will, in principle. Promote the use of nanoremediation.
4. Uncertainty in whether or not a technology will meet its remediation targets is likely to prevent its use when there are other options where outcomes are more certain.
5. In Italy even *in situ* bioremediation is rare for chlorinated solvent problems. This is due to a reluctance of public authorities to permit *in situ* bioremediation. However, this reluctance is not related to any specific point of law. It arises from a lack of knowledge of the technology which is a consequence of a general lack of dialogue in Italy between the research community and public authorities. This is a long standing problem resulting from

institutional; / structural reasons. Anecdotally, in one region of Italy there is a major service provider dominant in the local market who chooses not to deploy *in situ* bioremediation. Part of the reason for this is that for more “uncertain” technologies the regulator may impose more stringent (and so costly) verification requirements in order to guard against uncertainty / lack of knowledge. Companies therefore prefer to apply remediation techniques which do not carry these additional commercial risks.

6. These barriers for *in situ* bioremediation use certainly carry a message for attempts to introduce nanoremediation in Italy. It was commented that this could be an issue of timeline, for example twenty years ago regulators were similarly hesitant about *in situ* bioremediation in the UK, and had a similar response to impose more stringent verification needs. So perhaps a key question is how to shorten this timeline.
7. These barriers to the use of *in situ* bioremediation exist, even although in many cases it is one of the cheaper remedial options to deploy.
8. Another institutional barrier suggested was that for some service providers proposing a long term expensive and infrastructure based approach such as pump and treat may be a preferable commercial outcome.
9. A concern raised was that the disconnect between science and business in Italy is particularly great because there is little business investment in research projects at Italian universities. This is a systemic problem in Italy, but one consequence is that the lack of research partnership and shared endeavour between universities and business is a barrier to the developing a shared knowledge of bioremediation.
10. Moving forwards NanoRem’s information will make a difference, as long as there is a way to connect this information to businesses and regulators. However, validated cost and performance data would make a yet bigger difference. The importance of providing guidelines for nanoremediation deployment was emphasised as a way of bridging this communication “gap”. The production of pan-European guidance by NanoRem might be very persuasive. It was also noted that in general improving Italy-EU dialogues would be beneficial.
11. Italian language guidance would be helpful, although not necessarily decisive.
12. It was suggested that gaining the influence of an influence decision maker such as politician would be a good means of market influence in Italy.
13. Regarding the framing diagram, several of the delegates felt that the scenario in Italy at present is one where there is a lot of information available, but not very much dialogue. The information available is also of insufficient quality as it is not somehow validated.
14. Also of great influence on market sentiment would be a first trial at a major industrial client in Italy, and presented at RemTech to provide a national reference point.
15. There are developing information networks in Italy, one of which is called Reconnet which is also linked to the RemTech conference series,

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