



Aggregates Recycling: Exploring the Technology, Drivers & Market

EXECUTIVE SUMMARY

16 November 2005 held at The Great Barr Hotel, Pear Tree Drive, Newton Road, Great Barr, West Midlands B43 6HS.

Speakers	John Barritt David Coleman Jeff Kersey Alan Peplow Keith Roberts	Wrap Coleman & Company CIRIA Churngold Remediation Safetykleen & CIWM
Chairperson	Jasbir Kaur	Warwickshire County Council & West Midlands Regional Aggregates Working Party

THE ISSUES

Available equipment, high disposal costs and a firm market for recycled products are all supporting alternative approaches to the landfill disposal of inert construction and demolition wastes. However, for contaminated materials, the business case for recycling needs to be better understood. This has become more important as July's Hazardous Waste Directive begins to bite.

In considering the future commercial viability of material treatment and recycling, the seminar explores the interplay between:

- Inert aggregate waste materials and their potential uses in high value construction applications;
- Recycling technologies and market demand for products;
- Contaminated excavation wastes and treatment capabilities.

Two prime discussions on the transference of knowledge between non-hazardous and hazardous contexts from speakers with national and regional knowledge will cover:

- The local authority perspective and dynamics of a regional recycling market;
- Capital grants and business planning considerations of the aggregates recycler;

- Standards, specifications and quality protocols for the production of aggregate products from waste;
- New regulations and processes for investigating Brownfield land and characterising contaminated materials.

LEARNING POINTS

1. The Waste and Resources Action Programme (WRAP) looks at resources, sustainability and promotes specifically the use of recycled aggregates. Currently 25% of the UK's aggregate demand is met by recycled aggregates.
2. Construction, Demolition and Excavation Waste (CD&EW) is a raw material that can be reprocessed; the past practice of 'dig and dump' is less prevalent.
3. The 'Great Barr Urban Quarry' produces 9,000-10,000 tonnes of recycled material per month and demand is beginning to outstrip supply.
4. There is a trade-off between the 'added-value' of the recycled product and the required 'investment' in the processing equipment required to realise that added-value.
5. Throughput is the key to the success of any processing regime. The complexity of the processing option has less impact on product costs as throughput increases and the financial case to purchase plant is stronger for production of high-value products if the plant is operated at higher throughput.
6. There are major commercial implications for miscalculation of waste quantities and type for those developing/ constructing on Brownfield sites. Landfill disposal costs for hazardous wastes have increased from £40-45/m³ to £150-250/m³. Non-hazardous waste costs have increased by approximately 30%.
7. Whilst landfill is still an effective remediation technique there are other cost and time effective techniques for remediation. Current legislative changes are being made to make these techniques more readily applied.
8. The Hazardous Waste Regulations have imposed new classification methods, producer registration procedures, new consignment procedures, mixing and separation requirements, record keeping and fixed penalties for failure to comply with the regulations.
9. There are a number of issues and implications for the construction industry as a result of these regulations. The Environment Agency is a valuable source of information if you have any uncertainty over your site and/or situation.

CHAIRMAN'S INTRODUCTION

Jasbir Kaur, Warwickshire CC & West Midlands RAWP

The Office of the Deputy Prime Minister (ODPM) is pushing policies on regions and Local Authorities (LA) to restrict landfill capacity. Regulation is increasing, for example the Hazardous Waste Directive and new waste development frameworks clearly detail restrictions on waste. One of the current innovations, being employed currently on Brownfield sites, is the introduction of 'Waste Statements' which identify the waste issues on that site.

The industry needs to look for alternatives to landfill. The commercial viability of the treatment of waste has to be considered. Through the use of innovation the industry can look at recycling technologies and the current levels of demand from those products.

WRAP ACTIVITIES TO SUPPORT SUSTAINABILITY

John Barritt, *Wrap*

The Waste and Resources Action Programme (WRAP) looks at resources, sustainability and promotes specifically the use of recycled aggregates. Currently 25% of the UK's aggregate demand is met by recycled aggregates. WRAP provides a comprehensive knowledge base and works to develop best practice within the industry.

WRAP have developed 'AggRegain'. This is a web-based system that holds a complete online guide to sustainable aggregates. AggRegain is comprised of 10 modules which cover the following:

- Specifier;
- Supplier Directory;
- Case Studies;
- Planning;
- Recycling Infrastructure;
- Quality;
- Waste Management Regulations;
- Demolition;
- Procurement;
- Sustainability.

All of the modules are designed to help people at different levels of the supply chain. For example, the site gives specification information for sustainable materials for the Client and information for the Contractor on what materials will meet which specifications. The recycler can discover what equipment and plant is required. There are a number of Case Studies that show how past problems have been resolved.

The 'Demolition' module looks at the supply chain, demolition and new build best practice, implementing that best practice, the ICE 'Demolition Protocol' and interactive building: material recovery and re-use. The module incorporates four policy documents which detail how to improve sustainability from four different stakeholder perspectives, namely:

- Policy Makers & Planners;
- Developers & the Design team;
- Contractors;
- Suppliers.

The 'Procurement' module considers the benefits of using recycled and secondary aggregates from the perspective of meeting client procurement demands. Procurement strategies are fundamental in driving increased use of recycled materials and recycled content. Other sections cover "quick wins" for contractors, contract management and case studies of past projects. The quick win section includes numerous reference documents including:

- Housing;
- General building;
- Civil engineering and preliminary works;
- Commercial refurbishment.

One of the concerns that is often raised when using recycled aggregates is the level of quality that can be achieved. Recycled aggregates are as good as or better than products used in roads and concrete, etc. Another issue is when does a waste cease to be a waste and become a product. The 'Quality' module includes quality management tools, introduction to a Quality Management System (QMS), reviews quality protocols and provides information on European and British and aggregates

standards. There is also information on local test houses providing aggregate testing services.

The WRAP Capital Programme 2004 to 2006 is funded through a capital grant support programme. It includes 23 projects to date, 17 of which are still in progress. The current target is to achieve a 3,000,000 tonne capacity by the end of the programme. The ODPM has targets for recycled aggregates of 60,000,000 tonnes by 2016; WRAP forecast this to be nearer 70,000,000 tonnes. The total usage of aggregate in the UK is approximately 4tns/capita compared to 6-8tns/capita in Europe and 10tns/capita in the US. Figure 1 below shows the recycled aggregate production in 2003:

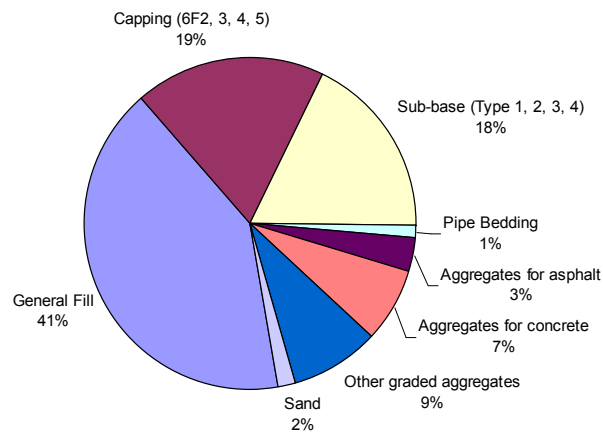


Figure 1 Recycled Aggregate Production 2003

What is the sustainable balance between natural materials and used recycled aggregates? What impact will recycled aggregates have on the market over the next ten years? The points below discuss the market demands impact on crushed rock and future sustainable resource use:

Impact of RA Crushed Rock

- Initial impact on low grade fills i.e. scalpings and capping;
- Growing impact on sub-base sales;
- Loss of market share ;
- Increase in stocks of low grade fills;
- Increase in stocks of dust through loss of sub-base sales;

Impact on Crushed Rock of Market Demand

- Reduction of 'dig & dump' cuts demand for low grade fills;
- Increased use of ground stabilisation reduces demand for low grade fills;
- Reduced demand for dense blocks cuts demand for dust;
- Increased demand for smaller sized graded stone increases production of dust;
- Increase in stocks of low grade fills;
- Increase in stocks of dust.

Sustainable Resource Use

- Invest in washing plant for dust;
- Develop crushing processes that generate less dust;
- Invest in processing plant for scalpings;
- The sustainable supply of

- Change profile of crushed rock production;
 - Increase output of higher value products;
- aggregates requires the balanced development of all suitable resources.

THE GREAT BARR 'URBAN QUARRY' RECYCLING SITE: RISKS, CHALLENGES & SUCCESSES

David Coleman, *Coleman & Company*

Coleman & Company (C&C) is a well-established private company that specialises in complex or large projects. Their services as a specialist contractor include:

Demolition	• City Centre	– Facade retention; – Structural Alterations; – Temporary works; – Office blocks;
	• High rise structures	– Deconstruction; – Explosive demolition; – High reach demolition;
	• Industrial	– Decontamination; – Factories Process plants;
Earthworks	• Land reclamation	– Decontamination; – Reprocessing; – Lime stabilisation;
	• Bulk Excavations	– Cut & Fill; – Import/Export; – Material testing;
Recycling	• Meriden	– Road stones; – Bulk fill; – Topsoil;
	• Shady Lane	– Gravels; – Sand.

In conjunction with recycling activities and the production of added value materials, they are now offering civil engineering services using their recycled aggregates. This area of business will be developed into the future, to compliment their existing operations. Over recent years they have been developing a management structure that is tailored to cope with both current and future activities and have expertise in the following disciplines:

Engineering	– Site surveying with full AutoCAD and plotting facilities;
Project Management	– Mechanical & Electrical expertise; – Civil Engineering; – Ground stabilization; – Building Works.

C&C invest in the future of their business, whilst developing innovative safe systems of work and specialist equipment to execute projects safely.

Training	Health & Safety & Environmental Management, Quality Assurance, Project Management & Engineering.
Shady Lane Remediation	Unique washing/recycling/processing plant. Development of specialist trommel

screening plant The only one of its kind in the UK.

Drilling Rig	Including unique research into problems associated with whole body vibration has seen the design and development of a prototype machine. Used to reduce risks associated with the preparation of buildings for controlled explosive demolition.
Remote Controlled Plant	A 5 tonne remote controlled excavator, which has worked on prestigious projects such as Birmingham Town Hall a Grade I listed building, removing structural reinforced concrete up to 600mm in thickness. The plant was developed with Komatsu to remove the risk to operatives who would ordinarily be working adjacent an unprotected edge.
Ultra High Reach No. 2	40-metre telescopic boom to demolish structures up to 15 storeys in height, fitted with remote vision cameras and high-powered dust suppression equipment.

C&C are committed to providing their clients with the best available resources to manage their projects, safely and efficiently, whilst not losing the traditional values of a privately owned business.

Construction, Demolition Waste and Excavation Waste (CDEW) is a raw material that C&C need for their processes; the past practices of 'dig and dump' are now resigned to history. The company has used new innovations and initiatives to develop further competitive advantage. Great Barr is a new site (development costs approx. £6m) that was developed through grants from WRAP and various contract awards. As an example, a recent project produced approximately 200,000 tonnes of CDEW which was reprocessed and re-used, only 400 tonnes was finally sent to landfill sites.

As a company C&C support and shape sustainability. Great Barr produces various washed aggregates, sub-bases and sand are produced. The only potential waste products, the silts and the clays are used as impermeables to contain contaminated materials in landfill sites. Great Barr produces 9,000-10,000 tonnes of recycled material per month and demand is beginning to outstrip supply.

EFFECTIVE BUSINESS PLANNING FOR AGGREGATES RECYCLERS

Jeff Kersey, *CIRIA*

CIRIA have recently undertaken a research project looking at the business planning requirements of the recycling sector. The Business Data for Recycling project has produced a publication. This takes the form of an outline business plan targeted at those setting up or improving an aggregates recycling facility. It is also generally relevant to those who are interested in the management of CD&EW from construction activities. This complements past CIRIA research into waste and resources and sustainability. The publication looks at the business opportunities.

Many materials derived from waste are suitable for recycling into aggregate products, such as:

- Masonry, bricks, tiles & ceramics, stone, asphalt, terracotta, unbound granular materials (trench arisings and excavation wastes);

They can be processed into a range of products, for example:

- Unprocessed & processed fill, sub-base, aggregates for asphalt, fine & coarse aggregates for concrete, other graded & single size aggregates, building sand.

There are many different kinds of machinery required to process the CDEW raw material into different products however. Figure 2 below shows various types of processing equipment and its corresponding function:

Weighbridge	Determining load sizes
Excavator	Moving feedstock
Impact crusher	Sizing aggregate
Wheeled loader	Moving product
Pre-screen	Removing over-size items
Picking station	Removing foreign material
3 way screen	Sorting aggregate
Flotation system	Removing foreign matter
Secondary crusher	Sizing aggregate
Air knife	Removing foreign matter
Impact crusher, granulator for asphalt	Sizing aggregate
Screen for crushed asphalt	Sorting aggregate

Figure 2 Processing Equipment

An issue that has to be considered when doing research into recycling CDEW is what will provide higher value. The processing equipment provides options for moving materials into appropriate applications and higher performance applications results in higher added value and better commercial opportunities; this however requires investment. There is a trade-off between the ‘added-value’ of the recycled produce and the required ‘investment’ in the processing equipment required to realise that added-value. The following costs need to be factored into investment decisions:

- Labour;
- Energy for different equipment;
- Water supply and sewerage (washing plant!);
- Equipment purchase, rental, maintenance;
- Vehicle operating costs.

The publication has an information database which has tables which record cost data for each project (cost per tonne, etc.). So what are the potential benefits given the commercial risk involved in recycling CDEW? The markets are underpinned by a number of factors, listed below:

- Demand for products and stable
- Changes to waste management

- prices;
- Industry confidence;
- Euro Aggregates Standards (non-discriminatory);
- licensing;
- Increasing availability of affordable equipment (washing plant);
- Public sector and other policy drivers.

A key conclusion of the research is that throughput is important to the success of any processing regime. The complexity of the processing option has less impact on product costs as throughput increases and the financial case to purchase plant is stronger for production of high-value products if the plant is operated at higher throughput.

Figure 3 below shows the applicability of the various types of processing equipment to different levels of product value (high, medium or low):

Equipment	Low	Medium	High
Weighbridge	✓	✓	✓
Excavator	✓	✓	✓
Impact crusher	✓	✓	✓
Wheeled loader	✓	✓	✓
Pre-screen		✓	✓
Picking station		✓	✓
3 way screen		✓	✓
Flotation system			✓
Secondary crusher			✓
Air knife			✓
Impact crusher, granulator for asphalt			✓
Screen for crushed asphalt			✓

Figure 3 Equipment Viability at Differing Throughput Levels

The costs of the following potential requirements also need to be considered:

- Acquisition of land (if purchased);
- Access roads and signage;
- Civils – bunding, drainage, sewerage;
- Boundary protection;
- Site office and sanitary facilities;
- Dust suppression and noise abatement.

The price of the recycled product is determined by a number of factors, shown below:

- Product demand;
- Production and transport costs;
- Distance of demand;
- Local market price;
- Rate of output that can be sustained;
- Detailed financial appraisal.

There are also further considerations which are covered within the outline business plan. There are sections which cover planning requirements, the Waste Management Licensing system, environmental impacts, pollution, Landfill Tax, Health & safety and Quality management.

The publication also contains an economic modeling spreadsheet that enables the user to input figures regarding a specific project to determine the following:

- The Net Present Value (NPV);
- The Internal Rate of Return;
- The Payback Period;
- The NPV per tonne of a product.

HAZARDOUS WASTE SOILS: ON-SITE TREATMENT & RECOVERY OPTIONS VS OFF-SITE SOLUTIONS Alan Peplow, *Churngold Remediation*

The following section will cover definitions of waste and hazardous waste and options available for dealing with that waste. There are essentially three options for dealing with hazardous waste landfill, on-site treatment options and off-site treatment options, finally a summary of Mobile Plant and Treatment licenses will be undertaken.

Do you have a waste? The regulatory definitions of waste are as follows:

- “The producer discards, or intends or is required to discard”; (Waste Framework Directive 75/442/EEC);
- Once a substance has become waste it will remain waste until it has been fully recovered (treated) and no longer poses a threat to the environment or human health;
- September 2004 European Court of Justice - Van de Walle implies that all impacted soil is waste..... Irrespective of the intention to discard.

The Environment Agency’s (EA) definition of waste suggests that contaminated soil becomes waste when we pick it up to use it, this is a paradoxical view as use could be seen as the opposite to discarding that soil. The EA ‘Guidance on the Application of Waste Management Licensing to Remediation 2001’ classifies contaminated soil arisings as controlled waste. Uncontaminated natural arisings may be classified as waste as the purpose of those excavations is development and not to win material. There is a confused position which needs a pragmatic approach from the regulators.

Current EA interpretation is that post treatment material is exempt from Waste Management if the post treatment contamination levels are below Site Specific Threshold Values (SSTV’s) under paragraph 9 and 19. This remains the case even if SSTV’s exceed hazardous waste classification. For example, Petrol Range Organics of 1000mg/kg often fall below SSTV but above the hazardous waste threshold value. Another example would include lead which has low values compared to the SSTV, an exception to this philosophy would be asbestos in contaminated ground.

Is your waste hazardous? On the 16 July 2005 the Hazardous Waste Regulations (HWR) came into force in the UK. The Waste Acceptance Criteria (WAC) now applies to all hazardous waste going to landfill. So what are the options for dealing with hazardous waste? The first and historically, the primary choice would have been disposal via landfill. Waste is now classified into three categories Hazardous, Non-hazardous and Inert. The three types of waste can no longer be disposed off in the same area, hazardous waste must also be pre-treated prior to landfill. The new regulation and the cost and complexity of treating and disposing of hazardous waste has resulted in only 8 hazardous waste landfill sites remaining available in the UK, this is a reduction of over 250 sites.

Disposal costs for hazardous wastes have increased from £40-45/m³ to £150-250/m³. This clearly has major commercial consequences for miscalculation. Even non-hazardous waste costs have increased by approximately 30%. The onerous or duty of care is on the producer of that waste to classify that waste correctly. A well rounded knowledge of these regulations could result in potential cost savings.

There are alternatives to landfill however including both in-situ and ex-situ on-site treatments and off-site treatments at 'soil surgeries'. There are a number of differing methods for soil remediation. There are a number of factors such as what the contaminants are, where they are, how they are treated, how long treatment takes and cost which determine the method chosen. These methods and there corresponding costs are shown below:

BIOREMEDIATION

Ex-Situ
TPH, some PAH, VOC, BTEX, Ammonium
£8 – 35/m³

In-Situ
VOC, BTEX, Chlorinated Solvents, some PAH, most TPH, Ammonium, Metals (MRC / HRC)
£25 – 60/m³

THERMAL

In-Situ (Steam Stripping)
Hydrocarbons, VOC, BTEX, most PAH, Chlorinated Solvents, (DNAPL / LNAPL)
£10 – 35/m³

PHYSICAL

In-Situ

(SVE/AS)
VOC, BTEX, some Chlorinated Solvents
£1 – 10/m³

(DPVE)
LNAPL, VOC, BTEX, Hydrocarbons
£6 – 10/m³

STABILISATION

Fixation (Cement)
Heavy Metals, some PAH, Hydrocarbons
£8 – 40/m³

In-Situ / Ex-Situ (PIMS)
Heavy Metals
£25 – 40/m³

CHEMICAL

In-Situ (Fenton's Reagent Chemical Oxidation)
VOC, BTEX, Chlorinated Solvents, PAH, some Hydrocarbons
£8 – 35/m³

PHYSICAL

Ex-Situ

Sorting and screening
Cement bonded Asbestos
£15 – 30m³

(P&T)

All contamination to some degree limited
mostly to dissolved phase contamination
£1 – 10m³/m³ *of treated water

OTHERS

Phytoremediation

Heavy Metals, Hydrocarbons, PAH

OTHERS

Electro Kinetics

Heavy Metals

The above techniques are all available on-site there is however, an off-site option using ‘soil surgeries.’

Finally there has also been a change with mobile plant licenses. In the past the application and approval of these licenses has been a lengthy, uncertain process. The historical process (up to April 2006) was to have a generic license for each piece of technology and then apply for Site Specific Licences which would take an undefined period of time (usually 6-8 weeks). Following April 2006 there is one generic treatment license for each company covering all named remediation technologies. Site specific ‘Deployment’ forms are then required which have to be approved or rejected within one month of application. This will result in a much greater, structured approach to licensing and furthermore result in shorter programme times from start to finish.

In summary, whilst ‘dig and dump’ is still an effective remediation technique there are other very cost and time effective techniques for remediation. Current legislative changes are being made to make these technologies more readily applied, including regulatory interpretation of statute and case law.

IMPLICATIONS OF THE HAZARDOUS WASTE REGULATIONS

Keith Roberts, *Safetykleen & CIWM*

The following statistics show the levels of waste produced in the UK per annum and how much of that waste is recycled:

- 330m tonnes of waste in UK in 2002/3;
- 67.9m tonnes of industrial/commercial;
- 100m tonnes of construction/demolition;
- 43% of total to landfill and 43% recycled.

Construction and demolition wastes are classified into a number of differing categories, including:

- Non-hazardous general waste;
- Hazardous/non-hazardous excavated waste;
- Oils/diesel;
- WEEE;
- Asbestos;
- Gypsum containing wastes.

Hazardous wastes include contaminated land, oils, solvents, paints, Asbestos and potentially plasterboard. The Hazardous Waste Regulations have imposed new classification methods, producer registration procedures, new consignment procedures, mixing and separation requirements, record keeping and fixed penalties for failure to comply with the regulations.

Classification should now be based on the European Waste Catalogue (EWC), chapter 17 focuses specifically on construction and demolition practices. It is imperative when the decision for waste disposal is made, especially in Landfill terms, to correctly classify waste as hazardous or non-hazardous, this will result in cost savings.

The new producer registration procedures require registration of premises which takes place annually with an applicable annual fee. The main contractor will be required to register but only if hazardous waste is being produced however. Production is the key however, all sites will have to be registered if hazardous waste is produced, regardless of whether that waste will leave the site or not. There are however, certain exemptions:

Offices, shops etc. producing less than 200kg p.a. are exempt from registration (does not cover construction);

Mobile service could cover certain builders;

200kg exemption per premises when operating service;

Only exempt from notification.

The changes to consignment notes are as follows:

No pre-notification to the EA;

No deposit copy to the EA;

More comprehensive note;

Code theoretically provided by the producer;

Carriers' Round replaced by Multiple Collection Round;

A fee is payable for each collection.

Mixing and separation guidance has been issued by the EA. It is important to understand that mixing must not deter recycling. Non-compatible materials must not be mixed; this doesn't stop the mixing of oils however. These requirements apply to producers, carriers and disposers of the waste. If non-permitted mixing has occurred the waste will have to be separated before disposal.

The new regulations require that records are kept and that they are kept for at least three years. The waste contractor must send a record of what has been collected every quarter to the producer, this record can be retained electronically but it must be kept at the site of production and be made available for inspection by the EA upon request.

Should you fail to comply with these regulations there are fixed penalties of up to £300 for certain offences, including paperwork offences. The EA will not prosecute if the fixed penalty is accepted however they will prosecute in all cases where that is rejected.

The issues and implications for the construction industry as a result of this change in the regulations are therefore as follows:

Issues

- Who will register with the EA;
- How to determine whether a waste is hazardous;
- How to segregate waste streams;
- Who will be responsible for managing waste on site;
- How do you keep records.
- Implications
- Inspections by the EA;
- Cost of registration and consignments;
- An operator may have several registrations at any one time;
- Segregation requirements give potential to reduce disposal costs;
- Recycling and re-use will become more prevalent;
- Secretary of State has powers to introduce regulations requiring Waste Management Plans for each contract (Clean Neighbourhood Bill.)

So in summary is important to understand what type of waste you are producing and to make someone responsible for the management of that waste. Segregation will lead to recycling and re-use which will inevitable result in cost savings. Choose waste contractors carefully and it is imperative to remember that the duty of care is placed upon the waste producer. The EA is a valuable source of information if you have any uncertainty over your site and/or situation.

DISCUSSION SESSION

Q? Would Plasterboard be classed as hazardous waste?

A: A rule of thumb is that if the Gypsum content of the plasterboard is greater than 20% it would be classed as hazardous waste, between 10% and 20% it is not classed as biodegradable waste (due to Hydrogen Sulphide production) and less than 10% Gypsum is classed as non-hazardous waste.

Q? Following the demolition of a building what Gypsum content can be re-used?

A: It has to comply with standard testing, there is no specific figure, it becomes impure at a certain point.

Demolition projects are soft-stripped including the plasterboard; it would fall into the less than 10% category and thus qualify for landfill. The Gypsum content would be lost in the dilution factor however during the demolition process.

WRAP has a new plasterboard programme – refer to WRAP main website.

Q? How many recycling facilities are there in the UK currently?

A: There are over 500-600 standard recycling facilities currently in the UK. Of the more technologically developed washing type plants (such as the ‘Great Barr

Urban Quarry’) there are currently only 15 facilities; this is the next stage of evolution however. The location of these sites is important; see the ‘AggRegain’ website or CIRIA internet register of recycling sites for information on the location of sites.

Q? Where will un-recyclable waste go in the long-term?

A: There is potential for inert clays and soils to be used in a more sustainable manner through land and quarry restoration.

Q? Do legislative requirements allow excavated material to be used in other areas with similar characteristics?

A: Companies are screening at source in order to allow re-use of excavated material. The Environment Agency’s views may change in the future with respect to waste definitions and a more pragmatic approach will be adopted. The Olympic site in London is a good example; there is pressure for a central site for waste product treatment and re-use. There is a willingness to move in the right direction.

Q? Is there any technological advancement needed?

A: One key thing is to manage water; there are processes to do it. The biggest problem is water and silt management. More cost effective processes are required.

FURTHER INFORMATION

www.ciria.org.uk
www.aggregain.org.uk
www.wrap.org.uk

www.coleman-co.com
www.churngold.com