Provision for Archaeological Science at interventions undertaken as a consequence of Planning Policy Guidance Note 16 (Department of the Environment 1990) is variable. Some examples of good practice, which have resulted in effective and targeted programmes of analysis, or mitigation by in situ preservation (Corfield et al. 1998), are given in Appendix 1. Many others could be cited. However, in some cases the quality of work in scientific archaeology leaves much to be desired. There is a clear need for a set of statements outlining good practice, which can be adopted or adapted by Local Authority archaeological curators when writing Briefs and Specifications. Consequently, this document has been produced by the nine English Heritage Regional Advisors for Archaeological Science (Appendix 2). Its purpose is to outline minimum standards of good practice for PPG16 interventions, partly in the form of model clauses for Briefs and General Specifications. Detailed Specifications, Project Designs or Written Schemes of Investigation (however termed), are prepared by contracting Units in many Local Authority areas, and are not considered here.

Preamble

1.2 PPGs 15 and 16 are currently under revision (January 2003). Subsequently a new Planning Policy Statement (PPS15) will be issued, covering all aspects of planning in relation to the Historic Environment. Whilst it is anticipated that the broad principles of PPG 16 will be retained, current uncertainty about its precise form means that this guidance document is inevitably provisional. Consequently it will not be published as a hard copy document, pro tem.

1.3 For present purposes, Archaeological Science is taken to include:

- Geophysical prospection
- Scientific dating
- Geoarchaeology
- Biological analysis
- Artefact conservation and investigative analysis
- Technical analysis of technological residues, ceramics, glass and stone
- Any other scientific method that might be employed for the detection of archaeological sites, investigation of archaeological evidence, the preservation of excavated and in situ evidence and the mitigation of the effects of development.

This document is concerned primarily with these aspects of archaeology but there is a degree of overlap with other aspects which would not generally be considered ‘scientific’, such as artefact retrieval. For these, and some other areas such as geophysical prospection, curators will already have standard clauses supported by Procedures/Standards Manuals, which will be fuller and more specific than those given below. The aim here is simply to state minimum

standards of good practice.

1.4 An earlier draft of this document was circulated to individual archaeological curators in England, Regional ALGAO groups and archaeological scientists. It was also presented and discussed at a meeting of the ALGAO Planning and Legislation Committee. Numerous helpful responses were received and, where possible, these have been incorporated. There were, however, many irreconcilable differences of opinion between curators, most contentiously about what constitutes a reasonable requirement within PPG16 (see below). A document of this type cannot hope to meet with agreement from all parties, for there is no consensus.

Contact with ALGAO was timely, for it coincided with a reconsideration of the existing Model Briefs and Specifications (ACAO 1993). In view of the fact that practice varies widely between Local Authorities in the types of Briefs and/or Specifications issued, there is no proposal by ALGAO to revise and up-date this document. Instead, ALGAO has instigated a Briefs and Specifications Checklist Project, into which most of the points raised in the present document have already been incorporated. This document is intended to supplement and amplify the Checklist document which ALGAO will publish. They are underpinned by existing guidelines documents already published by English Heritage, the United Kingdom Institute for Conservation, the Institute of Field Archaeologists (1999, 2001 inter alia) and other bodies.

1.5 This document refers to both evaluations and excavations, ranging from Pre-Determination evaluations through to evaluations and excavations secured by conditions attached to Planning Permissions. For the benefit of archaeologists unfamiliar with the planning system, it is important to emphasise that, though the purpose of evaluation in archaeological terms is to inform subsequent mitigation, in planning terms the objective is to provide sufficient information for a planning application to be determined.

Evaluations differ widely in scope, scale and objectives. Small-scale Pre-Determination evaluations, designed to establish whether developments will have any archaeological impacts at all, may last for only a few days and cost less than £2000. Some curators use the term ‘second-stage evaluations’ to describe subsequent interventions undertaken to characterise the resource more fully, to assess the potential for the preservation of the site and all categories of material in it, and to determine the archaeological significance of material preserved. These are typically larger in scale and better-resourced.

The clauses for archaeological evaluations presented below have been written with ‘second-stage evaluations’ principally in mind. Whether a given initial small-scale Pre-Determination evaluation should include an Archaeological Science component is for curators to decide, basing their decision on site-specific considerations and time-tabling. Plainly, the clauses presented below should not be used in an uncritical blanket fashion: their application should be related to the significance of the site, and the scale and objectives of the intervention. Underpinning this will be the notion of a ‘reasonable requirement’.

1.6 Situations arise where no further archaeological intervention is proposed following evaluation, yet significant scientific material has been retrieved. There is no provision for analysis of such material within PPG 16, but serious consideration should be given to obtaining

funding for analysis and publication of significant material wherever possible. The EH Regional Science Advisors are able to support applications for such funding from developers and others, where this is appropriate and helpful.

1.7 Several curators have emphasised the desirability of including contingency funding for Archaeological Science at all stages in the planning process, to deal with unpredictable finds. However, this should not be used as a substitute for a properly costed programme of scientific work, but rather a potential supplement to it.

1.8 It is expected that most archaeological contractors will be able to meet requirements in-house or by sub-contracting to appropriate specialists, but where additional and impartial advice is required, the appropriate English Heritage Regional Advisor for Archaeological Science should be consulted (Appendix 2). An essential and basic requirement is that specialists in Archaeological Science should be named, and their competence to undertake investigations should be demonstrated. This obviously raises problems, but it is not unreasonable to expect a qualification, record of publication or training/mentoring by an experienced specialist. Conservators now have an accreditation scheme, but there is no specific accreditation of specialists in environmental archaeology, other than by membership of the IFA. Meanwhile, one objective criterion of competence is the ability of specialists to show that they have access to adequate laboratory facilities, including reference collections where appropriate. Pro tem, the phrase ‘recognised specialist’ is used below as a neutral, non-prescriptive term.

1.9 The Valletta Convention of 1992 (European Convention on the protection of the archaeological heritage (revised): www.coe.int) was implemented by the UK government in 2001. Article 1 presents a definition of the archeological heritage which is broader than that embodied in previous UK legislation. Paragraph 2 states:
"To this end shall be considered to be elements of the archaeological heritage all remains and objects and any other traces of mankind from past epochs:

i. the preservation and study of which help to retrace the history of mankind and its relation with the natural environment;
ii. for which excavations or discoveries and other methods of research into mankind and the related environment are the main sources of information….". [writer's italics].

This more inclusive definition might prove to be relevant where support is needed for study of sediment sequences which do not include artefacts or structures.

1.10 More generally, application of new and developing methodologies rather than just repetitive use of the same suite of techniques should be fostered. Biomolecular studies and newly refined dating techniques such as Optically Stimulated Luminescence dating (OSL) are examples. Site visits by archaeological scientists should be encouraged, including those from areas such as conservation, where field visits are not now customary. The Local Authority may require the EH Regional Science Advisor to monitor procedures.

2. Brief for Archaeological Evaluations

2.1 The minimum requirement for Archaeological Science during evaluation is that the archaeologicalcontractor should commission programmes of investigation which are adequate to provide a sound basis for developing the Specification/Project Design for any subsequent excavation, or for other forms of mitigation strategy, in particular in situ preservation. The results of these investigations will be presented in the Evaluation Report.

2.2 Scientific investigations during evaluation should be undertaken in a manner broadly consistent withthe English Heritage document The Management of Archaeological Projects (English Heritage 1991).

3. General Specification for Archaeological Evaluations

3.1 General

All specialists in Archaeological Science, (both those employed in-house by the contracting field unit or those sub-contracted), should be named in project documents. Agreement of specialists must always be obtained before their names are listed. Their competence to undertake proposed investigations, and the availability of adequate laboratory facilities and reference collections should be demonstrated. There should be agreement in writing on time-tables and deadlines for all stages of work.

3.2 Desk Based Assessment

The Desk Based Assessment should include reference to the geology, topographic position, soil type and drainage of the development area, whether rural or urban. Particular reference should be made to the anticipated preservation conditions at the site, and especially to variables affecting preservation of biological remains and organic artefacts. Reference should also be made to Geological and Soil Survey Maps, and to any previous investigations in Archaeological Science at the site, or immediately adjacent to it.

3.3 Field Evaluation

3.3.1 Where a programme of Geophysical Survey has been required by a Local Authority a recognised specialist in the techniques involved should be employed. This specialist should be named in any detailed specification submitted to the Local Authority. Magnetometer and earth resistance survey are the techniques most commonly applied, whilst other techniques such as Ground Penetrating Radar may also be suitable, depending upon specific circumstances (Gaffney, Gater and Ovenden 2002). The choice and deployment of techniques needs to be justified and agreed with the Local Authority after an assessment of site conditions. Overall, the standards recommended in the English Heritage document Geophysical Survey in Archaeological Field Evaluation (English Heritage 1995) represent preferred practice.

3.3.2 All finds (artefacts and ecofacts) visible during excavation should be collected and processed, unless variations in this principle are agreed with the Local Authority. In some cases, sampling may be the most appropriate strategy. Finds should be appropriately packaged and stored under optimum conditions, as detailed in the RESCUE/UKIC publication First Aid for Finds (Watkinson and Neal 1998).

3.3.3 Where there is evidence for industrial activity, macroscopic technological residues (or a sample ofthem) should be collected by hand. Separate samples (c. 10ml) should be collected for micro-slags (hammer-scale and spherical droplets). Reference should be made the Centre for Archaeology Guideline on Archaeometallurgy (English Heritage 2001).

3.3.4 Subject to time constraints, samples should be taken for scientific dating (principally radiocarbondating at the evaluation stage) in specific circumstances. This could apply where dating by artefacts is insecure or absent, and where dating is necessary for development of the Project Design/Specification for subsequent mitigation strategies. For example, OSL dating has been used at a site in Norfolk to date colluvial sediments during evaluation: the results helped to guide the appropriate depth of machining during subsequent excavation (see Appendix 1).

3.3.5 Buried soils and sediment sequences should be inspected and recorded on site by a recognised geoarchaeologist, since field inspection may provide sufficient data for understanding site formation processes. Procedures and techniques presented in the English Heritage document Environmental Archaeology should be followed (English Heritage 2002). More detailed English Heritage guidance on Geoarchaeology is currently in preparation. Samples for laboratory assessment should be collected where appropriate, following discussion with the Local Authority.

3.3.6 Deposits should be sampled for retrieval and assessment of the preservation conditions andpotential for analysis of biological remains (English Heritage 2002). The sampling strategy should include a reasoned justification for selection of deposits for sampling, and should be developed in collaboration with a recognised bioarchaeologist. Flotation samples and samples taken for coarse-mesh sieving from dry deposits should be processed at the time of the fieldwork wherever possible, partly to permit variation of sampling strategies if necessary, but also because processing a backlog of samples at a later stage causes delays. Sampling strategies for wooden structures should follow the methodologies presented in Brunning (1996).

3.3.7 Lifting of human skeletal remains should be kept to the minimum which is compatible with an adequate evaluation. At sites known in advance to be cemeteries, provision should be made for site inspection by a recognised specialist. Excavators must be aware of, and comply with, the relevant legislation and any Home Office and local environmental health concerns. Further guidance is provided in Church Archaeology: its care and management (Council for the Care of Churches 1999) and in English Heritage (2002 and 2002a).

3.4 Post Fieldwork

3.4.1 Artefacts, biological samples and soils should be assessed for evidence of site and deposit formation processes and taphonomy, and especially for evidence of recent changes that may have been caused by alterations in the site environment. Assessment should include x-radiography of all iron objects, (after initial screening to exclude obviously recent debris), and a selection of non-ferrous artefacts (including all coins).. Where necessary, active stabilisation /consolidation will be carried out, to ensure long-term survival of the material, but with due consideration to possible future investigations. Once assessed, all material should be packed and stored in optimum conditions, as described in First Aid for Finds. Waterlogged organic materials should be dealt with following the documents Guidelines for the care of waterlogged

archaeological leather (English Heritage/Archaeological Leather Group 1995) and Waterlogged wood: the recording, sampling, conservation and curation of structural wood (Brunning 1996).

3.4.2 Assessment of any technological residues should be undertaken.

3.4.3 Samples for dating should be submitted to promptly, and prior agreement should be made with thelaboratory on turn-around time and report production, so as to ensure that results are available to aid development of specifications for subsequent mitigation strategies.
3.4.4
Processing of all soil samples collected for biological assessment, or sub-samples of them, shouldbe completed. The preservation state, density and significance of material retrieved should be assessed by recognised specialists(English Heritage 2002). Special consideration should be given to any evidence for recent changes in preservation conditions that may have been caused by alterations in the site environment. Unprocessed sub-samples should be stored in conditions specified by the appropriate specialists.

3.4.5 Samples collected for geoarchaeological assessment should be processed as deemed necessary by a recognised specialist, particularly where storage of unprocessed samples is thought likely to result in deterioration. Appropriate assessment is to be undertaken. Where preservation in situ is a viable option, consideration should be given to the possible effects of compression on the physical integrity of the site and to any hydrological impacts of development (see English Heritage 2002).

3.4.6 Animal bone assemblages, or sub-samples of them, should be assessed by a recognised specialist (see English Heritage 2002).

3.4.7 Assessment of human remains will have been based partly on in situ observation, but where skeletal remains have been lifted assessment should be undertaken by a recognised specialist. For guidance on methodology, see Human Remains from Archaeological Sites. Guidelines for producing assessment documents and analytical reports (English Heritage 2002a).

3.5 Evaluation Report

3.5.1 The results from investigations in Archaeological Science should be included in the Site Archiveand presented in the Evaluation Report. Reports should include sufficient detail to permit assessment of potential for analysis. They should include tabulations of data in relation to site phasing and contexts, and include non-technical summaries. The objective presentation of data should be clearly separated from interpretation. Recommendations for further investigations, (both on samples already collected, and at future excavations), should be clearly separated from the results and interpretation.

3.5.2 Understanding the current state of preservation of an archaeological site is necessary in any attempt to ensure its future preservation in situ or adequate recording during excavation. It is advised that those involved in evaluations and excavations should take all necessary steps to ensure that sufficient information is collected to provide a firm basis for informed decisions. Techniques for assessing the state of preservation will vary, depending on the type of site and

its perceived importance.
A cost-effective method of assessing the preservation of buried archaeological remains is to make use of information that should be included within specialist assessment reports. For example:

- are pollen grains well preserved, or is there a high proportion of indeterminate grains and those of durable taxa?;
- are plant macrofossils preserved by waterlogging, mineral-replacement or only in a charred form? If present, do waterlogged macrofossils shows signs of degradation?

The artefact conservation assessment should identify the degree of preservation of each material class recovered, and identify whether there is evidence contained in, for example, the nature of corrosion products on metalwork to suggest that the burial environment is changing, or has changed recently.

A clear and concise synthesis of such data in the Evaluation Report, combined with assessment of site hydrology, will help to inform future site-specific management, particularly with respect to vulnerable materials that might be at risk from proposed re-development schemes.

3.5.3 A copy of the Evaluation Report should be sent to the appropriate English Heritage RegionalAdvisor for Archaeological Science.

4. Brief for Archaeological Excavation

4.1 Scientific investigations should be undertaken in a manner broadly consistent with the EnglishHeritage document The Management of Archaeological Projects.

4.2 An outline strategy of sampling for scientific dating, geoarchaeology and soil science, biological analysis, artefact conservation and analysis, and analysis of technological residues, ceramics, and stone should be agreed with the Local Authority, in consultation with the English Heritage Regional Advisor for Archaeological Science (RA) before commencement of site work. This strategy should be based on the evaluation results, and should be contained in the Project Design/Specification. The strategy will be subject to variation as appears necessary during the excavation, following consultation with the Local Authority and the RA.

5. General Specification for Archaeological Excavations

5.1 General

All specialists in Archaeological Science, (both those employed in-house by the contracting unit, or those sub-contracted), should be named in project documents. Agreement of specialists must always be obtained before their names are listed. Their competence to undertake proposed investigations, and the availability of adequate laboratory facilities and reference collections should be demonstrated. There should be agreement in writing on time-tables and deadlines for

all stages of work.

5.2 Fieldwork

5.2.1 All finds (artefacts and ecofacts) visible during excavation should be collected and registered, unless variations in this principle are agreed with the Local Authority. In some cases sampling may be most appropriate. All finds should be appropriately packaged and stored under optimum conditions, following methods detailed in First Aid for Finds. A regular transfer of finds from the site to the conservation laboratory is desirable, particularly in the case of long term excavations

5.2.2 Where there is evidence for industrial activity, macroscopic technological residues (or a sample ofthem) should be collected by hand. Separate samples (c. 10ml) should be collected for micro-slags (hammer-scale and spherical droplets). Reference should be made to the Centre for Archaeology Guideline document Archaeometallurgy (English Heritage 2001).

5.2.3 Samples should be collected for scientific dating (radiocarbon, dendrochronology, luminescence dating, archaeomagnetism and/or other techniques as appropriate), following the outline strategy presented in the Project Design/Specification. Sampling for dendrochronology should follow procedures presented in the document Dendrochonology: guidelines on producing and interpreting dendrochronological dates (Hillam 1998).

5.2.4 Buried soils and sediment sequences should be inspected and recorded on site by a recognised geoarchaeologist. Samples may be collected for analysis of chemistry, magnetic susceptibility, particle size, micromorphology and/or other techniques as appropriate, following the outline strategy presented in the Project Design/Specification, and in consultation with the geoarchaeologist (see English Heritage 2002).

5.2.5 Deposits should be sampled for retrieval and analysis of all biological remains following the outlinestrategy presented in the Project Design/Specification. The sampling strategy should include a reasoned justification for selection of deposits for sampling, and should be developed in collaboration with a recognised bioarchaeologist. Sampling methods should follow English Heritage (2002). Flotation samples and samples taken for coarse-mesh sieving from dry deposits should be processed at the time of the fieldwork wherever possible, partly to permit variation of sampling strategies if necessary, but also because processing at a later stage causes delays.

5.2.6 Human remains must be treated at all stages with care and respect. Excavators must be aware of,and comply with, the relevant legislation and any Home Office and local environmental health concerns. Burials should be recorded in situ and subsequently lifted, washed in water (without additives), marked and packed to standards compatible with Excavation and post-excavation treatment of cremated and inhumed human remains (McKinley and Roberts 1993). Site inspection by a recognised specialist is desirable in the case of isolated burials, and necessary for cemeteries. Proposals for the final placing of human remains following study and analysis will be required in the Project Design/Specification. Further guidance is provided in Church Archaeology: its care and management (Council for the Care of Churches 1999) and in Human Remains from Archaeological Sites. Guidelines for producing assessment documents

and analytical reports (English Heritage 2002a).

5.3 Assessment
5.3.1 The site assessment report should include reports on all aspects of Archaeological Scienceinvestigated, and include assessment of their suitability for analysis, so as to inform the updated project design.

5.3.2 Assessment of artefacts should include x-radiography of all iron objects, (after initial screening to separate obviously modern debris), and a selection of non-ferrous artefacts (including all coins). An assessment of all excavated material should be undertaken by conservators and finds researchers in collaboration. Where necessary, active stabilisation /consolidation will be carried out, to ensure long term survival of the material, but with due consideration to possible future investigations.
Once assessed, all material should be packed and stored in optimum conditions, as described in First Aid for Finds. Waterlogged organic materials should be dealt with following the English Heritage documents Guidelines for the care of waterlogged archaeological leather and Waterlogged wood: the recording, sampling, conservation and curation of structural wood (Brunning 1996).

5.3.3 Assessment of any technological residues should be undertaken.

5.3.4 Processing of all samples collected for biological assessment, or sub-samples of them, should becompleted. Assessment will include recording the preservation state, density and significance of material retrieved, to inform up-dated project designs. Methods presented in English Heritage (2002) should be followed. Unprocessed sub-samples should be stored in conditions specified by the appropriate specialists.

5.3.5 Samples collected for geoarchaeological assessment should be processed as deemed necessary by the specialist, particularly where storage of unprocessed samples is thought likely to result in deterioration. Appropriate assessment should be undertaken (see Canti 1996, English Heritage 2002).

5.3.6 Animal bone assemblages, or sub-samples of them, should be assessed by a recognised specialist (English Heritage 2002).

5.3.7 Assessment of human remains should be undertaken by a recognised specialist. See Human Remains from Archaeological Sites. Guidelines for producing assessment documents and analytical reports (English Heritage 2002a).

5.4 Analysis

5.4.1 Within a time specified by the Local Authority a time-table for post-excavation work should be produced, following consultation, (including team meetings for larger-scale sites), with all specialists involved in the project. Agreement of time-tables should be made in writing with external specialists.

5.4.2 A detailed and cost-effective strategy for scientific dating should be prepared, in consultation with appropriate specialists. Samples for dating should be submitted to promptly, and prior agreement should be made with the laboratory on turn-around time and report production.

5.4.3 All artefacts should be conserved and stored in accordance with First Aid for Finds. Investigative conservation will be undertaken on those objects selected during the assessment phase, with the aim of maximising information whilst minimising intervention. Where necessary, active stabilisation/consolidation will be carried out, to ensure long-term survival of the material, but with due consideration to possible future investigations. Proposals for ultimate storage should follow the UKIC publication Guidelines for the Preparation of Excavation Archives for Long-Term Storage (Walker 1990).

5.4.4 Appropriate analysis of technological residues should be undertaken, as outlined in English Heritage (2001).

5.4.5 Samples or sub-samples collected for all types of biological and geoarchaeological analysis should be processed, and material retrieved analysed by recognised specialists. Any unprocessed sub-samples should be stored in conditions specified by the specialists, or a reasoned discard policy should be developed (English Heritage 2002).

5.4.7 Analysis of animal bones should be undertaken by a recognised specialist, as specified in the updated
project design. See also English Heritage (2002).

5.4.8 Analysis of human remains should be undertaken by a recognised specialist, as specified in the up-dated project design. Guidance on methods and report preparation is in Human Remains from Archaeological Sites. Guidelines for producing assessment documents and analytical reports (English Heritage 2002a).

5.5 Excavation Report

5.5.1 The results from investigations in Archaeological Science, including negative results, should be included in the Site Archive and reported to the SMR.

5.5.2 A time-table for completion of reports should be agreed with all specialists, and agreements in writing with sub-contracted external specialists are desirable. The time-table should allow for adequate provision by the excavator of contextual information, provisional dating and stratigraphic relationships of contexts.

5.5.3 Reports should include clear statements of methodology. The results from scientific analysis should be clearly distinguished from their interpretation. Non-technical summaries of results should be included.

5.5.4 Reports on Archaeological Science should be published fully, in the text of printed reports or in themain body of reports disseminated by electronic means, wherever the results merit it.

6. Archiving

Preparation and deposition of the site archive, from both evaluation and excavation, should be undertaken with reference to the appropriate repository guidelines and standards, and to Guidelines for the Preparation of Excavation Archives for Long-Term Storage (Walker 1990) and Selection, Retention and Dispersal of Archaeological Collections (Society of Museum Archaeologists 1993). The contractor should demonstrate that arrangements have been made with an appropriate organisation for the deposition of the project archive, as part of the project specification.

7. Comments and revision

This is working document that will be amended in the light of increasing experience and methodological advances. Comments are welcome and should be directed to Peter Murphy, Regional Advisor for Archaeological Science, English Heritage, East of England, Brooklands, 24 Brooklands Avenue, Cambridge CB2 2BU (peter.murphy@english-heritage.org.uk).

8. Bibliography

Association of County Archaeological Officers, 1993, Model Briefs and Specifications for Archaeological Assessments and Field Evaluations. ACAO: Bedford.
Brunning, R., 1996, Waterlogged wood. Guidelines on the recording, sampling, conservation and curation of waterlogged wood. English Heritage, London.
Canti, M., 1996, Guidelines for carrying out assessments in Geoarchaeology. Ancient Monuments Laboratory Report 34/96. English Heritage.
Corfield, M., Hinton, P., Nixon, T. and M. Pollard (eds.), 1998, Preserving archaeological remains in situ. Proceedings of the conference of 1st-3rd April 1996. Museum of London Arachaeology Service: London.
Council for the Care of Churches, 1999, Appendix 3. Draft guidelines for the treatment of human remains and Appendix 4. The Vermilion Accord, in Church archaeology: its care and management. A report to the council from the Archaeology Working Group. CCC: London.
Department of the Environment, 1990, Planning Policy Guidance Note 16: Archaeology and Planning. HMSO: London.
English Heritage, 1991, The Management of Archaeological Projects. London.
English Heritage, 1995, Geophysical Survey in Archaeological Field Evaluations. London.
English Heritage/Archaeological Leather Group, 1995, Guidelines for the care of waterlogged archaeological leather. English Heritage: London.
English Heritage, 2001, Archaeometallurgy. Centre for Archaeology Guidelines 2001/01. English Heritage: London.
English Heritage, 2002, Environmental Archaeology. A guide to the theory and practice of methods, from sampling and recovery to post-excavation. Centre for Archaeology Guidelines 2002/01. English Heritage: London.
English Heritage, 2002a, Human Bones from Archaeological sites. Guidelines for producing assessment documents and analytical reports. Centre for Archaeology Guideline, unnumbered. English Heritage: London.
English Heritage, undated Minimum Standards for MAP2 Project Designs and Assessments:

supplementary guidance to MAP2.
Gaffney, C, Gater, J and Ovenden, S, 2002, The use of geophysical techniques in archaeological evaluations. IFA Paper No 6.
Goodburn-Brown D. and UKIC Archaeology Section, revised edition 2001, Excavated Artefacts and Conservation UK Sites
Hillam, J., 1998, Dendrochonology: guidelines on producing and interpreting dendrochronological data. English Heritage: London.
Institute of Field Archaeologists, 1999, Standard and guidance for archaeological desk-based assessment; Standard and guidance for archaeological field evaluation; Standard and guidance for an archaeological watching brief; Standard and guidance for archaeological excavation; Standard and guidelines for finds work , IFA blue folder of policy, standards and guidance. IFA.
Institute of Field Archaeologists, 2001, Standard and guidance for the collection, documentation, conservation and research of archaeological materials, IFA blue folder of policy, standards and guidance. IFA.
McKinley, J. and Roberts, C., 1993, IFA Technical Paper 13 Excavation and post-excavation treatment of cremated and inhumed human remains. Institute of Field Archaeologists.
Society of Museum Archaeologists, 1993, Selection, retention and dispersal of archaeological collections. Guidelines for use in England, Northern Ireland, Scotland and Wales. SMA: London.
Walker, K., 1990, Guidelines for the preparation of excavation archives for long-term storage, Archaeology Section of the United Kingdom Institute for Conservation.
Watkinson, D. and Neal, V., 1998, First Aid for Finds (3rd edition), RESCUE and the Archaeology Section of the United Kingdom Institute for Conservation.
{mospagebreak}

Appendix 1. Examples of good practice

Developing, defining and applying best practice for archaeological science within the framework of PPG 16 is a learning process. In part, this relates to an accumulation of experience. The key point to emerge is the necessity for good will, good communication and close collaboration between archaeological curators, contractors, consultants and advisors at all stages of archaeological projects. It also is a learning process in the sense that new techniques are continually becoming available, and their utility on site and in the laboratory has to be tried and tested. The following case studies exemplify this.

Caister-on-Sea, Norfolk: applying OSL dating in evaluation

An archaeological evaluation was undertaken at this site in 2001 by Archaeological Project Services (APS). The site was to the east of the Roman coastal fort and civil settlement, on the former northern shore of the Yare/Bure estuary. Features of Roman date were detected cut into gravels, and over part of the site they were sealed by colluvium. The colluvium included

abundant earthworms and other fauna. Bioactivity had obliterated any stratification within it, and there was no sign of a basal palaeosol. It is common practice to machine off colluvium during evaluation and excavation, in order to expose underlying features. However, in this instance the curator, David Gurney (Norfolk Landscape Archaeology) and the Regional Science Advisor (RSA) were concerned that evidence for late Roman activity, perhaps of an ephemeral or insubstantial character, might be removed if this were done. The RSA suggested that OSL (optically stimulated luminescence) dating might prove useful. APS and their consultant Dr James Rackham concurred with this view, and negotiated additional funding from their client, Lidl Supermarkets. Dr Ed Rhodes (Luminescence Laboratory, Research Laboratory for Archaeology and the History of Art, University of Oxford) undertook sampling of the colluvium and analysis of samples, giving them high priority to ensure that the results could feed back rapidly into the project. The results were as follows.

Depth (cm)	
Date (AD)	
Age ranges (2 SD)	
40	
1800 ± 40	
1720-1880 AD	
55	1470 ± 60
1350-1590 AD	
70	
790 ± 120	
550-1030 AD	
85	
110 + 200	
290 BC-510 AD	

They suggest a very uniform rate of accumulation. This is perhaps surprising, and could be related to post-depositional faunal activity. However, it seemed by interpolation that a late Roman surface might occur at around 75-80cm depth. It was agreed that a sample area of the site would be partly machined to this level, then hand-dug, to examine this surface. In the event, nothing of significance was found at this level. This can be regarded as a useful, albeit negative, result. Without it, the question of a late phase of activity at the site would have remained unresolved.

Warkworth, Northumberland: radiocarbon dating during an evaluation phase.

Warkworth, on the Northumberland coast, is a small town dominated, as many such towns in the region, by its castle. A housing development was proposed for the low lying ground to the west, and at the foot, of the castle thus it was especially important to undertake a pre-planning consent evaluation of the site. The presence of deep peats on the site had been noted during prior geotechnical investigations. Specifications for an evaluation excavation were drawn up by the Local Authority Curator following discussion with the Regional Science Advisor. Given the known presence of peat it was proposed that pollen would need assessing and radiocarbon dates obtained since well-dated mid Holocene deposits had been studied, and were published, from only a few kilometres away. It was thus felt that if the Warkworth material was of the same date then little extra information would be gained from full analysis of its peats given that the pollen from this type of inferred deposit was most likely to produce, at best, a semi-regional picture.

The evaluation demonstrated that few, if any, archaeological remains were present. A small area of a peat-filled channel was uncovered and pollen from both it and the lower peats was investigated as to its quality and quantity. There were bands of well preserved pollen within the peats and indications of an essentially cleared landscape with local alder woodland and some pastoral and arable activity. Not unexpectedly the pollen itself provided no clue as to precise dates. The client provided funds to date both the lower and the palaeochannel peats in the first instance and agreed, if necessary, to provide funds for full analysis. The three dates thus obtained confirmed that the lower peats were broadly of the same age as those further along the coast and that no further work was therefore required. The palaeochannel peat proved to be late Medieval to post-Medieval and subsequently full analysis of pollen was undertaken. This provided a snap shot of an essentially grassland-dominated area during the period 1410-1620 Cal AD with very small amounts only of cereal cultivation, although the locality may have precluded inclusion of cereal pollen in the deposits. It seems most likely that the low lying, periodically inundated, grazed grassland of today was also present on this valley floor some 500 years ago.
Two developments in the Severn Estuary Levels.

The archaeological potential of the Severn Levels relates to the extensive alluvial sediments and the peat deposits laid down in response to Holocene sea level change. A preview of the archaeological potential is afforded by exploration of the extensive intertidal area on both the Welsh and English shores which has resulted in excavation and recording, much of which is published in the journal Archaeology in the Severn Estuary. This demonstrates that development on the Levels requires archaeological mitigation even if there is little to been seen at or close to the present ground surface.

The first example illustrates an approach taken in 1997 along the route of a pipeline in South Gloucestershire. Apart from the difficulties of trying to detect buried archaeology in a wet floodplain, the construction method meant that access was not easy or possible at some locations. Despite this, the co-operation of the developer meant that much useful and new information was recovered.

The second example is part of ongoing industrial development in the Avonmouth Levels north of Bristol. Some development of techniques was attempted with modified geophysical survey and

archaeomagnetic study carried out in addition to more standard approaches on the floodplain. Surface and buried archaeological sites were investigated.

The Seabank to Pucklechurch pipeline, Severn Levels, South Gloucestershire

In 1997 a new gas pipeline was laid running from the Seabank power station, north of Avonmouth to Pucklechurch to the east of Bristol. The route ran for 2km from NW to SE across the Severn floodplain (Severn Levels) and for 6km from SE to NW along the floodplain roughly parallel with the break of slope before crossing the higher ground and turning SE towards Pucklechurch. Most of the pipe was laid in an open trench with a 2km section from the Seabank power station constructed by tunnelling through the silts and peats. The requirement for provision for archaeological work was made under the Pipelines Act (1962). The main contractor for the project on behalf of Seabank Power was Entrepose-Laing JV who commissioned a staged programme of archaeological work. This was specified by the archaeology and conservation officer for South Gloucestershire liasing with the English Heritage SW advisor for archaeological science on the archaeological science aspects. McGill Archaeological Consultants carried out the archaeological field investigations and wrote the archive report (McGill 1996-7, 19982001),

having subcontracted the environmental aspects of two stages of the work to different specialist groups coordinated by Helen Keeley and Julie Jones, respectively. The final reports for publication were commissioned from Headland Archaeology (Carter et al forthcoming and Masser et al forthcoming) and await publication.

The stages of archaeological investigation were

1. Pre–construction survey included a desktop survey, geophysical survey (on the non floodplain areas) and fieldwalking.
2. Geotechnical borehole records to bedrock and shallow hand augered profiles through the silts and peats were made available to the curator by the Entrepose Laing JV. These were a useful first stage for the curator and EH archaeological science advisor in determining areas of likely potential both in terms of depth and nature of the stratigraphy and identifying buried ‘islands’ of higher areas of the Mercia Mudstone bedrock. The boreholes demonstrated that in places the stratigraphy was up to 14 metres deep crossing a probable former course of the Severn.
3. Three additional cores achieved by hand held percussion auger were commissioned specifically to provide samples for environmental investigations including pollen, diatoms, foraminifera and plant macrofossil analysis. Radiocarbon dates were obtained from one of the sequences.
4. Seven trial trenches were machine excavated along the route to a depth of 2.5 – 3.0 metres but safety considerations did not allow detailed inspection in all cases.
5. Additional excavation was carried out at Farm Lane, Easter Compton where it was not possible to alter the route of the pipeline to avoid a Romano-British site. Detailed investigation at this site allowed recording and sampling of the pre-Roman stratigraphy, which included buried soils; the basal layers were radiocarbon dated. Biostratigraphic analyses of the sediments

included pollen, diatoms, foraminifera and micromorphology in order to identify the environments of deposition and vegetation change and human activity in the vicinity.

6. Finally, a watching brief was carried out during the stripping of topsoil along the 28 metre-wide easement of the pipeline and excavation of the pipe trench and drilling pits was carried out at the ends of the tunnelled section. The pipe trench was 2 metres deep and the drilling pits extended 4-5 metres below ground. Adjacent to the start of the tunnelled area leading from the power station, the archaeological potential was already know in the form of the Roman settlement at Crooks Marsh Farm. As well as drawn sections, in two locations more detailed records were made of probable buried soil horizons and radiocarbon dates were obtained.

On the section of pipeline off the Severn Levels towards Pucklechurch, a more standard approach to the archaeology was possible as it was not buried by alluvium. This will not be described here.

The works that took place represented the best approach that could be agreed within the framework of a difficult landscape with buried archaeology not readily detectable by geophysical methods and not always accessible in the pipe trench owing to construction methods and safety considerations. Several years on, with some development of geophysical techniques and equipment for use in alluvial landscapes and further experience we would probably recommend the following:

- electromagnetic conductivity survey to determine the buried topography and attempt to locate palaeochannels
- magnetometer survey using high sensitivity instrumentation configured to optimise the detection of weak magnetic anomalies at depth, such as a caesium vapour total field magnetometer system. This could be backed up by some archaeological cores prior to evaluation trenching to determine the areas of greatest potential.

References

Carter, S., Jones, J. and McGill, B. forthcoming. Pucklechurch to Seabank Pipeline. Sediment stratigraphic and palaeoenvironmental data from the Avonmouth Levels.
Masser, P., Jones, J. and McGill, B. forthcoming. Romano-British settlement and land-use on the Avonmouth Levels: the evidence of the Pucklechurch to Seabank Pipeline project.
McGill Archaeological Consultants 1996-7. Pucklechurch to Seabank Pipeline. Archaeological Assessment. On behalf of Entrepose Laing JV.
McGill Archaeological Consultants 1998-2001. Pucklechurch to Seabank Pipeline Archaeological Programme, 3 volumes (unpublished Archive report on behalf of Entrepose Laing JV)
Cabot Park Phase 2, Poplar, Packgate and Moorend. Avonmouth, Bristol
Development of the Cabot Park site on land to the north of Avonmouth, Bristol on the Severn

Floodplain has been taking place for several years. This summary refers to aspects of the work carried out in 1998 and 1999 and does not represent all that has been done.
Proposals by Burford Group PLC for stage 2 of the development were received by Bristol City Council. Under PPG 16, the City Archaeologist requested a staged approach to archaeological evaluation and issued briefs accordingly. The archaeological science aspects were discussed and monitored, with the City Archaeologist, and by the EH archaeological science advisor. Archaeological desktop survey, evaluation and excavation were carried out by Glamorgan-Gwent Archaeological Trust Ltd. (GGAT). A desk-top study was undertaken which flagged up known sites of medieval and later date on the present land surface. This recommended a subsequent programme of survey, evaluation, excavation and watching brief.

In 1998 the buried deposits were investigated in a series of evaluation trenches located on the footprints of the intended new buildings. The aims were to

a) determine the presence or absence of archaeological deposits at sites of potential interest;
b) establish the extent, nature and date of such deposits and their relationship with underlying stratigraphy
c) to define the significance of the deposits and potential for further investigation
d) to agree with the curator an appropriate mitigation strategy should the development proceed.

The trial pits were machine excavated to 4m, the uppermost 1.2 metres recorded before further excavation. The six boreholes used a 100mm cable percussion rig to 20m depth. The unit descriptions were confirmed by GGAT after logging by the crew. In their evaluation report GGAT also made use of other relevant borehole logs and recent archaeological investigations as examination of the deep stratigraphy helps to establish past drainage patterns which can be helpful in predicting areas of likely past occupation (Locock, Robinson and Yates 1998).

In the interests of advancing the survey methodologies available for archaeological investigations in the Severn Estuary Levels, English Heritage carried out a fluxgate magnetometer survey on part of the area with lowered sensors, readings taken at 0.25 x 0.5 metre intervals and signal averaging applied to each measurement. This detected a palaeochannel. The location of natural features such as palaeochannels and buried ‘islands’ of higher bedrock are extremely useful in determining the location of evaluation trenches as past human settlement and activity are often in close vicinity. [High sensitivity, multi-sensor magnetometers are now available to contractors, as noted above for the Seabank pipeline and would be recommended for the rapid collection of densely sampled data sets].

Evaluation of the surface earthworks showed that occupation dated from the 11th century AD at Moorend Farm, the 11
th
– 13
th
centuries at Yeomans and the other farmstead sites proved to be of 17
th

– 19
th
century date. The deeper stratigraphy revealed a series of palaeochannels and 3 late Bronze Age activity sites comprising heat-cracked stones, animal bone, pottery and charcoal. Radiocarbon dates were obtained from the occupation sites.

The stratigraphic sequence was examined and buried organic and /or gleyed horizons of Neolithic and Bronze Age date were noted within the estuarine silts and clays (as elsewhere in the Avonmouth levels). Three possible stabilised landsurfaces were identified with the help of soil micromorphology. Pollen, diatom, foram and plant macrofossils were assessed though preservation was restricted, only allowing a general and partial picture of the vegetation and sediment salinity. Between them the pollen, plant macrofossils and forams suggested salt marsh surfaces with nearby woodland of alder and/or hazel (Walker et al 1999). Full analysis was not recommended.

One of the prehistoric activity areas (Kites Corner) was later excavated. An archaeomagetic study was carried out at this site by Geoquest on the uppermost 1.13 metres of the clay and silt stratigraphy, but it was demonstrated that the archaeomagnetism was unstable and unlikely to reflect the direction of the Earth's magnetic field at the time of deposition. It was felt that the waterlogged sediments at greater depth may contain an archaeomagetism of greater fidelity (GeoQuest 1999).

References

GeoQuest Associates 1999. Archaeomagnetic study of a sediment sequence at Kite's Corner, Cabot Park, Avonmouth, On behalf of Glamorgan Gwent Archaeological Trust Ltd.
Locock, M, Robinson, S. and Yates, A. 1998. Cabot Park phase 2: Poplar, Packgate and Moorend, Avonmouth, Bristol. Archaeological Evaluation. On behalf of Burford Group PLC. Report 98/047.
Locock, M, Robinson, S. and Yates, A. 1999 Late Bronze Age Sites at Cabot Park, Avonmouth. Archaeology in the Severn Estuary 9 (1998), 31-36.
Walker, MJC, Caseldine, AE, Barrow, K, Cameron, NG, Dobinson, SJ, James, JH, Kresier, A and Macphail, RI. 1999 Palaeoenvironmental assessment of samples from archaeological evaluation, August 1998. GGAT report 99/025

Developing an analytical strategy for a major urban cemetery excavation: St Mary Spital, Bishopsgate, London

The Spitalfields area contains a Scheduled Ancient Monument on the plan of the medieval Priory and Hospital of St Mary Spital. The area was formally evaluated in the early 1990s and its potential was well understood; indeed a series of excavations have already been published. The most recent work has been on a very ambitious scale and required the preparation of a substantial and extremely detailed Project Design before Scheduled Monument

Consent would be granted. An archaeological scientist was involved from the very outset and contributed significantly to the construction of appropriate sampling strategies, good financial provision for archaeological science and suitable facilities for on-site staff. The English Heritage Inspector involved scientists from the former Ancient Monuments Laboratory and the project

design was approved.
From the outset of the project, archaeological scientists were present on site and considered essential members of the project team, involved in planning aspects of the fieldwork and sampling. The site was monitored weekly by the senior environmental archaeologist from the unit and subsequently by the English Heritage Regional Advisor for Archaeological Science when she came into post, with occasional input from the former Ancient Monuments Laboratory staff. Owing to the unexpectedly large number of skeletons appearing within the cemetery, additional funding was secured for their recovery and

assessment. Meanwhile the media coverage brought the site, and most particularly the environmental and conservation aspects, into the public domain. Several television programmes were made on the story of the human remains, and additional funding for scientific analyses was secured via the media.

The project is now being assessed, with a rigorous scientific programme, including radiometric dating, conservation, and geoarchaeology as well as the more conventional faunal and botanical assessments. The site is dominated by the human bone assemblage (over 10,500 bodies) and the assessment is not only taking into account the research potential, but also other aspects such as long term retention and curation.

Appendix 2. The English Heritage Regional Advisors for Archaeological Science.
REMOVED, CAN BE CONSULTED AT ENGLISH HERITAGE WEBSITE .