PLANNING A CHANGE

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1 INTRODUCTION

The publication of the draft Technical Guidance Note on the Regulation of Noise Under Integrated Pollution Prevention and Control (IPPC)[1] and the revised Mineral Planning Guidance Note MPG 11[2], as well as the planned revision of BS 4142:1997[3] point towards a need to review the assessment procedures associated with the noise implications of new noise generating and noise sensitive development. Additional pressure on land use planning has resulted from Government advice on the use of brown-field sites in preference to development on green-field sites. This, coupled with an increasing awareness of the public on environmental issues, emphasises the requirement for a balanced assessment framework within which to review development applications.

This paper reviews current strategies on the control of industrial noise in the context of planning and development and proposes an alternative approach that is consistent with the more recent and emerging guidance on noise control and avoids placing undue restrictions on development.

2 CURRENT GUIDANCE

At present, planning policy relating to the noise implications for development is based on the guidance given in PPG 24[4]. Whilst this document provides detailed guidance and absolute criteria for residential sites affected by transportation noise, or noise from mixed industrial and transportation noise where neither is dominant, the policy on industrial noise is based solely on BS 4142.

BS 4142, however, is intended to be used for the measurement of noise from industrial (or similar) sources and the measurement of background noise and provides a method to determine whether the industrial noise may give rise to complaints. Whilst it states in the Foreword that *the standard may be helpful in certain aspects of environmental planning and may be used in conjunction with recommendations on noise levels and methods of measurement published elsewhere*, there is no guidance on how to apply the methodology to either planning for new industrial development or new residential development in an industrial area. Additionally, the standard is most often used in isolation, without consideration of "recommendations published elsewhere".

This often leads to either anomalous planning decisions, or the application of unnecessarily stringent planning conditions that do not comply with the overall principles of PPG 24 that the planning system should be used to *minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.*

Two examples serve to illustrate typical problems that can occur when BS 4142 is used for environmental planning without consideration of other guidance. The first concerns a proposal for the residential development of a brown-field site in an urban area, the second a proposal for industrial development in an area of mixed industrial and residential use.

2.1 Proposed Residential Development

A planning application was submitted for a mixed development of residential properties with some commercial (retail and office) use on a disused industrial site adjacent to an operational factory and the town centre. The other boundaries of the site were to residential or other quiet properties. The location provides a good example of re-use of redundant industrial land for housing, close to local amenities and consistent with the Government controls on development of green-field land.

During the daytime, the site is affected in some areas by road traffic noise from the nearby ring road and by noise from the adjoining factory, in other areas by industrial noise alone. Noise levels were generally found to be in the range 55-60 dB L_{Aeq}. At night, the industrial noise tends to be dominant and in the range 49-57 dB L_{Aeq}, with most locations below 55 dB L_{Aeq}.

If the noise levels were due to traffic noise alone, or mixed traffic noise and industrial noise (as is the case for some locations during the day), the site would be assessed using the PPG 24 Noise Exposure Categories (NECs) and would be judged to be in NEC B (55-66 dB L_{Aeq} during the daytime and 45-57 dB L_{Aeq} at night) and development would normally be permitted with conditions imposed to ensure an adequate level of protection against noise. Noise control requirements are well within normal mitigation strategies, such as single aspect housing, space planning to minimise exposure of noise sensitive rooms to the industrial noise sources, screening of the industrial sources by the buildings at the site boundary to protect noise sensitive rooms and external amenity spaces and, where necessary, attenuated ventilation systems as an alternative to openable windows for natural ventilation. These strategies would easily provide noise levels within dwellings and in gardens and other amenity areas that comply with the criteria recommended in BS 8233:1999[5] and by the WHO[6].

The use of BS 4142, however, gives rise to a somewhat different assessment and emphasises a crucial problem when applying the standard to residential development in a mixed area where there is established industrial use. The assessment of the likelihood of complaints is based on a comparison of the rating level of the industrial noise and the background noise level.

Where there is established industry, is the background noise level for the assessment that generated by the industrial sources, or the background level in the absence of that noise?

Normally, the background noise level would be considered as the level of noise normally obtaining in an area and taking account, therefore, of all established sources, whether these are transportation, industrial, or recreational noise sources. In this case, however, the local environmental health department concluded that the difference between the rating level for the site and a notional background noise level assuming no industrial sources would be such as to give rise to complaints and that the noise levels were too high for residential development.

It does, however, seem somewhat perverse to propose that the background noise levels for assessment of the likelihood of complaints from residents moving into that area would be based on a notional background noise level that may exist in the absence of the established industry, when the residents are, in practice, unable to make that comparison. It may be considered far more likely that any potential resident would form a judgement of the ambient noise in the area and determine for themselves whether that absolute level was acceptable or not and that that judgement would be broadly consistent with the findings of the research that led to the criteria recommended by the WHO and adopted in BS 8233.

2.2 Proposed Industrial Development

The Department of Trade and Industry had identified the need for a new power station in an industrial area and a power station developer brought forward a proposal to site the development on an industrial estate. The estate was adjacent to a residential area, but the power station was to be located on the far side of the estate, some 600 m from the housing. The environmental impact assessment that was carried out included a background noise survey and demonstrated that the noise from the power station would be about 3 dB(A) above the average night-time background noise of 39 dB L_{A90}. The local authority accepted this, as it complied with its policy of allowing development if it was within the "marginal significance" threshold given in BS 4142. The proposal was then delayed by the Government moratorium on the building of gas fired power stations and subsequently revived three years later.

By this time the responsibility for noise issues had passed to the Environment Agency, but, as this body had not yet developed the expertise to assess the noise impact of the proposal, the original local authority was asked to continue with the assessment. A new background noise survey was undertaken because a major factory had closed on the industrial estate. This survey showed that the background noise in the residential area, during certain wind conditions, could fall to between 30 and 34 dB L_{A90}, although at other times levels of 40 dB L_{A90} or more commonly occurred. Again the local authority imposed a criterion of background level plus 5 dB, but using the lower values as the reference. Although careful design allowed the power station noise to be reduced to 40 dB L_{Aeq}, under downwind or temperature inversion conditions, this was not acceptable to the local authority as it did not meet the lower target.

The noise of the power station would, however, be well within the BS 8233 and WHO criteria for day and night-time noise. Furthermore the housing was situated to the south of the estate and, therefore, the prevailing winds were such that the predicted level of 40 dBL_{Aeq} would have occurred for only a relatively small percentage of the year. At other times, lower levels would have been expected. Despite the design of the power station allowing the noise in the community to be well within the absolute criteria recommended in BS 8233, the local authority did not recommend that planning permission should be granted and the power station is now unlikely to be built.

3 PLANNING FOR CHANGE

The existing guidance, and in particular the emphasis on a rigid interpretation of BS 4142 for assessing the implications of industrial noise, clearly limits the use of brown-field sites for residential development and new or expanded industrial development and often results in a presumption to refuse such development. This can result in conflict with other environmental policies, such as conservation of green-field sites, and place needless restrictions on necessary economic and infrastructure development.

It is relevant to note that, whilst PPG 24 differentiates between transportation sources and industrial noise and treats them differently for assessment purposes, this approach is not used in either the WHO guidance or BS 8233, both of which define absolute, rather than relative criteria to limit internal and external environmental noise levels.

Interestingly, the limitations of BS 4142 have been recognised in the Scottish planning guidance, PAN 56[7], in which it is stated at paragraph 35 that *Whilst a useful guide, BS 4142 should not be solely relied upon to accurately establish the impact of industrial development in terms of noise.* Moreover, it is also recommended in paragraph 36 that *In applying BS 4142 authorities should also bear in mind the significance of absolute levels.* Attention is also drawn to the general guidance on acceptable noise levels in buildings found in BS 8233, at paragraph 37.

Further guidance is now available in the form of the IPPC Draft Noise Guidance, which is to provide a general regulatory framework for control of noise and vibration. The principle underlying the IPPC approach is the use of "best available technique (taking account of costs and benefits)" (BAT) to control emissions, including noise. Significantly, the overall aim of noise control is *wherever feasible, to ensure that proposed additions to existing plant and activities do not add to the background level*, although it is also recognised that *in some cases this may be unreasonable or beyond BAT.* The noise criterion proposed in IPPC is that *noise levels should not be loud enough to give reasonable cause for annoyance to persons in the vicinity*, changing the emphasis from one solely based on the "likelihood of complaints" to one based on "annoyance", an approach that is consistent with the WHO guidance and BS 8233.

The draft IPPC guidance provides advice on the setting of noise criteria, but at this stage remains somewhat ambivalent in its approach – suggesting both relative and absolute criteria, the former based on BS 4142, the latter on WHO recommendations. Clearly, where background noise levels are low (below 45 dB L_{A90} or so), a rating level that meets the WHO criteria (50 dB L_{Aeq} during the daytime and 45 dB L_{Aeq} at night) will exceed criteria based on relative levels. Additionally, the suggested starting point of a rating level that is equal to the background noise level is incompatible with another aim of the IPPC – not to increase background noise levels.

As has been shown in section 2.2 above, noise limits based solely on relative criteria severely limit the availability of locations for noise generating development, except at those locations where noise levels may already be high and, in some cases near or in excess of the WHO recommendations. It could be argued that an increase in noise levels in such areas is undesirable, to limit both annoyance and a further deterioration in the environment. Conversely, a limited increase in noise levels, where ambient levels are low, may not give rise to annoyance provided that the WHO guidelines are not breached.

The IPPC guidance recognises the conflicting influences on setting noise limits and goes some way to addressing these by providing an overall aim, but accepting that departures from this can be justified. The overall aim is stated as setting the rating level from an installation at the numerical value of the background noise level.

A less stringent standard may be acceptable in the case of:

- a remote location with no noise sensitive receptors;
- open air activities (eg landfill or minerals workings);
- temporary or short term installations;
- a small area only being affected.

A more stringent standard could be imposed for:

- tonal or other acoustic characteristics;
- a tranquil area that requires preservation;
- to prevent "creeping background"
- a large area is affected.

Notwithstanding the above, it is also stated that for new sites, or for existing sites where noise is a problem, the operator should justify levels which exceed background, or a rating level of 50 dB(A) during the day and 45 dB(A) at night.

Whilst the draft IPPC guidance can, at first reading, appear to be ambivalent and inconsistent, it clearly recognises the conflicts between a rigid application of BS 4142 and the requirement for economic and infrastructure development and offers a more pragmatic approach to the control of environmental noise.

Both noise sensitive and noise generating development are unavoidable and constraints on the availability of land for such development, coupled with an increasing awareness of environmental noise, inevitably leads to the risk of conflict between the desire to maintain or improve the environment and economic or infrastructure requirements. Planning for this change needs to resolve the conflict and ensure a realistic and consistent framework for development.

Any such framework cannot be based on a consideration of noise issues in isolation, but must take account of other factors to provide an holistic approach to land use planning. This strategy would be similar to the approach adopted for an environmental impact assessment, where all the environmental benefits and adverse effects are assessed in the context of the general benefits of the scheme to determine whether a balance in favour of the development accrues. Where noise generating development is concerned, the IPPC encourages this methodology to some extent, in that it is a regulatory system that seeks to employ an integrated approach to controlling the environmental impacts of industrial activities, including air quality and minimisation of waste, as well as noise control.

The Consultation Paper on Minerals Planning Guidance Note MPG 11 also recognises that the social and economic need for mineral extraction must be balanced against the environmental effects, including noise. Whilst the paper recognises the influence of background noise levels, the preferred strategy is to set absolute, rather than relative limits to control noise emissions, although options are proposed that relate a series of absolute limit to ranges of background noise levels. Where background noise levels are low (below 35 dB L_{A90}) a limit of 42 dB(A) or background plus 10 dB is suggested, with the proviso that these criteria should be applied *with* *care and flexibility, having regard to the circumstances of the site.* Minerals extraction would not necessarily be precluded from these areas, unless the environmental effects cannot be adequately controlled or mitigated using "best available techniques not entailing excessive cost" (BATNEEC). Again, the guidance is based on the concept of sustainable development, taking account of economic, social and environmental factors rather than the inflexible application of simplistic criteria based on the likelihood of complaints.

A similar strategy can be used to assess noise sensitive (eg residential) development on brown-field sites, in preference to a rigid and, as demonstrated in section 2.1, questionable policy based solely on BS 4142. It is considered that such an approach is consistent with the Government policy for sustainable development and would also provide the balance required by PPG 24.

The factors that would need to be considered in the setting of noise criteria for noise generating and noise sensitive development are summarised in Table 1, below:

Development type	Basis for criteria	Influencing factors
Noise generating development in noise sensitive or mixed noise sensitive and noise generating area	Overall limits: 50 dB L_{Aeq} daytime 45 dB L_{Aeq} night-time Supplementary criteria: Difference between new L_{Aeq} (weighted for character) and pre-existing L_{A90} limited to control change in ambient noise levels	WHO guidance on annoyance and sleep disturbance Need for development in general Need for development in selected area Existing ambient noise levels Preservation of tranquil areas Number of properties/area adversely affecte Practicability of noise control (BAT) Cost
Noise sensitive development in mixed noise sensitive and noise generating area	Overall limits: WHO recommendations BS 8233: 1999 criteria	WHO guidance on annoyance and sleep disturbance Need for development in general Need for development in selected area Site and internal layouts to minimise noise exposure Screening noise sensitive buildings/areas to control external noise Sound insulation (double glazing and attenuated ventilation) to achieve internal criteria

TABLE 1: Factors influencing noise criteria for development

In contrast with the existing policy, where an isolated approach to noise implications and a rigid application of BS 4142 often results in a presumption to refuse planning consent, this strategy would enable each development proposal to be judged on its merits and in the context of all benefits and constraints.

4 CONCLUSIONS

Current planning policy in relation to development and noise and in particular the use of BS 4142, in isolation, to set noise control criteria can be shown to be inconsistent with a policy for sustainable development and often leads to a presumption to refuse consent on noise grounds.

It is proposed that a more broadly based approach, similar to those now being established in the IPPC Noise Guidance (IPPC H3) and MPG 11 Consultation Document and adopting criteria more closely aligned to those recommended in the WHO *Guidelines for Community Noise* would provide the balance required by PPG 24 when assessing the implications of noise.

An emphasis on absolute noise criteria for new noise-sensitive development in areas affected by industrial noise, rather than a relative assessment based on notional, but non-existent background noise levels, would be consistent with the methodology currently used for transportation noise effects and with Government policy encouraging the use of brown-field sites.

REFERENCES

[1] Environment Agency, (2001) *Integrated Pollution Prevention and Control (IPPC) Draft Noise Guidance, Part 1 – Regulation and Permitting*, Environment Agency, Bristol

[2] Department of the Environment Transport and the Regions, (2000) *Mineral Planning Guidance Note 11: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Consultation Paper*, DETR, London

[3] British Standards Institution (1997), *BS 4142: 1997, Method for Rating industrial noise affecting mixed residential and industrial areas*, British Standards Institution, London

[4] Department of the Environment, (1994) *PPG24: Planning and Noise*, The Stationery Office, London

[5] British Standards Institution, (1999) *BS 8233: 1999, Sound insulation and noise reduction for buildings – Code of practice*, British Standards Institution, London

[6] World Health Organisation, (1999) *Guidelines for Community Noise*, WHO, Geneva

[7] The Scottish Office, (1999) *Planning Advice Note PAN 56, Planning and Noise*, The Scottish Office, Edinburgh

Proceedings of the Institute of Acoustics

DOES THE NEW SOUND LEVEL METER STANDARD IEC 61672 MAKE ANY DIFFERENCE TO MY MEASUREMENT?

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1. INTRODUCTION.

For over 10 years now, a Working Group in the IEC (International Electrotechnical Commission) has been revising and updating the International Standards for sound level meters, to replace the existing standards which are now quite elderly. IEC 60651:1979 (1) for sound level meters and IEC 60804:1985 (2) for integrating-averaging sound level meters will shortly be withdrawn and all new sound level meters will have to comply with IEC 61672 if they are to meet the latest requirements. Many specifications have been changed and more added, which in turn will probably mean longer development times and higher costs for new instruments, but will this result in better measurements?

The author has been a member of IEC/TC29/WG4, the group responsible for producing the new Standard, since the project started. In this paper I will examine the principal differences between the existing and the new Standards, and attempt to quantify their effect on measurements made with sound level meters.

2. THE BACKGROUND TO IEC 61672.

The progress towards the new Standard has been slow and at one time almost stopped when rules for producing new Standards changed just when this Standard was approaching completion. Originally it was conceived as having three sections: the first would contain the requirements for any type of sound level meter, the second would be the tests to be performed by any laboratory certifying the meter as conforming to the standard (pattern or type approval) and the third the tests required to periodically verify that the meter was still performing acceptably. The first section was originally completed several years ago and drafts of the second and third parts were under discussion when the requirement to include measurement uncertainty was suddenly introduced by the IEC. None of the discussions on the new standard up to that point had really considered this aspect of "tolerances" at all, and the need to include the component of the measurement uncertainty in the tolerance allowed for each aspect of the meter caused a considerable delay in rewriting the requirements. In many cases, it was necessary for National Laboratories to make measurements and evaluate their uncertainties before a revised "tolerance" could be safely included in the new standard. This in turn led to some rethinking of other aspects of the requirements and delayed completion of the main text.

2.1 Current proposals for the Standard.

As a result of this delay, it was agreed to split the document into several parts. IEC 61672-1 will be the requirements, IEC 61672-2 will be the tests for pattern evaluation, IEC 61672-3 will be the tests for periodic verification and a new part, IEC 61672-4, will be the OIML report format. Each part will be published separately. This last section, which has yet to be started, is a new aspect for IEC Standards. In the past the Organisation for Legal Metrology (OIML) have produced separate standards. These detail the format and content of reports used to show that pattern evaluation according to International requirements has been correctly and completely effected by a National Laboratory, which has been approved for the purpose. Now the IEC working group is producing this as well as defining the tests, thereby removing the need for a separate group at OIML (many of whom were often in the IEC Group too).

2.2 Current progress of the Standard.

At the time of writing (October 2001), IEC 61672-1 was undergoing its final vote, which, if positive as expected, will lead to publication early in 2002. This lays down the requirements for all new meters and allows manufacturers to design and specify instruments to this specification.

IEC 61672-2 for the pattern evaluation tests has been completely drafted and is undergoing its final comment stage. A planned meeting of the working group in November 2001 should produce the final version which will need another vote before publication. With a smooth passage, this should also be published in 2002.

IEC 61672-3 for periodic testing has yet to be completed and has not been seen by anyone other than the working group. The completion of this part will be accelerated once part 2 has been approved as it is essentially a subset of part 2,

IEC 61672-4 likewise can only be produced when part 2 is finalised.

3. WHAT ARE THE MAIN DIFFERENCES IN IEC 61672?

The first difference is the reduction in the number of types or classes of meter defined. In the past there were Types 0, 1 2 and 3. Now there will only be Class 1 or Class 2. As an approximation, Class 1 is a little better than the existing Type 1, but not a Type 0; Class 2 is very similar to the existing Type 2. Class 1 is intended as the precision device and Class 2 as the general purpose unit.

However, in terms of the Standard, the biggest single difference is the inclusion of Uncertainty budgets in every tolerance quoted. This has the effect to the casual observer of appearing to make the tolerances no better, or in some cases worse, than the old standards, but the working group has been at great pains to ensure that the values are realistic and wherever possible has actually reduced the margin of error allowed to the manufacturer. As an example, the tolerance given for the accuracy of a Type 1 meter's frequency response at 12.5kHz used to be between +3 and –6 dB. This figure is unchanged in the new standard for a Class 1 meter, but the tolerance now includes an uncertainty of measurement of 1.0 dB, so the combined effect of the tolerance and level of uncertainty means that the meter will only pass testing to the new standard if the true answer lies between +2 and –5 dB, thus tightening the requirements of the meter's performance. The same comparison at 250 Hz had the tolerance as ±1.0 dB, but the new standard now says ±1.4dB, but the uncertainty allowed is 0.4 dB, so the true answer still has to lie within ±1.0 dB, thus no change. More information regarding uncertainties and sound level meters can be found in ref. (3).

3.1 Specific changes from IEC 60651 and 60804.

3.1.1 Mandatory requirements.

Certain features have been made mandatory if compliance to the new standard is claimed. For a meter claiming to operate as a sound level meter, an integrating sound level meter and an integrating-averaging sound level meter, (which most new designs usually do), A weighting, F (fast) time weighting, A weighted time-average sound level (Leq) and A weighted sound exposure level (SEL) must all be available. In addition, a Class 1 meter must have C weighting in some form. A "hold" facility to capture maximum and peak levels is also mandated, as is a means of inserting the specified electrical test signals. Sound level meters with fixed microphones and no means of a test laboratory inserting electrical test signal are no longer permitted.

3.1.2 Frequency weightings.

A weighting is the only frequency weighting mandated, but additionally C weighting, and the new Z weighting are specified in the Standard. B weighting has been removed, but manufacturers are free to include any other weightings provided they are defined by the manufacturer and the tolerances in the Standard are adhered to. Z (or zero) weighting is what has often been called linear or flat in the past, and essentially defines an unweighted bandwidth over the same range of frequencies as the other weightings fitted to identical tolerances.

3.1.3 Acoustic testing.

In order to more fully assess the true measuring capability of a sound level meter, more emphasis has been placed on acoustic testing than in the previous standards. This is evident in the tests for frequency response already mentioned where the test for one of the specified frequency weightings is to be performed both acoustically and electrically. This is to ensure that effects such as the shape of the sound level meter case and all microphone through to display errors are taken into consideration in one measurement. By testing the meter acoustically and then electrically, the errors introduced acoustically can be determined and other weightings can then be tested purely electrically with the acoustic errors added to give the overall performance. This has proved a little controversial as any other errors in the meter's measurement, such as linearity, are also included in the supposed acoustic response. These are reduced to almost zero if the weighting tested is the Z weighting. However this may not be possible to use. It is not mandated that this is fitted and ultimately the choice of weightings fitted lies with the manufacturer.

The tests of directional response have been considerably increased. In addition to normal incidence, tolerances have been defined for changes in direction of up to 30°, 90° and 150°, and these have to be tested from 250 Hz up to 8 kHz for Class 2 and up to 12.5 kHz for Class 1 in each plane of symmetry. For pattern evaluation, it is suggested that increments of not more than 10° are used and that at higher frequencies, increments of not more than one-twelfth octave steps are applied. This makes for a considerable amount of acoustic testing which is both time-consuming and difficult to achieve with high precision, so is likely to prove expensive. However, this is a fundamental aspect of the overall design of a meter, and will not change from unit to unit of the same design if all other manufacturing details are kept the same, so it will not be necessary to include this in the periodic testing.

Meters meeting all the acoustic requirements to the tolerances specified will have considerably better measuring capabilities than many of the designs currently on sale. This is because the methods specified for measuring and testing the performance in the past have not been interpreted as including all the factors which are now mandatory in the new standard.

3.1.4 Effects of Temperature, Humidity and Atmospheric Pressure.

The requirements here have been changed as in attempting to define the uncertainties for the new standard, it was found that several of the original tolerances were smaller than the measurement uncertainties which, at that time, were not included! It was also accepted that the tight temperature tolerances expected for all 4 Types of sound level meter in the old standard were unrealistic and widely ignored for Types 2 and 3. Consequently, the new Class 1 temperature tolerance is ± 0.8 dB with 0.3 dB uncertainty included (was ± 0.5 dB for all types) but for class 2 is now ±1.3 dB with 0.3 dB uncertainty. The operating temperature range has also been altered. Class 1 retains the original –10° to + 50°C whilst Class 2 is now 0° to +40°C. The reference temperature is now 23°C (was 20°C) to align with the specifications for microphones, and the tolerances define the maximum change from this point to any other within the permitted range.

Humidity has also acquired a Class 1 and a Class 2 specification, slightly tighter than before for Class 1, slightly wider for Class 2. Atmospheric pressure effects have been defined over a slightly wider pressure range with slightly widened tolerances, so the overall effect is no real change.

Once again, the tests for each of these three properties are time-consuming, especially those for temperature and humidity. In the past, these tests have often been performed too quickly with inaccurate results, and ignored altogether for cheaper instruments whose microphones were frequently quite good thermometers as well! In order to try and alleviate the problems whilst not increasing the time to test horrendously, a combined temperature and humidity test has been introduced. Selected combinations of temperature and humidity are defined for each Class of meter and tighter tolerances than are permitted for either test when carried out separately have been introduced. If the meter passes these tests at the tighter tolerances it is deemed to meet the standard for both parameters. If the meter fails these tests, it is still permissible to test each parameter separately to the full tolerances and for the meter to pass if these individual tests are to specification. Time for the meter to stabilise to any temperature or humidity is defined as a minimum of 7 hours for each change after an initial 12 hours at the reference point of 23°C and 50% RH. Again these are tests of the model and should only be required at pattern evaluation stage.

3.1.5 Peak Response.

The requirements in IEC 60651 for peak response made no reference to a frequency weighting and were often applied to any weighting the meter happened to possess. Whilst the tests defined would usually be met by testing with A weighting or no weighting (Linear), testing with C weighting was often very marginal due to the effects of transients on that particular weighting. As the use of C weighted Peak has become more widespread recently, the new Standard has changed the tests to now define C weighted peak only. If a meter is fitted with Peak, it must also have C weighting, although not necessarily have C weighting for anything else other than Peak measurements. This in turn has led to a need for an ability to have a C weighted r.m.s. parameter available during testing, which in practice will mean that any meter measuring Peak will have C weighting available for all the measurements it can make. No test is now specified for any other frequency weighting.

3.1.6 Underrange and Overload indicators.

Meters will now be required to indicate underrange as well as overload. The display of numbers below the bottom of range will not be allowed unless a warning flag of some sort is also displayed and saved with any stored data using these numbers. On measurement ranges where the self-noise of the instrument is on-scale, underrange need not be indicated provided the linearity range specification for that range is fulfilled to the permitted tolerances.
Overload detection remains unaltered, although the tolerances and tests have been tightened.

3.1.7 Level Linearity.

The biggest change here is the requirement for all meters to have at least a 60 dB dynamic range meeting the tolerances. The old standards only required this value for a Type 1 integrating meter, and reduced to as little as 15 dB for a plain sound level meter. The confusing concept of primary indicator range in IEC 60651 is removed and all the valid measurement range of the entire meter has to meet the same tolerance for all measurements. These tolerances, now including uncertainty, have been slightly simplified but remain essentially similar to those currently in use.

3.1.8 EMC.

The requirements for radio frequency emissions from the meter and its susceptibility to static discharges remain unaltered from the fairly recent additions to IEC's 60651 & 60804. However, the requirements for the meter to be unaffected by radio frequency fields incident on it have been made more demanding. The field strength has been increased to 10V/m across the slightly wider spectrum of 26 – 1000 MHz. The tolerances, now allowing for uncertainty, remain effectively unaltered. This is an attempt to improve the immunity of the meter from the ever-increasing presence of interference from such sources as mobile telephones.

3.1.9 Other Changes.

Time weightings F and S only are now specified. The I or impulse weighting has been removed as its results are often misleading, but a specification for it is included in an informative annex for historical reference.

Multichannel sound level meters are now defined and tests of crosstalk between channels are included in the new Standard.

Tests on the adequacy of the power supplies for acceptable changes between different supplies (either change of battery voltage or changes from internal to external supplies) are now included.

The requirements to be included in the handbook for the meter have increased significantly and it is mandated that this be in printed form.

4. WHAT DOES THIS MEAN TO MEASUREMENTS?

It is often said that modern sound level meters are already so good and contain so many features that the errors in measurement are now due to the operator of the meter and not the meter itself. If this is true, do we need a new standard and what will it achieve? It is undoubtedly true that the operator can have a very significant effect on the accuracy of the readings made with the meter. Where were they standing in relation to the microphone, what about sound reflections at the site chosen and wind and weather effects if measuring outdoors? These effects can often make whole dB's-worth of differences and here we are demanding accuracies in the meter of tenths of a dB. Are these differences worth having and at what price?

It is impossible to give an exact answer to these questions as the circumstances in which sound level meters are used vary enormously as does the importance of accuracy. What the new Standard achieves can be broadly summarised as follows:-

- The basic parameters remain essentially unchanged.
- The acoustic response, both at normal incidence and for sound arriving from other directions, are defined more accurately, which in turn should lead to more accurate measurement of the sound field.
- The performance of the meter in changing environmental conditions is defined more accurately, and can now be applied sensibly to both Classes of meter, whereas before it was often ignored for Types 2 & 3.
- The dynamic range is more in keeping with real-life measuring situations.
- The EMC requirements are in keeping with the types of interference that can be expected today.

Overall, what the new Standard should achieve is a uniformity of measurement accuracy across all conditions that meters are expected to cope with, to the same degree of accuracy as was previously often obtained only in a test laboratory under controlled conditions.

4.1 What will this improvement cost?

The effect of the new Standard on a well-designed, good quality meter already in existence could be minimal. Where accuracies have been tightened, some designs may not be capable of achieving the new accuracy, but many will. Also the additional tests and test methods now prescribed may require minor changes to existing designs, such as adding an underrange indicator if one was not already displayed. For many meters at the low-cost end of the market, this will, however not be true. It is an unfortunate fact that many of these meters make claims to meet IEC 60651 and IEC 60804 which, if tested properly, are shown to be completely false, but because there is no mandatory testing of these meters to demonstrate the claims made for them, many people are misled into thinking their meter is better than it is.

The new Standard will not eliminate this problem, but it may make it a bit more obvious. Only in countries where evidence of a successful Pattern Evaluation test having been completed is required before products can be put onto the market claiming compliance to IEC 61672 will the improvements described in the paper become effective. In countries (such as the UK), the onus will be on the customer to ask if the meter has undergone successful testing. With this sort of information becoming available on the Internet, this is becoming easier to establish, but educating customers to ask this sort of question is a lot more difficult.

However, the reputable manufacturers will obtain the necessary Approval, and will probably make it more evident than in the past as it will undoubtedly take longer to acquire and cost more. One estimate is that the total time to test a new sound level meter to IEC 61672-2 has increased four-fold over the tests currently being made at laboratories like the PTB in Germany. Only the manufacturer has to pay this, and then only once for each model, but this is bound to have some effect on the selling price of the meter. For a Class 2 meter which was never tested in the past, will manufacturers bother spending all this money when they have not needed to up to now? Probably only if market forces insist, and that will take time to occur in some countries, but almost certainly will lead to price rises for new instruments.

4.2 Periodic verification.

So far I have largely concentrated on the design and pattern evaluation aspects of the new Standard, largely because at present these are the best-defined parts. What also has a considerable bearing on measurement accuracy is whether the instruments are maintained and checked regularly. Part 3 will define the tests to be repeated at whatever interval is thought appropriate. It is unlikely that the Standard will mandate any period (although it may recommend annual or bi-annual) for this to occur as different countries impose National Legislation in this area from time to time, but the tests to be performed can be standardised. As only an outline of the requirements has so far been drafted, it is impossible to say how expensive it will be to perform these tests, but as a target, the total time to test and report has been set at 1 day per meter maximum. If this becomes reality, it will probably increase costs considerably for the laboratories which perform all the tests included – a cost which will inevitably be passed on to the end user. At present, there is no provision for omitting any tests if the meter has that measurement capability, but this may yet change. For a Class 1 meter, the increase may be quite small, especially if the tests can be automated, but for a Class 2 meter at the lower end of the price range, the cost of this testing may well prove higher than the purchase price of the meter. With meter prices generally declining in real terms, but testing needing a skilled operator whose costs continue to rise, this will become an increasing problem which is difficult to easily resolve.

There is no doubt that having equipment regularly checked by competent laboratories is the most reliable method of ensuring the meter is not giving false or misleading results. Anything that promotes more people to have regular checks made is to be encouraged. The increases in measurement performance that the new Standard will produce can easily be lost if the cost of periodic checks deter users from having them made. The working group has a daunting task to try and balance the conflicting requirements of an adequate test routine versus the cost of performing it. Whatever is produced, laboratories such as those UKAS accredited in the UK, will need to produce new procedures to cover the tests in the new Standard, and will soon have to phase out testing to BS 7580 part 1, currently the only Standard defining an adequate set of tests to the specifications in IEC 60651 & 60804, for new meters. Currently, hardly any Type 2 meters are regularly checked. If the new Standard can alter this situation, it will indeed be a significant improvement in overall measurement accuracy.

5. CONCLUSION.

IEC 61672 will make differences to sound level meters in many ways.

- Improve the standardisation of testing both at pattern evaluation and periodic verification stages.
- Make significant improvements to the accuracy of meters under a much wider range of external conditions than previously.
- Give the user more information about the meter's performance and how best to realise it.

However, this is likely to be at increased costs to both the manufacturer and the user. Not every aspect of sound level meter measurements is covered though. Manufacturers have always been able to innovate and add different measurement capabilities that are not defined in any Standard and there is no reason to believe this will not continue to happen. As their usage becomes more common, some of these parameters do in turn become Standards. It is surprising to note that, despite its long history of use, the percentile level, or Ln as it is usually referred to, is not included in

IEC 61672, which is a shame as there are many different methods employed to produce these answers, and a standard method and test would have been very helpful. It was the wide diversity of methods (and results) that caused the abandonment of its inclusion in the new standard as no consensus could be reached on a single method for its derivation. Equally, although Z weighting does at least define tolerances for a uniform frequency response over the audio bandwidth, it does nothing with any infra- and ultra-sound components which different designs of meters may or may not cope with. Measurements made on this weighting will still be subject to the variability of the meter's design below 10 Hz and above 20 kHz, and this can produce dramatically different readings of the same noise source on different meters.

Whilst there are a few omissions from IEC 61672, when it is complete and published, it will represent a significant advance over the existing Standards that is likely to remain valid for many years to come, leading to overall improvements in sound measuring accuracy.

6. REFERENCES

1) IEC 60651:1981 Specification for Sound Level Meters

2) IEC 60804:1985 and IEC 60804 Ed.2:2001 Specification for Integrating-Averaging Sound Level Meters

3) Uncertainty budgets – are we certain we understand them? R. Tyler. Proc. IOA vol.23 part 1 pp.1 – 7. February 2001.