



## Ground Gas Investigation Interpretative Report

Project Mensa Additional Ground Gas Investigation,  
Project Mensa, AWE Burghfield, Berkshire

AWE plc

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Planning & Development

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## Executive Summary

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An additional programme of gas monitoring has been undertaken within the Mensa Development area to provide a more robust dataset for the assessment of risk posed by the presence of potentially harmful ground gases. Previous gas monitoring within the Mensa Development area has indicated elevated levels of carbon dioxide to be present.

It was originally planned that the additional monitoring programme would include 17 No. of the existing monitoring installations within the development area. However a site audit found that of these 17No. installations, only four were in a serviceable condition. RPS were then instructed by AWE to install shallow monitoring wells at three additional locations within the footprint of the proposed Mensa building.

In total, 4No. fortnightly rounds of gas monitoring were undertaken on the four remaining and three new installations, in general accordance with CIRIA C665 (Ref. 1).

The data from the additional monitoring was combined with the previous monitoring data to form the basis of a ground gas risk assessment.

Carbon dioxide was recorded in the majority of borehole installations, with a maximum concentration of 14.9%. Methane was recorded on one occasion only, with a concentration of 1%. Flow rates were predominantly negative during the monitoring programmes, but a maximum flow of 5.3 l/hr was recorded in Borehole BHGM-001, coinciding with a carbon dioxide concentration of 4.3%.

The gas risk assessment, undertaken in line with CIRIA C665 and BS8485 (Ref. 2) has given the following classifications:

- Characteristic Gas Situation 2 (CS2), 'Low Risk' for carbon dioxide; and
- Characteristic Gas Situation 1 (CS1), 'Very Low Risk' for methane.

On the basis of this risk assessment, gas protection measures are considered to be required to be installed in new buildings.

# 1 Introduction

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## 1.1 Background

RPS Planning and Development (RPS) have been requested by AWE plc to undertake an additional ground gas monitoring programme to support the AWE Project Mensa development.

Previous gas monitoring (*Ref. 3*) has identified the presence of elevated levels of carbon dioxide in the shallow soils (London Clay), with a maximum concentration of 14.9%. Methane has only previously been recorded on occasion, with a maximum concentration of 1.0%, within the Mensa development area.

An additional gas monitoring programme has therefore been undertaken to provide a more robust dataset to allow a better understanding of the gas regime. This dataset would therefore be used to determine the requirement for gas protection measures within the proposed structures, in line with CIRIA C665 (*Ref. 1*) and BS8485 (*Ref. 2*). Locations of monitoring wells are provided on *Drawing JER3996-GM-001a*.

Prior to the commencement of the gas monitoring programme, a site audit by RPS revealed that of the 17No. standpipes that were selected for monitoring (*Ref. 4*), only 4No. remained in a serviceable condition. Therefore RPS were instructed by AWE to install three new shallow monitoring wells in the footprint of the proposed Mensa building to be incorporated into the monitoring programme. The details of these monitoring wells are recorded in the *Factual Report (Ref. 5)*.

## 1.2 Key Objectives

The key objectives of this report are:

- To assess risks associated with the presence of ground gas in line with CIRIA C665 (*Ref. 1*) and BS8485 (*Ref. 2*); and
- Provide recommendations on the requirements for gas protection measures within structures, if required.



### **1.3 Report Structure**

The remainder of the report is structured as follows:

*Section 2: Site Setting Summary;*

*Section 3: Monitoring Methodology and Results;*

*Section 4: Ground Gas Risk Assessment; and*

*Section 6: Recommendations and Conclusions.*

## 2 Site Setting Summary

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### 2.1 Introduction

This section of the report summarises the site setting of the main Mensa development area at AWE Burghfield, which includes a description of the site and its surroundings, the regional geology, hydrogeology and hydrology where relevant.

### 2.2 Site Location and Description

#### 2.2.1 General

AWE Burghfield is located approximately 0.5 km east of Burghfield village and 6km to the south-west of Reading. The National Grid Reference for the site centre is approximately 468000 168000. AWE Burghfield is around 264 acres in size and roughly rectangular in shape. The topography of AWE Burghfield is relatively flat with a general slope from south (46.5 mAOD) to north (42.5 mAOD).

AWE Burghfield is an operational facility, operated by AWE plc to produce explosives, explosive devices and assemble weapons associated with AWE operations in their capacity to maintain the UK nuclear weapons capability. Consequently, some areas of AWE Burghfield are nuclear licensed. AWE Burghfield comprises areas containing occupied and unoccupied buildings and structures used for a variety of purposes including offices, laboratories and testing facilities, fuel and chemical storage, maintenance and workshops.

Concrete roadways and paths allow access to the various buildings and structures. Much of AWE Burghfield also comprises soft landscaped areas mainly with grass cover with some semi-mature trees interspersed across the site.

Access to AWE Burghfield is from the north-west, via the road called 'The Mearings'. AWE Burghfield is surrounded by a high security fence and is subject to strict security controls. The eastern, southern and western edges of AWE Burghfield are bounded by roads.

A small stream, Burghfield Brook, flows along the southern and eastern edges of AWE Burghfield. Furthermore a second stream lies some 200m north of the AWE Burghfield site boundary.

The general site area is shown on *Drawing JER3860-GCTO-001c*

### 2.2.2 General Description of Gas Monitoring Area

At the time of the monitoring, the Mensa development area comprised an active demolition site, with a number of the former buildings and associated hardstanding having been demolished. A number of concrete stockpiles associated with the demolition activities were located within the general site area.

The ground surface predominantly comprised wet clay that had been heavily rutted during the demolition activities.

## 2.3 Geology

The British Geological Survey (BGS) 1:50,000 Sheet 268 geological map and 1:10,000 SU 66 NE geological map indicates that the site is underlain by the sequence presented in Table 2.4.

*Table 2.4 General Geological Sequence*

Soil Type	Description	Likely Thickness
London Clay	Stiff grey clays overlying beds of silty sands, clayey sands, clays and sandy clays.	10-13m
Reading Beds	Grey and brown sands and sandy clays.	18-27m
Upper Chalk	Soft white nodular chalk with flint seams.	90-130m

Previous investigations undertaken within the central Mensa Development area have typically recorded a thin (<1m) band of Made Ground overlying London Clay to a depth of around 14.0 mbGL (metres below ground level). The London Clay tends to comprise stiff brown and grey clay and is directly underlain by the Reading Beds.

## 3 Monitoring Methodology and Results

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### 3.1 Introduction

The additional gas monitoring exercise was designed in accordance with CIRIA C665 (*Ref. 1*) and BS8485 (*Ref. 2*) to allow a more robust assessment of risk posed by the presence of ground gases located within or close to the Mensa Facility Development.

Initially it was proposed to monitor 17No. existing boreholes within the Mensa Facility Development and surrounding 50m buffer, namely Boreholes BH113, BH114, BH2A007S, BH2A008D (G), BH2A011S, BH2A012D (G), BH2A019S, BH2A020S, BH2A021S, BH2A022D, BH2A023D, BH2A024D (G), WS2A033 (M), WS2A056 (M), WS2A060 (M), WS2A073 (M), WS2A521 (M). These boreholes were to be monitored four times at fortnightly intervals, the results of which would be combined with the existing monitoring data to enable the assessment to be undertaken.

Prior to undertaking the gas monitoring works, a site audit was undertaken by RPS to ascertain the serviceability of these gas monitoring installations. Of the installations listed above, it was found that only Boreholes BH113, BH2A011S, BH2A012D (G) and BH2A020S were in serviceable condition.

On this basis, RPS were instructed by AWE to install new gas monitoring wells to a depth of 6.0mbGL at three locations within the footprint of the proposed Mensa building, as described in the *Factual Report (Ref. 5)*.

The locations of all gas monitoring installations are shown within *Drawing JER3996-GM-001a*.

### 3.2 Gas Monitoring Results

#### 3.2.1 Introduction

Four rounds of gas monitoring were undertaken within the all installations within the Mensa Development area, between 1<sup>st</sup> September and 16<sup>th</sup> October 2008. The results of the recent monitoring are included within *Appendix A* and the results of the previous rounds of monitoring are included in *Appendix B*.

### **3.2.2 Atmospheric Pressure**

The atmospheric pressure ranged between 1007 and 1021Mb, with the highest pressure recorded during the second monitoring round on 19<sup>th</sup> September.

The atmospheric pressures recorded during the previous monitoring rounds undertaken on the 17No. existing installations varied between 993 and 1031Mb.

### **3.2.3 Flow Rates**

The soil gas flow rate data recorded included peak and average soil gas concentration readings per monitoring visit. The peak soil gas concentrations identified have been utilised in calculation of 'worst case' scenarios on site.

Peak flow rates during the recent gas monitoring ranged between -11 l/hr and +5.3 l/hr in Boreholes BH113 and BHGM-001 respectively. Both of these readings were obtained during the first round of additional monitoring (1<sup>st</sup> September 2008) where an atmospheric pressure of 1008-1009Mb had been recorded.

The peak flow rate of 5.3 l/hr from Borehole BHGM-001 on 1<sup>st</sup> September 2006 was indeed the only positive flow rate recorded during the entire recent gas monitoring programme, with flow rates varying between -0.4 and 5.3 l/hr at this location.

Peak flow rates recorded during previous monitoring rounds varied between -1.9 and 0.91 l/hr. The minimum peak flow rate of -1.9 l/hr was recorded in Boreholes BH113 and BH114, both on 8<sup>th</sup> June 2004. The maximum peak flow rate was recorded in Borehole BH2A021S on 1<sup>st</sup> September 2005.

### **3.2.4 Methane**

Methane was not recorded in any of the borehole installations during the more recent gas monitoring programme.

Methane was recorded once during the previous monitoring rounds, within Borehole BH2A021S where a concentration of 1.0% recorded on 8<sup>th</sup> August 2005.

### 3.2.5 Carbon Dioxide

Carbon dioxide was recorded in each of the boreholes installations during the recent gas monitoring programme, with a maximum peak concentration of 4.5% recorded in Borehole BHGM-001 on 19<sup>th</sup> September 2008, during the second monitoring round.

During the previous monitoring rounds, a maximum carbon dioxide concentration of 14.9% was recorded in Borehole BH2A021S on 1<sup>st</sup> September 2005.

### 3.2.6 VOCs

The presence and measured concentrations of Volatile Organic Compounds (VOCs) vapours within the borehole installations during the recent gas monitoring programme appears to be variable. During the first round, peak VOC concentrations ranged between 0ppm (Borehole BHGM-002) and 259ppm (Borehole BH2A020S). During the second round, a peak concentration of 0.9ppm was recorded within Borehole BHGM-001 and during the third round, no VOCs were recorded in any of the installations. The fourth monitoring round recorded VOCs to be present in Borehole BH2A011S (peak concentration of 8.5ppm) and Borehole BH2A012D(G) (peak concentration of 77.2ppm).

It is considered likely that the variability of these readings may be as a result of variable levels of atmospheric moisture, which may induce the PID to give false readings.

The previous gas monitoring data only records 7No. occurrences where VOCs have been detected within the installations. A maximum peak concentration of 20.7ppm was recorded in Borehole BH113 on 12<sup>th</sup> November 2003.

### 3.2.7 Oxygen

With respect to oxygen concentrations, 'peak' levels of oxygen recorded during the recent gas monitoring programme ranged between 20.8% and depleted down to 13.7%. Two exceptions to this were recorded during the second monitoring round on 19<sup>th</sup> September 2008, where 'peak' oxygen concentrations of 0.4% and 0.9% were recorded in Boreholes BH113 and BHGM-003

respectively. At the same time within BHGM-003, a nitrogen reading of 99% was recorded.

During the previous monitoring rounds, the 'peak' concentrations of oxygen were recorded to vary between 0% and 21.9%. The oxygen concentration of 0% was recorded in Borehole BH2A007S on 11<sup>th</sup> July 2005.

### **3.2.8 Hydrogen Sulphide**

No hydrogen sulphide was recorded in any of the borehole installations during the recent and previous gas monitoring programmes.

### **3.2.9 Carbon Monoxide**

Carbon monoxide has been recorded only once during the recent and previous gas monitoring programmes.

A peak concentration of 20ppm was recorded within BHGM-003 during the first round of the recent gas monitoring. The absence of carbon monoxide within the later monitoring visits may suggest that this result is erroneous.

## 4 Ground Gas Risk Assessment

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### 4.1 Ground Gas Assessment Criteria

In the UK, current guidance on the assessment of landfill gases is derived primarily from the recently updated British Standard, BS 8485 2007 (*Ref. 2*) and the CIRIA Report C665 (*Ref. 1*). Previous guidance has also been referred to in the assessment of ground gas risks to the development including *Waste Management Paper 27 (Ref. 6)* which is updated by *Guidance on the Management of Landfill Gas (Ref. 7)*. Section C1 of the *Building Regulations 2000* also sets out assessment and mitigation requirements for new buildings. The Building Regulations require that a risk assessment approach is adopted to determine whether gas protective measures are required to protect development from ground gases.

The *Guidance on the Management of Landfill Gas (Ref. 7)* identifies environmental benchmarks for methane and carbon dioxide concentrations above background levels that require a qualitative or semi-qualitative assessment.

For the purposes of this report in order to identify the potential risk posed by ground gases the criteria of 1% methane and 1.5% carbon dioxide have been adopted to allow an initial assessment of the collected data. Where concentrations exceed these 'threshold' levels, a qualitative risk assessment is undertaken as detailed in the following sections.

### 4.2 Methane Initial Screening Assessment

Methane was recorded in one instance only during the recent and previous gas monitoring programmes, with a concentration of 1% recorded in Borehole BH2A021S, lying at the environmental benchmark.

### 4.3 Carbon Dioxide Initial Screening Assessment

During the recent gas monitoring programme, carbon dioxide was recorded above the 1.5% environmental 'threshold' on four occasions, with a maximum concentration of 4.5% recorded in Borehole BHGM-001. Furthermore three of



these four instances were recorded in Borehole BHGM-001, suggesting a potential gas source at this location. The corresponding borehole log (within *Ref. 5*), records rootlets to be present within the London Clay, hence the natural degradation of organic matter within this stratum may be the cause of the elevated carbon dioxide here.

In total, the 1.5% 'threshold' for carbon dioxide has been recorded on eleven occasions during the previous monitoring exercise, with a maximum concentration of 14.9% recorded in Borehole BH2A021S. The corresponding borehole log for this location does not indicate an obvious source of carbon dioxide but this may also be due to the natural degradation of organic material within the London Clay.

#### **4.4 Summary of Risk to On Site Receptors from Ground Gases**

The gas monitoring dataset has generally recorded low levels of ground gas within the Mensa Development area. Maximum concentrations of 1% methane and 14.9% carbon dioxide have been recorded, and in the absence of any obvious sources this is likely attributable to the natural degradation of organic material within the London Clay.

Gas Screening Values (GSVs) have been derived in accordance with CIRIA C665 (*Ref. 1*) to assess the risk posed by the elevated carbon dioxide and the presence of methane at the environmental benchmark level. The derivation of the GSVs are summarised in *Table 4.4*, and have been calculated using the following equation:

$$\text{Gas Concentration \% / 100} \times \text{Gas Flow (l/hr)} = \text{Gas Screening Value (l/hr)}$$

The GSV is synonymous with the Hazardous Gas Flow rate as outlined in BS8485 (*Ref. 2*).

In accordance with BS8485, it is appropriate to consider borehole gas flow rates and concentrations on a location by location basis where there is a comprehensive dataset and the combination of historical and recent gas monitoring data provides a robust dataset, which has been used for this risk assessment.

Table 4.4 Gas Screening Value Summary

Monitoring well ID	Gas Type	Peak Concentration (%)	Peak Flow Rate (l/hr)	Gas Screening Value (l/hr)	CIRIA C665 Characteristic Situation
BH2A021S	Carbon Dioxide	14.9	0.91	0.13559	CS2 'Low Risk'
BHGM-001	Carbon Dioxide	4.5	5.3	0.2385	CS2 'Low Risk'
BH2A021S	Methane	1	-0.3 (taken as 0.1 for purpose of risk assessment)	0.001	CS1 'Very Low Risk'

Based on the soil gas monitoring results overall, the following risks have been identified to the Mensa Facility Development:

- Carbon Dioxide: **Low Risk** (mitigation measures required);
- Methane: **Negligible Risk**;
- Hydrogen Sulphide and Carbon Monoxide: **Negligible Risk**; and,
- VOCs: **Negligible Risk**.

That is, based on the soil gas monitoring data reviewed, no significant quantities of methane are being generated by natural soils or Made Ground at the site. No hydrogen sulphide was detected and therefore this gas does not require additional assessment or consideration.

A maximum carbon monoxide concentration of 20ppm was recorded in Borehole BHGM-003 during the first round of recent gas monitoring. Based upon the fact that carbon monoxide has not been recorded in this borehole since, and has not been recorded in any other installation throughout the whole monitoring period, it is likely that this positive reading is erroneous.

Carbon dioxide fluxes based on the peak concentrations and flow rates for Boreholes BHGM-001 and BH2A021S are slightly elevated and according to the CIRIA guidance, the site would be classified as Characteristic Situation 2 where suitable protection will be required.

Levels of VOCs during the monitoring period appear to be variable, with a maximum concentration of 259ppm recorded in Borehole BH2A20S during the first round of recent gas monitoring. It is suspected this value may be erroneous due to the effect atmospheric moisture may have on the PID monitoring equipment, and that there was no indication of hydrocarbon contamination noted during the monitoring and no obvious source of contamination. It is considered likely however that where gas protection measures are adopted to mitigate the risk posed by carbon dioxide, these will also mitigate against any potential risk posed by VOCs.

#### **4.5 Summary of Risk to Off Site Receptors from Ground Gases**

As outlined in *Section 4.4* the risks presented from all potentially hazardous ground gases (methane, carbon monoxide, hydrogen sulphide, VOCs and carbon dioxide) have been demonstrated to be low to negligible.

Only one significant (>1 l/hr) flow rate was recorded during the recent monitoring programme and this associated with an elevated concentration of carbon dioxide. All other flow rates were either negative or 0 l/hr, and low flow rates (<1 l/hr), have been recorded during the previous rounds of gas monitoring in the Mensa Facility area.

Given the very low permeability soils in the area, and low generation rates, it is considered unlikely that significant off site migration would occur therefore the risk to off site buildings or receptors from ground gas is considered negligible.

## 5 Recommendations and Conclusions

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### 5.1 Conclusions

An additional programme of gas monitoring has been undertaken within the Mensa Facility to provide an increased dataset on which a detailed assessment could be based, to determine the requirement for gas protection measures for any new development.

The gas monitoring and assessment has identified the following key findings:

- Over the entire monitoring period, a maximum carbon dioxide concentration of 14.9% was recorded;
- Methane has been recorded on one occasion only, with a concentration of 1%;
- Flow rates have been recorded to be predominantly negative over a range of atmospheric pressures. A maximum flow rate of 5.3 l/hr was recorded, coinciding with a carbon dioxide concentration of 4.3%;
- Variable concentrations of VOCs were encountered, with a maximum concentration of 259ppm;
- No hydrogen sulphide was recorded and only one carbon monoxide concentration was recorded at 20ppm;
- A CIRIA Characteristic Gas Situation (CS2) has been determined for the site (**Low Risk**), based upon peak concentrations of carbon dioxide and flow rates recorded in Boreholes BHGM-001 and BH2A021S. On the basis of this classification, the overall risk is considered to be low but gas protection measures will be required to protect the development;
- A CIRA Characteristic Gas Situation (CS1) has been determined for methane (Very Low Risk), based upon the concentration and flow rate recorded in Borehole BH2A021S on 8<sup>th</sup> August 2005;

- The risk to the Mensa development from VOCs, hydrogen sulphide or carbon monoxide is considered to be negligible;
- The risk to off-site receptors from ground gas considered to be negligible, given the low permeability of the underlying ground conditions and London Clay.

## 5.2 Recommendations for Gas Protection Measures

The ground gas risk assessment undertaken in *Section 4* has concluded that the presence of carbon dioxide poses a Low Risk to the Mensa development, as per CIRIA C665 (Ref. 1), based on a Characteristic Gas Situation CS2 for carbon dioxide and CS1 for methane.

The scope of protection measures to address the risk posed by the presence of carbon dioxide, in line with *Table 8.6* of CIRIA C665, may comprise one or more of the following for an Office / Commercial / Industrial development:

- Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200g DPM<sup>2</sup>; or
- Beam and block or pre cast concrete slab and minimum 2000 g DPM / reinforced gas membrane; or
- Possibly underfloor venting or pressurisation in combination with either option above, depending on use.
- All joints and penetrations are to be sealed.

The scope and design of the gas protection measures can be fully refined following final foundation design details for the development.

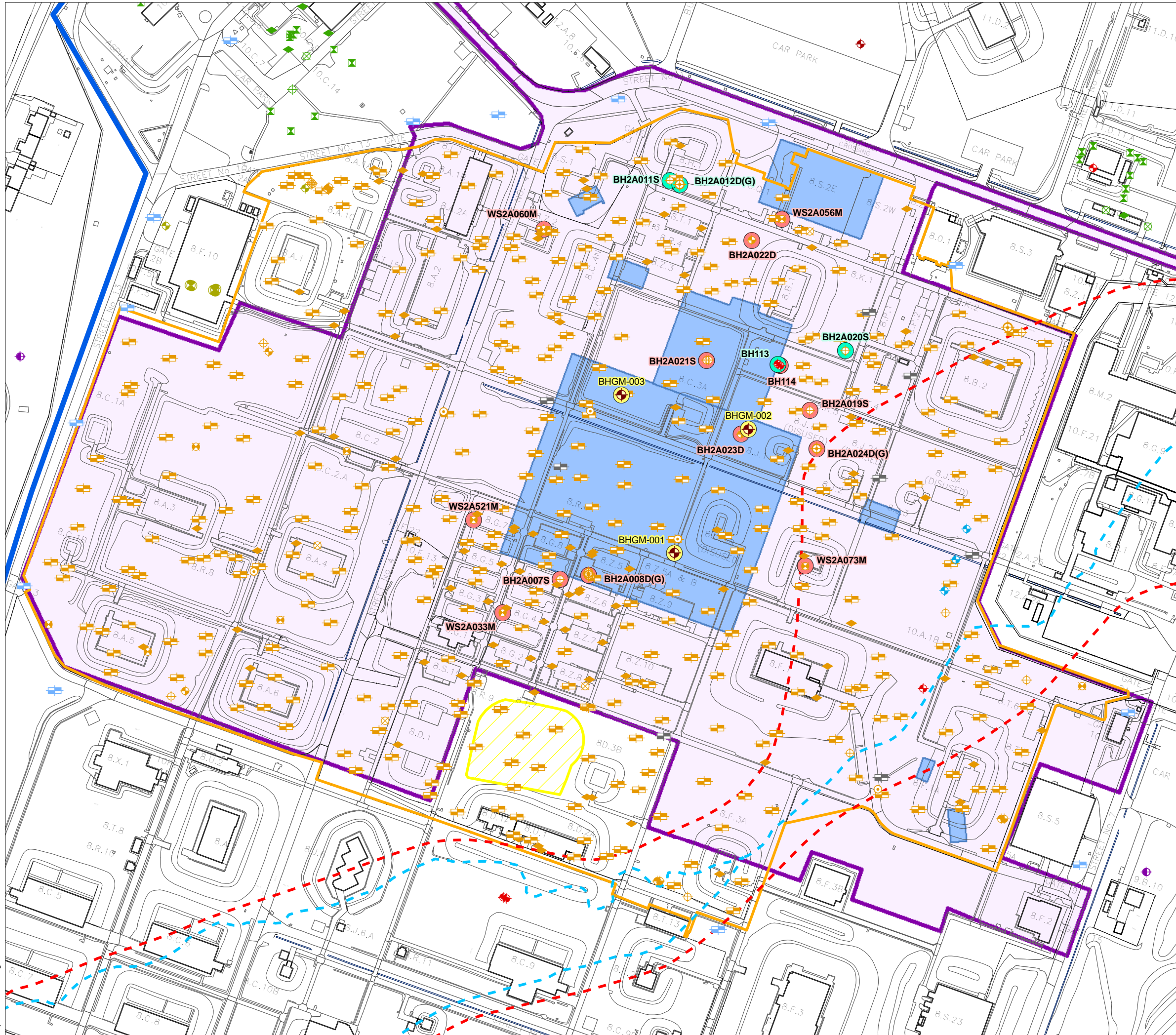
## 6 References

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- 1 CIRIA Report C665. Assessing risks posed by hazardous ground gases to buildings. 2007.
- 2 British Standards Institution BS 8485: Code of Practice for the characterization and remediation from ground gas in affected developments.
- 3 RPS, Ground Conditions Technical Report, Project Mensa Development, AWE Burghfield, JER3860/Mensa/GCTR, Rev 0, April 2008.
- 4 RPS Ground Investigation Proposal, Project Mensa Additional Site Investigation – Mound 1 Delineation and Gas monitoring, Rev 0, July 2008
- 5 RPS Factual Report, Project Mensa Additional Site Investigation – Gas Monitoring, Rev 0, October 2008.
- 6 HMSO Waste Management Paper 27. The Control of Landfill Gas, 1995.
- 7 Environment Agency, Guidance on the Management of Landfill Gas (2004).

## Drawings

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- LEGEND**
- Mensa Application Area
  - AWE Burghfield Fence Line
  - Burghfield Brook (Former Course)
  - Approximate Extent of Alluvium Boundary on BGS 1:10,000 Geology Map
  - Phase 2A Demolition Area
  - Mound 1
- Gas Monitoring Locations**
- Lost / Destroyed / Not Servicable
  - Previous Installation
  - New Installation
- Investigation Locations**
- ⊕ Borehole with Monitoring Well
- Previous Investigation Locations**
- Octans Investigation (2007)**
- ⊕ Borehole with Monitoring Well
- Gate 22 Investigation (2006)**
- ⊕ Trial Pit
- Dynamic Soil Properties Investigation (2005)**
- ⊕ Borehole
- Building 8F10 Ground Investigation (2005)**
- ⊕ Borehole
  - ⊕ Window Sample & Dynamic Probehole Location
- Phase 2A Demolition Area LQA (2005)**
- ⊕ Borehole with Monitoring Well (Deep)
  - ⊕ Borehole with Monitoring Well (Shallow)
  - ⊕ Probehole with Monitoring Well
  - ⊕ Probehole
  - ⊕ Geotechnical Borehole with Monitoring Well (Deep)
  - ⊕ Rotary Borehole
  - ⊕ Trial Pit
  - ⊕ Sediment Sample
- Phase 1 Demolition Area LQA (2005)**
- ⊕ Borehole with Monitoring Well (Shallow)
  - ⊕ Probehole
  - ⊕ Hand Dug Pit - Geophysical Anomalies
  - ⊕ Sediment Sample
- Gas Ring Main Investigation (2004)**
- ⊕ Trial Pit
- Initial Characterisation Survey LQA (2003-2004)**
- ⊕ Borehole with Monitoring Well
- Soil Mechanics Investigation (1994)**
- ⊕ Borehole with Piezometer

Rev:	Date:	Amendment:	Name:	Checked:
A	22/09/08	Surveyed Locations, 2008 Basemap	RJ	GM

■ Data Source: RPS 2008  
 Status: PRELIMINARY

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■ Client: AWE Plc  
 Project: Mensa Additional Ground Investigation

Title: Gas Monitoring Locations

Scale: A3 @ 1:2,000  
 0 0.04 0.08km

Date: 07/07/2008 Datum: OSGB36 Projection: BNG  
 Drawn: RJ Checked: GM Job Ref: JER3996

■ Figure No: JER3996-GM-001a Revision: A

Project Ref: J:\Drawings\JER3996





### Legend

- AWE Burghfield Fence Line
- Mensa Application Area
- Mound 1

#### Mensa Facility Development & Ancillary Buildings

- Energy Centre
- Main Process Facility
- Support Facility
- Intake Substation
- Additional Buildings

#### Previous Investigation Areas

- CMR Application Site Area
- Phase 1A Demolition Area
- Phase 2A Demolition Area

For further detail of the Mensa Facility Development please refer to drawings:  
 B.MENSA-MOT-00-GF-DRW-CE-CB-00101 (Rev P5) and;  
 B.SITE-MOT-00-GF-DRW-CE-CB-00101 (Rev P14) and;  
 243405\_AE\_GA001 (Rev P6).

C	30/09/08	Revised Mensa Boundary & Mound 1	RJ	GM
B	25/07/08	Revised Mensa Boundary & Buildings	RJ	SJ
A	17/03/08	Revised Mensa Boundary	RJ	SJ
Rev:	Date:	Amendment:	Name:	Checked:

■ Data Source: RPS 2008  
 Status: PRELIMINARY

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■ Client: AWE Plc  
 Project: Project Mensa

Title: Mensa Application Site Area including Previous Investigation Areas

Scale: A3 @ 1:5,000  
 0 0.125 0.25 km

Date: 11/10/2007 Datum: OSGB36 Projection: BNG  
 Drawn: RJ Checked: SJ Job Ref: JER3860

■ Drawing No: JER3860-GCTR-001c Revision: C

Project Ref: J:\Drawings\JER3860

## Appendices

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## Appendix A

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### Recent Gas Monitoring Data









## **Appendix B**

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### **Previous Gas Monitoring Data**



Investigation	Borehole	Round	Date	Atmospheric pressure (mB)	Air Temperature	Peak flow (l/hr)	Average Flow (l/hr)	Peak VOC (ppm)	Average VOC (ppm)	Peak CH4 (%)	Air CH4 (%)	Peak CO2 (%)	Air CO2 (%/v)	Peak O2 (%)	Air O2 (%/v)	dP (Pa)	Peak LEL (%)	Peak H2S (ppm)	Peak CO	N2	GW (mB/TIC)	Base (mB/TIC)	Correcto n to GL	Eastings (m)	Northings (m)	Level (mAOOD)	Borhole Pressure (mB)	Depth to Gwr BGL (m)	Depth to Well Base BGL (m)	Gwr Level (mAOOD)	Well Base Level (mAOOD)	PID Average	Top of Response Zone 12	Top of Sand/silt	Time	Comments			
Initial LGA	BH114		15.10.03	1024	16.0	0								20.8							7.32	17	0.09				1024	7.41		36.924									
Initial LGA	BH114		12.11.03	1010	13.5	0		2.1						20.9							8.38	16.3	0.09				1010	8.47		35.864									
P2A	BH2A007(S)		09/09/2005	1010	24.9	0		0	0.00	0.00				19.40		0	0	0.00	0.00							467940.99	168013.21	45.073	1010	2.64	6.17	42.433	38.903						
P2A	BH2A008(DG)		11/07/2005	1025	29.5	0		0	0.00	0.00				19.40		0	0	0.00	0.00							467939.82	168007.42	45.069	1025	9.50	19.000	35.569	28.069						
P2A	BH2A008(DG)		08/08/2005	1014	21.2	0		0	0.00	0.00				20.20		0	0	0.00	0.00							467939.82	168007.42	45.069	1014	8.63	19.03	36.439	26.039						
P2A	BH2A008(DG)		05/09/2005	1008	18.9	-0.1		0	0.00	0.00				21.10		0	0	0.00	0.00							467939.82	168007.42	45.069	1008	9.70	19.25	35.249	25.699						
P2A	BH2A008(DG)		12/07/2005	1025	22.0	0		0	0.00	0.00				20.60		0	0	0.00	0.00							468005.10	168224.76	44.526	1024	8.94	15.850	36.155	29.655						
P2A	BH2A021S		06/09/2005	1003	17.9	-0.1		0	0.00	0.00				21.40		0	0	0.00	0.00							468019.42	168130.58	45.195	1003	5.50	5.91	39.595	39.175					PURGED	
P2A	BH2A022D		08/09/2005	1016	26	0		0	0.00	0.00				20.00		0	0	0.00	0.00							468043.72	168194.82	44.359	1016	8.51	16.05	35.849	28.309						
P2A	BH2A022D		11/07/2005	1027	25.6	-0.31		0	0.00	0.00				20.60		0	0	0.00	0.00							468043.72	168194.82	44.359	1027	8.37	16.860	35.989	27.489						
P2A	BH2A023D		11/07/2005	1025	22.3	0.01		0	0.00	0.00				21.10		0	0	0.00	0.00							468037.97	168091.10	44.529	1025	8.81	17.410	35.719	27.119						
P2A	BH2A024D		11/07/2005	1027	23.5	0.1		0	0.00	0.00				20.30		0	0	0.00	0.00							468078.47	168083.17	44.171	1027	8.36	19.000	35.811	25.171						
P2A	WS2A056(M)		09/09/2005	1008	26.7	0		0	0.00	0.00				20.50		0	0	0.00	0.00							467910.19	167995.30	45.123	1008	0.69	3.06	44.423	42.063						
P2A	WS2A056(M)		05/09/2005	1008	17.5	0.1		0	0.00	0.00				21.20		0	0	0.00	0.00							468006.79	168206.30	44.136	1008	0.90	2.75	43.126	41.276						
P2A	WS2A056(M)		12/07/2005	1025	21.8	0		0	0.00	0.00				19.80		0	0	0.00	0.00							468005.79	168206.30	44.136	1025	1.35	3.110	42.986	41.026						
P2A	WS2A060(M)		05/09/2005	1008	15.1	0		0	0.00	0.00				21.40		0	0	0.00	0.00							467894.59	168045.09	45.409	1008	0.46	2.00	44.829	43.289						
P2A	WS2A521		12/07/2005	1008	19.1	0.1		0	0.00	0.00				21.30		0	0	0.00	0.00							467894.59	168045.09	45.409	1008	0.46	2.00	44.829	43.289						
P2A	WS2A521		09/09/2005	1010	26.2	-0.6		0	0.00	0.00				20.5		-1	0	0.00	0.00							467894.59	168045.09	45.409	1010	0.65	3.08	44.759	42.329						
P2A	WS2A521M		12/07/2005	1025	20.2	0		0	0.00	0.00				21.10		0	0	0.00	0.00							467894.59	168045.09	45.409	1025	0.70	3.060	44.709	42.329						
P2A	BH113		12/07/2005	1022	26.3	0		0	0.00	0.00				19.60		0	0	0.00	0.00							468057.67	168128.45	44.323	1022	1.17	5.000	43.153	39.323						
P2A	BH113		06/09/2005	1008	19.5	-0.1		0	0.00	0.00				21.50		0	0	0.00	0.00							468057.67	168128.45	44.323	1008	1.29	5.87	42.913	38.333						
Initial LGA	BH114		08.06.04	1008	29.0	-1.9		0	0.00	0.00				18.8		-6	0	0	0							468057.67	168128.45	44.323	1008	7.88		38.554							
P2A	BH114		12/07/2005	1022	29.6	0.4		0	0.00	0.00				20.10		0	0	0.00	0.00								468058.96	168127.79	44.334	1022	8.52	16.580	35.814	27.754					
P2A	BH114		06/09/2005	1008	21	0		0	0.00	0.00				21.20		0	0	0.00	0.00							468058.96	168127.79	44.334	1008	8.69	16.40	35.524	27.814						
P2A	BH2A022D		05/09/2005	1008	21	-0.1		0	0.00	0.00				21.20		0	0	0.00	0.00							467940.99	168013.21	45.073	1008	2.52	6.86	42.493	38.933						
P2A	BH2A022D		06/09/2005	1003	17.5	0.1		0	0.00	0.00				20.70		0	0	0.00	0.00							468043.72	168194.82	44.359	1003	5.54	16.70	38.709	27.559						
P2A	BH2A023D		05/09/2005	1008	19.5	-0.1		0	0.00	0.00				21.30		0	0	0.00	0.00							468037.97	168091.10	44.529	1008	9.01	17.24	35.389	27.159						
P2A	BH2A024(DG)		08/09/2005	1016	23.0	0		0.1	0.00	0.00				21.30		0	0	0.00	0.00							468078.47	168083.17	44.171	1016	8.62	19.00	35.511	25.171						
P2A	WS2A056(M)		08/09/2005	1016	19.5	-0.1		0	0.00	0.00				21.90		0	0	0.00	0.00							468005.79	168206.30	44.136	1016	1.08	2.97	43.056	41.166						
P2A	WS2A060(M)		08/09/2005	1016	21	0.4		0	0.00	0.00				21.40		0	0	0.00	0.00							467932.16	168200.77	43.995	1016	0.84	2.10	43.156	41.895						
P2A	WS2A060(M)		12/07/2005	1025	21.7	0		0	0.00	0.00				21.20		0	0	0.00	0.00							467932.16	168200.77	43.995	1025	0.85	3.400	43.146	40.595						
Initial LGA	BH114		10/12/2003	1010	7.3	0		0	0.00	0.00				20.4		0	0	0	0							7.96	17.48	0.13											
P2A	BH114		08/08/2005	1015	23	0		0	0.00	0.00				20.80		0	0	0.00	0.00							468058.96	168127.79	44.334	1015	8.61	16.51	35.724	27.824						
P2A	BH2A024(DG)		11/07/2005	1025	28.4	0.11		0	0.00	0.00				20.00		0	0	0.00	0.00							467940.99	168013.21	45.073	1025	3.08	6.230	41.993	38.843						
P2A	BH2A024(DG)		08/09/2005	1016	23	-0.1		0	0.00	0.00				20.90		0	0	0.00	0.00							468005.10	168224.76	44.526	1016	8.65	15.79	35.955	29.715						
P2A	BH2A024(DG)		05/08/2005	1008	17.1	0		0	0.00	0.00				20.40		0	0	0.00	0.00							468005.10	168224.76	44.505	1008	8.63	15.64	35.755	28.745						
P2A	WS2A073		09/08/2005	1009	26.4	0		0	0.00	0.50				20.10		0	0	0.00	0.00							468072.31	168020.29	43.975	1009	2.41	3.05	41.565	40.925						
P2A	WS2A073		05/09/2005	1008	19.1	-0.1		0	0.00	0.																													