

7 March 2003

Our ref: 0534

Dr RJ Roberts  
Consultant in Public Health Medicine  
North Wales Health Authority  
Hendy Road  
Mold, Flintshire  
CH7 1PZ

Dear Dr Roberts

**Re: Proposed relocation Ysgol John Bright, Llandudno, Conwy.  
Peer review on behalf of North Wales Health Authority of risk assessment and  
remediation proposal reports**

1. Further to our commission from you and relevant contract with Conwy County Borough Council (CCBC Ref DFR/PAS/P.160), we have reviewed the information about the proposed Ysgol John Bright received from Conwy CBC. A list of this information is attached. Technical reports prepared by Komex and Babtie for the Lattice Property Holdings and Council owned parcels of land form the core information concerning the contamination risks on the sites and the proposed remediation and are therefore reviewed in this letter report. The remaining documents are related to various planning applications and correspondence with respect to the proposed School.

*Pre amble*

2. Land Quality Management Ltd is a small company based at the University of Nottingham, that specialises in contaminated land contract research, niche consultancy and specialist training. There is a very close relationship with the Land Quality Management Group of the University which carries out research in contaminated land and brownfield regeneration issues and delivers an MSc course in Contaminated Land Management. Both are headed by Dr Paul Nathanail.
3. LQM staff have been involved in the development of the SNIFFER method used by Babtie at John Bright and in the development of the CLEA Soil Guideline Values and associated CLR reports 7, 9 and 10 that replaced the ICRCCL 59/83 trigger values used by both Babtie and Komex.
4. We have a wide client base ranging from central government (ODPM, DEFRA, DTI, MOD, Scottish Executive), local government (many local authorities),

Environment Agency, SEPA, land owners, and consultants. Much of our work involves supporting local authorities by reviewing reports for Part IIA of the Environmental Protection Act or in support of planning applications.

5. Dr Nathanail founded and heads up the Land Quality Management Group within the University of Nottingham and is founding Managing Director of Land Quality Management Ltd. His research interests span the entire spectrum of contaminated land management from local authority inspection strategies through site characterisation to risk assessment and remedial strategy selection. Increasingly he is involved in research examining the broader social, environmental and economic issues of sustainable brownfield regeneration. He is particularly committed to widening knowledge of the issues involved in contaminated land and in helping widen access to relevant information. He has a first degree in Natural Sciences from Cambridge University and an MSc in Engineering Geology at Imperial College. He also has a PhD in Engineering Geology from University of London (Imperial College) and is a Chartered Geologist and a Specialist in Land Condition.

*Client brief*

6. The following is an extract from our commission:

*“The Welsh Assembly, who are providing PFI finance, have requested the County to provide an assurance that ‘the necessary independent technical expertise will be applied to setting and delivering the appropriate standard for remediation of the site’ in response to local concerns.*

*In order to progress this, the Health Authority Director of Public Health has reached an agreement with the CEO of Conwy County for the Authority to procure an independent review of the proposals.*

*While the Director of Public Health would commission and receive the report, the intention is that the report would then be made available to all interested parties including the local community.*

*All fees would be met by Conwy County.”*

7. The scope of works agreed between Dr Roberts of North Wales Health Authority and Dr Nathanail was to:
  - Review risk assessment report to assess whether:
    - a. the correct pollutant linkages have been identified and the conceptual model of the site is robust;
    - b. the assessment criteria are authoritative, scientifically based and relevant (the tests in Part IIA for guideline values).
  - Review Remediation Proposal report to assess whether the proposed remediation will demonstrably break the identified pollutant linkages.
  - Prepare letter report on the above (this document).
  - Present findings to local liaison group/public meeting (this was fulfilled on Tuesday 25 February 2003).
8. Our commission was based on a number of discussions Dr Nathanail had with staff from Conwy Council and Health Authority and is based on our recommendations of what we believe was needed to allow the Authority to satisfy itself that it had considered the protection of health. Our proposal that this review be shared with members of the public was welcomed with enthusiasm.

*UK Policy on Land Contamination & Technical Guidance*

9. The UK has a long history of industrial activity stemming from the birth of the industrial revolution. For a variety of technical, legal and social reasons, past industrial and waste disposal activities have left us with a legacy of land affected by contamination. Government policy evolved during the 1970s and 1980s and culminated in 1994 with '*Framework for Contaminated Land*'. Legislation has since been put into place to identify and urgently manage historically contaminated land to ensure it is fit for its current use, to remediate land affected by contamination that is to be redeveloped, and to prevent or remove new pollution.
10. The key legislation is Part IIA of Environmental Protection Act 1990 (inserted by s57 of Environment Act 1995) and associated statutory guidance published by the Welsh Assembly. Part IIA came into effect in 2001.
11. UK policy on land contamination is based on ensuring that unacceptable risks are identified and mitigated to ensure land is suitable for its current use and, for redevelopment sites, for its intended use. Risks are assessed by considering whether there are sources of contamination that can reach specific receptors (people, water, ecosystems etc) along pathways. Such source-pathway-receptor relationships are called pollutant linkages.
12. Key technical guidance on the assessment of risks to human health was published by DEFRA and the Environment Agency in March 2002. The guidance represents a shift in the way certain toxic effects (non threshold effects) are assessed (CLR 9) and in the provision of data on UK populations, diets, soil conditions, building construction etc (CLR 10). A software model, CLEA, has been used to develop generic Soil Guideline Values, exceedance of which should trigger either remediation or further site specific assessment of exposure to contaminants. Unfortunately SGV for only eight substances (6 metals, arsenic and selenium) have been published to date. The guidance documents and CLEA

software can be downloaded from the DEFRA website ([www.defra.gov.uk](http://www.defra.gov.uk)). Further information on CLEA is available from the Environment Agency ([www.environment-agency.gov.uk](http://www.environment-agency.gov.uk) then search for CLEA).

13. There is a wide range of other technical guidance dealing with the characterisation, assessment and remediation of land contamination from many bodies. British Standard BS 10175:2001 requires the development of a conceptual model showing source-pathway-receptor relationships and uncertainties. The Environment Agency ([www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)) commissions and produces many R & D reports, some of which can be downloaded free from their website while others are on sale from the Environment Agency web bookshop. CIRIA ([www.ciria.org.uk](http://www.ciria.org.uk)) publishes information mainly aimed at the construction industry and has helped raise the standard of contaminated land practice. The US Environmental Protection Agency (US EPA) ([www.epa.gov](http://www.epa.gov)) provides a very wide range of technical information through its web site. There is a plethora of other technical information available from many sources.
14. The Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL) published a series of guidance documents, two of which have been cited in the consultants reports reviewed:
  - ICRCL 59/83 Guidance on the assessment and redevelopment of contaminated land. 2<sup>nd</sup> ed, July 1987
  - ICRCL 18/79 Notes on the redevelopment of gasworks sites. 5<sup>th</sup> ed, April 1986.
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15. ICRCL 59/83 2<sup>nd</sup> edition has long been the basis for many contaminated land risk assessments. In 1990 the House of Commons Select Committee on the Environment identified problems with ICRCL 59/83 guidance in their report on contaminated land. In December 2002, DEFRA formally withdrew ICRCL 59/83 ([www.defra.gov.uk/environment/landliability/pubs.htm#2a](http://www.defra.gov.uk/environment/landliability/pubs.htm#2a)). Both Komex and Babbie have referred to this document in their reports we have received. Komex also made reference to ICRCL 18/79 in setting some of their site limits. While this document has not been withdrawn by DEFRA, the scientific basis of the contaminant concentrations it presents is far from clear. DEFRA do say that “It is hoped to review other ICRCL publications as resources permit with a view to updating and re-presenting their content where still appropriate”.

*Contaminants associated with Gasworks and Landfill sites*

16. Gasworks contaminants can pose a range of threats to human health and the environment. Contaminants associated with former gas works include:
  - Heavy metals (Cd, Cr, Cu, Pb, Hg, V, Zn),
  - Semi metals/non metals (As S<sup>0</sup>),
  - Cyanide (complex, free/liberatable),
  - Organics (phenol, aromatics, PAH) and
  - Others (SO<sub>4</sub><sup>2-</sup>, S<sup>2-</sup>, asbestos, pH).
17. The development of North Sea natural gas supplies marked the end of the manufactured town gas industry and the redundancy of over 1000 gas works around the country that supplied their local communities with gas for lighting,

heating and cooking purposes. Urban development has resulted in many of these sites being in residential areas and many have been redeveloped for a wide variety of end uses (including housing, retail, leisure).

18. Contaminated land issues at landfill sites include:

- Landfill gas generation;
- Leachate generation;
- Presence of a complex mixture of waste potentially containing wide variety of contaminants.

#### *Assessment criteria*

19. Assessment criteria are used by risk assessors to help them decide if the contaminants of a site are likely to pose an unacceptable risk to relevant receptors. The criteria represent estimates of concentrations of contaminants that would not pose an unacceptable risk. The test for using assessment criteria under Part IIA is that they be authoritative, scientifically based and relevant to the site circumstances. In a redevelopment context one objective must be to avoid creating statutory “contaminated land” as defined in Part IIA. Assessment criteria may be:

- Generic (e.g. Drinking Water Standards, Soil Guideline Values (NB there are no SGVs for Schools) or
- Site specific (calculated using site parameters e.g. Batie’s use of SNIFFER or RBCA).

20. Representative contaminant concentrations are compared against either generic or site specific assessment criteria. Assessment criteria are:

- Land use specific: determines receptors, behaviour and relevant pathways
- Medium specific: soil vs water

21. Where unacceptable risks are found, remediation is needed. Such remediation should demonstrably break all source-pathway-receptor pollutant linkages.

Remediation could

- Remove or destroy the source of contamination,;
- Interrupt the pathway or;
- Change the land use to remove the receptor.

#### *The site*

22. The site comprises three parcels of land. A former gas works and liquefied petroleum gas storage facility owned by Secondsite<sup>1</sup> and investigated by Komex, a former council depot also investigated by Komex and a former landfill site investigated by Babbie.

#### *Former Secondsite parcel of land*

23. The Secondsite (former Liquefied Petroleum Gas store) parcel is underlain by made ground and gasworks structures over alluvial/estuarine deposits. Shallow perched groundwater is present in the superficial deposits over non aquifer. The general groundwater flow is to the east. This parcel of land will contain part of a

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<sup>1</sup> Secondsite were formerly known as Lattice Property Holdings and before that was part of British Gas.

school building, but will be hard surface car park/footpaths and some soft landscaping.

24. The Komex Environmental Assessment report on the LPH site (50067-7 July 2001) covers desk study and intrusive investigations about the Secondsite owned parcel of land. It contains assessment criteria, a qualitative and quantitative risk assessment and a proposed remediation scheme. .
25. Overall this is a detailed competent report that identifies the key issues expected on site of this type. General levels of contamination were low with local hotspots (free cyanide and PAH) associated with specific structures and post decommissioning waste disposal. Water levels in and out of tanks differed showing that the tanks did not leak or leaked very slowly. There were however several deficiencies in the Komex report, the most pertinent of which are summarised below.
26. The Komex report should have had three signatures: 1 (that of the Junior Author) is missing, 1 (that of the Project Director) is 'pp'd' and 1 (that of the Project Manager) is present.
27. The rationale behind the site investigation (sampling and analytical strategies) is poorly explained in the text. It appears to be principally targeted at known features – eg tar tanks etc. 312 locations were sampled at 19 trial pits and 12 boreholes. This is equivalent to an average spacing of some 20m. This is in accordance with guidance in BS 10175:2001. 63 soil samples were analysed and three for leachability. Many of the soil analyses were not UKAS accredited whereas most of the water and leachability analyses were accredited. The report disingenuously claims a UKAS accredited laboratory was used, when in fact laboratories are accredited for individual analytical methods.
28. Although there is no conceptual model as such, a plan and cross section show the distribution of materials and structures across the site. In the review copy, Figure 6 was missing (purported to show distribution of contaminants).
29. The assessment criteria Komex used (their Table G) are drawn from a variety of sources. The non scientific approach to selecting assessment criteria is understandable given the lack of UK guideline values even today for most of the substances of concern. Nevertheless the potential for unsuitable materials to be reused on site and a pathway to site users remaining/being created cannot be discounted on the basis of the information in the Komex report. Komex have compared analytical results to 'selected hardcover type landuse guidelines as these match the present and future site use' (p 18). This does not allow for the possibility of any soft landscaping areas leaving site soils that are below the site assessment criteria but above criteria determine using the guidance in CLR 9 & 10 at or near the surface where children could come into contact with them.
30. Overall the selected assessment criteria are poorly justified and are now out of date.
  - ICRCL 18/79 1986 cited in references

- ICRCCL 59/83 was withdrawn Dec 2002 but has been considered out of date for some time.
  - No UK guidelines exist even today for many of these substances.
  - No use of risk assessment models was made to calculate site specific parameters.
31. By inspection only, the criteria for polyaromatic hydrocarbons (PAH), easily liberatable cyanide and toluene, ethyl benzene and the xylenes (TEX) seem high.
32. The Komex remediation proposals involve excavation and off site disposal (the most common remediation technique in the UK) and the use of caps to break pathway (probably the second most common). However, the extent of areas requiring remediation is poorly justified. The report does not propose the removal of the gas holder contents.

*The Council owned parcel of land (Council Depot, Cwm Road)*

33. The Komex Environmental Assessment SI Report to CCBC (50067 - 8 July 2001) describes the site investigation and risk assessment of the council depot site. The Council owned parcel of land (Council Depot, Cwm Road) was formerly part of the gas works and an asphalt works. The site is underlain by thin Made Ground in a depression over Alluvium. There are locally elevated total PAH and TPH associated with the garage and the above ground gas holder A. This land will contain part of a school building, soft landscaping and car parking.
34. The site investigation rationale is poorly explained. For example, there appears to be no total petroleum hydrocarbon (TPH) analysis in Trial Pit 3 where strong diesel odour was detected. Trial Pit logs make no use of the space to summarise visual and olfactory contamination even though the detailed sample descriptions do make reference to hydrocarbon odours.
35. The location of the diesel/petrol tank found by EAC is not shown or apparently considered in the report<sup>2</sup>.
36. The borehole and trial pit logs contain examples of poor logging practice. For example the log of BH 01-1 log refers to the TP2 log for details of made ground even though the two appear to have been logged by different individuals. The highest TPH concentration of 14,000ppm was encountered in TP1 sample 1/3 (0.05 – 0.1m). However, the log of TP1 does not show sample 1/3 or the depth from which it was collected.
37. There is no conceptual model as such but the information on sources and pathways is there. There is poor focus on future site users, greater emphasis is given to nearby residents. A cross section shows two drains at 3m AOD in natural ground. This is surprising as most drains would have involved excavation of a trench which would be infilled with made ground/fill and should not be shown as natural deposits (Alluvium in this case).

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<sup>2</sup> Komex verbally reported the tank to have been a now-removed above-ground diesel tank and a trial pit was excavated in its vicinity (telecon Arch/Nathanail 25.2.03)

38. There is a recommendation for further SI after demolition of the buildings<sup>3</sup>.
39. It is unclear from the report in what way the ‘hard cover and residential land uses ... most closely match the present site usage and proposed future use of the site as a school/parking’ (p 13). In particular CLR 10 differentiates between residential land use with and without consumption of homegrown vegetables. It is also unclear from the report why a similar approach was not adopted by Komex for the Secondsite parcel.
40. No details of groundwater assessment criteria are provided. General references are made to UK Environmental Quality Standards and Predicted No Effect Levels (PNEC) for PAH. It is unclear why for PAH, PNEC values were used for groundwater but EQS values for leachability tests (p 16).
41. Furthermore, assessment criteria are drawn from various sources:
- Soil: current practice, Canadian MUST, ICRCL 59/83
  - Groundwater: EQS, DWS, PNEC
42. The use of total PAH does not represent ‘best practice’ as of 2001. While the standard of ‘best practice’ is not one that can be reasonably expected, the use of ‘total PAH’ in 2001 was potentially not good practice either. The Canadian MUST 1991 were not best practice in 2001 (TPH CWG more up to date).
43. It is also unclear why guidelines for residential use are presented here but not for the Secondsite parcel<sup>4</sup>.
44. The Komex remediation proposals for the council depot involve:
- Excavation and off site disposal (the most common remediation technique in the UK)
  - Use of caps to break pathway (probably the second most common).
45. The extent of remediation areas is poorly justified. It is unclear how the extent of Area A and B was determined. The extent of area C (around the tar pit) is not shown on the remediation plan. The way the depths to which the remediation should extend were determined in an unclear way.

*Former landfill site*

46. This Council owned parcel of land was considered in the ‘Babtie Site remediation statement’. The land was formerly a:
- Landfilled waste tip
  - Waste transfer station,
  - Playing field,
  - Refuse destructor and
  - Partially infilled clay pits.

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<sup>3</sup> Although no evidence of this was supplied, Komex have said that EAC conducted window sampling after demolition (telecon Arch/Nathanail 25.2.03).

<sup>4</sup> It is understood from Komex that the reason for citing residential criteria was due to some uncertainty about the intended use of this part of the site (telecon Arch/Nathanail 25.2.03).

47. It will contain most of the school buildings (of which only a small part of the sports hall will be over the known landfill), playing fields (mainly over landfill), and soft landscaping. A considerable area of existing surface area is proposed to remain as soft landscaping/informal play area.
48. The analytes that were encountered include total petroleum hydrocarbons (TPH). The reports do not refer to analysis of BTEX (benzene, toluene, methylbenzene and ethyl benzene) or chlorinated solvents.
49. Landfill gas at high concentrations was encountered. Maximum reported concentrations were 69% CH<sub>4</sub>, 21.5% CO<sub>2</sub>. The report contains an inconsistent interpretation of the consequences of LFG (p 9 no change at perimeter due to redevelopment; p 19 need for gas migration barrier between two schools as gas may migrate to junior school after redevelopment).
50. The use of SNIFFER and RBCA to calculate site specific assessment criteria represented good practice at the time of the report but both are no longer current. Dutch guidelines were used for groundwater.
51. The criterion for PAH is based on multiplying up the criterion for BaP (p 22). It appears that the assessment criterion for BaP was scaled up to a total PAH criterion using the fraction of BaP in the PAH at the site. This effectively ignores the toxicity of all other PAHs and is not in accordance with practice at the time of the report. Only naphthalene has been assessed separately but naphthalene is one of the least toxic PAHs.
52. It is unclear why drinking water standards were not used as assessment criteria. The test in Part IIA is whether or not pollution of controlled waters is occurring or is likely to occur – ie entry of ANY polluting matter. Benzene is referred to as being present above Dutch values and other contaminants above UK drinking water standards. It is unclear why both sets were used.
53. The remediation proposal made by Babbie involves excavation and off site disposal (the most common remediation technique in the UK) and the use of caps to break the pathway (probably the second most common). The use of a landfill gas barrier is also common practice in the UK.

#### *Discussion*

54. All three reports address the need to protect the occupants of future school buildings and grounds. None contains a conceptual model in the sense of BS 10175:2001 or the DETR & Environment Agency Guidelines for Environmental Risk Assessment, although they do contain sufficient information to allow the spatial relationships between contaminants and receptors to be ascertained.
55. The assessment criteria used would not be appropriate for the local authority to use in fulfilling its responsibilities under Part IIA of the Environmental Protection Act 1990. There are inconsistencies in the approaches adopted by the two consultants and by Komex for the two parcels of land they assessed. Babbie did develop site specific assessment criteria using tools current at the time of their

report but rendered obsolete in March 2002 with the release of CLR 9 and CLR 10 guidance from DEFRA and the Environment Agency.

56. The proposed remediation strategy is capable of demonstrably breaking most of the identified pollutant linkages.
- Cover system will break pathway between contaminants at depth and children and people at the surface
  - Most of the school buildings are not above the area of refuse disposal, however some high methane concentrations were encountered beneath the proposed school footprint.
  - The passive and active gas protection measures proposed for the school are adequate and industry standard. Of course the key for their long term efficacy is in their proper maintenance.
  - The gas migration barrier should prevent lateral migration of gas to underneath both the proposed secondary school buildings and the existing primary school.
  - However the use of inappropriate assessment criteria could result in unsuitable material being left in place at/near the surface or being replaced after being found to be below the site assessment criteria thereby allowing contact with school children and other people.
57. Overall the site has been thoroughly investigated but the reports could have been better compiled. The assessment criteria used by both consultants are out of date. The remediation scheme involves techniques that are commonly applied in the UK. The remediation is capable of demonstrably breaking the identified pollutant linkages at the proposed school site.

### *Conclusions*

58. I believe that the exercise of public consultation, such as the meeting on 5 February 2003, should have been carried out some time ago. The approach taken in investigating and remediating the proposed site represents commonly applied technologies. The use of barriers to prevent contact with contaminants is used in many residential and commercial redevelopments.

### *Recommendations*

59. The assessment criteria should be reviewed, and if necessary revised, in light of the guidance in CLR 9 and CLR 10.
60. A meeting to establish a technical consensus on the way forward should be convened to ensure that sufficient evidence is being collected about the remediation to demonstrate its effectiveness and to ensure that the new school and its grounds would not fall under the definition of contaminated land in Part IIA. The process of public consultation and information should be continued. Consideration should be given to organising an open day to the remediation works to allow parents and future parents the opportunity to see for themselves the works being undertaken at the proposed school site.
61. The proposed ways in which the remediation is to be verified should be reviewed before the end of the remediation and while there is still the opportunity to collect additional evidence if necessary.
62. Remediation completion reports should be independently reviewed to ensure the site is demonstrably safe for use as a school.
- 63.

Yours sincerely

**Dr C Paul Nathanail**  
**For and on behalf of Land Quality Management Ltd**

## **LIST OF REPORTS RECEIVED FROM CONWY COUNTY BOROUGH COUNCIL**

1. BAPTIE GROUP: *John Bright School Llandudno Site Remediation Statement Volume I*. BPS 051224.007. July 2001, Revision A, August 2001
2. BAPTIE GROUP: *John Bright School Llandudno Site Remediation Statement Volume II*. BPS 051224.007. July 2001, Revision A, August 2001
3. KOMEX CLARKE BOND LIMITED *Environmental Assessment Site Investigation Report: Llandudno Storage Facility, Maesdu Road, Llandudno*. Report 50067-7. July 2001
4. KOMEX CLARKE BOND LIMITED *Environmental Assessment Site Investigation Report: Council Depot, Cwm Road, Llandudno*. Final interpretive report. Report 50067-8. July 2001
5. KOMEX CLARKE BOND LIMITED *Remediation Documents for the Former Gaswork at Maesdu Road, Llandudno*. Final Report. Report 50067-9/10. July 2001
6. BAPTIE GROUP: *John Bright School Llandudno Planning Summary*. BPS 051224.012. August 2001
7. ENTERPRISE EDUCATION. *Application for planning permission 0/25380. Reserved matters relating to outline permission 0/23328*. 11<sup>th</sup> October 2001.
8. CONWY CBC *Correspondence relating to Planning Consultation. Correspondence forming part of planning committee submission for committee determination 20<sup>th</sup> December 2001*. File Copies. 25<sup>th</sup> September 2001 – 19<sup>th</sup> December 2001