CLEAPSS

Improving school laboratories?

A Report for the Royal Society of Chemistry on the number and quality of new and refurbished laboratories in schools

October 2006

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Improving school laboratories?

Executive Summary of a Report for the Royal Society of Chemistry on the number and quality of new and refurbished laboratories in schools

There is increasing concern about the number of young people who choose not to study the sciences beyond the age of 16 or, having studied science subjects to GCE A-level, choose not to pursue them in higher education. A contributory factor is the poor quality of science accommodation in many schools.

There has been a commitment by the government in recent years to building new schools or refurbishing old ones. The government's aim, set out in *Science and Innovation Investment Framework 2004-2014,* (*SIIF*), was to:

> *provide capital funding to schools and authorities to meet the Roberts Review target of bringing schools laboratories up to a satisfactory standard by 2005-06 and to bring them up to a good or excellent standard by 2010.*

The subsequent document *Science and Innovation Investment Framework 2004-2014: Next Steps*, 2006, clearly reiterates this commitment in para 6.23:

> *The policy priority is to improve the state of school science accommodation by making school science laboratories a priority.*

However, there do not appear to be any nationally-available statistics on the extent to which this has actually affected laboratory provision and in particular whether there has been a significant improvement in the situation identified in a previous report in 2004. Accordingly, the Royal Society of Chemistry, with support from the Royal Society, asked CLEAPSS to gather evidence and report on the numbers of new and refurbished science laboratories in maintained secondary schools in England. At the same time CLEAPSS was asked to investigate the types of laboratory being upgraded or built, costs, the quality of furniture and fittings, and the fitness of laboratories for teaching and learning.

The major part of the research for this report was carried out by a questionnaire, sent to half of all maintained secondary schools in England. Of 1646 questionnaires sent out, 370 were returned, or 22.5%. The schools responding represent a typical cross-section of the 3292 maintained secondary schools in England. The report shows that 2271 (69%) have had at least one laboratory newly-built or refurbished in the period 2000 – 2005. We estimate there were about 26 000 laboratories in secondary schools in England in 2005. Of these 2860 (11%) were newly built in the previous 5 years and 5980 (23%) were refurbished in the same period. On average, 1222 (4.7%) of all school science laboratories have been refurbished per year and 572 (2.2%) have been newly built, a total of 1794 (6.9%) per year. Some of the new laboratories may have been to make up the shortfall identified in the earlier report; others may have replaced unsatisfactory accommodation but may still leave a shortfall. Higher-spending local authorities and those in the most deprived areas have a higher rate of new building than most. Establishments with specialist school status tend to have had more laboratory upgrading than other schools. The small number of secondary modern schools had had less upgrading.

The survey also asked for information about new builds or refurbishments taking place during the current school year and/or due to take place during the next two years. These indicate a reduced rate of 2.1% per year for refurbishments and 2.6% for new builds, a total of 4.7% but this may simply reflect the fact that the science department is not yet aware of what is proposed.

When asked about the level of satisfaction with the range of teaching and learning styles made possible by new laboratories, 24% were *Very satisfied*, 64% were *Satisfied*, while 11% were *Unsatisfied* and 2% *Very unsatisfied*. The main aspects that teachers thought contributed to good teaching and learning were flexibility of arrangements for pupils, increased ICT provision, larger spaces to work in and more attractive environments. Comments about unsatisfactory or poor provision were numerous and concentrated on lack of space, problems with services (gas, water, electricity), lack of ICT provision, and inflexible design. Some schools were settling for restricted designs, a problem increasingly commented on by science advisers and consultants. 20% of respondents are *Very satisfied* with their ICT provision, 43% are *Satisfied*, but 24% are *Unsatisfied* and 13% *Very unsatisfied*. About one third of refurbished and newly-built laboratories are fitted with a fume cupboard.

Amongst respondents, 35% had had *A great deal* of involvement in the design process, 32% *Some*, 25% only *A little* and 8% *Not at all*. Anecdotal evidence suggests that good involvement means good design, 'ownership' of the final product and good staff morale.

Where there has been refurbishment or newly-built laboratories, in only 43% of cases have the prep rooms also been *Improved*. In 41% of cases, provision has *Stayed the same*, although the number of laboratories may have increased. In 16% of cases, prep room provision has actually *Deteriorated*. Sometimes no prep rooms are included in new builds at all, rooms are removed for other purposes (often offices), storage areas are reduced, health and safety is ignored and experienced staff input also ignored.

Average costs for refurbishment, to an unspecified standard, were £38 000 per laboratory (range £2000 to £125 000) and, for new build, £120 000 per laboratory (range £11 000 to £375 000). Of the laboratories in the sample, approximately 54% appear to have been funded by local authorities, 18% under Private Finance Initiative (PFI) or other direct government funding, 15% by schools directly, and 8% under the Specialist Schools and Academies Trust (SSAT) schemes.

Respondents rated the quality of building works, furniture and fittings as *Very good* in 12% of the laboratories, *Good* in 61% while in 23% it was *Unsatisfactory* and in 5% *Poor.* The biggest complaint was of poor-quality furniture and fittings, especially of cupboards, their doors and locks, often falling to pieces very quickly under normal usage. Poor standards of workmanship and design were also mentioned, along with other concerns including services, flooring, bench surfaces, fume cupboards and so on. 71% of respondents stated that they had had maintenance problems with the new or refurbished laboratory. At the top of the list of concerns is the repairs needed to cupboards that are falling apart, but this is closely followed by problems with services that raise health and safety concerns. Plumbing and drainage are mentioned frequently, as are problems with gas supplies.

The government has had a target of making all laboratories good/excellent by 2010. Over the past 5 years, about 6.9% of all laboratories were refurbished or newly built per year. However, nearly 30% of these are not good/excellent. Assuming a 30 year life for a laboratory (comparable to the 25 year life of most PFI projects), normal wear and tear will downgrade about another 3.3% of the already good/excellent laboratories per year. These two factors would put back the achievement date to 2021. To achieve the target, the

upgrading rate achieved in recent years would have to double and the quality improve markedly. If the predicted rate of refurbishments and new builds is correct (at 4.7% per year), taking quality and deterioration into account, the achievement date would be 2034. To achieve the target of 2010, the predicted rate of 4.7% per year would have to increase by $3^1/_2$ times.

The Report makes a number of recommendations for improving the situation. These are as follows.

- That the DfES School Building and Design Unit investigate whether it is actually possible to build schools to the specifications in *Building Bulletin 80* and other *Building Bulletins* within budgets that are normally available.
- That where government funding is available for new or re-furbished laboratories compliance with *Building Bulletin 80* shall be made a condition of the contract.
- That where government funding is available for new or re-furbished laboratories contractors shall be required to consult with recognised experts in the field of school laboratory design and the science curriculum.
- That where government funding is available for new or re-furbished schools, some of that money shall be ring-fenced in order to ensure that laboratories meet a good or excellent standard, as in the document *Science and Innovation Investment Framework 2004-2014: Next Steps*, 2006.
- That where government funding is available for new or re-furbished laboratories, science subject leaders shall be actively consulted at the design stage, actively involved in monitoring the progress of the project and consulted about any necessary changes during the project.
- That science advisory staff working for local authorities and/or the Specialist Schools and Academies Trust should have job descriptions which include advising on laboratory design and planning and that where local authorities do not have such staff in post they should employ competent consultants with expertise in this field.
- That in order to develop competence in the area of laboratory design, there should be financial support for in-service training for science advisory staff, consultants, architects and project managers and science subject leaders.
- That where government funding is available for new or re-furbished laboratories, there should be a requirement that science advisory staff working for local authorities or the Specialist Schools and Academies Trust or competent independent advisers should be consulted on new projects.
- That schools' self-evaluation for Ofsted shall be required to report on the quality of laboratory accommodation, whether or not the result of up-grading.
- That the government commission consultants to monitor the quality of existing and new or re-furbished accommodation and hence monitor progress towards meeting government targets.

Improving school laboratories?

Contents

Improving school laboratories?

A Report for the Royal Society of Chemistry

on the number and quality of new and refurbished laboratories in schools

1. The scope of this report

1.1 The reason for this report

There is increasing concern about the number of young people who choose not to study the sciences beyond the age of 16 or, having studied science subjects to GCE A-level, choose not to pursue them in higher education. A contributory factor is the poor quality of science accommodation in many schools. This was highlighted in an earlier report, *Laboratories, Resources and Budgets*[1], commissioned by the Royal Society of Chemistry and produced by CLEAPSS in 2004. As well as estimating that 25% of laboratories were unsafe/unsatisfactory and a further 41% basic/uninspiring, this identified a shortfall of about 1 laboratory per school.

There has been an emphasis by the government in recent years on building new schools or refurbishing old ones. However, there do not appear to be any nationally-available statistics on the extent to which this has affected laboratory provision and, in particular, whether there has been a significant improvement in the situation identified in the previous report. Accordingly, the Royal Society of Chemistry asked CLEAPSS to gather evidence and report on the numbers of new and refurbished science laboratories in secondary schools in England. At the same time, CLEAPSS was asked to investigate the types of laboratory being upgraded or built, the costs, the quality of furniture and fittings, and the fitness of laboratories for teaching and learning. On this occasion, unlike the previous report, equipment provision was not explored as there is absolutely no evidence to suggest there has been much change in the position reported then whereas there has clearly been an emphasis on new school buildings and refurbishment.

1.2 Methodology

CLEAPSS appointed Andy Piggott as project officer. He is an experienced science education consultant who worked as the project officer for the national *Laboratory Design for Teaching and Learning* project and is course leader for the *Laboratories for Learning* course at the National Science Learning Centre. He was also a project officer for the previous report on laboratories for the RSC: *Laboratories, Resources and Budgets*, 2004.

Most of the research for this report was carried out by a questionnaire, sent to half of all maintained secondary schools in England (excluding middle schools). It was agreed to focus on improvements during the period 2000–2005. The questions were piloted with a small group of schools and minor amendments made. The full questionnaire, as sent out to schools, is in Appendix 1.

Of 1646 questionnaires sent out, 370 were returned, or 22.5%, which is a good rate of return; see Appendix 2. Responses were received from all types of schools and all types of local authorities (responsible for education). The coverage matches in almost all respects the responses to the questionnaires sent out for the previous report, giving good confidence in the reliability of the data.

Although the survey was confined to schools in England, we have no reason to think that results from elsewhere in the UK would be significantly different. Post-16 colleges and independent schools other than academies were not included in the survey.

Science advisers/inspectors/consultants and design & manufacturing firms supplied information on laboratories installed, which provided valuable cross-checks on some of the questionnaire data.

1.3 Acknowledgements

We are pleased to acknowledge the support provided to the project by the Royal Society.

[1] This report can be downloaded from the Royal Society of Chemistry web site at http://www.rsc.org/pdf/education/labreports2004.pdf.

We should like to take this opportunity to thank the staff of those schools who returned the questionnaires for their willingness to find time during a busy day, or, more probably, after a busy day, to find and fill in the statistics and comment where appropriate. The good return rate is a measure of the importance attached to this research.

Thanks are also due to the various science advisers/inspectors/consultants and staff from design and manufacture firms who provided important back-up data to validate the main research findings.

CLEAPSS administrative staff dealt with the mailings, set up the databases, handled the data entry and answered questions with unfailing courtesy. Our thanks go to all of them.

1.4 Context of this report

The government's aim, set out in *Science and Innovation Investment Framework 2004-2014,* (*SIIF*), was to:

> *provide capital funding to schools and authorities to meet the Roberts Review target of bringing schools laboratories up to a satisfactory standard by 2005-06 and to bring them up to a good or excellent standard by 2010.*

The subsequent document *Science and Innovation Investment Framework 2004-2014: Next Steps*, 2006, clearly reiterates this commitment in para 6.23:

> *The policy priority is to improve the state of school science accommodation by making school science laboratories a priority.*

In April 2005, the Secretary of State for Trade and Industry made an announcement, confirmed later by the Prime Minister, that there would be guaranteed funding of £75 000 for every secondary school to pay for a new science laboratory over the next three years; over £2 000 000 in all. This funding was to be in addition to the *Building Schools for the Future* (BSF) programme. However, the Association of School and College Leaders has since received a letter from the DTI confirming that there is to be ***no*** additional funding for school science laboratories[2].

1.5 Main findings

In the sample of schools which responded, 11% of their laboratories were newly built in the previous 5 years and 23% were refurbished in the same period. Looked at in another way, 69% have had at least one laboratory newly-built or refurbished in the period 2000 – 2005.

The responding schools represent a typical cross-section of the 3292 maintained secondary schools in England, therefore across the country 2271 have had at least one laboratory newly-built or refurbished in the period 2000 – 2005. We estimate that there were about 26 000 laboratories in secondary schools in England in 2005. Of these, 2860 were newly built in the previous 5 years and 6050 were refurbished in the same period. On average, 1222 (4.7%) of all school science laboratories have been refurbished per year and 572 (2.2%) have been newly built, a total of 1794 (6.9%) per year. Some of the new laboratories may have been to make up the shortfall identified in the earlier report; others may have replaced unsatisfactory accommodation but may still leave a shortfall.

The survey also asked for information about new builds or refurbishments taking place during the current school year and/or due to take place during the next two years. These indicate a reduced rate of 2.1% per year for refurbishments and 2.6% for new builds, a total of 4.7% but this may simply reflect the fact that the science department is not yet aware of what is proposed.

When asked about the level of satisfaction with the range of teaching and learning styles made possible by new laboratories, 24% were *Very satisfied*, 64% were *Satisfied*, while 11% were *Unsatisfied* and 2% *Very unsatisfied*. The main factors contributing to good teaching and learning were flexibility of arrangements for pupils, increased ICT provision, larger spaces to work in and more attractive environments. The numerous comments about unsatisfactory or poor provision concentrated on lack of space, problems with services (gas, water, electricity), lack of ICT provision, and inflexible design. Some schools were settling for restricted designs, a problem increasingly commented on by science advisers and consultants.

20% of respondents were *Very satisfied* with their ICT provision, 43% were *Satisfied*, but 24% were *Unsatisfied* and 13% *Very unsatisfied*. There was a fixed data-projector and screen in 74% of laboratories. Internet access was available, by cable and/or wireless, in 92% of such

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[2] Association of School and College Leaders press release, 9 March 2006.

laboratories. The trend seems to be toward laptops for pupils. However, ICT provision for laboratories appears to be an afterthought which is funded by the school, sometimes well after the laboratory is first in use, rather than included in the overall contract for a forward-looking design and build.

About one third of refurbished and newly-built laboratories are fitted with a fume cupboard. The 2004 report found that 63% of schools teaching Key Stages 3 and 4 and 81% of those teaching post-16, needed more than two extra fume cupboards. Consequently, the one-third figure for refurbished and newly-built laboratories may not represent much improvement. Nearly all school science laboratories are designed to be multi-disciplinary. Where schools do allocate laboratories according to subjects, this tends to happen more in schools teaching at A-level. Schools with post-16 students report about 12% of their new or re-furbished laboratories are used for A-level biology or chemistry, but only around 8% for physics.

Amongst the respondents, 35 % had had *A great deal* of involvement in the design process, 32% *Some*, 25% only *A little* and 8% *Not at all*. Anecdotal evidence suggests that good involvement 'ownership' of the final product leading to good staff morale. However, alienation of end users can result when architects and planners ignore suggestions.

In only 43% of refurbished or newly-built laboratories have the prep rooms also been *Improved*. In 41% of cases, provision has *Stayed the same*, although the number of laboratories may have increased. In 16% of cases, prep room provision has actually *Deteriorated*. Sometimes no prep rooms are included in new builds at all, existing prep rooms are removed for other purposes (often offices), storage areas are reduced and the views of experienced staff ignored.

Average costs for refurbishment, to an unspecified standard, were £38 000 per laboratory (range £2000 to £125 000) and for new build £120 000 per laboratory (range £11 000[3] to £375 000). For refurbishments, this is consistent with the £30 000 to £55 000 estimated in the 2004 report. For new build, it is a little lower than the £145 000 estimated but it may be that the whole costs were not known to respondents.

Of the laboratories in the sample, approximately 54% appear to have been funded by local authorities, 18% under Private Finance Initiative (PFI) or other direct government funding, 15% by schools themselves, and 8% under the Specialist Schools and Academies Trust (SSAT) schemes.

Respondents rated the quality of building works, furniture and fittings as *Very good* in 12% of the laboratories, *Good* in 61% while in 23% it was *Unsatisfactory* and in 5% *Poor.* Where the rating was good, both the quality of furniture and fittings and the standards of workmanship shown by contractors were praised. The biggest complaint was of poor-quality furniture and fittings, especially of cupboards, their doors and locks. These are often said to fall to pieces very quickly under normal usage. Poor standards of workmanship and design were also mentioned, along with other concerns including services, flooring, bench surfaces and fume cupboards.

71% of respondents stated that they had had maintenance problems with the new or refurbished laboratory. At the top of the list of concerns is the repairs needed to cupboards that are falling apart, but this is closely followed by problems with services that raise health and safety concerns. Plumbing and drainage are mentioned frequently, as are problems with gas supplies.

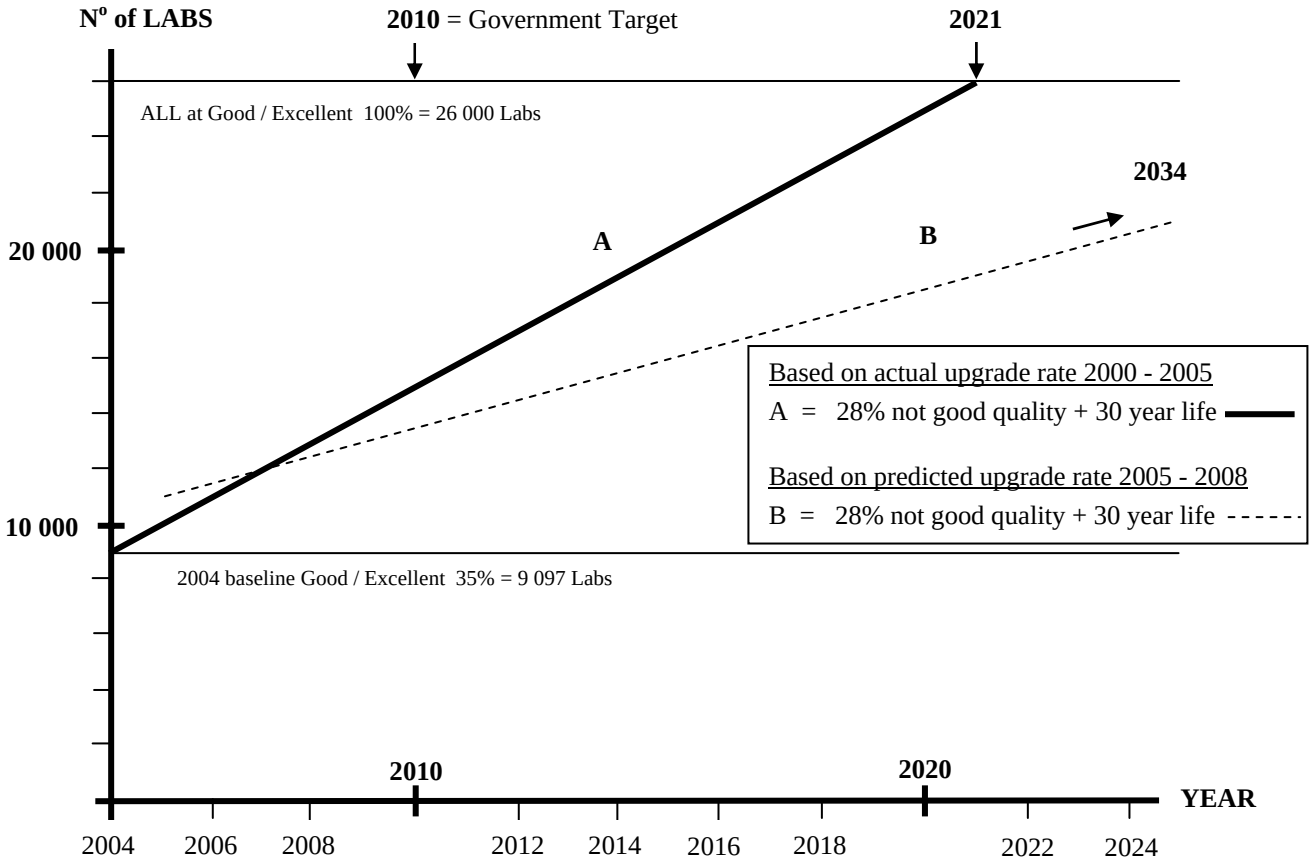
Over the past 5 years, about 6.9% of all laboratories have been refurbished or newly built per year. However, 28% of these are *not* good/excellent. Assuming a 30 year life (see section 2.12) for a laboratory, normal wear and tear will downgrade about 3.3% of the already good/excellent laboratories per year. These two factors would put back achievement of the government's target for improving science laboratories to 2021; see Figure 1. If the predicted rate of refurbishments and new builds is correct (at 4.7% per year), taking quality and deterioration into account, the target would not be achieved until 2034. These dates are summarised in the following table.

[3] This figure cannot possibly be correct as you could not even equip a laboratory with new benches for this sum. However, other reported figures were all more plausible.

Original Government target for all labs to be at Good / Excellent standard	2010			
Year when all labs will be at Good / Excellent standard	*Best possible* (unrealistic, as quality and deterioration disregarded)	*With poor quality taken into account*	*With poor quality and a 30 year 'life' (see section 2.12)*	*With poor quality and a 15 year 'life' (see section 2.12)*
Based on 2000-2005 questionnaire data on existing refurbishments and new builds	2013	2017	2021	2029
Based on 2005-2008 questionnaire data on predicted refurbishments and new builds	2017	2022	2034	2106
Based on Minister's data 14th June 2006 (see section 2.13)	2017	2020	2032	

To achieve the government's target of all laboratories good/excellent by 2010, the reported upgrading rate in recent years of 6.9% of labs per year would have to double, with quality improved markedly. The predicted rate of 4.7% per year would have to increase by $3^1/_2$ times to achieve the government's target.

Figure 1



2. Discussion of the results

2.1 Responses from schools and others

Of 1646 questionnaires sent out, 370 were returned, or 22.5%, which is a good rate of return for any postal questionnaire. The previous survey[4] achieved a response rate of 42% on the laboratory provision questionnaire but 26% on the resources and budgets questionnaire. A more recent survey for the RSC[5] had a response rate of 25%. The questionnaire for the current

4 *Laboratories, Resources and Budgets*, RSC, 2004.

5 *Surely That's Banned?,* RSC, 2006.

survey was addressed to the Head of Science / Senior Technician. Heads of Science returned about 38% and technicians about 59%.

The vast majority of forms were fully completed. Three questions contained small boxes for comments, but respondents frequently carried over longer comments to other areas of the questionnaire sheets. Where arithmetical errors were made by respondents, it was often possible to cross-check between different parts of the form in order to input consistent data. In a few cases, information was unreadable or unintelligible and was therefore omitted from the database. 114 schools sent in forms showing zero laboratories refurbished or built over the report period, some 31% of the total. However, this may well be an underestimate, as we suspect that schools which did not have new or refurbished laboratories may have been less inclined to respond, as most of the questions were about the nature of the improvements. They may not have appreciated that a nil return was also important.

Responses were received from all types of schools and all types of local authorities (responsible for education). The coverage matches in almost all respects the responses to the questionnaires sent out for the previous report, giving good confidence in the reliability of the data. Responses were analysed across the following sub-groups (see Appendix 2).

- Local authority: High-, Medium- and Low- spending authorities.
- Type of school: Comprehensive, Grammar, Secondary modern, Specialist science all-ability , Specialist non-science all-ability, Specialist restricted intake, Other.
- Age ranges: 11-16, 11-18, 14-18, Other.
- Status of school: Community, Foundation, Voluntary controlled, Voluntary aided, (City) Academy, Other.
- Deprivation: 5 equal bands, using the government's Neighbourhood Profile.

The number of Specialist schools has changed over the two years since the 2004 report but, if numbers for all all-ability schools are put together, the match in percentages of responses across the types of school is almost identical to the previous report and thus we can be very confident that the sample was representative.

Local authorities were classified as high-, medium- or low-spending based on the average pupil funding per head for 2001-2, as reported in the House of Commons *Hansard Written Answers* for 26th October 2001. The 148 local authorities responsible for education in England were divided into three groups of 49 or 50, depending on the rank order. This categorisation was also used in the 2004 report but the figures are more dated and hence results need to be interpreted with caution. Note that low-spending authorities tend to be shire counties with many schools, whereas high-spending authorities tend to be relatively small metropolitan authorities or London Boroughs.

The deprivation measure is an additional classification, based on the government social statistics for the postcode of the school (www.neighbourhood.statistics.gov.uk, the *Index for Multiple Deprivation*, 2004, at LSOA level). Schools responding were roughly evenly spread over the five equal bands created from the scale, with slightly fewer in Band 1 (most deprived). Schools do not necessarily have a pupil intake that matches the deprivation index of the post code of the school, especially selective schools, but the index does give a broad picture of the social circumstances of the schools.

In general, the analysis shows that there is little variation in response across different types of school. Where there are differences, these are noted in the appropriate section below.

Science advisers/inspectors/consultants from local authorities were asked for corresponding data on an authority basis. Ten advisers responded, but it was apparent that several had great difficulty in finding the information. Only three were able to provide comprehensive information across the years requested (2000 – 2005) and were confident about its accuracy. Their responses (see Appendix 3) broadly validate the questionnaire data. Science advisers, etc spend their working life supporting, checking and evaluating science teaching and provision in schools and are in a good position to compare laboratories across a range of establishments. However, few now seem to have the opportunity to help in the design and build of the very laboratories that affect science learning, although in the past this was often an important part of their role. Those advisers that provided comments were often worried by lack of quality in new-builds, by lack of attention to modern teaching and learning needs, and by issues surrounding health and safety.

Companies that design and manufacture school science laboratory furniture were also approached to assess the number of laboratories that were actually installed from 2000 – 2005. One very large company and two smaller-sized companies responded, helpfully supplying the numbers of laboratories they had installed in England over this period.

Estimates of the number of upgraded laboratories based on their figures (see Appendix 4) show good agreement with the results from the questionnaires.

2.2 Numbers of laboratories

Total number

The 370 responding schools had 2921 laboratories, giving a scaled-up total for all maintained secondary schools in England of approximately 26 000 (25 989), or 7.9 laboratories per school. This compares very well with the estimated total from the 2004 report of 26 333 laboratories (7.5 laboratories per school). The average number of laboratories per school in the 2004 report would be expected to be slightly smaller as it included 54 schools classified as 'middle-deemed-secondary', at 2.3 laboratories per school. It may also be the case that, as a result of recent upgrading, there has been a small but welcome increase in the average number of laboratories.

Upgrades 2000 - 2005

Schools were asked to record the numbers of laboratories they had had refurbished or newly built for each of the five academic years from 2000 – 2005. There is no clear trend over the five years.

Average percentage of refurbished laboratories = **4.7% per year**
Average number of new builds = **2.2% per year**

The raw figures from the sample (see Appendices 6 and 7), scaled up for the whole of England, give:

2000 – 2005	approximately	6110 refurbished laboratories
	and	2860 newly-built laboratories
	Total	**8970 upgraded laboratories**
Or, on average,		1222 refurbished laboratories per year
	and	572 newly-built laboratories per year
	Total	**1794 upgraded laboratories per year**

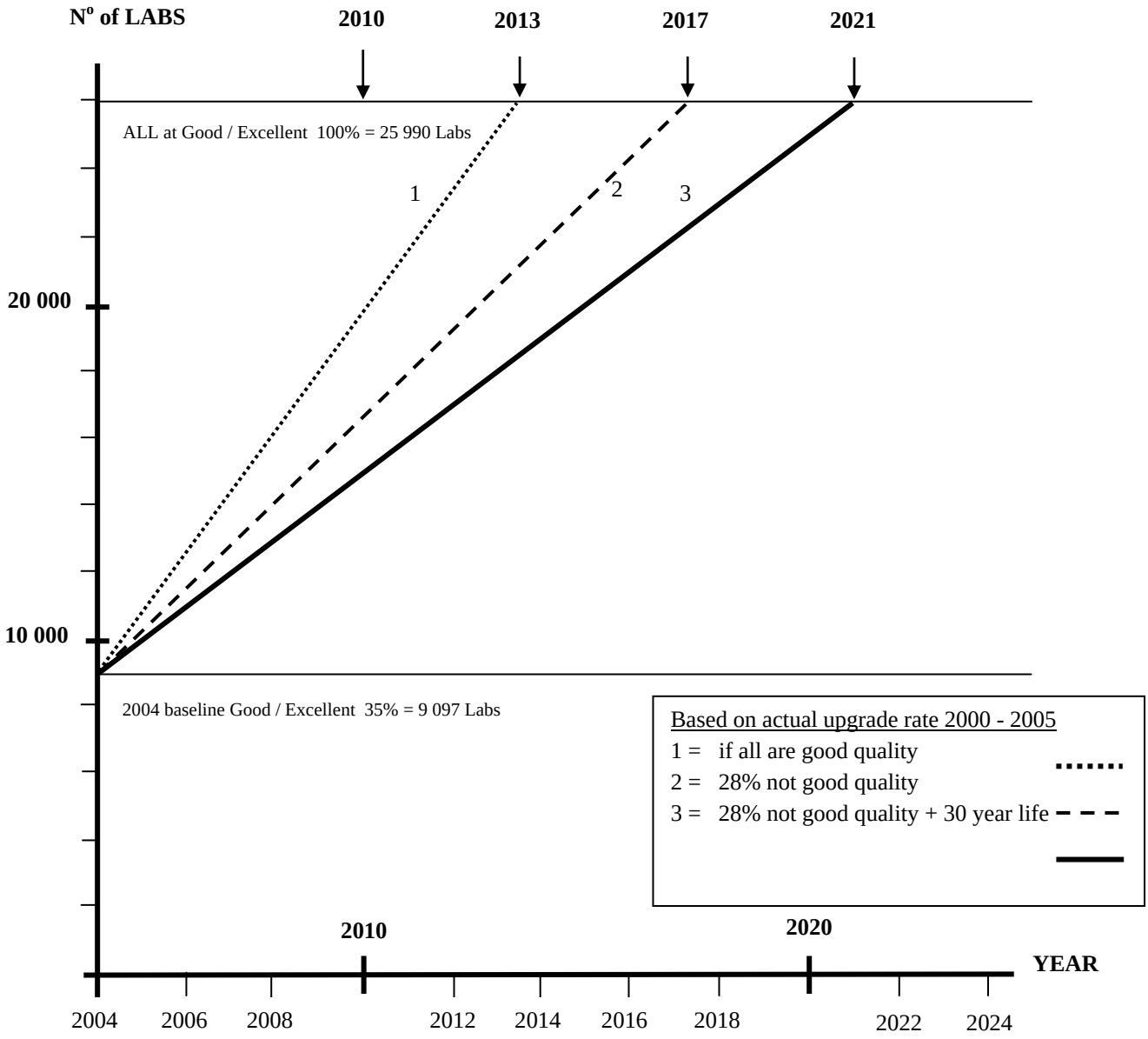
The previous report set out criteria for judging the standards of laboratories and, in 2004, 35% were judged to be Good or Excellent which would equate to approximately 9100 of the current total. Thus approximately 16 900 laboratories needed upgrading in 2004. At the rate of 1794 per year in this survey, it would take 9.4 years to improve all the other laboratories to these standards or from 2004 to 2013. See Figure 2 and Appendix 7.

This would fail to meet the government's own target set out in *Science and Innovation Investment Framework 2004-2014* to:

> *provide capital funding to schools and authorities to meet the Roberts Review target of bringing school laboratories up to a satisfactory standard by 2005-06 and to bring them up to a good or excellent standard by 2010.*

However, it is clear from this survey that the quality of furniture, fittings and workmanship is not enough for all such laboratories to be classified as Good or Excellent – see sections 2.10 and 2.12, below. Consequently the target will slip further unless additional programmes, such as *Building Schools for the Future*, have a much quicker impact than seems likely. See Figure 2 below. The position would be even worse if a 15-year laboratory life were assumed (see section 2.12) but this seems unrealistic.

Figure 2


Nº of LABS
2010
2013
2017
2021
ALL at Good / Excellent 100% = 25 990 Labs
1
2
3
20 000
10 000
2004 baseline Good / Excellent 35% = 9 097 Labs
Based on actual upgrade rate 2000 - 2005
1 = if all are good quality
2 = 28% not good quality
3 = 28% not good quality + 30 year life
2010
2020
YEAR
2004
2006
2008
2012
2014
2016
2018
2022
2024

Planned upgrades 2005 - 2008

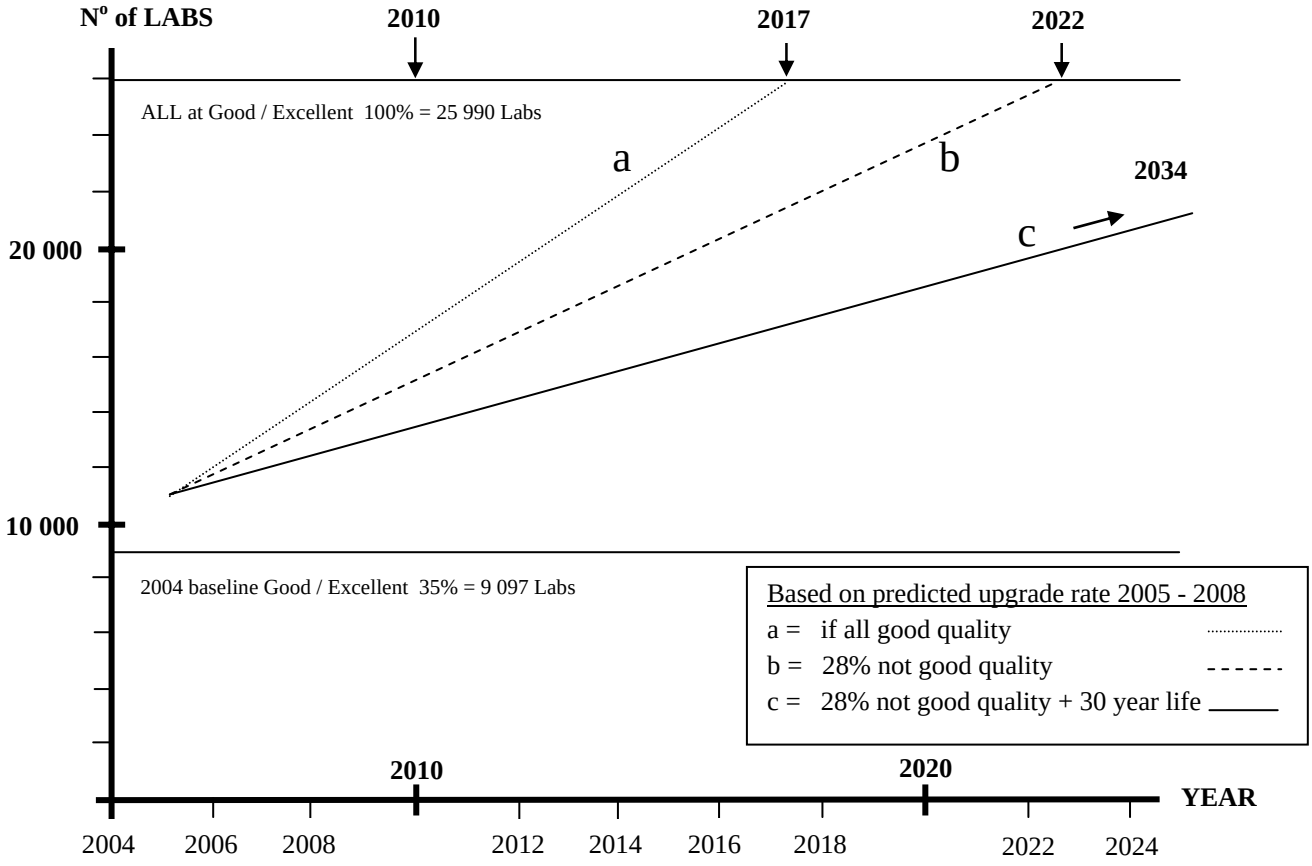
Responses about laboratories being refurbished or newly built during 2005-2006 or planned up to 2008, indicated lower figures for 2005-2006 (those actually started or imminent), picking up towards 2008.

2005-2006	total percentage refurbishment and new build	= 3.9%
2006-2007	anticipated percentage	= 4.2%
2007-2008	anticipated percentage	= 5.9%
	Average total percentage of planned upgrades	**= 4.7%**

The figure for 2005-2006 is very low compared to the previous years and is probably reliable as science departments would be involved, or just about to be, when answering the questionnaire. Figures for 2006-2008 may be lower than will actually happen as science departments may not have been fully aware of what was planned.

However, if trends are calculated on the average percentage figure of 4.7% for 2005-2008, this would mean only 1221 laboratories per year improved to meet good/excellent standard. Assuming build quality was good it would take until 2017 to achieve the target of all laboratories meeting a good/excellent standard. It would take even longer if some upgraded laboratories fail to meet the good/excellent standard. See Figure 3 below and Appendix 7.

Figure 3



No laboratories refurbished or newly built

About 31% of respondents reported that there had been no laboratories refurbished or newly built in their school during 2000-2005 and 23% not only reported none in 2005-2006 but that they did not anticipate any in 2006-2008 either. The position may in fact be even worse if schools with no upgrades (actual or planned) decided not to return the questionnaire.

Variations 2000-2005 *(see Appendix 6)*

The percentage of newly-built laboratories each year appears to correlate with authority spending. In high-spending authorities 3.8% of laboratories were newly-built per year. In

medium-spending authorities it was about 2.1% and in low-spending authorities 1.6%. Refurbishments seem similar across all three bands, between 4.2 – 4.5%.

Schools in the most deprived areas appear to have more than double the percentage of new builds of any of the other four bands (eg, Band 1 = 3.4% per year, Band 3 = 1.3% per year).

Secondary modern schools report the lowest percentages of both refurbishments (3.3% per year) and new builds (0.7% per year) of all types of school, although the sample was small. This is serious because secondary moderns were often badly provided for in the first place. Comprehensives have the greatest rate of new builds at 2.6%.

Specialist schools in general have higher refurbishment rates (all ability 5.1% per year and restricted range ability 6.1% per year). Curiously, schools with science specialisms report lower rates of both refurbishment (2.3%) and new build (1.2%).

11-16 schools have a slightly-better record of refurbishment and new build than 11-18 schools (refurbishments = 5.4% to 4.1% and new builds = 2.4% to 2.1%).

Voluntary aided and Foundation schools have had the lowest percentage of new builds per year (1.2% and 0.9%), while they both also report lower-than-average percentages of refurbishments (4.2% and 4.4% per year).

2.3 Teaching and Learning

Respondents were asked how satisfied they were with the range of teaching and learning styles that the upgraded laboratory makes possible. The range of answers (see Appendix 5) was:

Very satisfied	= 23.8%
Satisfied	= 63.8%
Unsatisfied	= 10.8%
Very unsatisfied	= 1.6%

These are encouraging responses although 12.4% *Unsatisfied* or worse is disappointing. There were many comments on the attractiveness of the new environment.

- *Bright, clean, cheerful environment*
- *Most rooms are light and welcoming with whiteboards*
- *Labs light and airy and look nicer*

These new laboratories motivate both staff and pupils even when providing fairly basic improvements. Features which were seen as contributing to better teaching and learning included flexibility of arrangements for pupils, larger spaces to work in, and increased ICT provision.

- *Greater space allows safer practicals, interactive whiteboards enhance learning possibilities.*
- *Huge labs each with separate lecture, demonstration and practical areas.*
- *This refurbishment changed the orientation of the room to allow more flexibility of teaching styles ….*
- *… benches/pods stand as islands and make the teaching flexible.*

The high level of *Satisfied* comments should be treated with some caution because a significant number of comments revealed that respondents were settling for restricted designs, a problem increasingly commented on by science advisers and consultants and even some architects. One science adviser points out that some schools in his area ignored advice and

- *…simply replaced 1950s/60s designs with new furniture and [did not think] creatively about possible future learning needs …*

and that

- *I have also had to put a health and safety limit on some refurbishments … because they have broken the rules on safe circulation requirements.*

Some typical respondents' comments included:

- *all pupils facing front;*
- *all students facing teacher;*
- *no child has back to teacher.*

These comments generally reflect one style of teaching, teacher exposition, and assume that the teacher stays in one position all the time. Practical work, and other forms of group and individual work, demand that the teacher moves around to interact with pupils and the pupils cannot all be 'facing the teacher' all of the time. Some respondents are recognising this.

- *Often taught in rows. Not good for group work.*

- *Furniture can't be moved – straight rows which staff wanted, but not good for discussion groups.*

The number of comments about *Unsatisfied* provision is almost the same as that for *Satisfied*, even though the percentage of *Unsatisfied* was much smaller. They concentrate on lack of space, problems with services (gas, water and electricity), lack of ICT provision, and inflexible design.

- *Not used as a lab. Students and staff cannot get to services. Even as a classroom it lacks space to circulate.*

Behaviour of pupils is also an issue, with the design often blamed for this.

- *Some furniture allows pupils to hide.*
- *Pupils can have their backs to teachers and fiddle with gas and electricity supplies.*

Perhaps the one terse comment *Good teaching is down to staff* indicates that design can only go so far – only effective teachers can manage pupils properly.

2.4 ICT provision

Asked about the level of ICT provision in their new laboratories, 20% of respondents said they were *Very satisfied* and 43% were *Satisfied*. However, far too many were *Unsatisfied*, 24%, or indeed *Very unsatisfied*, 13%. (See Appendix 10.) No particular standards of ICT provision are specified by the DfES for school laboratories. However, in view of the encouragement given by governments in recent years to the development of ICT in schools these figures are disappointing. It is clear from the responses that schools are asking for basic levels of provision, eg internet access, not wall-to-wall plasma screens.

In 74% of refurbished or newly-built laboratories, there was a fixed data-projector and screen, but this left 26% of such laboratories without. Internet access was available, by cable and/or wireless, in 92% of such laboratories, but not at all in the other 8%.

There seems to be a trend toward laptops for pupils, which has implications for the design of laboratories. For example, trolleys of laptops need spaces in the prep areas for storage and for re-charging as well as spaces in the laboratories so that pupils can use them.

- *The labs were designed with computer benching and network points down one side – these are no longer needed as we a have a trolley of laptops for use in the labs and wireless internet connection.*

ICT provision for laboratories often appears to be an afterthought, which is funded by the school, sometimes well after the laboratory is first in use, rather than included in the overall contract for a forward-looking design and build. For example:

- *Cable installed, but no machines available to use network.*
- *Added later from own funding.*
- *Not fitted at the time.*
- *Benches and facilities provided for PCs but none have been provided.*

Variations

Science-specialist schools consider themselves better off for overall ICT provision in their new laboratories, with 95% *Satisfied* or *Very Satisfied*. Technology-specialist schools are less satisfied and ICT-specialist schools report a staggering 38% *Very Unsatisfied* and *Unsatisfied*.

A fixed data-projector and screen is available in 93% of new science laboratories in science-specialist schools, while this drops in technology-specialist schools and further, to only 65%, in ICT-specialist schools.

Science-specialist schools report the lowest number of laboratories without internet connections (3%), while technology-specialist schools report the highest number of their laboratories with both cable and wireless connections (34%).

2.5 Science subject provision

Nearly all school science laboratories have been designed to be multi-disciplinary. To achieve maximum flexibility, all laboratories would need a fume cupboard and the DfES recommends[6] that between 50% and 100% of laboratories used for teaching key stage 4 (in practice, almost all laboratories) should have one. In fact, about one third of refurbished and newly-built laboratories are fitted with a fume cupboard (see Appendix 11). The 2004 report found that

6 *Building Bulletin 88 Fume Cupboards in Schools*, DfEE, 1998.

63% of schools teaching Key Stages 3 and 4 needed more than 2 extra fume cupboards and of those teaching Post-16, 81% needed more than 2 extra. Consequently, the one-third figure for refurbished and newly-built laboratories may not do much to improve their overall total of fume cupboards.

Where schools do allocate laboratories according to subject this tends to happen more in schools teaching at A-level. Schools with Post-16 pupils report that about 12% of their laboratories are used for A-level biology or chemistry, but only around 8% for physics. New builds have slightly higher percentages than refurbishments (see Appendix 11).

At Key Stage 4, schools rarely timetable specific laboratories mainly to specific subject areas – only in about 5% of cases. New builds have an even lower percentages allocated to specialist subjects than refurbishments, possibly pointing to further development of the policy of flexible use of laboratories at KS4 (see Appendix 11).

Variations

High-spending local authorities appear to be installing fume cupboards in newly-built laboratories at twice the rate of Medium- and Low-spending authorities. This may be because the schools concerned suffered underprovision before the new laboratories were built.

Specialist science schools report between 70% and 80% of their refurbished and newly-built laboratories have fume cupboards installed. Grammar schools appear to have around 47% of refurbished or newly-built laboratories with fume cupboards. 11-16 schools report fewer fume cupboards installed in their newly-built laboratories (around 18%).

Schools teaching A-levels in deprived areas (Deprivation Bands 1 and 2) tend to allocate fewer laboratories to biology and chemistry and fewer still to physics. Those in higher-spending local authority areas also tend to have fewer allocated to biology and chemistry, while physics is lower across all authorities. There is also a tendency right across classifications for there to be more newly-built laboratories allocated to physics than for refurbishments. Given the traditional nature of grammar schools, it is not surprising that they have nearly twice as many A-level specialist laboratories as comprehensives. Physics laboratories are still scarcer in grammar schools than biology or chemistry. Science specialist schools appear to allot more refurbishments to physics (14%) and a great deal more to chemistry (31%).

2.6 Consultation and involvement of end-users

Teachers and technicians were asked to what extent they were consulted during the design process and subsequent building works. Their responses (see Appendix 5) were as follows.

A great deal	= 35.4%
Some	= 31.8%
A little	= 24.8%
Not at all	= 7.9%

Teachers and technicians do not necessarily know what might be the best design but they do know a great deal about the practical side of what is needed and they will be the end-users. Consequently, the percentage that were only consulted *A little* or *Not at All* is worryingly high. Good involvement generally results in 'ownership' of the final product and contributes to good staff morale.

Ignoring advice from end-users can result in alienation, for example:

- *We had … consultations with architects and planners to ensure our needs were fulfilled. Unfortunately, when the actual building was being done a great deal of this was just ignored … . The school as a whole has had a lot of problems with (a large private consortium) … .*
- *[We] had meetings with architects … to discuss options and requirements … . It makes you wonder whether architects/designers have any idea what goes on in a school science department …*
- *No notice was taken of our recommendations prior to the build being planned, despite providing a copy of CLEAPSS booklet L14[7], resulting in bad design and extra expense as things had to be altered (for health and safety reasons).*

[7] L14 *Designing and Planning Laboratories* can be found on CLEAPSS website www.cleapss.org.uk and also see Documents, www.ase.org.uk/ldlt.

In science specialist schools staff were consulted more.

A great deal	= 40%
Some	= 38%
A little	= 22%

This may well be the reason for less dissatisfaction with Quality in such schools (see section 2.10).

2.7 Preparation rooms and storage

Unfortunately, the upgrading of laboratories was not matched by similar work in the prep rooms and store rooms. This is a major problem, as good standards in preparation areas are vital to the success of the science practical curriculum. The DfES recommends[8] that there should be between 0.4 and 0.5 m^2 of prep. room + storage space per pupil laboratory place. Thus, for example, a science department with 6 laboratories, each accommodating 30 pupils, ie 180 pupil places, needs 72 – 90 m^2 of prep. room + storage space.

Responses about provision for prep rooms (see Appendix 6) were

Improved = 43% *Stayed the same* = 41% *Deteriorated* = 16%

In several instances, *Stayed the same* was reported when the number of laboratories had actually increased. Thus the same prep room and storage areas were servicing a larger number of laboratories and probably more practical work and in effect there was a deterioration in provision.

It appears that funding is not allocated to prep rooms and storage at the contract and design stage. Respondents are very clear about the problems encountered by technicians: sometimes no prep rooms are included in new builds at all, rooms are removed for other purposes (often offices), storage areas are reduced, the requirements of health and safety are ignored and the input from experienced staff on layout and facilities is also ignored. For example,

- *Centralised, one room, but not enough storage, only one sink! ... weird design features and definitely different from what we were insisting on.*
- *The prep room is very badly planned. No gas supply, small tiny sink (only one), no ventilation fan, small chemical store, no space for gas cylinders, etc.*
- *... health and safety factors being completely ignored by planners.*

Oddly, deterioration of prep rooms was greatest in the highest-spending authorities (23%); where they also build the greatest percentage of new laboratories. Perhaps the concentration on laboratory building took attention away from support areas?

The highest deterioration reports were in Bands 1 and 2 (23% and 20%) of the Deprivation Index (see section 2.1). Note that Band 1 schools also had the highest percentage of new builds of laboratories.

A high deterioration rate (20%) was reported from Specialist schools, although the Science Specialist schools (30 schools in the sample) had the lowest rate at just 8%. Voluntary Aided schools report the highest rate deterioration of all at 26%.

2.8 Costs

The costs reported for refurbishment and new builds to an unspecified standard, were as follows:

- *Refurbishment* average costs £38 000 per lab range £2000 to £125 000
- *New build* average costs £120 000 per lab range £11 000 to £375 000

£11 000 for a new build is obviously wrong, as you could not even buy the benches for this price. However, in general the figures compare well with the estimates in the previous report, *Laboratories, Resources and Budgets*, RSC, 2004, which gave the costs of upgrading school laboratories to a Good/Excellent standard as:

- *Refurbishment* between £30 000 and £55 000 per lab (depending on the existing state and several other factors)
- *New build* £145 000 per lab

[8] *Building Bulletin 80, Science Accommodation in Secondary Schools. A Design Guide*, DfES Schools Building and Design Unit, 2004. Available for download from teachernet http://www.teachernet.gov.uk/_doc/6152/BB%2080_19.pdf.

The consistency between reports is very high for refurbishment. For new build, it may be that the whole costs were not known to respondents because 24 schools reported new build costs at less than the average costs for refurbishments.

There is also good consistency with figures reported by science advisers who reported costs per lab, for unspecified standards:

- *Refurbishment* range £15 000 to £70 000
- *New build* range £67 000 to £150 000

Science specialist schools spent, on average, far more on refurbishments, at £52 000, and, where they built new, less on average, at £89 000.

2.9 Sources of funding

Funding arrangements were not always clear from the responses given. About 20% of laboratory upgrades appear to have been funded from more than one source; often the school contributed as well as the main funder(s). Where more than one source was given, the source of funding was allocated to the main funder(s) where this appeared evident.

Funding sources for the refurbishments and new builds in this report were as follows.

Local authorities	54%
Schools	15%
PFI (Private Finance Initiative)	14%
SSAT (Specialist Schools and Academies Trust)	8%
Other government	4%
Diocese	2%
Development Agency	1%
Insurance	1%
Other	1%

As would be expected, the SSAT funded a greater percentage of laboratory upgrades in Science specialist schools:

Local authorities	45%
SSAT	27%
PFI	14%
Schools	11%
Other	3%

2.10 Quality of building works, furniture and fittings

Asked to judge the quality of the building works, furniture and fittings, respondents put this at (see Appendix 5):

Very Good	12%
Good	61%
Unsatisfactory	23%
Poor	5%

It is worrying that nearly 30% of new or refurbished laboratories cannot be classified as good or excellent. It means that of the 1794 laboratories per year that are refurbished or newly built, 520 need further upgrading. See Figure 2, section 2.13 and Appendix 7. The previous report (2004) showed that only 35% of existing laboratories were classified as *Good* or *Excellent*; 73% is obviously an improvement but not as good as might have been hoped.

Comments about quality were given by around 180 schools, with comments on poor quality outnumbering those on good quality by two to one. Teachers and technicians who reported good quality praised the quality of furniture above all else, along with the standards of workmanship and the superior quality of bench surfaces.

- *Done by … highly skilled and experienced, using ... specialists for electrics, fume cupboard, gas, etc.*
- *Nearly three summers on, the fittings and fixtures are still in good condition.*

The adverse comments were numerous and often lengthy. The biggest complaint was of poor-quality furniture and fittings, especially of cupboards and their doors and locks. These are often said to fall to pieces very quickly under normal use. Poor standards of workmanship and design were also mentioned, along with a host of other concerns, including services, flooring, bench surfaces and fume cupboards.

- *Local building firm employed to refurbish – used kitchen fittings for cupboards and doors. Poor quality hinges. Doors and drawer fronts regularly fall off.*

- *Island units provided were flimsy. Gas pipe ruptured and caused a fire. Heating has never worked properly. Poor ventilation.*
- *Not enough storage, poor access to equipment. … Staff had to decorate and fit all shelving (to cut costs) in their own time!! Poor design – sink and taps.*
- *Cheap fixtures and fittings. Doors can be pulled off. Can't lock some – incorrectly aligned. Sockets not fitted properly. Cabling down from ceiling so pillar installed – restricts pupils view of teacher. Fume cupboards incorrectly wired. Gas pods easily broken. Insufficient provision in electrical system for all new technology ie whiteboard. Poor flooring. Windows falling out.*

It may be that Specialist science schools are able to exert a little more influence as their *Unsatisfactory / Poor* responses were lower, at 20%.

2.11 Maintenance

'Have there been any maintenance problems with this lab?' may well have been a leading question. Inevitably, in any building project there will be a period of 'snagging', in which minor items are attended to towards the end of the contract. This is normal and cannot be regarded as a maintenance problem, although teachers and technicians may be unaware of this. Nevertheless, 71% of respondents reported maintenance problems with their brand new laboratories, despite the fact that over 70% were happy with the quality of these laboratories.

Screening out comments on minor items that any refurbishment or new build might face, still leaves a lot that cause concern. At the top of the list is the repairs needed to cupboards that are falling apart, but this is closely followed by problems with services that can have serious health and safety implications. Plumbing and drainage are mentioned frequently, as are problems with the gas supplies (with leaks, faulty cut-offs, or even no cut-offs at all). Some structural problems are reported, including holes in walls and leaky roofs.

- *Gas system is prone to fail if solenoid in food rooms and kitchens below the science labs has failed.*
- *Water pressure system is intermittent, violent one minute, non-existent the next – can be quite dangerous.*
- *Need[ed] to install a gas emergency button. Have had to fix benching to floor to stop movement to islands housing (gas, water, electricity) supplies.*
- *Poor heating. Joiner employed to rectify joinery problems. Floor areas relaid. Blocked sinks due to new piping joined to old plumbing system.*
- *Floor covering not strong enough to take stool legs (making holes). Bench tops wrong varnish used so stained. Cupboard doors falling off and handles waited 12 months for repair and still waiting.*

(The problem with stools, reported above, is almost certainly due to the lack of ferrules on the legs; possibly the stools were not replaced when the laboratory was refurbished.)

2.12 Expected deterioration

At the rates of upgrading of laboratories seen in section 2.2 it would take around 10 years or more to improve all laboratories to a good or excellent standard. Unfortunately, normal wear and tear over that timescale will inevitably downgrade a certain proportion of laboratories. Manufacturing firms can be expected to provide good-quality furniture and fittings, but they cannot be expected to supply furniture and fittings that will last for ever.

Normal use of laboratories for practical work will inevitably lead to wear and tear and, in some schools, poor behaviour can also damage laboratories. Changing patterns of curriculum, of teaching and learning styles, and of ICT provision are likely to drive demand for more frequent updating of all learning spaces. With all these factors, it is not possible to predict a standard life for any laboratory, but PFI projects are working to 25 years, so we might take 30 years as a generous interpretation of the life of a laboratory. For secondary schools, that is over four times the length of time any one student might be learning in those laboratories, or more than twice the entire period that any child spends at school.

A 30 years laboratory life means that 1 in 30 laboratories per year will fall from any good or excellent standard that it may have had. Using the 2000-2005 rate of upgrade this further delays the date by which all laboratories could be made up to the good / excellent standard to around 2021, see Figure 2. Use the 2005-2008 predicted upgrade rate it becomes 2034. See Figure 3 and Appendix 7.

During a phone conversation, one sales representative admitted that the furniture carcasses supplied by his firm all had an expected life of 15 years, no matter what quality of bench surface was put on top. Using 2000-2005 figures and putting the 'life' of a laboratory at 15 years would delay the date by which all laboratories are made good / excellent to 2029. (Appendix 7). Using 2005-2008 predicted figures would delay it to 2106. Although we have included the consequences of a 15-year life in the table on page 3, and repeated below, we think it so unrealistic that we have ignored it in drawing the graphs in Figures 1, 2 and 3.

2.13 When will all school science laboratories meet Government targets?

It is not entirely clear what the Government targets are for upgrading science accommodation and hence it is difficult to judge the extent to which it is meeting those targets.

The government's aim is set out in *Science and Innovation Investment Framework 2004-2014*, (SIIF), and states that its aim is to:

> *provide capital funding to schools and authorities to meet the Roberts Review target of bringing school laboratories up to a satisfactory standard by 2005-06 and to bring them up to a good or excellent standard by 2010.*

The data in this report show that in recent years around 6.9% of all laboratories have been upgraded per year, which would mean that 2013 would be the soonest we could expect all laboratories to be at good/excellent standards; only just outside the government's SIIF time-span. However, the quality of recent work is such that 30% of new laboratories are not of a good/excellent standard and normal wear and tear will downgrade about another 3.3% of the already good/excellent laboratories per year (a 30 year life). These two factors would delay the target date to 2021. See Figure 2.

Using data on predicted refurbishments and new builds (at 4.7% per year), then the earliest date to achieve all laboratories at good/excellent standards is 2017. A more realistic date (taking quality and deterioration into account) would be 2034. See Figure 3.

The *Building Schools for the Future* (BSF) programme aims to have every secondary school that needs it, replaced or upgraded in 15 'Waves', starting from 2005-06. Many statements assume that a Wave will equal a year: see, for example*, Building Schools for the Future Factsheet*, from www.number-10.gov.uk/output/Page5801.asp:

> … *every child will be educated in a 21st Century environment within 15 years …*

or from the *Science and Innovation Investment Framework* (SIFF) 2004-2014,

> *… renewing all secondary schools in England, including science provision, through the* Building Schools for the Future *programme, in a ten to fifteen year programme starting in 2005-06 …*

However, the BSF's own document *Prioritisation and Forward Planning Information, November 2004*, clearly and repeatedly points out that their information is in 5 year tranches (matching the idea of three five-year parliaments) and

> *… does not constitute a formal decision. … The actual programme will, of course, only emerge over the coming years, and will be subject to:*
>
> *future public spending decisions;*
>
> *refinements to the* Building Schools for the Future's *policy aims;*

Government statements often refer to schools 'being funded'. However, this does ***not*** mean schools exist on the ground. In BSF Wave 1, both Pathfinder authorities and regular Wave 1 authorities were still at the negotiating stages for the building of their schools in March 2006. One Pathfinder authority, maybe ahead of others, expects their schools to be operational in 2008 (see Bradford authority website, www.bradford.gov.uk). A Wave 1 authority aims to choose its developer by August 2006 (see Knowsley authority website, www.knowsley.gov.uk). Therefore, starting from 2005-06, the soonest such schools might be operational is 2008-09.

The Minister of State for Education, Jim Knight, stated in the House of Commons, 14th June 2006, that, including the BSF programme, the Academies programme and other capital investment,

> *… by 2010 almost a third of all secondary schools will be funded to improve their science teaching facilities.*

Note that this is 'funded' and not existing on the ground, and does not say that all science facilities will be upgraded although complete new builds would obviously do so. Direct funding

to schools for projects is stated to be, on average, £100 000 per year, per secondary school, but schools have many other claims on such funding in addition to science.

Taking the best interpretation of the Minister's figures, one third of all secondary schools in England would be about 1097 schools. If each has the average 7.9 laboratories, this would mean 8666 laboratories. If these are all upgraded to a good/excellent standard by the year 2010, this still leaves roughly the same number over again to be upgraded if all are to be good/excellent (16 900 needing upgrading overall). Thus the government's original target of all at good/excellent standard by year 2010 would become year 2015. Given that there is, in reality, a least a 2-year gap between 'funding' and actual schools on the ground, this becomes year 2017 at best.

If the quality of the new work is the same as reported in the questionnaire data (28% not good/excellent), the date for all to be at good/excellent slips to the year 2020. If inevitable deterioration is also taken into account, it slips to the year 2032. This is remarkably close to the worst figure estimated from questionnaire results (2034).

The range of possibilities is summarised in the following table.

Original Government target for all labs to be at Good / Excellent standard	2010			
Year when all labs will be at Good / Excellent standard	*Best possible* (unrealistic, as quality and deterioration disregarded)	*With poor quality taken into account*	*With poor quality and a 30 year 'life'*	*With poor quality and a 15 year 'life'*
Based on 2000-2005 questionnaire data on existing refurbishments and new builds	2013	2017	2021	2029
Based on 2005-2008 questionnaire data on predicted refurbishments and new builds	2017	2022	2034	2106
Based on Minister's data 14th June 2006	2017	2020	2032	

When the data from the returned questionnaires was first examined, the fact that the 2005-2008 predicted figures were low was tentatively attributed to teachers and technicians in schools not knowing about future developments. However, the minister's statement matches these low predicted rates quite well and appears to confirm that, far from accelerating the upgrading of science laboratories, future upgradings will actually take place a slower rate than over 2000-2005.

On the Minister's figures, at the very best estimate, all laboratories will be at good/excellent standard by 2017. This would mean that, for a substantial minority of schools, 7 entire cohorts of pupils will continue to undergo their science education in unsafe, unsatisfactory or uninspiring surroundings. If realistic estimates are taken, many, many more pupils will do the same.

To achieve the government's year 2010 target, the reported upgrading rate in recent years of 6.9% of labs per year would have to double, with quality improved markedly. The predicted rate of 4.7% per year would have to increase by $3^1/_2$ times to achieve the government's target.

Problems with science accommodation in schools are not new. John Murray, for the Science Masters' Association (forerunner of the Association for Science Education, ASE), published a report called *Provision and Maintenance of Laboratories in Grammar Schools* (1961). This was concerned only with 'adequacy' of science accommodation and was restricted to grammar schools, or schools with grammar streams. Statistics that can be derived from the report point to at least an 8% improvement per year, probably more than 10% per year, which was better than is currently being achieved.

3. Conclusions and recommendations

3.1 General discussion

This report has identified two types of problem – slippage in the government's programme of school laboratory improvement and the disappointing quality of some of those newly-built or refurbished laboratories. The rate of new building ad refurbishment obviously depends on the rate at which money is released by government and on the ability of the system to cope with that rate of release.

There is clearly an intention on the part of government to improve the quality of school laboratories, even if the time scale is not entirely clear. What is also evident is that, even on the most optimistic interpretations, target dates will not be met. In any case, the money available is generally not ring-fenced to improving science facilities. Thus the BSF programme could result in generally improved schools without necessarily resulting in good or excellent laboratories.

There is perfectly good guidance on the design of school laboratories from the DfES[9], CLEAPSS[10] and others[11]. It is evident that many of the new and refurbished laboratories fail to follow that guidance, eg by providing quite inadequate prep room or storage space. In some cases this may be the result of schools, in effect, doing D-I-Y refurbishment on the cheap as a result of frustration at not being eligible for better-funded improvements, taking a "something is better than nothing" attitude. In other, properly-funded projects, it may still be the case that the money available is simply not sufficient to meet the specifications in *Building Bulletin 80* and other *Building Bulletins* relevant to other areas of the school. CLEAPSS often hears of schools where a design has been agreed at the beginning but more and more items are cut as the work proceeds and the money runs out.

A problem which is evident from calls to the CLEAPSS ***Helpline*** is that science staff are, in effect, too trusting. They are not aware of the above sources of advice, or, if they are aware, assume that they do not need to be familiar with them. They trust architects and project managers to be aware of the advice, to have the best interests of the science department in mind and to understand the department's priorities. For most heads of science, acquiring a new laboratory, or, better, a suite of new laboratories, is likely to be a once-in-a-lifetime event. They cannot draw on previous experiences and learn from past mistakes. What they fail to realise is that most project managers within schools and many architects designing science departments are in a similar position. Generally, science departments do not want untried, futuristic designs that fall apart after 5 years but the sources referred to above will give good guidance on suitable designs. Once a design has been agreed, heads of department don't realise that they need to monitor the implementation. If financial constraints result in cuts in the planned design, heads of department need to insist on being consulted so the cuts do the least damage. If they had to choose between a fume cupboard (probable life 25 years or more) and a wall-to-wall plasma screen (probable life 5 years), most science departments would choose the former.

However, sometimes the problems can only be attributed to incompetence. Designing a science department without a proper chemical store room – or, even worse, without a prep. room – demonstrates total ignorance of how science departments function. Architects and contractors may turn around and say that store rooms and prep rooms were not specified in the contract – but then who drew up the contract, how much expertise and experience did they have in designing school science departments?

At one time most local authorities had architects departments. Over time these often developed considerable experience of designing schools. Similarly, most local authorities had science advisers or inspectors who had a significant role in the design of new laboratories and in monitoring the results and how those laboratories were then used. In most cases this local authority expertise has gone. However, many local authorities still have science advisers or inspectors, or consultants appointed under the Secondary National Strategy or School Improvement Partners, who, with a slightly changed job description and some training could develop this role. In some cases, specialist schools or the Specialist Schools and Academies Trust might develop as an alternative source of expertise and there are a few independent consultants in the field, often former advisory staff.

Similarly, in the past, Ofsted section 10 inspection teams would have reported on the quality of school laboratories and the impact on teaching and learning. With the new-style short inspections these aspects will not be picked up at all on routine inspections. There will be

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9 *Building Bulletin 80, Science Accommodation in Secondary Schools. A Design Guide*, DfES Schools Building and Design Unit, 2004. Available for download from teachernet http://www.teachernet.gov.uk/_doc/6152/BB%2080_19.pdf.

10 Guide L14, *Designing and Planning Laboratories*, CLEAPSS, 2000. Available for download from http://www.cleapss.org.uk/download/L014.pdf.

11 *The Laboratory Design for Teaching and Learning* software. Available for download from http://www.ase.org.uk/ldtl/

about 30 inspections per year focusing on science but this is less than a 1% sample of schools. Ofsted will thus be hampered in its attempts to monitor how well the government is meeting its targets for laboratory improvement.

3.2 Recommendations

- That the DfES School Building and Design Unit investigate whether it is actually possible to build schools to the specifications in *Building Bulletin 80* and other *Building Bulletins* within budgets that are normally available.
- That where government funding is available for new or re-furbished laboratories compliance with *Building Bulletin 80* shall be made a condition of the contract.
- That where government funding is available for new or re-furbished laboratories contractors shall be required to consult with recognised experts in the field of school laboratory design and the science curriculum.
- That where government funding is available for new or re-furbished schools, some of that money shall be ring-fenced in order to ensure that laboratories meet a good or excellent standard, as in the document *Science and Innovation Investment Framework 2004-2014: Next Steps*, 2006.
- That where government funding is available for new or re-furbished laboratories, science subject leaders shall be actively consulted at the design stage, actively involved in monitoring the progress of the project and consulted about any necessary changes during the project.
- That science advisory staff working for local authorities and/or the Specialist Schools and Academies Trust should have job descriptions which include advising on laboratory design and planning and that where local authorities do not have such staff in post they should employ competent consultants with expertise in this field.
- That in order to develop competence in the area of laboratory design, there should be financial support for in-service training for science advisory staff, consultants, architects and project managers and science subject leaders.
- That where government funding is available for new or re-furbished laboratories, there should be a requirement that science advisory staff working for local authorities or the Specialist Schools and Academies Trust or competent independent advisers should be consulted on new projects.
- That schools' self-evaluation for Ofsted shall be required to report on the quality of laboratory accommodation, whether or not the result of up-grading.
- That the government commission consultants to monitor the quality of existing and new or re-furbished accommodation and hence monitor progress towards meeting government targets.

Addendum

As this Report was being finalised in July 2006, the Commission for Architecture and the Built Environment (CABE) published their report, *Assessing secondary school design quality*. CABE's expert and professional opinion states that, between 2000 and 2005, over 50% of schools built were of a poor (31%) or mediocre (21%) standard. This matches with science teachers and technicians views in this report (also based 2000-2005) that 28% of their newly built or refurbished laboratories were of a poor quality. The previous RSC report, *Laboratories, resources and budgets*, 2004, showed that 25% of all science laboratories at that time were unsafe or unsatisfactory, and a further 40% uninspiring.

All three reports therefore show that there is a real problem with the quality of design and build standards in schools and in science accommodation over the period 2000 –2005. The DfES is said to have commented on the CABE report (*BBC News* and *Guardian*, 04-07-2006) that

> *The report represents a retrospective look at school design which does not bear any resemblance to where we are now*.

The spokesman concerned has obviously not read the CABE report, where it quite clearly states that

> *… our experience indicates that many of the BSF schools on the drawing board are facing the same problems as previous programmes.*

Anecdotal evidence also shows that current programmes for replacing science laboratories are working from criteria that are in part outdated, sometimes even faulty.

While the spokesman is also quoted as saying that the DfES has enlisted CABE to advise on individual projects to ensure that high-quality design was "*an absolute priority*", there is, as yet, little indication that the BSF programme has consulted specialist advice from science associations and institutions.

Appendix 1: Questionnaire – as sent to schools

CLEAPSS School Science Service
***on behalf of the* Royal Society of Chemistry**

Survey of School Laboratory Refurbishments and New Builds

A. Basic School Data

Q1	Name of person filling in form	
Q2	Position held	
Q3	Name of school	
Q4	School postcode	
Q5	Name of LEA in which school is situated	
Q6	Type of school (*please tick one box*)	
	• Comprehensive (all ability)	
	• Specialist (all ability – *state specialism*)	
	• Specialist (restricted ability range – *state specialism and range*)	
	• Grammar (resticted range – higher)	
	• Secondary Modern (restricted range – lower)	
	• Other (*please specify*)	
Q7	Age range (*please tick one box*)	
	• 11-16	
	• 11-18	
	• 14-18	
	• Other (*please specify*)	
Q8	Status of school (*please tick one box*)	
	• Community school (i.e 'ordinary' LEA school)	
	• Voluntary controlled school	
	• Voluntary aided school	
	• Foundation school	
	• Academy	
	• Other (*please specify*)	
Q9	Numbers of pupils (*please write number in each box, writing zero where appropriate*)	
	• Pupils 11-16	
	• Pupils 16-18	

B. Numbers of teaching laboratories

Q10	How many laboratories do you now have, in total? Total number of laboratories		
Q11	How many of these laboratories were newly refurbished, or newly built , and put into use* in academic year:		
		Newly refurbished	Newly built
	2000-2001		
	2001-2002		
	2002-2003		
	2003-2004		
	2004-2005		

Q12	How many of the newly refurbished / built laboratories you have indicated above:		
		Newly refurbished	Newly built
	a. have one (or more) fume cupboards		
	b. are used for teaching post-16 (AS, A2) lessons in		
	biology		
	chemistry		
	physics		
	c. are mainly timetabled for KS4 lessons in (put 0 if laboratories are multipurpose)		
	Biology (including double award balanced science)		
	Chemistry (incl. double award balanced science)		
	Physics (including double award balanced science)		

Q13	If you have refurbishments or new builds going on, or immediate plans to start, please estimate how many newly refurbished / built laboratories you will have put into use* in academic year:		
		Newly refurbished	Newly built
	2005-2006		
	2006-2007		
	2007-2008		

Q14	As a result of the above developments has the provision for prep rooms / storage (*please tick one*)		
	Improved	Stayed the same	Deteriorated
	Please explain		

** put into use*

By this we mean that the laboratory was handed over and you are able to use it, even if there are items outstanding (sometimes called 'snagging'). Refurbishments and new builds can take several months and spread over more than one academic year, so we are asking for the academic year in which you start using that lab.

C. Each refurbished or newly built laboratory

If each refurbished or newly built laboratory is different, please use **separate forms for each one** (*2 are provided - photocopy as necessary*). If several are the same, please use one form for the **group of laboratories**.

We realise that it may not be possible to answer some questions due to staff changes, non-involvement in the process and other reasons. However, if you could give as much information as you know about, this will help in putting together an overall picture. If you want to comment on any question, please do so (use the reverse of this page if needed**)**

Name of school				
Q15	If one lab only, please give name / room no. of lab:			
	If more than one lab, please give number of labs referred to:			
Q16	a. Was this / were these? (*please tick one*)	Refurbishment	New build	
	b. Which academic year was this / were these put into use?			200 - 200
Q17	What was the approximate cost of a single laboratory? (*if necessary, divide the total cost by the number of labs*.)			£
Q18	Who funded the refurbishment / new build? (*please tick one*)			
	PFI (Private Finance Initiative)	LEA (Local Education Authority)	Development Agency	
	Specialist Schools & Academies Trust	Sponsor	School itself	
	Other (*please specify*)			
Q19	Was the quality of the building works, furniture and fittings: (*please tick one*)			
	Very Good	Good	Unsatisfactory	Poor
	Comments:			
Q20	To what extent were members of science staff (teachers &/or technicians) consulted during the design process and subsequent building works? (*please tick one*)			
	A great deal	Some	A little	Not at all
Q21	Have there been any maintenance problems with this lab / these labs?			YES / NO
	If Yes, please outline the problem.			
Q22	How satisfied are you with the range of teaching and learning styles that this laboratory makes possible? (*please tick one*)			
	Very satisfied	Satisfied	Unsatisfied	Very unsatisfied
	What is good about the teaching and learning possibilities? *What is bad?*			
Q23	How satisfied are you with the level of provision of ICT in this lab / these labs? (*please tick one*)			
	Very satisfied	Satisfied	Unsatisfied	Very unsatisfied
	a. Is there a fixed data-projector and screen (with or without an interactive whiteboard)?			YES / NO
	b. Is there internet / intranet access: (*please tick one*)			
	by cable	by wireless	None at all	

Appendix 2: Questionnaire returns

Sent and Returned

	N	%
Total sent	1646	100
Total returned	370	22.5

Deprivation of area in which school located (based on postcode from Index of Multiple Deprivation, www.neighbourhood.statistics.gov.uk)

Deprivation band	1 (Most deprived)		2		3		4		5 (Least deprived)		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Returns	61	16.5	71	19.2	76	20.5	80	21.6	82	22.2	370	100

Note: in this, an all other tables, % refers to the percentage of those responding to a particular question

Spending level of local authority

Spending band	High		Medium		Low		Total	
	N	%	N	%	N	%	N	%
Returns	66	17.8	141	38.1	163	44.1	370	100

Type of School

Type	Comp.		Specialist All ability		Specialist restricted		Grammar		Secondary Modern		Other		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Returns	169	45.7	161	43.5	8	2.2	22	5.9	10	2.7	0	0	370	100

Age Range

Range	11-16 years		11-18 years		14-18 years		Other		Total	
	N	%	N	%	N	%	N	%	N	%
Returns	151	40.8	201	54.3	9	2.4	9	2.4	370	100

Status of schools

Status	Community		VC		VA		Foundation		Academy		Other		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Returns	258	69.7	5	1.4	59	15.9	45	12.2	3	0.8	0	0	370	100

Pupils represented

Age range	11-16	11-18	Total
	344290	46084	390374

Appendix 3: Information supplied by science advisers from nine local authorities

Local authority	A (County)			B (Urban)			C (Urban)		
	Schools=	37		Schools=	10		Schools=	18	
YEAR	Refurb %	New %	Total %	Refurb %	New %	Total %	Refurb %	New %	Total %
2000-01	2.2	1.8	4				7.4		
2001-02	1.8	4	5.8						
2002-03	2.2	0	2.2	2.7	0	2.7			
2003-04	2.5	0.4	2.9	0	5.3	5.3		3	
2004-05	1.4	0.4	1.8	0	0	0		3.7	
Average	2	1.3	3.3	0.9	1.8	2.7			
Cost	Refurb	New		Refurb	New		Refurb	New	
Cheapest	£15 000	£100 000		-	-		-	-	
Expensive	£55 000	-		-	-		-	-	

Local authority	D (County)			E (Urban)			F (County)		
	Schools=	32		Schools=	14		Schools=	71	
YEAR	Refurb %	New %	Total %	Refurb %	New %	Total %	Refurb %	New %	Total %
2000-01				0	0	0			
2001-02				0	21.9	21.9			
2002-03	3.3	0.8	4.1	3.8	0	3.8			
2003-04	2.9	0.8	3.7	3.8	0	3.8	3.9		
2004-05	1.7	3.3	5	1.9	1	2.9	2.6		
Average	2.6	1.6	4.3	1.9	4.6	6.5			
Cost	Refurb	New		Refurb	New		Refurb	New	
Cheapest	-	-		£18 000	£100 000		£50 618	£86 055	
Expensive	-	-		£35 000	£150 000		-	-	

Local authority	G (Urban)			H (Urban)			I (County)		
	Schools=	8		Schools=	10 of 42		Schools=	12 of 14	
YEAR	Refurb %	New %	Total %	Refurb %	New %	Total %	Refurb %	New %	Total %
2000-01	6.7	3.3	10	1.3	0	1.3	10	1.1	11.1
2001-02	10	0	10	4	17.3	21.3	0	0	0
2002-03	6.7	0	6.7	0	17.3	17.3	6.7	2.2	8.9
2003-04	8.3	0	8.3	0	0	0	1.1	6.7	7.8
2004-05	3.3	8.3	11.6	0	18.7	18.7	3.3	2.2	5.5
Average	7	2.3	9.3	1.1	10.7	11.7	4.2	2.4	6.7
Cost	Refurb	New		Refurb	New		Refurb	New	
Cheapest	£35 744	£66 669		£30 000			£21 000	£100 000	
Expensive	£69 580	£111 800		£50 000			£35 000	-	

Appendix 4: Design and manufacturing firms

Numbers of laboratories installed
(includes both refurbishments and new builds)

Market research for one firm puts the industry's input at about £32 million per year.

Each laboratory installation (that is the furniture and fixed equipment) is approximately = £13 500.

Therefore the UK industry installs about (32 000 000 / 13 500) = 2370 laboratories / year.

This compares well with the total estimated for England alone = 1794 laboratories / year.

Manufacturers report:

Three manufacturers supplied data about their installations averaged over2000 – 2005 for England.

Large firm	approximately =	850	laboratories / year
Medium firm	approximately =	148	laboratories / year
Smaller firm	approximately =	38	laboratories / year

Appendix 5: Teaching & Learning, Consultation, Quality, Maintenance

Teaching and Learning (Question 22)

	Very Satisfied		Satisfied		Unsatisfied		Very Unsatisfied		Total		No response
Laboratories	N	%	N	%	N	%	N	%	N	%	N
All	219	23.8	586	63.8	99	10.8	15	1.6	919	100	117
Science specialist	27	25.7	67	63.8	10	9.5	1	1.0	105	100	9

Consultation (Question 20)

	A great deal		Some		A little		Not at all		Total		No response
Laboratories	N	%	N	%	N	%	N	%	N	%	N
All	348	35.4	313	31.8	244	24.8	78	7.9	983	100	53
Science specialist	44	40.0	42	38.2	24	21.8	0	0	110	100	4

Quality (Question 19)

	Very Good		Good		Unsatisfactory		Poor		Total		No response
Laboratories	N	%	N	%	N	%	N	%	N	%	N
All	114	11.5	602	60.5	226	22.7	53	5.3	995	100	41
Science specialist	17	15.5	71	64.5	19	17.3	3	2.7	110	100	4

Maintenance (Question 21)

	Yes		No		Total		No response
Laboratories	N	%	N	%	N	%	N
All	696	70.9	286	29.1	982	100	54
Science specialist	82	74.5	28	25.5	110	100	4

Appendix 6: Laboratories and Prep Rooms

Laboratories and Prep Rooms: All

Total number of laboratories = 2921

Schools with no upgraded laboratories and none planned = 85 (23.0%)
Schools with no upgraded laboratories in the last five years = 114 (30.8%)
Schools with no upgraded laboratories but some planned for the future = 29 (7.8%)

All refurbished and newly-built laboratories 2000 - 2005

ALL	Refurb		New Build		Total	
	N	%	N	%	N	%
2000/2001	147	5.0	62	2.1	209	7.2
2001/2002	112	3.8	54	1.8	166	5.7
2002/2003	154	5.3	67	2.3	221	7.6
2003/2004	124	4.2	47	1.6	171	5.9
2004/2005	144	4.9	85	2.9	229	7.8
Totals for 5 years	681	23.3	315	10.8	996	34.1
Averages for 1 year	136	4.7	63	2.2	199	6.9

All refurbished and newly-built laboratories predicted for 2005 - 2008

All	Refurb		New Build		Total	
	N	%	N	%	N	%
2005/2006	74	2.5%	41	1.4%	115	3.9%
2006/2007	65	2.2%	59	2.0%	124	4.2%
2007/2008	43	1.5%	130	4.5%	173	5.9%
Totals for 3 years	182	6.2%	230	7.9%	412	14.1%
Averages for 1 year	61	2.1%	77	2.60%	47	4.7%

All Prep Rooms

Prep Rooms	Improved		The same		Deteriorated		Total response	
	N	%	N	%	N	%	N	%
	101	43.0%	97	41.3%	37	15.7%	235	100

Laboratories by Deprivation Index

BAND	1	2	3	4	5
Total Labs N =	461	559	616	620	665

	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2000/2001	24	5.2%	12	2.6%	33	5.9%	3	0.5%	28	4.5%	20	3.2%	27	4.4%	10	1.6%	35	5.3%	17	2.6%
2001/2002	12	2.6%	4	0.9%	38	6.8%	13	2.3%	25	4.1%	7	1.1%	13	2.1%	19	3.1%	24	3.6%	11	1.7%
2002/2003	21	4.6%	19	4.1%	25	4.5%	15	2.7%	30	4.9%	6	1.0%	35	5.6%	7	1.1%	43	6.5%	20	3.0%
2003/2004	33	7.2%	10	2.2%	7	1.3%	13	2.3%	28	4.5%	5	0.8%	27	4.4%	10	1.6%	29	4.4%	9	1.4%
2004/2005	24	5.2%	33	7.2%	24	4.3%	6	1.1%	23	3.7%	3	0.5%	33	5.3%	28	4.5%	40	6.0%	15	2.3%
Total	114	24.7%	78	16.9%	127	22.7%	50	8.9%	134	21.8%	41	6.7%	135	21.8%	74	11.9%	171	25.7%	72	10.8%
Average/year		4.9%		3.4%		4.5%		1.8%		4.4%		1.3%		4.4%		2.4%		5.1%		2.2%

None in last 5 yrs	19 Schools (31.1%)	27 Schools (38.0%)	25 Schools (32.9%)	24 Schools (30.0%)	19 Schools (23.2%)

	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
2005/2006	20	4.3%	0	0.0%	16	2.9%	11	2.0%	6	1.0%	19	3.1%	20	3.2%	9	1.5%	12	1.8%	2	0.3%
2006/2007	20	4.3%	15	3.3%	10	1.8%	6	1.1%	14	2.3%	14	2.3%	15	2.4%	14	2.3%	6	0.9%	10	1.5%
2007/2008	12	2.6%	15	3.3%	2	0.4%	21	3.8%	7	1.1%	34	5.5%	13	2.1%	10	1.6%	9	1.4%	50	7.5%
Total	52	11.3%	30	6.5%	28	5.0%	38	6.8%	27	4.4%	67	10.9%	48	7.7%	33	5.3%	27	4.1%	62	9.3%

Laboratories by local authority spending level

Local authority	Low spending	Medium spending	High spending
Total Labs	1324	1090	507

	Refurb		New Build		Refurb		New Build		Refurb		New Build	
	N	%	New Build	%	N	%	New Build	%	N	%	New Build	%
2000/2001	69	5.2%	21	1.6%	57	5.2%	20	1.8%	21	4.1%	21	4.1%
2001/2002	46	3.5%	23	1.7%	41	3.8%	17	1.6%	25	4.9%	14	2.8%
2002/2003	49	3.7%	23	1.7%	81	7.4%	21	1.9%	24	4.7%	23	4.5%
2003/2004	55	4.2%	18	1.4%	56	5.1%	18	1.7%	13	2.6%	11	2.2%
2004/2005	56	4.2%	19	1.4%	56	5.1%	38	3.5%	32	6.3%	28	5.5%
Total	275	20.8%	104	7.9%	291	26.7%	114	10.5%	115	22.7%	97	19.1%
Average/year		4.2%		1.6%		5.3%		2.1%		4.5%		3.8%

None	52 Schools			44 Schools			18 Schools		
	31.9%			31.2%			27.3%		

	Refurb		New Build		Refurb		New Build		Refurb		New Build	
2005/2006	40	3.0%	25	1.9%	25	2.3%	15	1.4%	9	1.8%	1	0.2%
2006/2007	40	3.0%	24	1.8%	23	2.1%	34	3.1%	2	0.4%	1	0.2%
2007/2008	21	1.6%	77	5.8%	14	1.3%	30	2.8%	8	1.6%	23	4.5%
Total	101	7.6%	126	9.5%	62	5.7%	79	7.2%	19	3.7%	25	4.9%

Laboratories by age range of school

Age Range	11 to 16	11 to 18	14 to 18
	2 add schools	2 add schools	5 add schools
Total Labs	995	1787	139

	Refurb		New Build		Refurb		New Build		Refurb		New Build	
2000/2001	46	4.6%	9	0.9%	87	4.9%	51	2.9%	14	10.1%	2	1.4%
2001/2002	59	5.9%	17	1.7%	50	2.8%	29	1.6%	3	2.2%	8	5.8%
2002/2003	41	4.1%	46	4.6%	102	5.7%	18	1.0%	11	7.9%	3	2.2%
2003/2004	58	5.8%	26	2.6%	59	3.3%	21	1.2%	7	5.0%	0	0.0%
2004/2005	68	6.8%	20	2.0%	65	3.6%	65	3.6%	11	7.9%	0	0.0%
Total	272	27.3%	118	11.9%	363	20.3%	184	10.3%	46	33.1%	13	9.4%

None	46 Schools			65 Schools			3 Schools		
	30.1%			31.5%			21.4%		

	Refurb		New Build		Refurb		New Build		Refurb		New Build	
2005/2006	24	2.4%	10	1.0%	47	2.6%	31	1.7%	3	2.2%	0	0.0%
2006/2007	7	0.7%	20	2.0%	58	3.2%	39	2.2%	0	0.0%	0	0.0%
2007/2008	15	1.5%	12	1.2%	24	1.3%	118	6.6%	4	2.9%	0	0.0%
Total	46	4.6%	42	4.2%	129	7.2%	188	10.5%	7	5.0%	0	0.0%

Status

Specialist Science Schools	30 schools
Total Labs	250

	Refurb		New Build	
2000/2001	2	0.8%	1	0.4%
2001/2002	4	1.6%	2	0.8%
2002/2003	6	2.4%	3	1.2%
2003/2004	8	3.2%	8	3.2%
2004/2005	9	3.6%	1	0.4%
Total	29	11.6%	15	6.0%

None	4 Schools		
	13.3%		

	Refurb		New Build	
2005/2006	3	1.2%	2	0.8%
2006/2007	4	1.6%	7	2.8%
2007/2008	2	0.8%	1	0.4%
Total	9	3.6%	10	4.0%

Status	Community	Voluntary Controlled	Voluntary Aided	Foundation	Academy
Total Labs	2082	41	401	367	30

	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
2000/2001	104	5.0%	55	2.6%	1	2.4%	4	9.8%	20	5.0%	0	0.0%	22	6.0%	3	0.8%	0	0.0%	0	0.0%
2001/2002	97	4.7%	47	2.3%	0	0.0%	2	4.9%	12	3.0%	1	0.2%	3	0.8%	4	1.1%	0	0.0%	0	0.0%
2002/2003	118	5.7%	60	2.9%	0	0.0%	0	0.0%	12	3.0%	2	0.5%	24	6.5%	5	1.4%	0	0.0%	0	0.0%
2003/2004	86	4.1%	34	1.6%	0	0.0%	2	4.9%	22	5.5%	9	2.2%	16	4.4%	2	0.5%	0	0.0%	0	0.0%
2004/2005	104	5.0%	57	2.7%	6	14.6%	0	0.0%	19	4.7%	12	3.0%	15	4.1%	2	0.5%	0	0.0%	14	46.7%
Total	509	24.4%	253	12.2%	7	17.1%	8	19.5%	85	21.2%	24	6.0%	80	21.8%	16	4.4%	0	0.0%	14	46.7%

None	70 Schools		0 Schools		29 Schools		14 Schools		1 School	
	27.1%		0.0%		49.2%		31.1%		33.3%	

	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
2005/2006	60	2.9%	39	1.9%	0	0.0%	0	0.0%	5	1.2%	2	0.5%	9	2.5%	0	0.0%	0	0.0%	0	0.0%
2006/2007	53	2.5%	39	1.9%	0	0.0%	0	0.0%	9	2.2%	12	3.0%	3	0.8%	8	2.2%	0	0.0%	0	0.0%
2007/2008	29	1.4%	82	3.9%	0	0.0%	0	0.0%	5	1.2%	20	5.0%	9	2.5%	28	7.6%	0	0.0%	0	0.0%
Total	142	6.8%	160	7.7%	0	0.0%	0	0.0%	19	4.7%	34	8.5%	21	5.7%	36	9.8%	0	0.0%	0	0.0%

Prep rooms by deprivation index

Prep Room		Improved		The same		Deteriorated		Total
Band	1	11	31.4%	16	45.7%	8	22.9%	35
	2	17	41.5%	16	39.0%	8	19.5%	41
	3	23	51.1%	18	40.0%	4	8.9%	45
	4	18	34.6%	23	44.2%	11	21.2%	52
	5	32	51.6%	24	38.7%	6	9.7%	62
Total		101	43.0%	97	41.3%	37	15.7%	235

Prep rooms by local authority spending level

Prep Room	Improved		The same		Deteriorated		Total
Low	44	40.4%	48	44.0%	17	15.6%	109
Medium	39	47.6%	33	40.2%	10	12.2%	82
High	18	40.9%	16	36.4%	10	22.7%	44
Total	101	43.0%	97	41.3%	37	15.7%	235

Prep rooms by type of school

Prep Room	Improved		The same		Deteriorated		Total
Comprehensive	46	44.7%	44	42.7%	13	12.6%	103
Specialist (all)	43	39.4%	44	40.4%	22	20.2%	109
Specialist (rest)	4	66.7%	1	16.7%	1	16.7%	6
Grammar	5	41.7%	7	58.3%	0	0.0%	12
Secondary Modern	3	60.0%	1	20.0%	1	20.0%	5
Total	101	45.5%	97	43.7%	24	10.8%	222

Prep rooms by age range of school

Prep Room	Improved		The same		Deteriorated		Total
11 to 16	43	45.7%	38	40.4%	13	13.8%	94
11 to 18	53	40.5%	55	42.0%	23	17.6%	131
14 to 18	5	50.0%	4	40.0%	1	10.0%	10
Total	101	43.0%	97	41.3%	37	15.7%	235

Prep rooms by status of school

Prep Room	Improved		The same		Deteriorated		Total
Community	70	41.2%	75	44.1%	25	14.7%	170
VC	5	100.0 %	0	0.0%	0	0.0%	5
VA	12	38.7%	11	35.5%	8	25.8%	31
Foundation	14	50.0%	10	35.7%	4	14.3%	28
Academy	0	0.0%	1	100.0%	0	0.0%	1
Total	101	43.0%	97	41.3%	37	15.7%	235

Prep rooms for specialist science status schools

Prep Room	Improved		The same		Deteriorated		Total
	12	50.0%	10	41.7%	2	8.3%	24

Appendix 7: Laboratories – calculations

Sample -- 370 schools with a total of 2921 laboratories

Questionnaires sent to 1646 schools (half of all secondary schools in England, not including Middle schools).

Assume 370 returns are typical ----

Total number laboratories in English state schools is

2921 x 1646 x 2 / 370 = 25 989 or approx **26 000.**

(2004 report gave a total of 26 333, which include some middle schools.)

Actual upgrades, 2000-2005

Refurbished

Sample has an average of 136 per year equivalent to 4.7% per year.

New Build

Sample has an average of 63 per year equivalent to 2.2% per year.

Total for new laboratories (refurbishments and new builds) = **6.9% per year**

Or 26 000 x 0.069 **= 1794 laboratories per year.**

Predicted upgrades, 2005-2008

Refurbished

Sample has an average of 61 per year equivalent to 2.1% per year.

New Build

Sample has an average of 77 per year equivalent to 2.6% per year.

Total for new laboratories (refurbishments and new builds**)** **= 4.7% per year**

Or 26 000 x 0.047 **= 1222 laboratories per year**

In 2004 (previous report)

35% of laboratories were judged to be of Good or Excellent standard –

35% of 26 000 = 9100 laboratories.

65% of laboratories were Unsafe / Unsatisfactory or Uninspiring –

65% of 26 000 = 16900 laboratories.

If all new laboratories were executed to Good or Excellent standard ---

16900 / 1794 = **9.4 years** to bring all up to Good / Excellent .

from 2004 this means that all would be achieved by the **year 2013.**

BUT Quality judgements give nearly 30% (22.7 + 5.3 = 28%) as Unsatisfactory or Poor - assume that this means they are not up to Good / Excellent standard.

28% of 1794 / year = 502 laboratories not brought up to good /excellent.

Therefore only (1794 – 502) =**1292 laboratories per year** are brought up to good / excellent.

At 1292 laboratories per year this takes 16900 / 1292 = 13.1 years.

From 2004 this means that all would be achieved by the **year 2017.**

AND Deterioration happens year on year.

See "Deterioration" -- a 'life' of 30 years is assumed (Not to put a laboratory out of action, although it might do that, but to take it out of the Good / Excellent category).

30 year life – 3.3% of laboratories fall from good/excellent per year.

3.3% of 9100 = 303 laboratories fall from good / excellent per year.

Therefore, with **Quality and Deterioration taken into account**,

Only net improvement to good / excellent of (1794 – 502 –303) = **989 laboratories per year**.

At 989 laboratories per year ---- 16900 / 989 = 17.1 years

From 2004 this means that all would be achieved by the **year 2021.**

Predicted 2005-2008

The predicted figures are currently less than the 2000-2005 figures at 4.7% per year or 1222 laboratories per year.

Using these figures and a 2005 baseline for numbers of laboratories that need to be brought up to good / excellent, 16900 – 1794 = **15106.**

If all 1222 were to good / excellent standard it would take 15106 / 1222 = 12.4 years

2005 + 12.4 = **year 2017.**

Quality removes 28%; 28% of 1222 = 342

Means only (1222 – 342) = 880 per year so it would take 15106 / 880 = 17.2 years

2005 + 17.2 = **year 2022.**

Deterioration removes 3.3%; 3.3% of 10894 (9100 + 1794) = 359.

Quality and Deterioration means only net improvement to good / excellent of (1222- 342 – 359) = 521 laboratories per year , so it takes 15106 / 521 = 29 years from 2005.

2005 + 29 = **year 2034.**

Deterioration – 'Life' of 15 years

(A 15 year life for the carcass was suggested by a representative of one of the manufacturers)

15 years = 6.7% per year dropping out of good / excellent.

2000-2005

Deterioration at 6.7% ---- 6.7% of 9100 = 610

Therefore, with **Quality and Deterioration taken into account**,

Only 682 (1794 – 502 - 610) **laboratories per year** are brought up to good / excellent

At 682 laboratories per year ---- 16900 / 682 = 24.8 years

From 2004 this means that all would be achieved by the **year 2029.**

Predicted 2005-2008

Deterioration at 6.7% ---- 6.7% of 10894 = 730

Quality and Deterioration means only 150 (1222-342-730) laboratories per year brought to good / excellent

15106 / 150 = 101 2005 + 101 = **year 2106.**

Calculations on Minister of State's figures

(Jim Knight, 14th June 2006, in House of Commons)

> *In all, by 2010 almost one third of all secondary schools will be funded to improve their science teaching facilities.*

All secondary schools in England (expect Middle deemed secondary) is approximately 3292

1/3 of 3292 = 1097

Average number of labs per school = 7.9

Therefore 1/3 of schools = 8666 labs in 'five years' (2005-06 –> 2010-2011)

16900 labs need upgrading to good/excellent (see above)

16900 / 8666 = 1.95 --- or about 10 years (1.95 x 5 years)

from 2005, 10 years is the **year 2015**

But there is a minimum 2-year lag between 'funding' and actual operation of schools on the ground ….. therefore the **year 2017**

Quality

If 28% of builds continue to be of insufficient quality to allow of a 'good/excellent' result:

8666 x (100% - 28%) = 6240 labs in five years

16900 / 6240 = 2.7 --- or about 13.5 years (2.7 x 5 years)

add the 2 year minimum lag = 15.5 years --

therefore from 20905, 15.5 years is the **year 2020**

Deterioration

If a 30 year 'life' is also assumed,

In five years 16900 x 5/30 = 2800 labs drop from the good/excellent standard

That leaves 6240 -2800 = 3440 labs in 5 years

16900 / 3440 = 4.9 – or about 24.5 years (4.9 x 5 years)

add the 2 year minimum time lag = 26.5 years

therefore, from 2005, 26.5 years is the **year 2032**

What would the upgrading rate need to be, to achieve the Government's target?

Government target = 2010

From 2005 – 2010 is therefore 5 years in which to make all labs to a to Good / Excellent standard.

At 2005, 15 106 labs were needed to be made up to Good / Excellent
(10 894 already at Good / Excellent)

15 106 needed – over 5 years = 15 106 / 5 = **3 021 labs / year**

3 021 / 26 000 = **11.6%**

But this assumes all at good quality and no deterioration

Quality
28% are reported as not good quality

3 021 x 128/100 = **3 927 labs/year** 3 927 / 26 000 = **15.1%**

Deterioration
30 year life 10894 x 1/30 = 363 /year

3 927 + 363 = **4 290 labs/year** 4 290 /26 000 = **16.5%**

If Deterioration only – ie all Quality problems resolved

3 021 + 363 = **3 384 labs / year** 3 384 / 26 000 = **13.0%**

Increases in rates of upgrading required to achieve government's target
2000-2005 rate of upgrading is reported at 6.9%: rate required (with deterioration) = 13%

13% / 6.9% = **x 1.9**

2005-2008 predicted rate of upgrading is 4/7%: rate required (with poor quality and deterioration) = 16.5%

16.5% / 4.7% = **x 3.5**

Appendix 8: Costs

	Refurbishment				New build	
Q17	£0	372	£32 500	11	£0	243
	£2 000	3	£33 000	3	£11 000	1
	£3 000	1	£35 000	29	£20 000	3
	£5 000	2	£37 593	2	£28 200	11
	£6 000	1	£38 000	5	£29 650	3
	£8 000	4	£40 000	47	£32 500	2
	£10 000	24	£41 666	6	£33 125	4
	£10 500	1	£42 500	2	£35 000	3
	£11 000	7	£45 000	14	£40 000	4
	£12 000	1	£50 000	21	£48 000	1
	£13 000	1	£52 000	2	£75 000	2
	£15 000	6	£55 000	2	£80 000	1
	£16 000	2	£58 000	1	£100 000	5
	£17 000	1	£59 000	1	£107 143	14
	£18 000	2	£60 000	21	£120 000	1
	£20 000	21	£65 000	7	£150 000	8
	£22 000	1	£70 000	4	£153 846	2
	£22 500	3	£75 000	1	£160 000	1
	£25 000	15	£76 923	9	£166 666	6
	£26 000	3	£80 000	7	£187 500	4
	£29 650	1	£83 333	3	£200 000	2
	£30 000	19	£90 000	1	£225 000	2
	£31 000	2	£100 000	3	£300 000	4
	£32 000	7	£125 000	2	£310 930	1
					£375 000	4
	Grand Total			*704*	*Grand Total*	*332*
Average of costs (where non-zero)			*£37 974.81*		*£119 205.28*	

Appendix 9: Sources of funding
(Question 18)

	All				Science specialist			
Laboratories / *Source*	Original N	+ from Other	Overall N	%	Original N	+ from Other	Overall N	%
PFI	112	11	123	14.0	14	0	14	13.7
Local authority	402	74	476	54.0	36	10	46	45.1
Develop. Agency	12	0	12	1.4	0	0	0	0
SSAT	41	25	66	7.5	17	11	28	27.5
Sponsor	1	14	15	1.7	0	1	1	1.0
School	130	4	134	15.2	7	4	11	10.8
Direct Gov.	0	31	31	3.5	0	0	0	0
Diocese	0	13	13	1.5	0	0	0	0
Insurance	0	6	6	0.7	0	0	0	0
Other	0	5	5	0.6	0	2	2	2.0
Totals			881	100			102	100

Where entries had been made in the ‘Other’ column, the detail was examined and the entry reallocated to the nearest appropriate column where possible.

Appendix 10: ICT provision

ICT provision: general satisfaction (Question 23)

(xx = number of laboratories)

	Very Satisfied %	**Satisfied %**	**Unsatisfied %**	**Very unsatisfied %**
ALL (1036)	**20.2**	**43.3**	**23.7**	**12.8**
Science specialist (114)	37.4	57.9	1.9	2.8
Technology specialist (163)	19.2	47.7	23.8	9.3
ICT specialist (70)	30.4	32.1	16.1	21.4

Fixed data-projector and screen (Question 23a)

	Yes %	**No %**
ALL	**73.5**	**26.5**
Science specialist	93.6	6.4
Technology specialist	74.8	25.2
ICT specialist	64.6	35.4

Internet access (Question 23b)

	Cable %	**Wireless %**	**Both %**	**None %**
ALL	**50.6**	**26.4**	**14.5**	**8.4**
Science specialist	58.2	31.8	7.3	2.7
Technology specialist	44.9	15.8	34.2	5.1
ICT specialist	50.8	26.2	16.9	6.2

Appendix 11: Specialist provision

Fume Cupboards

% of new laboratories (by refurbishment and new build – not total)

All schools

All	Refurb		New Build		Total	
F/C	218	32.0%	96	30.5%	314	31.5%

Fume cupboards by deprivation index

Band	1		2		3		4		5	
	Refurb	New Build	Refurb	New Build	Refurb	New Build	Refurb	New Build	Refurb	New Build
F/C	40 35.1%	21 26.9%	31 24.4%	14 28.0%	46 34.3%	20 48.8%	43 31.9%	19 25.7%	58 33.9%	22 30.6%

Fume cupboards by spending level of local authority

Band	Low		Medium		High	
	Refurb	New Build	Refurb	New Build	Refurb	New Build
F/C	83 30.2%	30 28.8 %	96 33.0%	26 22.8 %	39 33.9 %	40 41.2 %

Fume cupboards by type of school

Type	Comprehensive		Specialist (all Ability)		Specialist (restricted)		Grammar		Secondary modern	
	Refurb	New Build	Refurb	New Build	Refurb	New Build	Refurb	New Build	Refurb	New Build
F/C	89 31.2%	48 28.4 %	104 31.2%	42 33.1 %	3 18.8 %	0 0.0%	18 47.4 %	6 46.2 %	4 44.4%	0 0.0%

Fume cupboards by age range of school

Age range	11-16				11-18				14-18			
	Refurb		New Build		Refurb		New Build		Refurb		New Build	
F/C	79	7.9%	21	2.1%	126	7.1%	71	4.0%	13	9.4%	4	2.9%

Fume cupboards by status of school

Status	Community				Voluntary Controlled				Voluntary Aided				Foundation				Academy			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
F/C	159	31.2%	81	32.0%	2	28.6%	0	0.0%	27	31.8%	5	20.8%	30	37.5%	5	31.3%	0	0.0%	5	35.7%

Fume cupboards in specialist science schools

	Refurb		New Build	
F/C	24	9.6%	11	4.4%

Specialist laboratories post-16

% of new laboratories (by refurbishment and new build – not total)

Specialist laboratories post-16: all

	Refurb		New Build		Total	
Biology	82	12.0%	46	14.6%	128	12.9%
Chemistry	84	12.3%	37	11.7%	121	12.1%
Physics	50	7.3%	33	10.5%	83	8.3%

Specialist laboratories post-16: by deprivation index

Band	1				2				3				4				5			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
Biology	10	8.8%	9	11.5%	8	6.3%	5	10.0%	25	18.7%	6	14.6%	13	9.6%	11	14.9%	26	15.2%	15	20.8%
Chemistry	2	1.8%	5	6.4%	8	6.3%	4	8.0%	27	20.1%	4	9.8%	25	18.5%	12	16.2%	22	12.9%	12	16.7%
Physics	1	0.9%	6	7.7%	2	1.6%	3	6.0%	16	11.9%	3	7.3%	12	8.9%	10	13.5%	19	11.1%	11	15.3%

Specialist laboratories post-16: by local authority spending level

Band	Low				Medium				High			
	Refurb		New Build		Refurb		New Build		Refurb		New Build	
Biology	34	12.4%	17	16.3%	37	12.7%	17	14.9%	11	9.6%	12	12.4%
Chemistry	37	13.5%	12	11.5%	36	12.4%	15	13.2%	11	9.6%	10	10.3%
Physics	20	7.3%	8	7.7%	20	6.9%	14	12.3%	10	8.7%	11	11.3%

Specialist laboratories post-16: by type of school

Type	Comprehensive				Specialist (all Ability)				Specialist (restricted)				Grammar				Secondary modern			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
Biology	31	2.3%	25	1.9%	36	2.8%	17	1.3%	4	7.7%	0	0.0%	9	4.9%	4	2.2%	2	3.7%	0	0.0%
Chemistry	26	2.0%	23	1.7%	43	3.3%	11	0.8%	3	5.8%	1	1.9%	11	6.0%	2	1.1%	1	1.9%	0	0.0%
Physics	15	1.1%	21	1.6%	26	2.0%	9	0.7%	3	5.8%	0	0.0%	5	2.7%	3	1.6%	1	1.9%	0	0.0%

Specialist laboratories post-16: by age range of school

Age Range	11-16				11-18				14-18			
	Refurb		New Build		Refurb		New Build		Refurb		New Build	
Biology	0	0.0%	0	0.0%	74	4.1%	45	2.5%	8	5.8%	1	0.7%
Chemistry	0	0.0%	0	0.0%	67	3.7%	34	1.9%	17	12.2%	3	2.2%
Physics	0	0.0%	0	0.0%	45	2.5%	30	1.7%	5	3.6%	3	2.2%

Specialist laboratories post-16: by status of school

Status	Community				Voluntary Controlled				Voluntary Aided				Foundation				Academy			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
Biology	56	11.0%	37	14.6%	3	42.9%	1	12.5%	8	9.4%	3	12.5%	15	18.8%	3	18.8%	0	0.0%	2	14.3%
Chemistry	62	12.2%	30	11.9%	2	28.6%	0	0.0%	9	10.6%	3	12.5%	11	13.8%	2	12.5%	0	0.0%	2	14.3%
Physics	31	6.1%	27	10.7%	2	28.6%	2	25.0%	6	7.1%	2	8.3%	11	13.8%	0	0.0%	0	0.0%	2	14.3%

Specialist laboratories post-16: specialist science schools

30 schools

	Refurb		New Build	
Biology	3	10.3%	2	13.3%
Chemistry	9	31.0%	0	0.0%
Physics	4	13.8%	1	6.7%

Specialist laboratories Key Stage 4

Specialist provision

% of new labs (by refurbishment and new build – not total)

Key Stage 4

All

	Refurb		New Build		Total	
KS4 Biology	42	6.2%	15	4.8%	57	5.7%
KS4 Chemistry	44	6.5%	10	3.2%	54	5.4%
KS4 Physics	30	4.4%	9	2.9%	39	3.9%

Deprivation index of school

Band	1				2				3				4				5			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
KS4 Biology	5	4.4%	5	6.4%	5	3.9%	2	4.0%	9	6.7%	6	14.6%	7	5.2%	1	1.4%	16	9.4%	1	1.4%
KS4 Chemistry	8	7.0%	1	1.3%	4	3.1%	2	4.0%	7	5.2%	4	9.8%	9	6.7%	0	0.0%	16	9.4%	3	4.2%
KS4 Physics	6	5.3%	1	1.3%	2	1.6%	0	0.0%	8	6.0%	4	9.8%	3	2.2%	0	0.0%	11	6.4%	4	5.6%

Local authority spending

Band	Low				Medium				High			
	Refurb		New Build		Refurb		New Build		Refurb		New Build	
KS4 Biology	14	5.1%	6	5.8%	23	7.9%	3	2.6%	5	4.3%	6	6.2%
KS4 Chemistry	15	5.5%	5	4.8%	23	7.9%	1	0.9%	6	5.2%	4	4.1%
KS4 Physics	6	2.2%	3	2.9%	20	6.9%	3	2.6%	4	3.5%	3	3.1%

Type of school

Type	Comprehensive				Specialist (all Ability)				Specialist (restricted)				Grammar				Secondary modern			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
KS4 Biology	21	1.6%	7	0.5%	17	1.3%	5	0.4%	1	1.9%	0	0.0%	3	1.6%	3	1.6%	0	0.0%	0	0.0%
KS4 Chemistry	24	1.8%	5	0.4%	18	1.4%	3	0.2%	0	0.0%	0	0.0%	2	1.1%	2	1.1%	0	0.0%	0	0.0%
KS4 Physics	13	1.0%	8	0.6%	16	1.2%	1	0.1%	0	0.0%	0	0.0%	1	0.5%	0	0.0%	0	0.0%	0	0.0%

Age range of school

Age Range	11--16				11--18				14--18			
	Refurb		New Build		Refurb		New Build		Refurb		New Build	
KS4 Biology	13	1.3%	7	0.7%	25	1.4%	8	0.4%	4	2.9%	0	0.0%
KS4 Chemistry	16	1.6%	2	0.2%	22	1.2%	6	0.3%	6	4.3%	2	1.4%
KS4 Physics	17	1.7%	2	0.2%	13	0.7%	4	0.2%	0	0.0%	3	2.2%

Status of school

Status	Community				Voluntary Controlled				Voluntary Aided				Foundation				Academy			
	Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build		Refurb		New Build	
KS4 Biology	30	5.9%	11	4.3%	1	14.3%	2	25.0%	6	7.1%	0	0.0%	5	6.3%	2	12.5%	0	0.0%	0	0.0%
KS4 Chemistry	39	7.7%	9	3.6%	1	14.3%	1	12.5%	3	3.5%	0	0.0%	1	1.3%	0	0.0%	0	0.0%	0	0.0%
KS4 Physics	24	4.7%	7	2.8%	1	14.3%	2	25.0%	3	3.5%	0	0.0%	2	2.5%	0	0.0%	0	0.0%	0	0.0%

Specialist science status of school

	30 schools			
	Refurb		New Build	
KS4 Biology	3	10.3%	1	6.7%
KS4 Chemistry	1	3.4%	0	0.0%
KS4 Physics	3	10.3%	0	0.0%