New Methodology for Migrating Gas Protection from Landfill and Brownfield Sites

CPD CERTIFIED
The CPD Certification Service

Who Are We?

- SEL Environmental Ltd have operated within the environmental sector for over 20 years
- Primary expertise in Landfill gas extraction & control, landfill liners and caps
- Originally a division of Site Electrical Ltd who were formed in 1981
- SEL Environmental Ltd began trading independently in 2006
- Specialists in brownfield remediation solutions and integrated water management (SuDS)

Who Are We?

- SEL have a talented team headed by Andy Shuttleworth, Managing Director
- Andy qualified as a Civil Engineer in 1988
- Author, Co-Author and Steering Group members for many publications including the following:
  - Ciria C748 Use of plastic membranes as VOC vapour barriers
  - Ciria C735 Good practice on the testing and verification of protection systems for buildings against hazardous gases
  - Design and performance of a passive dilution gas migration barrier 2002
- Registered inventor for; GB2366504, WO0220186, US2004028475, GB2395103 fluid movement apparatus, trade marked as Virtual Curtain.

Agenda

- Legislation
- Risk Management Concept
- Design Considerations
- Traditional Barrier Methods
- Virtual Curtain System – How Does It Work
- Design Methodology
- Validation Trials
- Case Study
- Summary of Benefits
- Q & A

Legislation

- Part II of the Environmental Protection Act (1990) as clarified by DEFRA's Contaminated Land Statutory Guidance (April 2012).
- National Planning Policy Framework, Paragraph 121 (March 2012)
- Building Regulations Approved Doc Part C: Site Preparation and Resistance to Contaminants and Moisture 2013 version, taking account of Building Regulations 2010 and Building (Approved Inspectors etc.) Regulations 2010 and the 2013 amendments.

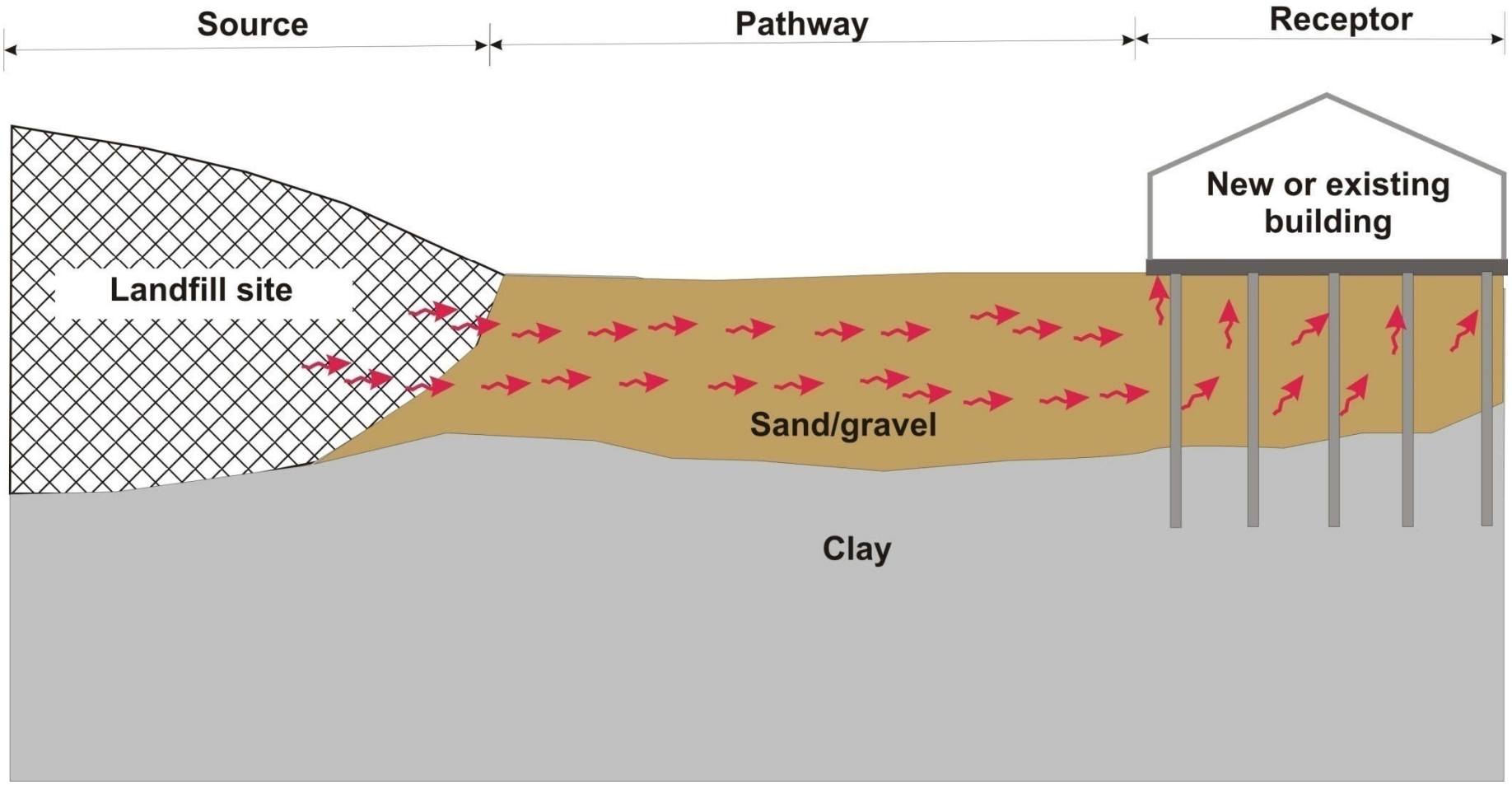
Risk Management Concept

Source

Pathway

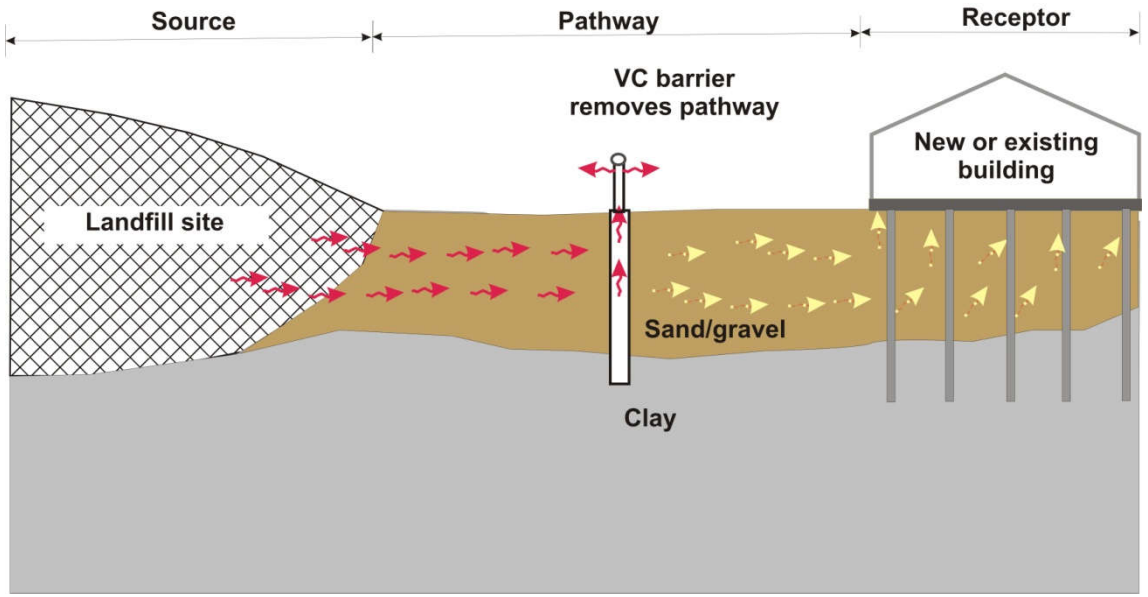
Receptor

Typical Construction Scenario



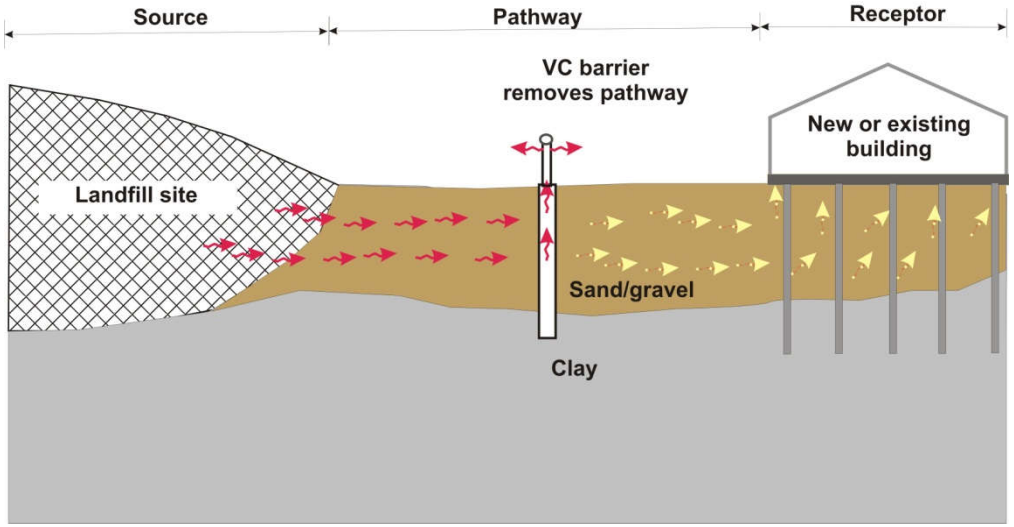
Design Considerations

- Gas regime
- Depth of pathway(s)
- Extent of pathway(s)
- Extent of pathway interception measures
- Proximity of existing and planned development
- Hydrogeology
- Existing and planned services
- Access
- Programme
- Vehicle movements



What Do We Need to Achieve?

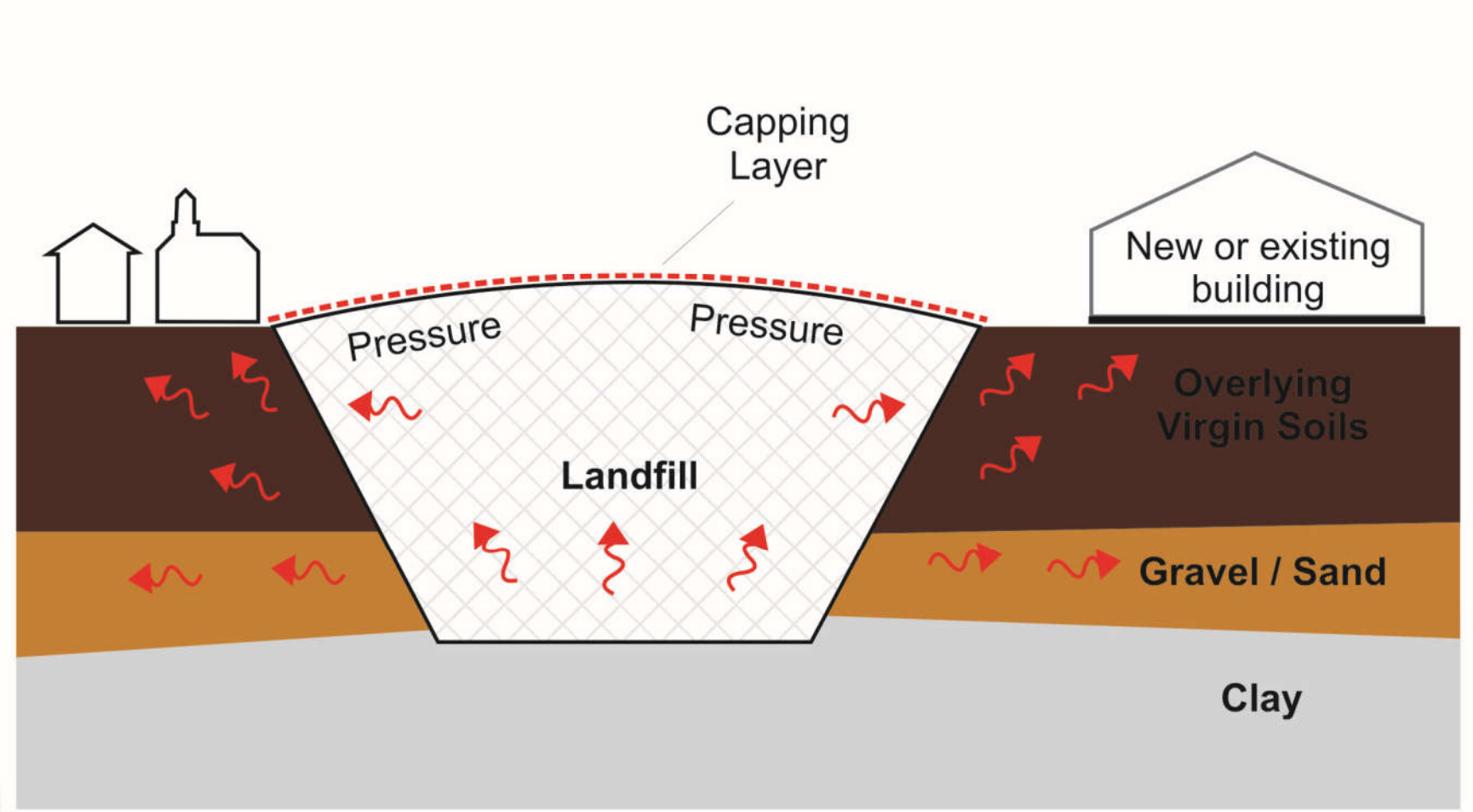
- Reduce risk by intercepting or removing pathway
- Achieve safe construction methods (CDM)
- Observe good environmental practices
- Minimise disruption and loss of amenity
- Avoid damage to existing infrastructure
- Avoid adverse effects on site hydrogeology
- Eliminate/avoid odour nuisance
- Introduce validation/monitoring protocols
- Minimise maintenance requirements
- Cost-effective



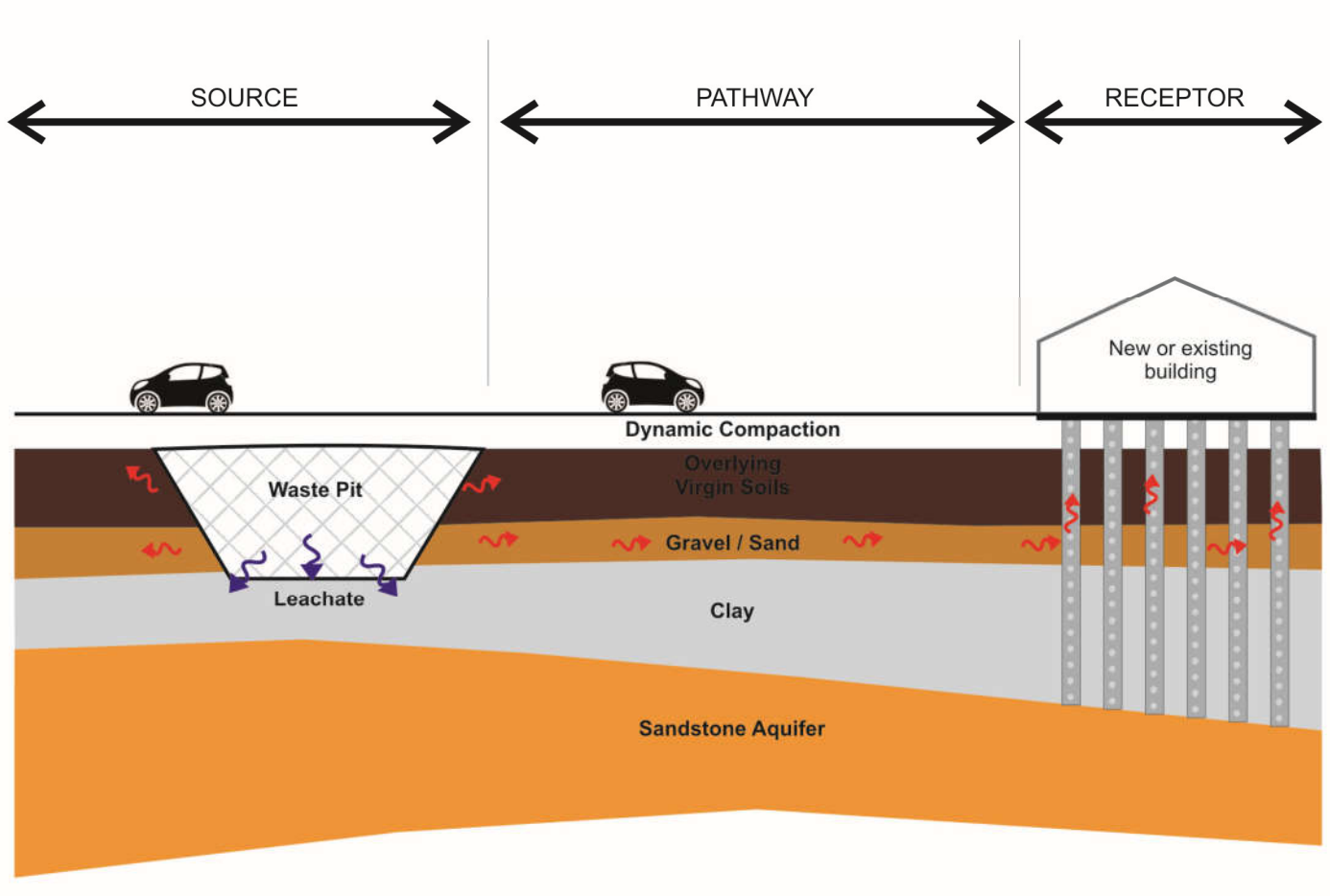
Traditional Interception/Barrier Methods

- Geomembrane
- Gravel Boreholes
- Gravel Trench
- Geocomposites
- Bentonite Slurry Wall
- Active Air Barrier
- Others

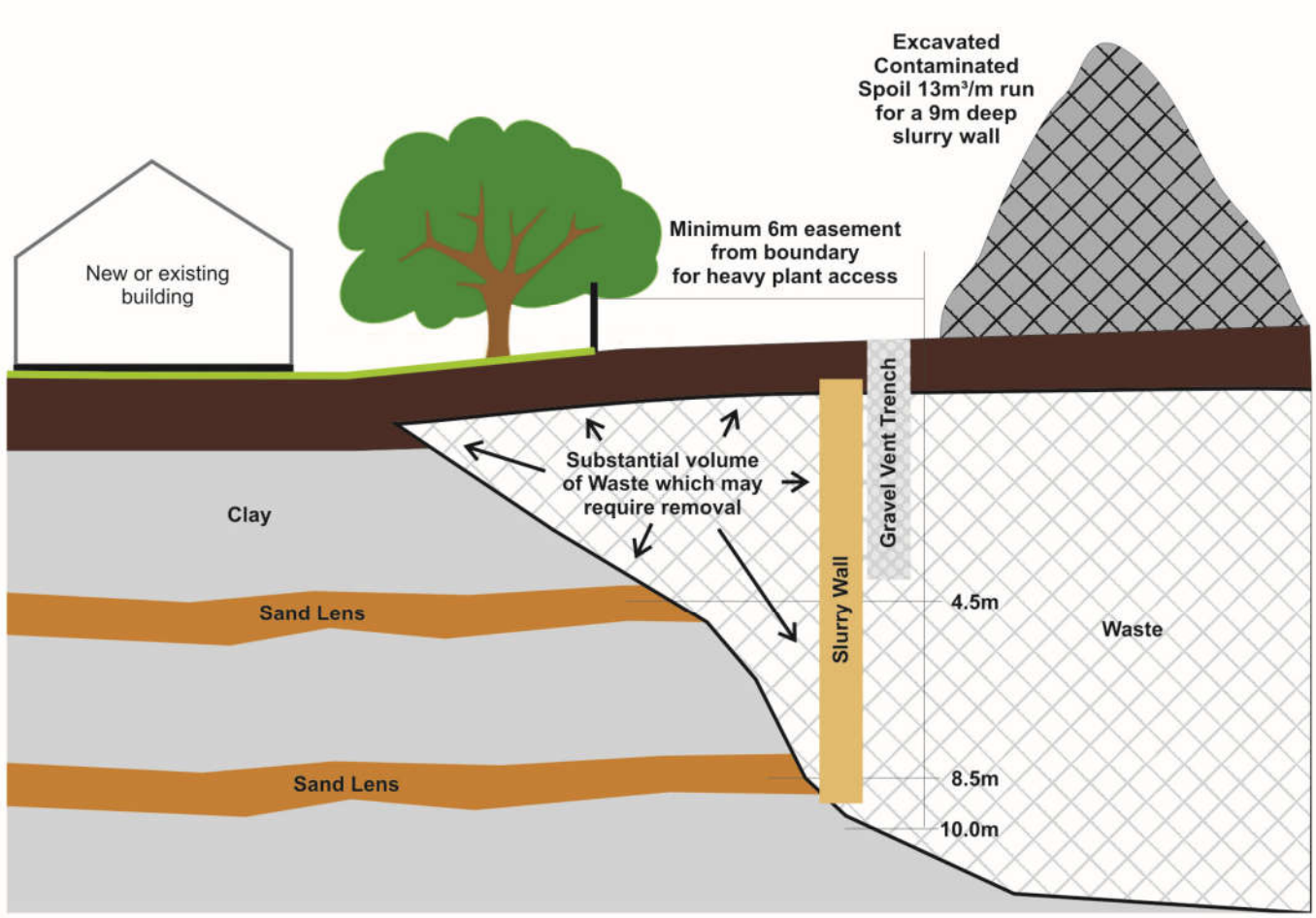
Typical Situation



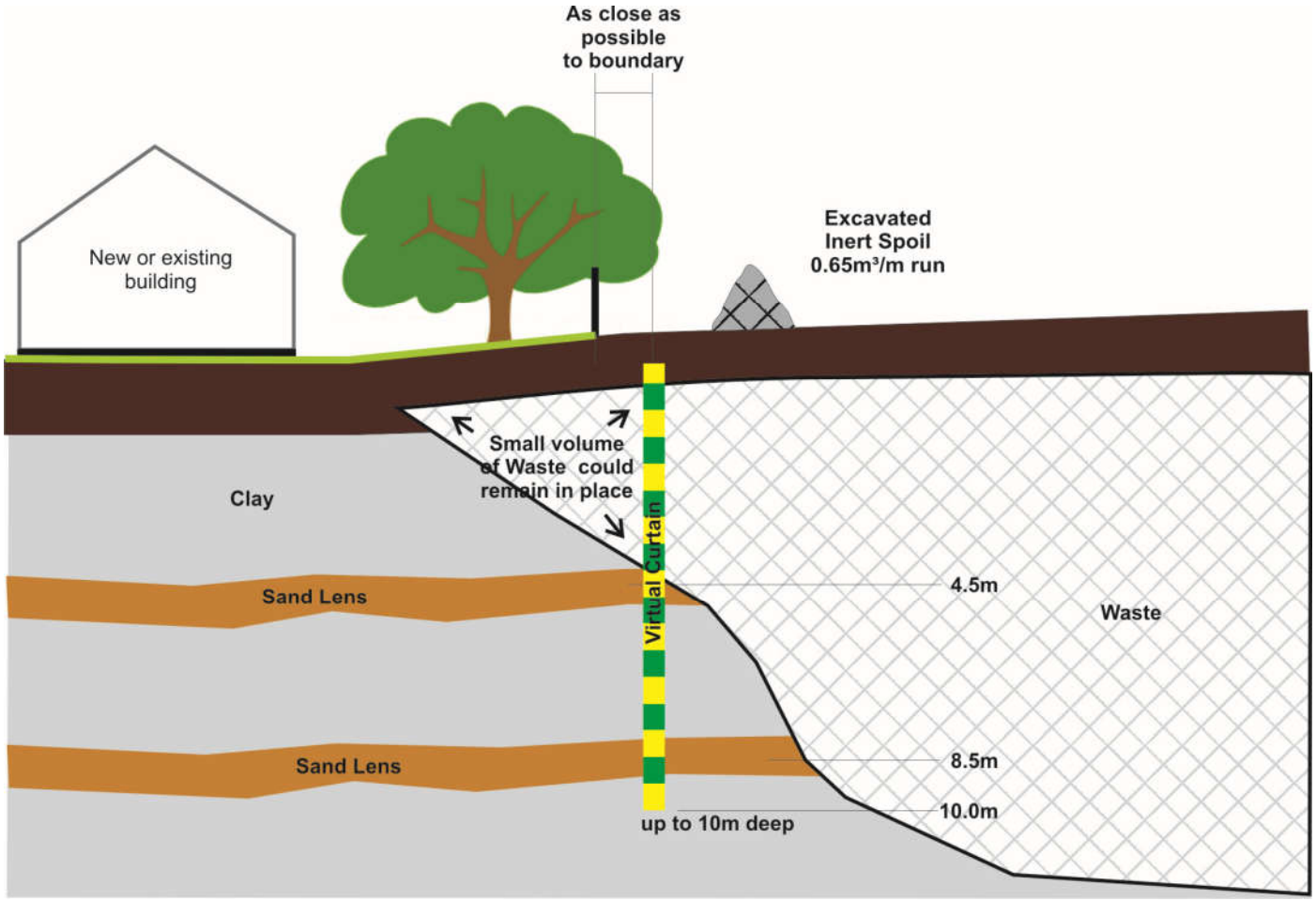
The Effect of Development on Landfill Ground Gases



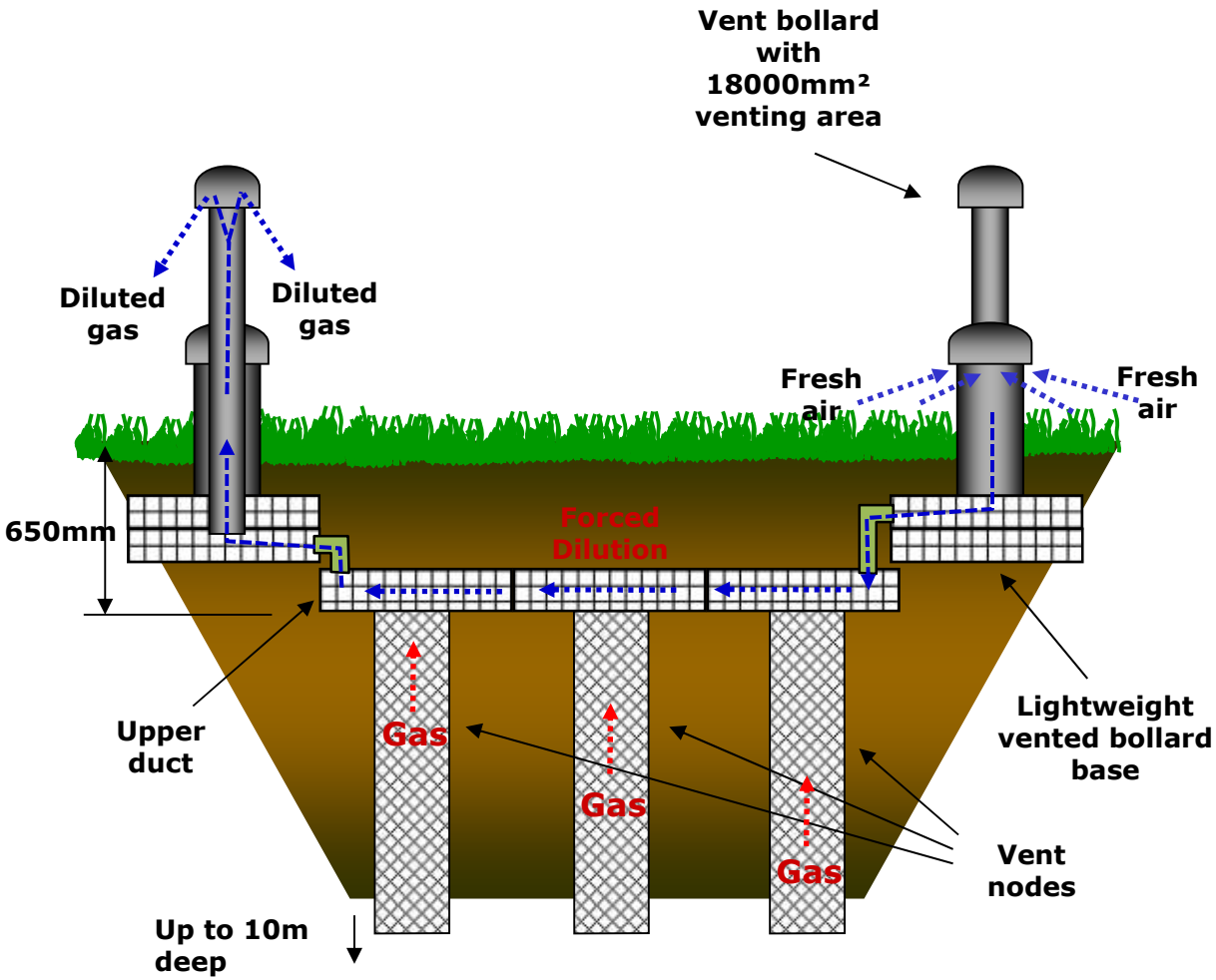
Typical Situation
Using Traditional Methods



Typical Situation
Desired Method

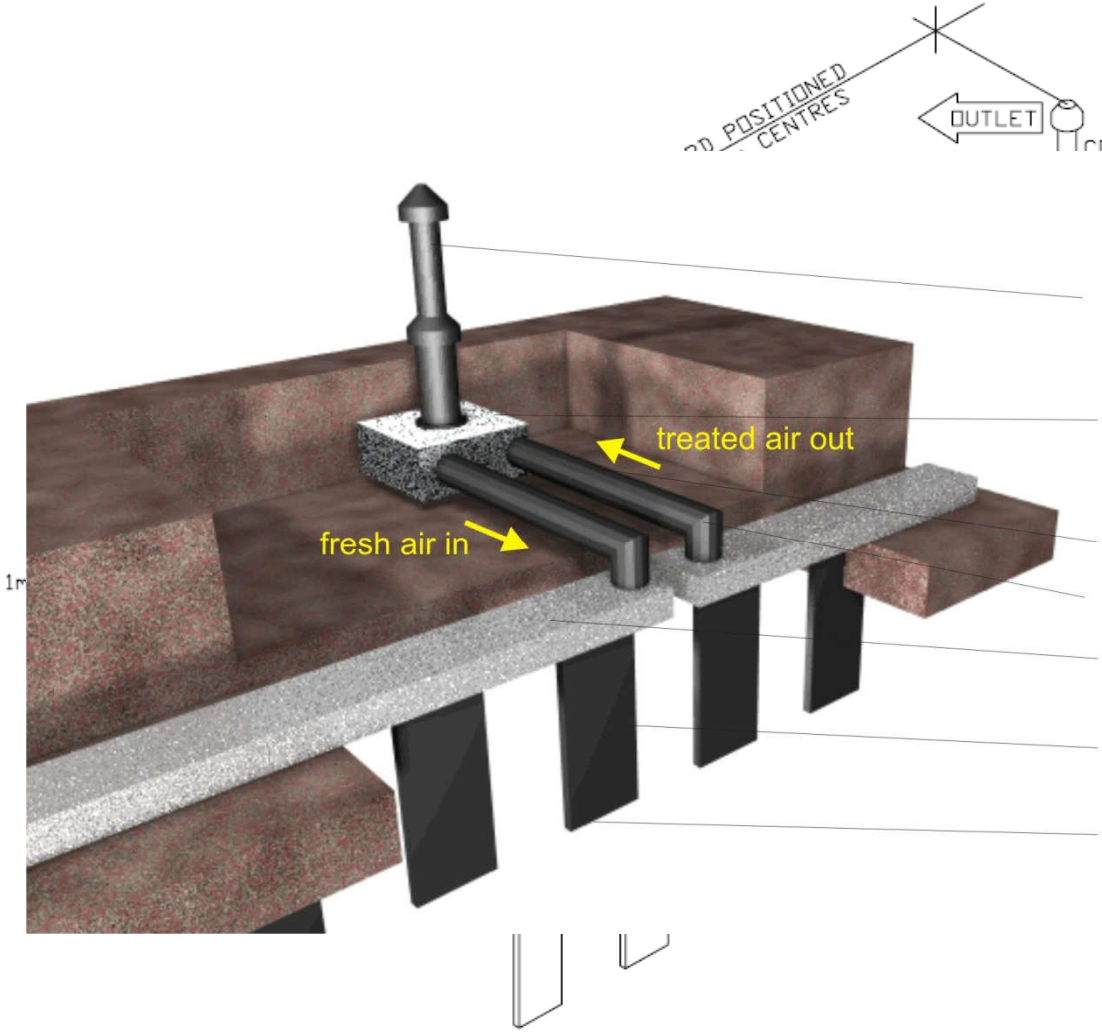


Virtual Curtain
Forced Dilution Principle



- Vibro inserted vent nodes to provide preferential pathway and create low pressure curtain
- Above ground inlet and outlet create differential air flow
- Induces negative pressure within duct and vent nodes that attract migrating gases
- Collects and dilutes gases within upper duct
- Treated gases vented to atmosphere via surface components

Typical General Arrangement



Combination vent bollard 225mm dia. at base section and 150mm dia. top section, requires a recommended 150mm clearance from lower vent to ground level.

Vent bollard base 708x708x300mm deep, requires recommended 325mm cover or 625mm from finished surface to invert.

150mm dia. twinwall gas collection pipework.

150mm twinwall 90degree 500mm bend

Permavoid gas collection duct typically 354mm wide x 150mm deep wrapped in a geotextile

Vent node 410mm x 50mm in section, depth and spacing varies according to design.

Disposable vent node driving shoe

How Does The Virtual Curtain Work

- Provides an effective “curtain” to intercept existing migration pathways.
- Creates air flow through top duct using differential inlet and outlet pressures.
- Disperses and dilutes gases through geocellular duct.
- Controlled dilution of gases to safe levels before releasing to atmosphere through bespoke venting components.
- Creates an alternative engineered preferential pathway.

Installation Process

Outer steel casing inserted using high frequency, low amplitude vibration unit

Installation Process

Outer casing acts as temporary shield

Insert Geosynthetic Vent Node.

Installation Process

Remove Outer Casing

Installation Process

Trim Node to level and prepare geotextile

Pull node flaps through rolled out geotextile

Installation Process

Lay geocellular duct

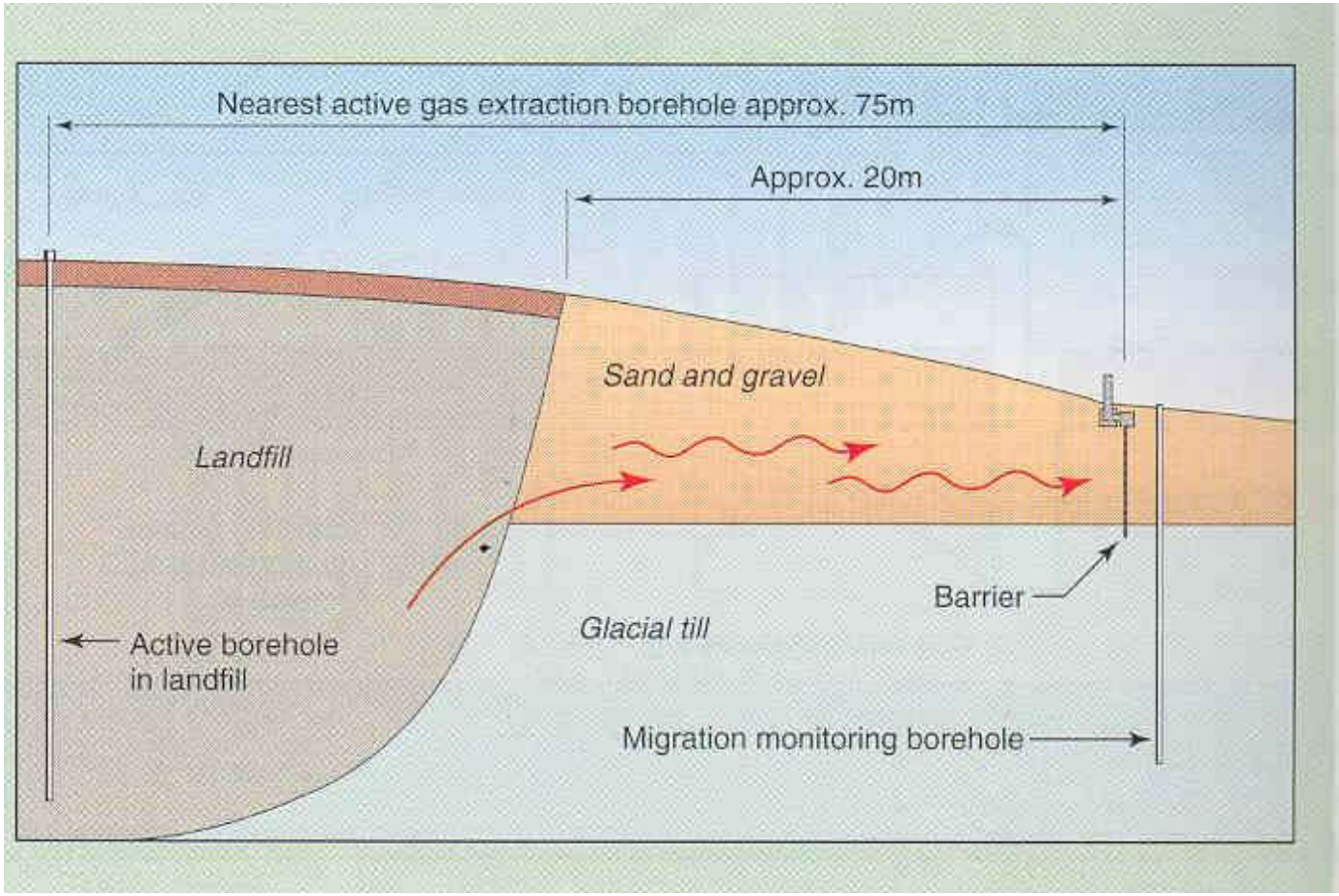
Secure using ties

Installation Process

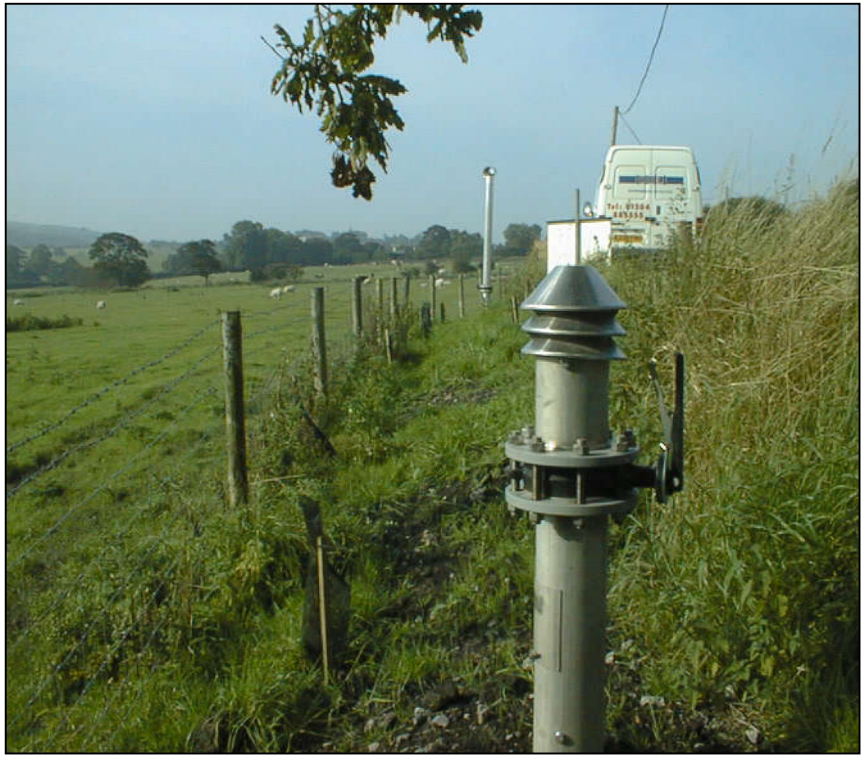
Place prefabricated vent bases

Secure combination vent terminations

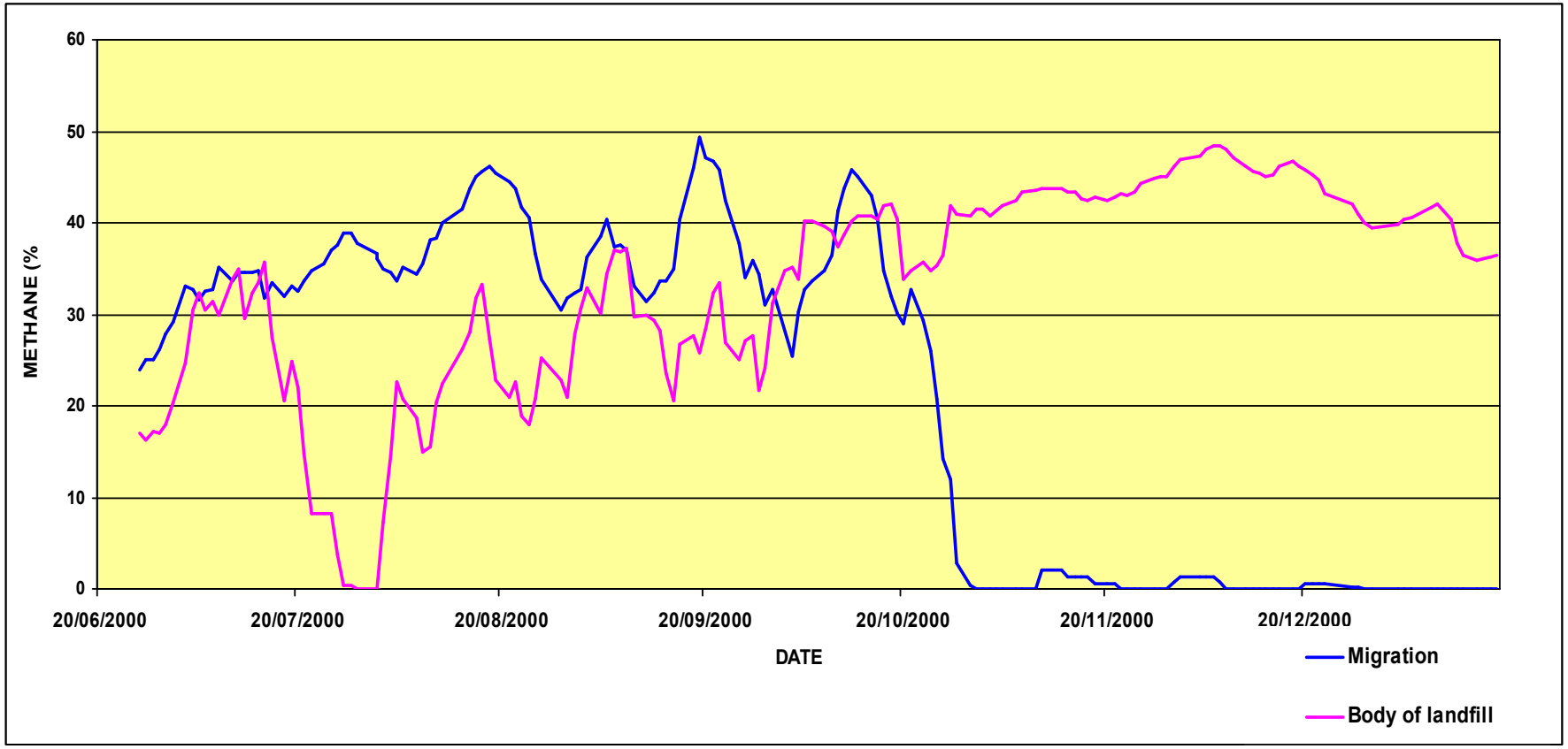
Validation Trial



Validation Trial



Validation Trial Results



Case Study

Scheme: Design, supply and install system to prevent carbon dioxide migration across the site boundary from adjacent landfill site.

Client: Holden Homes

Site: Fishwick, Preston

EHO: Derek Williams Preston B.C.

Date: September 2000

Case Study

Scheme: To effectively isolate the leisure development from the potential migration of gas from the proposed car park area all of which was constructed on landfill.

Client: Kier Southern

Site: Port Solent.

EHO: Portsmouth City Council

Date: 2000

Case Study

Scheme: Intercept migration pathways to prevent gas migration into the housing development. Approx 350m long curtain combination bollards at 5m centres.

Client: Taylor Wimpey

Site: Welwyn Garden City

EHO: Hatfield B.C.

Date: 2005

Case Study

Scheme: To provide an engineered preferential pathway for the controlled dilution to safe levels of ground gases beneath a new park and ride facility.

Client: Highways Agency
Skanska

Site: Scarborough Integrated Transport Scheme, A64 Park and Ride.

EHO: North Yorkshire County Council.

Date: June 2008

Case Study

Scheme: Virtual curtain required to prevent potential gas migration during the capping of an old landfill. A good example to show horizontal alignment versatility.

Client: North Lanarkshire Council.
George Lesley Contractors.

Site: Brownsburn Regeneration Park, South Airdrie.

EHO: North Lanarkshire Council.

Date: June – September 2008

Case Study

Scheme: To eliminate the off site migration of gases due to capping a closed landfill site. “Pressure cooker effect”. This scheme uses interlocking insertion tools to effectively produce a continuous gas curtain.

Client: SITA

Site: Tullos Hill, Aberdeen

EHO: Aberdeen City Council

Date: July 2009

Case Study

Scheme: Virtual Curtain installation to protect existing houses beyond the perimeter of a new school from potential migrating gases emanating during the filling operations during earthworks phase. Commonly known as “squeezing”.

Client: Tameside, Carillion

Site: Tameside BSF.
Ashton Campus.

EHO: Tameside Metropolitan Borough Council.

Date: June 2009

Case Study

Scheme: 3 sections of the virtual curtain to intercept the gas pathway and a grid of standalone pressure alleviation vents within the gassing source. These measures enabled reduced gas protection measures to each dwelling comprising a gas membrane barrier and a sub-floor void ventilated using airbricks.

Client: Halebank Developments

Site: Marsden Avenue, Warrington

EHO: Warrington Borough Council.

Date: December 2015

Case Study

Scheme: To install a pressure alleviation system to alleviate gas pressures within the landfill waste deposits and a Virtual Curtain gas migration barrier to mitigate risks associated with the off-site migration of landfill gas toward existing properties.

Client: Willmott Dixon

Site: Waterside Drive,
Walton on Thames

EHO: Elmbridge
Borough Council.

Date: April 2016

Case Study

Scheme: To install a pressure alleviation system to alleviate gas pressures within the landfill waste deposits of 3 separate cells to allow construction of new film studio production buildings.

Client: Sir Robert McAlpine

Site: Pinewood Studios
Iver Heath

EHO: South Bucks
District Council

Date: Sept 2015 (cells 1+2)
Oct 2019 (cell 3)

Benefits
Engineering & Environmental

- No-dig solution, minimal generation of excavated material.
- Contaminated ground remains in place.
- Reduces demand for aggregate.
- Reduces burden of site traffic on existing roads.
- No dewatering requirements
- No impact on site hydrogeology.
- No impact on existing foundations

Benefits – Health & Safety / CDM

- Minimise exposure to contamination.
- Gas dispersal is controlled and diluted.
- Reduced risk from vehicle movements.
- Shallow excavations.

Benefits – Commercial

- Low mobilisation / start-up costs
- Typical installation (up to) 50m day.
- Eliminate disposal of contaminated material
- Eliminate importation of materials
- Low maintenance requirements

Benefits – Commercial

Extract from recent options analysis for project in NW England 530m long x 10m deep cut-off trench:

Item	Weighting
Health and safety implications.	**2**
Local environment effects. The effect on residents during implementation is an important factor.	**2**
Cost – the proposed remediation must be cost effective.	**1.5**
Long term maintenance – client will require the remediation method to minimize the requirements for long term maintenance and monitoring, which is difficult to guarantee.	**2**
All others.	**1**

Method	Score
Virtual curtain barrier	201
Vent wells	184
Slurry wall	156.5
Active barrier	150
Vent trench	142
Membrane in a trench	139
Active abstraction	127
Internal alarms	122
Excavation and disposal	99

Table 5 Budget costs

Summary of costs						
	Design	**Licenses**	**Construction**	**Monitoring (5 years)**	**Maintenance (5 years)**	**Total**
Excavation and disposal	£83,200	£16,000	£87,194,448	£0	£0	**£87,293,648**
Slurry wall	£41,600	£0	£2,265,323	£0	£0	**£2,306,923**
Vent trench	£41,600	£0	£1,276,265	£0	£0	**£1,317,865**
Vent wells	£41,600	£0	£1,015,706	£0	£0	**£1,057,306**
Membrane in a trench	£41,600	£0	£818,941	£0	£0	**£860,541**
Active abstraction	£83,200	£10,000	£534,900	£24,000	£74,000	**£726,100**
Active barrier	£41,600	£0	475800	24000	74000	**£615,400**
Virtual curtain barrier	£41,600	£0	£502,210	£0	£0	**£543,810**
Internal alarms	£10,400	£0	£225,500	£24,000	£14,000	**£273,900**

Traditional System vs Virtual Curtain System

Which method would he choose? But it’s not up to him; it is up to you!

How to stay in touch

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www.virtual-curtain.com

Thank you

Any Questions?

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