Office for Nuclear Regulation

Guidance Note: Application of Climate Study to Class 7 Dangerous Goods Package Design

Radioactive Materials Transport Team

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Disclaimer

Users should note that this document is intended as an informative and explanatory guide to the regulations governing the transport of radioactive material. It is not intended as an authoritative or comprehensive statement of the law, nor a substitute for the source legislative material. It should be read in conjunction with the statutory provisions and any determinations, directions and regulations to which it refers.

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0 Introduction

This document should be used in conjunction with the Met Office report, Range of Environmental Temperature Conditions in the United Kingdom, Version 1.2, issued on 17th May 2011, and commissioned by the Radioactive Materials Transport Team. Paragraph numbers in this report correspond to those in the Met Office report to aid understanding. This Met Office report is available online at the following web address:

http://www.onr.org.uk/transport/temperature-range-report.pdf

Package type design requirements are well defined in TS-R-1[1], including defined temperature ranges to be considered for the design of some Industrial Packages, Type A, Type B(U) and Type C packages, and insolation values for the latter two types.

Type B(M) packages are, subject to Competent Authority approval, permitted to deviate from these bounding values, and be certified for use within a narrower range as justified by the applicant. Historically, a suitable temperature range and reduced insolation values for use solely within the UK was suggested in BS 3895:1976, which has since been withdrawn, and no replacement has been published. Additionally, some Industrial Packages[2] are not required to adhere to specific climatological criteria, although good design practice will define an acceptable range for package performance.

For Type B(M) packages, deviations from the regulatory temperature ranges are permitted if the package safety can be demonstrated by the applicant to the satisfaction of the Competent Authority, who may impose limitations on its use. The ranges selected for Type IP-1 or Type IP-2 packages may also vary, and the design approved by the applicant, with suitable documentary evidence justifying the design. The choice of temperature range when making such an application therefore becomes an operational or commercial decision balancing the cost of design, approval, manufacture and use against the risk of unavailability should the prevailing conditions exceed those for which the package is approved.

Considering the time elapsed since the British Standard was published, its withdrawal, and the consequent developments in technological capability and effects of climate change, it was considered appropriate to review existing guidance, with a view to aiding designers, duty-holders and regulators to better understand the prevailing and likely future conditions. The intention is to inform commercial decision making and development of regulation in the future, with the overriding priority of ensuring the safety of people and the environment. This document and the Met Office report it supports in no way takes precedence over current legislation.

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[1] Throughout this guide, references are made to TS-R-1, as the basis for legislation in the UK (via the UN Orange Book) for all modes, in order to aid clarity and brevity. However, it should be noted that the legislative texts in the UK are the latest editions at any time of ADR for road, RID for Rail, ICAO Technical Instructions for air, and the IMDG Code for sea, brought into force via various legal instruments. For road and rail in the UK (the subject of this note), this is the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended). These texts should be consulted prior to transport, and take precedence over TS-R-1 for regulatory compliance in the UK.

[2] Type IP-1, and Type IP-2 when not carried by air.

1 Climatic Conditions

1.1 Area of Interest

This section describes how the geographical area subject to the research was defined. The selected regions for this study are limited to main transport routes of both road and rail, and quality controlled to exclude extreme or otherwise inapplicable readings. Therefore, the data set may be considered representative of travel conditions in the UK.

The entire area of the Great Britain and Northern Ireland has been considered as one region. While there are notable differences in various parts of the country, this approach is adopted to enable transport throughout the country, and the bounding ranges will be suitable throughout. Local conditions for a specific application may be considered if suitably justified, although it is unlikely the Met Office report would be considered to be suitable supporting evidence in this case.

1.2 Comment on Analysis Methods

1.2.1 Data Extraction and Quality Control

1.2.1.1 Temperature

The temperature effects considered were long term average peak values and averages over 24-hour and high and low 8-hour periods.

The peak values are intended to give bounding temperature conditions for a package.

The 24-hour range is intended to be suitable for application to substantial, thick-walled packages with significant thermal inertia, for use when assessing cyclical temperature effects.

The 8-hour ranges would be more suitable for packages with low thermal inertia that would respond quickly to changes in temperature. The high 8-hour value represents daylight conditions, and the low 8-hour value represents night-time conditions.

1.2.1.2 Solar Radiation

As with the temperature values, the data acquired for solar insolation includes average peak values, 24-hour averages, and high 8-hour averages (the low 8hr average occurs overnight and is effectively zero). The same logic applies as to the application of these values to package design.

Diffuse radiation was included in the insolation values, to better represent the solar radiation experienced by the package, and eliminate variance in design through the use of different approximations to account for this effect.

1.2.2 Extreme Value Analysis

The extreme value analysis employed various statistical techniques to compute various probabilistic projections.

A confidence level of 95% was selected for all predictions, and so the range of projections (the difference between the highest and lowest) increases the more extreme the event projected, so a 1: 10 000 year event will have greater range for the given 95% confidence level than a 1: 10 year event.

Therefore, throughout the report, the 'Best' result is the most probable high (or low) figure for the given month or year (i.e. Best estimate). The 'Low' and 'High' figures represent the values on the distribution of predictions beyond which there is a very low probability (<5%) of the value being realised, i.e. the most likely value for a period is 'best', and there is a 95% chance that the actual value experienced is greater than 'Low' but less than 'High'. The selection of which values to use remains the responsibility of the applicant based on the tolerance of commercial risk; a lower tolerance of risk would lead to more extreme values being selected.

The main factors affecting insolation include the hours of daylight, cloud cover, and angle of incidence of the sun’s radiation to the surface. Bounding cases of these factors have been observed for the UK, and in general correspond to the annual cycle, as the days lengthen and shorten, and the position of the UK relative to the sun varies. The exception is cloud cover, although throughout any year, several instances will be observed which feature either total cloud cover, or a complete absence of clouds; extreme values will tend to represent this, such that the peak high values will be observed when there is no cloud cover. Thus, the extreme values with respect to insolation are likely to have already been experienced due to the physics underpinning the effect. Therefore the range bounded by the recorded data may be considered also to bound any conceivable extreme condition.

1.3 Maximum Temperature Results

Table 1 of the report shows a number of values between July and August where the 1 year return value approaches 30ºC, with an ‘all-year’ value of 31.3 ºC. Designing a package with an upper temperature limit of 30ºC is therefore likely to ensure its availability throughout most of any given year, although there are likely to be occasions over the life of the package where it is not suitable for use.

A single ‘occasion’, due to the sampling technique used, may conceivably occur over a number of sequential days, all of which have peak temperatures in excess of, for this instance, 30ºC. For a Type B(M) package, where the operating temperature range is defined in the certificate of approval, use of the package in temperatures in excess of this approved range would be a breach of the conditions of the approval.

At this point, it is worth noting that the common range currently in use, and as previously quoted in BS 3895:1976 prior to its withdrawal, was from -10ºC to +26ºC. Considering the values in Table 1, this suggests that in any given year, this temperature is likely to be exceeded on at least one occasion each month, for several of the hottest months of the year. There is therefore a significant chance that shipments may be disrupted as a result, with consequent operational issues.

Note that the Competent Authority will still accept applications for packages against this temperature range, and, subject to successful assessment, issue certificates with the appropriate restriction; the applicant is responsible for operating the package in compliance with the regulations and assessing the level of commercial risk they will accept at the time of the application. See Appendix 2 for an example of an acceptable climate monitoring regime.

The same table shows 10 year return values for the same months approaching, and in two cases[3] exceeding, 35ºC. Hence, designing a package for a temperature range with an upper limit of 35ºC is likely to mean that the package is operable throughout most of any given 10 year period, although there is ~95% probability that on one occasion during this period the ambient temperature will exceed this limit.

The current range quoted in TS-R-1 has a high peak value of 38ºC. Table 2 of the report gives 1:100 return values, of which only three[4] of the upper limit monthly estimates exceed 38ºC. A practical interpretation is therefore that any package designed against the full temperature requirements of TS-R-1 is likely to be operable throughout any given 100 year period, although there is ~95% probability that on one occasion during this period the peak ambient temperature will exceed this value, and that this occurrence will almost certainly be during one of the three months of June, July and August.

Similarly, the range quoted in Table 2 for 1:10 000 year return values, suggests that a design temperature of ~50ºC would be required to ensure availability of a package throughout most of any given 10 000 year period, with a corresponding probability of 95% that this value will be breached on one occasion during this period. Designing to suit this temperature value is well in excess of what is currently required by the regulations, and almost certainly over-engineering, due to the probable lack of capability of the transport infrastructure in these conditions.

1.4 Minimum Temperature Results

The best estimate average one year peak return value given in Table 3 for cold weather events is -16.3ºC. This is well below the convention generally applied in the UK of -10ºC for Type B(M) packages. As with the upper temperatures, the Competent Authority will still accept and approve applications for packages against the previously applied lower temperature limit of -10ºC, with the same caveat as before regarding operational use. Applying the same interpretation as applied to the upper bounds however, it can be seen that there is a significant risk that temperatures will drop well below -10ºC for a number of occasions in any given year. This means there are likely to be several periods when the package is unable to be operated in compliance with the regulations.

[3] Upper bound of 1:10 year value for July 35.1ºC and August 35.8ºC
[4] Upper bounds of 1:100 year value for June 38.8ºC, July 38.5ºC and August 42.9ºC

For the 1:10 year return values, designing to a lower temperature value of approximately -20ºC would mean that approximately one event may be expected to occur in any 10 year period where temperatures would fall beneath this value.

These temperatures fall to approximately -30ºC for a probability of an event occurring in a 1:100 year return period, and again to approximately -40ºC for the 1:10 000 year return value.

Consequently, designing to accept the lower temperature range specified for Type B(U) packages in TS-R-1 paragraph 664 of -40ºC is likely to be adequate to meet any reasonably foreseeable conditions within the UK.

1.5 Mean Temperature Results

The average mean temperature results are taken from both the hottest/ coldest stations and times of day, as appropriate, and may be considered to represent a normal temperature value for typical transport in the UK.

The values discussed in the previous sections represent momentary peaks; the values in this section are sustained over time, and are more likely to be sustained over a greater number of days. Sustained exposure to these temperatures therefore should be considered during design.

1.5.1 24 Hour Mean Temperature

This set of results is intended to be useful in the design of massive, thick walled packages with substantial thermal inertia. As an indication, this would typically include those packages with a thermal response period greater than 24 hours.

As a 24 hour average, this result will include the overnight period. Consequently, this value is likely to be colder than the 8-hour daytime average, and warmer than the 8-hour overnight average.

1.5.2 8 Hour Mean Temperature

This set of results is intended to be useful in the design of smaller, thinner walled packages with a quicker thermal response. Following the example given in the previous section, this would typically include those packages with a thermal response time of less than 8 hours.

Obviously, there is a significant middle ground (between 8 and 24 hours) arising as a result. The choice remains with the applicant of which values to use. In all cases the applicant should justify the mean value that has been assumed in the design.

1.6 Solar Radiation Results

To suit international application, the insolation values provided in TS-R-1 2009 Edition Table 13 are based on the equatorial region, and assume solar radiation occurs perpendicular to the Earth's surface. This is also the basis for the choice of a 12-hour period to reflect night and day. As the model assumes the sun is directly overhead, the insolation seen on various package surfaces decreases as exposure vertically upwards decreases. This is reflected in the Figures 1 & 2 below, taken from the 2008 Edition of TS-G-1.1, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material.

This model is a good approximation for design of a package with potentially global use. However, when considering the UK independently, it becomes apparent that many of these assumptions are no longer appropriate. This is considered in the analysis underpinning this report. For example, instead of using 12-hour values, in order to better represent UK conditions, an 8-hour period was considered more suitable. Allowance must also be made that as the angle of solar radiation relative to the Earth is no longer 90º, the distribution of insolation about the vertical sides of a package will no longer be equal. Therefore, although some non-horizontal sides will receive less energy, some will receive more, and so the assumptions based on equatorial conditions may not be bounding in the UK.

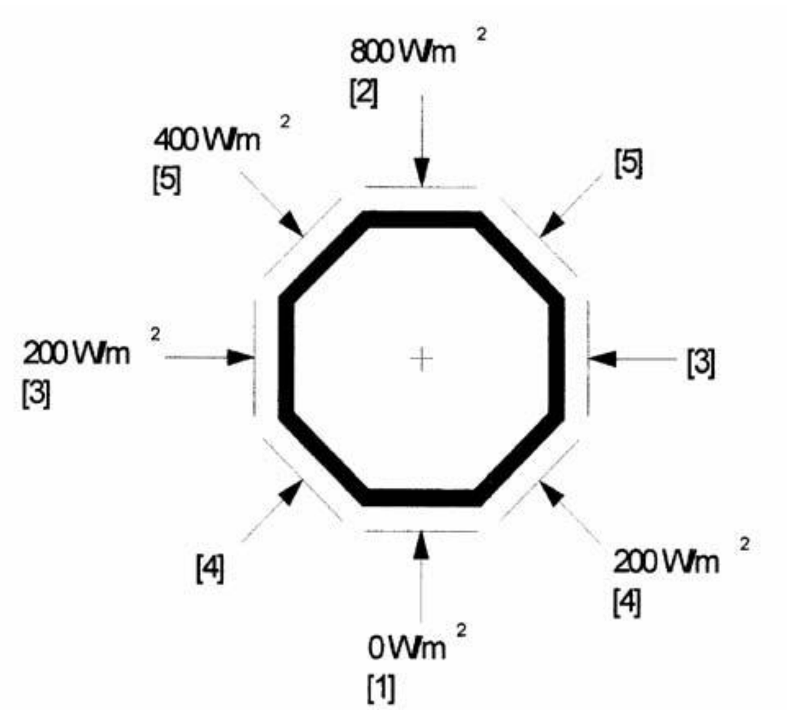

Figure 1: Taken from TS-G-1.1 2008 Edition, page 147 ***FIG. 3. Vertical cross-section of package with flat surfaces.***

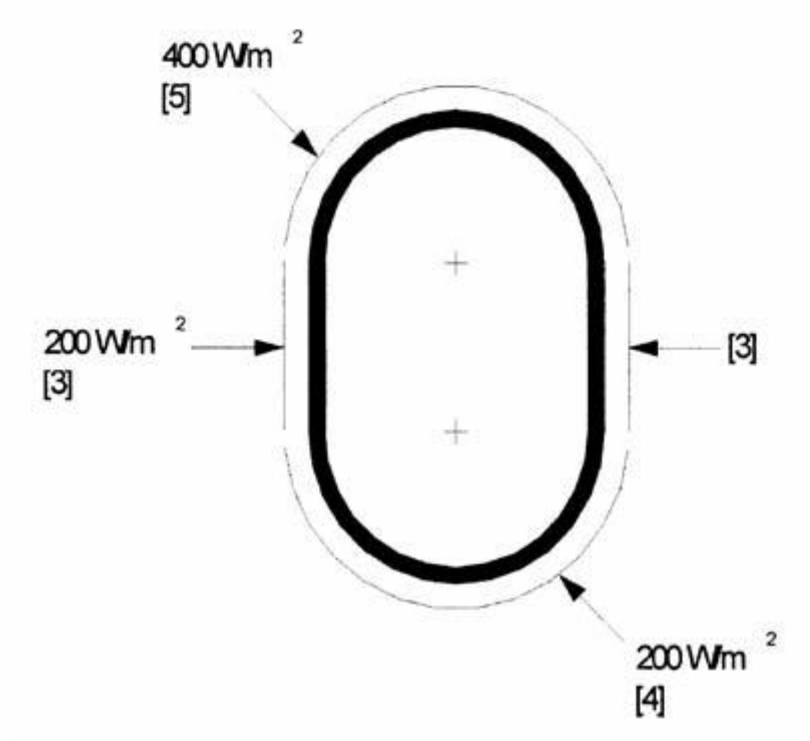

Figure 2: Figure 1: Taken from TS-G-1.1 2008 Edition, page 148 ***FIG. 4. Vertical cross-section of package with curved surfaces.***

Variations in solar radiation are dominated by sun spot activity, which varies over an estimated 11 to 18 year cycle. As the insolation data analysed for this report covers a 20 year period, there is reasonable confidence that the variations observed in the report will be representative of future variations.

1.6.1 24-Hour Average Insolation

The report notes that “The maximum hourly average insolation rate on the day with the highest total radiation (at Liverpool on 27th June 2005) was 976 W/m^2 for the hour ending 13:00 GMT”. This is an interesting, if counter-intuitive, result. Average insolation is greater in the North due to slightly longer periods of daylight, although peak values would normally occur in the south. The average values, over the 24 hour period, peak in June at approximately the value given in TS-R-1 (maximum average of 392 W/m^2 against 800 W/m^2 over 24 hours = 400 W/m^2 average in 12 hours, assuming equatorial conditions).

It is not expected that hourly values are considered explicitly in package design. They are provided to add context, and support the origin and derivation of the longer period average values. As this value includes the overnight hours (effectively no insolation received) this value will be lower than the 8-hour average.

1.6.2 8-Hour Average Insolation

The peak 8 hour average period occurs between 0800 and 1600 GMT throughout the country. Because the period overnight is excluded, these average values are greater than for the 24 hour period.

The peak average 8 hour values have a significant chance of exceeding the average values given in Table 13 of TS-R-1. It would be prudent therefore, to consider these 8-hour values given in the Met Office report as the thermal parameters when designing a thin walled package with a rapid thermal response in order to ensure a pessimistic approach is adopted, in order to maintain safety.

1.6.3 Insolation on a Vertical Surface

The table given in the report shows how the ratios of insolation between horizontal and south facing vertical surfaces vary throughout the year. Interestingly, at no stage does the ratio fall to 0.25, the value given in TS-R-1. In fact, due to the latitude of the UK, the ratios tend to the other extreme, so instead of the vertical insolation being a quarter of the horizontal value, it could be up to nearly four times greater (ratio of 3.86 in Lerwick, January). These peaks only apply to the most exposed vertical surface (typically, this would be the surface facing south). Other, less exposed, vertical surfaces receive correspondingly less insolation. Therefore, assuming that all vertical surfaces see the peak vertical surface insolation would be bounding but pessimistic. Correspondingly, while the maximum average insolation levels fall below the values in TS-R-1, this distribution may have an influence over the thermal characteristics of the package.

This could affect the design of the package, and its thermal safety case. Where there is a requirement to use UK specific conditions, the way that insolation is applied to the package should also be adjusted accordingly, in consideration of the ratios between vertical and horizontal surfaces. This may mean that insolation applied to the side of a package is anything up to four times greater than that seen on an upwards-facing horizontal surface, although the lower total amount of insolation received should not make this too challenging. Selection and justification of the values used remains the responsibility of the applicant.

1.7 Implications for RA Transport Package Design

Generally, designing to the temperature and insolation values given in TS-R-1, based on equatorial conditions, will accommodate all but the most extreme conditions in the UK. Even considering the significantly increased ratios between vertical and horizontal surfaces, this is true due to the lower total values of insolation; the highest ratios occur in winter when the angle of the sun is lowest, and the days are short.

Where there is a requirement to deviate from the values in TS-R-1, there is a commercial risk to be considered regarding the availability of the package, i.e. the smaller the operating range, the greater the risk that conditions on any given day will exceed those permitted, and the package will not be acceptable for use. The confidence limits in the report are intended to inform this decision making.

The second key point is that although average insolation levels are below those given in TS-R-1, they can peak in the UK above the equatorial average. The distribution of insolation about the package differs markedly from that at the equator, and this may have implications for the thermal case of a package, as the sides will receive a greater component than the lid. Dependant on the design, it may be appropriate to ensure this is reflected in the safety assessment, for example in the conditions applied in computational analysis.

Due consideration should be given to the thermal inertia of the package, as outlined in Section 1.5.1 and 1.5.2; where the thermal response is rapid, it is recommended that the generally more onerous 8 hour values are applied.

2 Predicted Trends in Climate Change

2.1 Introduction

This section of the report deals with predictions of future changes to climate. It is not directly comparable to the first section, as it is not possible to tailor the output to match the main transport routes with the data available to a reasonable level of confidence (see 2.4.1 Limitations).

Confidence limits for maximum and minimum values are set at 10% and 90%. Given the uncertainties and shape of the distributions, values outside this range are not considered sufficiently robust to add value to decision making.

2.1.1 UKCP09

The UK Climate Projections project (UKCP09) provides climate information designed to help those needing to plan how they will adapt to a changing climate. The data is focussed on the UK.[5]

Future climate information is available from the UKCP09 probabilistic experiments and the underlying regional climate model (RCM) data. The Met Office report uses the first of these, which gives a fuller description of the future uncertainties in the projections due to having taken other modelling centre's results into account and captured greater model uncertainties. A limitation is that the probabilistic information is not suitable for looking at particularly extreme events, however, given the aims of the study (to provide an indication of the direction and rate of change of temperature and insolation in the UK) the UKCP09 model was considered the most appropriate choice.

2.2 Climate Change: Temperature

2.2.1 Variables

The values given here are the average throughout night and day, over the entire decade under consideration. The intention is not to provide a bounding case; using this approach, extreme values will not be captured. However, it will provide an indication of the direction and extent of any change. This difference could then be applied to the current equivalent projection to get an estimate for future values.

Further values give the 99th percentile figure for the warmest and coldest days. As an estimating tool, these may be used to suggest what the bounding case is likely to be.

[5] UKCP09 is funded largely by the Department of Environment, Food & Rural Affairs, and detailed information is available at their website: http://ukclimateprojections.defra.gov.uk

Some of the key results are reproduced below, drawn from the Figures in the body of the main report:

- Annual ***mean daily temperatures*** between 6˚C and 12˚C by 2020s (6˚C and 15˚C for 2030s).
    - This result confirms previous conclusions that average temperatures are predicted to rise, and for many packages this time period will fall within the lifespan of the package.

- ***Summer mean daily mean temperature*** 15˚C to 21˚C, and daily maximum temperature 18˚C to 27˚C (2020s).
    - This result points to significantly increased probability that the current accepted UK temperature of 26˚C is likely to be exceeded on a frequent basis during summer months, rendering the package unavailable for use.

- 10th percentile runs project a negative change in ***maximum temperature of the warmest summer day***. 50th and 90th percentiles project positive changes to temperatures of up to 2˚C and 6˚C respectively.
    - This result adds uncertainty to the other conclusions, in that while the probability is that temperatures will rise, there is a smaller probability that the maximum temperature will be lower than at present.

- 10th percentile runs project a negative change in ***minimum temperature of the coolest winter day*** across the whole of the UK, whereas the 50th and 90th percentiles project positive changes to temperatures of up to 4˚C (2020s).
    - Replicating the previous result, this suggests that minimum temperatures are likely to be warmer, although there is a probability that they could become colder over time.

2.2.2 Implication of Results

Results presented concur with the wider literature - annual and seasonal mean and maximum temperatures across the UK can be expected to rise under scenarios of continued climate change. Confidence may therefore be drawn from these independent sources to support these results. Further, these same factors that affect package design are likely to also influence the design of supporting infrastructure and vehicles, which should be considered as part of the complete transport system.

There is likely to be a UK-wide increase in the summer mean temperature of the warmest day. Selection of a temperature range up to 26˚C is likely to become increasingly limiting over time. However, minimum temperatures, as well as the winter mean temperature of the coolest day are also very likely to rise, thereby reducing cold extremes, and hence a minimum operating temperature of -10˚C is likely to become increasingly forgiving.

Finally, as the scientific understanding improves through time, updated estimates of mean and extreme temperature changes will be available, and will be able to better define and characterise the temperature ranges of the future. The most recent data available is likely to provide the most reliable estimates.

2.3 Climate Change: Solar Insolation

2.3.1 Variables

The key result drawn from the body of the report is reproduced below:

- Changes in ***summer mean daily maximum solar flux*** of up to 30W/m^2 at the 90th percentile for the southwest of England and parts of Wales (2020s).
  - This change would bring the average daily values for June to a point closely approaching the value given in Table 13 of TS-R-1 of 800 W/m^2. Consequently, it is likely that as the time period in question (2020s) is approached, the Competent Authority may increasingly question the suitability of a reduced set of insolation values for general use in the UK, and may require additional operational controls to be in place for packages designed to an alternative range.

This result does not occur directly in response to solar activity; as previously noted, this tends to recur on a cycle of between 11 to 18 years. Rather, the possible increase in average levels of insolation is explained through decreasing levels of cloud cover arising from changes in temperature, humidity, and circulation patterns.

2.3.2 Implication of Results

The results show a slight increase in the range of expected average insolation values over the next few decades (The maximum peak values have already been experienced – see earlier discussions). The results cover the period up to the 2030s, and it is conceivable that new packages would have an operational life of some decades. New package designs should therefore consider these results, and any potential impact on the thermal safety case, during the design process.

Existing packages seeking re-approval may benefit from consideration of these results in design review to assess any implications arising, and potentially to determine appropriate operating envelopes that may restrict use of the package in order to maintain safety. Where this is necessary, it should be noted that owing to the comparative difficulty of measuring insolation (in comparison to, say, temperature) any operational restrictions may impose a substantial burden on duty-holders in order to ensure that safe conditions for use are maintained.

2.4 Wider Context

2.4.1 Limitations

There are some significant limitations to the UKCP09 model. Not all potential futures are modelled, only the most likely. Results are therefore best estimates only. Finer modelling resolution does not give greater confidence as the number of data points remains unchanged. Hence the smaller the area of interest, the fewer data points contribute to the result, with correspondingly weaker statistical strength.

Confidence levels vary depending on the climate variable and time period, so the further ahead the estimate, the wider the range for a given level of confidence. Temperature results generally have greater reliability due to the greater data available, in comparison to, for example, solar radiation. Finally, UKCP09 does not have projections for snow, which may have an impact in the winter months for extreme cold values, and the level of reflected solar radiation.

2.5 Conclusions

Longer term predictions are subject to great uncertainty. The results given here may therefore be more useful in terms of scenario planning rather than firm design parameters, although they do suggest a bounding range for a given level of confidence.

It would be prudent to ensure that new package designs consider not only the current temperature and insolation conditions, but also how these are likely to develop. Packages that are under existing approval that are likely to be submitted for recertification, may wish to consider the validity of their existing thermal safety case with a view to the remaining expected life of the package.

Comments from users of this document would be welcomed in order to improve the guidance for all. Please address all comments to Class7@hse.gsi.gov.uk *and include the phrase 'Climate Study Guidance' in the subject line.*

Appendix 1: Example Application of this Data

A package is required for transport within the UK for a unique application of greater than A_2 activity; no existing package is suitable. Manufacturing costs are likely to be high, and so the minimum possible number of packagings will be manufactured to meet the demand for the 1 year transport campaign. This campaign is critical to overall operation of the company. As the transport is internal to the UK, to control costs further, it is decided to develop the package for a limited temperature range, i.e. a Type B(M) design.

In this case, there is potential for significant additional costs to be incurred if shipments are delayed. The logistical plan shows there is only scope to accommodate eight delayed shipments of the planned 100 shipments in the year, without significantly affecting wider operations (i.e. a minimum of 92% of shipments must be made on schedule).

The package is likely to be of very substantial design, with slow thermal response, and therefore 24-hour mean values are most appropriate. The high estimate mean return for 1 year high temperature is 24.7°C (from the report). Therefore, designing to an upper ambient temperature limit of 25°C means there is at least a 95% chance that this package would be available for use throughout the year, as the 24.7°C figure is the 95% confidence high level value. This would be adequate to accommodate the 92% success rate required by the campaign.

However, as the design is based on a previous design that was approved for an upper limit of 26°C, it is decided to make the thermal case through comparison to the similar previous design (TS-R-1 paragraph 701 (b).) This has the further benefit of reducing costs when developing the safety submission for assessment and commercially de-risking the plan, by demonstrating safety to a higher limit.

Early in the design phase, an opportunity is identified to extend the use of this package for a number of similar campaigns over a 10 year period. The best estimate 10 year return value is 27.6°C, indicating the existing design basis of 26°C will be insufficient to maintain the previously required standard of availability over the 10 year campaign.

A number of options are identified, including:

- Choosing different materials for an increased cost for approval at a higher temperature range.
- Seeking an alternative package design to use instead.
- Re-programming to de-risk the transport campaign by avoiding shipping in July and August (as these are the months with a best estimate high temperature in excess of 26°C).

The approach taken will obviously depend on numerous additional factors, and should be the best commercial option for the organisation. The data in the report should inform the decision making.

Appendix 2: Example of a Scheme for Monitoring Temperature Conditions

The requirements of Competent Authority permissioning certificates for Package Designs and Shipment Approvals are intended to be clear, and unambiguously state the valid range of temperatures for which a Type B(M) package is approved. It may be anticipated that equivalent information would be included on design documentation for relevant Industrial Packages also. Operating a package outside of the conditions permitted by the certificate could well mean that the certificate is being breached, and it is expected that duty-holders have appropriate arrangements in place to ensure that this does not occur.

A method that would demonstrate an acceptable level of control is outlined below:

A Type B(M) package has been approved for a limited temperature range and the Insolation values specified in Table 13 of TS-R-1 2009 Edition.

Prior to despatch, the consignor should consult a recognised data source, for example the Highways Agency or Met Office websites, to determine current and predicted climatic conditions on the proposed route for the duration of the transport.

Where there is at least a 5°C margin between the prevailing conditions and the bounding limit, the package may be despatched with no requirement for further climatic monitoring.
If prevailing conditions exceed the bounding limits, then the package would not be despatched.

Where prevailing temperatures are within 5°C of the range, the consignor's procedures should require additional monitoring in transit. This should involve confirmatory checks of the temperatures en route from a similar reputable data source at suitable intervals. Depending on the journey length, this may be up to 8 hour intervals.

Where the temperatures are within 2°C of the bounding limit, the consignor should consider whether despatch is appropriate. If so, an enhanced monitoring programme is necessary, for example on an hourly basis.

All data collected and consignment decisions made should be recorded in an appropriate way. Where a package experiences conditions that exceed its design approval, the journey may be completed (in accordance with the relevant procedures), but it is necessary to report this as an incident to the Competent Authority, in accordance with the incident reporting procedure G-INF-007 Issue 2, found on the ONR website.