Research into the Effect of Temperature on the Criticality Safety of Fissile Systems

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Executive Summary

This report presents an investigation into the effect of temperature on the criticality of fissile systems. An explanation of the important nuclear phenomena that may result in changes in the reactivity of fissile systems, and that will change with temperature, is provided and the phenomena that are responsible for changes in reactivity with respect to changes in the system temperature are detailed.

A series of simple fissile systems that are representative of a range of typical fissile materials in a moderating medium are defined. Criticality calculations have been performed with models of these systems using the MONK® (version 10B) criticality code. The calculations included a wide range of moderator-to-fuel ratios and temperatures in the range 193 K to 1073 K (approximately -80 ºC to 800 ºC). Temperature trends have been identified in the calculated k-infinity values and these are discussed for specific systems. The overall trend in the results for the infinite systems and temperatures modelled here, is that for the majority of systems k-infinity decreases with increasing temperature. For high-moderation Pu-239 systems, k-infinity increases with increasing temperature. These trends are primarily a result of systems being sensitive to the resonance Doppler broadening of the neutron cross sections; principally a sensitivity to the capture cross sections. For the high-moderation Pu-239 systems, there is a sensitivity to the low energy fission cross section resonances.

The report is appended with plots and tables of results for all the modelled fissile systems which demonstrate these trends.

Also included in this report is a summary comparison of the major criticality codes MONK, MCNP and SCALE-KENO with respect to their current and developing abilities to model the temperature dependence of neutron multiplication. This includes consideration of the limitations of the available nuclear data. The code comparison is limited to information that is available in the public domain or which Wood has obtained permission to publish.

Disclaimer: The data in this report are only provided to guide understanding of the effects of temperature variation on criticality safety. Due to the complexities involved: moderation states; degree of heterogeneity; fissile and fissionable materials; structural materials; etc., the specific effects of temperature should be considered on a case by case basis.

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1 Introduction

This report presents an investigation into the effect of temperature on the criticality of fissile systems. It is comprised of the following sections;

Section 2 provides an explanation of the important physical and nuclear phenomena that may result in changes in the reactivity of fissile systems, and that will change with temperature. These can be categorised into nuclear physics effects, such as Doppler broadening of resonances and thermal scattering, and physical changes to the system, such as changes in density and physical dimensions.

Section 3 demonstrates the reactivity trends that can be expected for a range of idealised fissile systems, across a temperature range of 193 K to 1073 K. These trends are derived from the results of criticality calculations using the MONK10B code [1]. A concise discussion of generalised trends, aligned to the physics discussed in Section 2, is provided in Section 3.3. Detailed discussions of calculated trends as well as plots and tables of the results are appended to this report. These include the presentation of derived quantities such as changes in, or relative changes in, reactivity.

Section 4 gives a comparison of major criticality codes in their abilities for modelling the temperature dependence of neutron multiplication, which includes consideration of limitations in the available nuclear data. The code comparison is limited to information that is available in the public domain, or which Wood has obtained permission to publish. Where information concerning proposed developments to the codes, with respect to the treatment of temperature effects, have been made available, these have been highlighted.

This report assumes that the reader is familiar with terminology and nomenclature common to nuclear physics and nuclear criticality.

2 Physics Effects of Temperature Changes

This section describes the important nuclear phenomena that effect the reactivity of fissile systems, in particular those phenomena that are sensitive to changes in the system temperature and will therefore contribute to the change in reactivity that occurs when the system temperature changes.

2.1 The Neutron Multiplication Factor

For any fissile system, the reactivity can be described in terms of the neutron multiplication factor. This can be defined as;

$$\frac{\text{The number of neutrons gained by the system, in a generation}}{\text{The number of neutrons lost from the system, in a generation}}$$

Numerous physical processes influence the neutron multiplication factor to varying degrees. The processes which lead to a fissile system 'gaining' neutrons are as follows;

- Neutrons produced in **neutron-induced fission**. This is a very significant process.
- Neutrons produced in **other neutron-induced reactions**. These will be much less significant than the fission process but the most important reactions are (n,2n) and (n,3n) (where one neutron is absorbed by a nucleus and then two or three neutrons are emitted).
- Neutrons produced in spontaneous fission. This is generally a small contribution to the neutron gain, especially for unirradiated fissile material, as it is more likely to occur in the minor actinides, such as curium. Spontaneous fission is a radioactive decay process so cannot be influenced by changes in temperature or other system conditions. This will not be discussed further in this report.
- Neutrons produced in non-neutron particle-induced reactions, e.g. $^{7}Be(\alpha,n)^{12}C$. This is a very small contribution to the neutron gain. The 'non-neutron' particles, generally alpha particles or protons, will be a product of radioisotope decay, which is independent of temperature. It is not known whether the reactions themselves are sensitive to temperature. Overall, a fissile system will be insensitive to the temperature dependency (if any exists) of this process. This will not be discussed further in this report.
- Neutrons produced in the decay of certain radioisotopes. Whilst delayed neutrons are important in reactor physics and control, neutron-emitting radioisotopes are short-lived, so the production of delayed neutrons outside of a nuclear reactor operating environment is negligible, as well as the decay process being independent of system temperature. This will not be discussed further in this report.
- Neutrons physically entering the system from space considered external to the system. If this process is significant, then the model should explicitly define this additional source of neutrons. In other words, the model should be comprehensive enough that all significant sources of neutrons are accounted for by the phenomena described above. As all the models considered in this report are considered infinite in dimension (see Section 3.2), this will not be discussed further.

Conversely, the processes which lead to a fissile system 'losing' neutrons are;

- **Neutron absorption** by the nuclei within the system. Such absorptions may lead to further neutrons being produced via fission, (n,2n) or (n,3n) but these are accounted for separately.

- Neutrons physically leaving the space considered to be within the system, known as **neutron leakage.**

In addition to the change in the absolute number of neutrons with a system, a **change in the neutron energy** affects the likelihood of many of the above processes occurring.

These processes are all dependent on the incident neutron cross sections of the nuclei within the fissile system. Cross sections can be described as;

- Microscopic cross section; an inherent property of the nuclei and so is system-independent. The common unit of measurement is the barn (b) where 1 barn = 10^{-24} cm^2.
- Macroscopic cross section; the product of multiplying the microscopic cross section and the number density of the material in the fissile system.

Both classes of cross section are sensitive to changes in the temperature of the system materials. For the latter, the change in the density of a material via the mechanical expansion and contraction of the material is a phenomenon recognised and modelled across many engineering disciplines. The temperature dependency of microscopic cross sections is a subtler physics effect but equally important for fissile systems. Section 2.2 discusses these nuclear phenomena in detail.

2.2 Direct Effects of Temperature on Cross Sections

The neutron cross sections, which quantify the probability of interaction between a neutron and a stationary nucleus, are solely dependent on the energy of the incoming neutron and the species of the nucleus (i.e. the nuclide, usually identified by chemical element and atomic mass number). The cross sections, including the number, energies and widths of any resonances in the cross sections, are determined by the likelihood of quantum mechanical processes that occur when the neutron comes in close proximity to the nucleus. Such processes are independent of the material temperature and so these cross sections are sometimes referred to as the 0 K (zero Kelvin) cross sections.

However, the above situation assumes that the nucleus is stationary (in the laboratory frame-of-reference), i.e. the temperature is 0 K. In practical circumstances, the nucleus will be moving due to the thermal motion of the atoms within the material; in effect vibrating back-and-forth about an average position within the material.

2.2.1 Resonance Doppler Broadening

The first, and most widespread, effect of the material temperature on the neutron cross sections is the Doppler broadening of the resonances. As the temperature of the material increases, the speed of vibration of the nucleus increases. The effect of this on an interaction with a neutron is to change the kinetic energy involved in the interaction.

If the nucleus is moving toward the neutron as it interacts, the effective energy of the neutron is increased. Therefore, if the neutron energy is just below that of a resonance in the cross section, the effective energy is higher and more likely to be the same as the resonance energy, and so the neutron is more likely to interact with the nucleus.

Conversely, if the nucleus is moving away from the neutron as it interacts, the effective energy of the neutron is decreased. If the neutron energy is just above that of a resonance in the cross section, the effective energy is lower and more likely to be the same as the resonance energy, and so the neutron is more likely to interact with the nucleus. As resonance structures are narrow and represent a large change in the cross section, these small shifts in the effective neutron energy toward the resonance energy can result in a large change in the likelihood of interaction.

If a cross section is plotted as a function of neutron energy, this effect is represented by a broadening of the individual resonance structures. A 0 K resonance will be narrow with a large cross section at the peak of the resonance whereas a temperature-broadened resonance will be wider with a lower peak cross section, but the area under the plot will be unchanged. Despite the peak cross section being lower, the likelihood of a neutron interacting is increased as the cross section is increased for neutron energies either side of the resonance. Figure 2-1 shows the Doppler broadened shape of a typical cross section resonance at different temperatures.

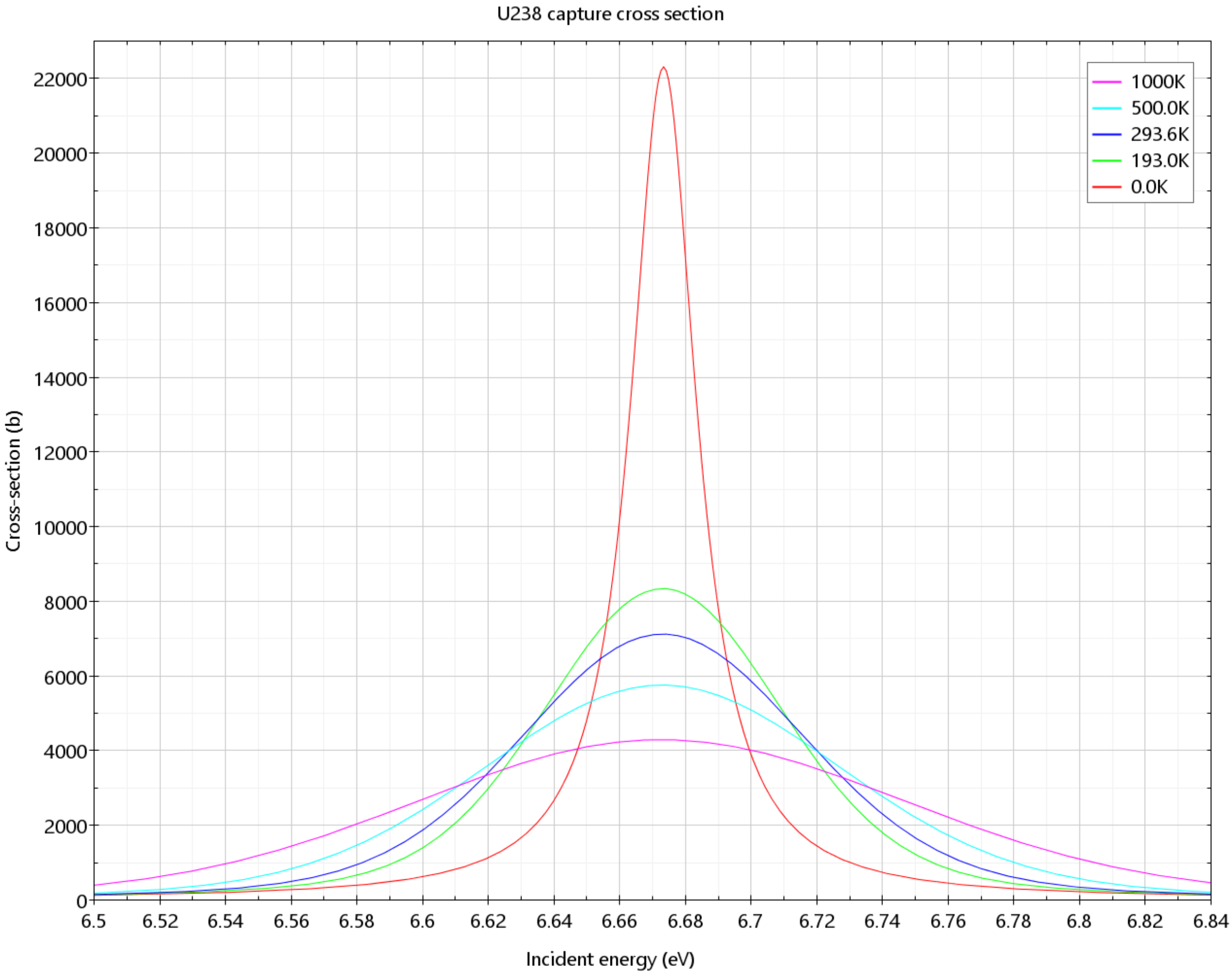

Figure 2-1: Cross section resonance Doppler broadened for different temperatures

Neutron interactions with any nuclide with resonances in its cross sections will be sensitive to temperature in the neutron energy range at which the resonances occur. Therefore, the overall temperature sensitivity will vary with the shape of the neutron spectrum. If a system is well moderated, with a significant thermal neutron spectrum, the system may have less sensitivity to temperature compared to a system with an intermediate neutron spectrum. Here, neutron energies coincide with resonance energies and therefore the neutron reaction rate will be highly sensitive to the change in broadening of the resonances that occurs with a change in energy. In the fast energy region, few nuclides have resonances so the cross sections are very insensitive to temperature. Whether the neutron multiplication increases or decreases with temperature will be dependent on the specific fissile nuclides and neutron spectrum in the system as capture and fission cross sections are both sensitive to Doppler broadening.

2.2.2 Bound Thermal Scattering

The second effect of the material temperature on the neutron cross sections is associated with the scattering of thermal neutrons with light nuclei, such as hydrogen, deuterium and carbon. This effect is known as bound thermal scattering and is significant when;

1. the energy of the neutron is comparable to that of the thermal energy of the material,
2. the mass of the nucleus is similar to the neutron mass, and
3. the nucleus has a high neutron scattering cross section.

In these special cases, similarity of the mass and energy of the neutron and nucleus mean that the specific nature of chemical bonds within the molecule must be accounted for in order to accurately model the physics of the neutron interaction processes.

For example, in a (liquid) water molecule, two hydrogen atoms are separately bonded to one oxygen atom. Each of these bonds can lengthen and contract as well as rotate relative to the other. The water molecule can move and rotate relative to other water molecules in the material. Many of these processes will have a temperature dependence as the frequency of these processes will change as the thermal energy of the material increases.

The bound thermal scattering process affects the effective cross section for the interaction of the incoming neutron but also the energy and direction of the outgoing scattered neutron. In any scattering interaction, a neutron can gain energy (known as upscatter) as well as lose energy. However, upscatter is much more significant (in terms of relative change in energy) for thermal neutrons than higher energy neutrons. As this is a complex process, it is not possible to generally state how an increase in the material temperature will change the effective cross section or the outgoing neutron energy and direction.

In most other circumstances, the thermal motion of a nucleus is treated using the free gas model. This assumes that the motion of the associated atom is independent of other atoms in the material and the nature of the chemical bonds between them.

The effect of bound thermal scattering on a fissile system is likely to be system dependent. The treatment of scattering will strongly influence the neutron spectrum at low energies. This will, for example, impact on the neutron interaction between fuel pins in a heterogeneous fissile system as well the neutron leakage from any fissile system. It is not possible to qualitatively state how the impact of the bound thermal scattering will vary with system temperature; modelling of specific systems is required to identify such trends.

2.2.3 In-Resonance Scattering

The third effect of the material temperature on the neutron cross sections is associated with in-resonance scattering. For non-thermal neutron scattering interactions, upscatter is not usually modelled as it is not significant. Due to this generalisation, the energy and direction of scattered neutrons is usually determined from the widely-used "billiard ball" collision model of classical mechanics where the neutron collides with a nucleus and energy and momentum are conserved. This model (referred to as the asymptotic scattering kernel) assumes that the scattering is isotropic and that the nucleus is stationary. This means that a) the neutron cannot gain energy and b) the material temperature is 0 K.

However, as discussed in the context of Doppler broadening, a small increase or decrease in the neutron energy in cases where the energy is similar to that of a resonance in the cross section can significantly increase the likelihood of interaction. In such cases, a temperature-dependent scattering kernel which accounts for the thermal motion of the nucleus and therefore allows for upscatter of the resonance can have a significant effect on the likelihood of interaction. Using this model, an increase in material temperature will lead to an increase in upscatter. If there is an increase in the number of neutrons gaining energy relative to those losing energy when scattering at a particular resonance, there is increased probability of neutrons being captured in the same resonance.

Previous work by Wood [2] showed that this effect is only significant in nuclides with large capture and scattering resonance cross sections, particularly Th-232 and U-238. The effect can be accounted for in MONK10B by invoking the Doppler Broadening Rejection Correction (DBRC) method (via an explicit request in the user input).

For a system with significant quantities of Th-232 and/or U-238, there should be some sensitivity of the neutron multiplication factor to this phenomenon. To show an effect, the moderation of the system should be such that there is a prominent neutron spectrum around the energies of the large capture resonances in these nuclides. As the Doppler broadening of these resonances increases with temperature, so will the significance of the effect.

2.3 Indirect Effects of Temperature on Cross Sections

The phenomena discussed above, resonance Doppler broadening, bound thermal scatter and in-resonance scattering, are a direct effect due to the motion of the atoms in a material. As a neutronics code is concerned with the motion and interactions of neutrons, the motion of the atoms is usually not explicitly modelled. Therefore, the phenomena due to the motion of the atoms is accounted for by modification of the nuclear data prior to its implementation in the neutronics modelling.

There is an additional phenomenon due to the motion of the atoms that indirectly leads to a sensitivity of k-infinity to the system temperature; the thermal neutron spectrum. The energy distribution of thermalised neutrons is usually modelled as a Maxwellian spectrum which is determined by the average thermal neutron energy which itself is proportional to the system temperature – because by definition, the neutrons are in thermal equilibrium with the surrounding atoms. This temperature dependence is demonstrated in Figure 2-2.

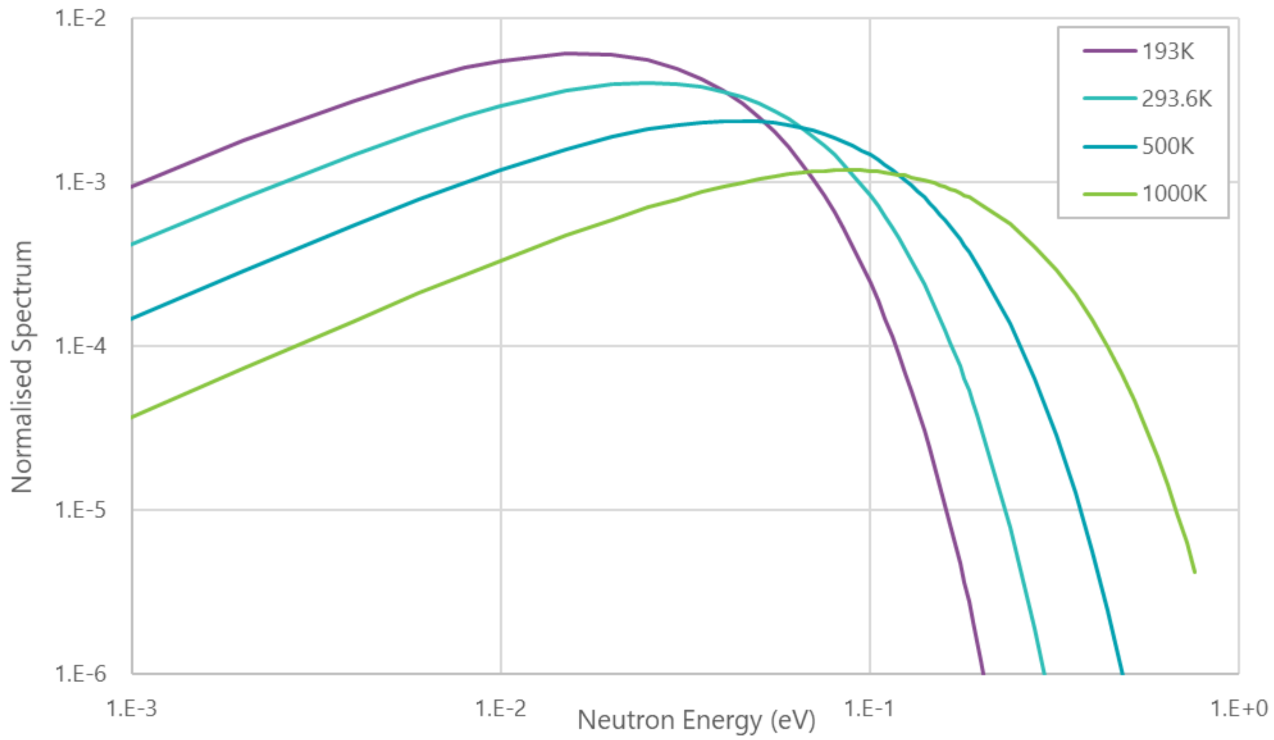

Figure 2-2: Temperature dependence of thermalised neutron spectra

An increase in the system temperature will increase the average thermal neutron energy. For a sufficiently well moderated fissile system, this will change the relative importance of the neutron fission and capture cross sections at low neutron energies because the neutron energy distribution will change. The impact on k-infinity will be system dependent; sufficient moderation is required to achieve a significant population of thermal neutrons and the materials present will dictate the thermal fission and capture cross sections.

3 Assessment of Temperature Effects

3.1 Introduction

A range of calculations were performed in order to estimate how a change in temperature, with respect to the nuclear phenomena discussed in Section 2, influences the neutron multiplication in fissile systems.

3.2 Calculation Specification

3.2.1 Fissile Systems Modelled

The complete set of fissile systems to be modelled in this work was agreed with the Office for Nuclear Regulation. The intention was to cover a range of different fissile material compositions, either oxide or metals, with the fissile/fissionable species being one or more of U-235, U-238, Pu-239 and Pu-240[1]. The fissile material was combined with a moderator material (water/ice, polythene or graphite). The two materials either formed a homogeneous mixture or a heterogeneous arrangement of fuel pins surrounded by moderator. All systems were modelled as either an infinite mixture or infinite array of pincells. Therefore, the measure of neutron multiplication considered in all cases is k-infinity.

It is noted that the infinite homogeneous cases will not provide insight into the impact on the neutron multiplication with respect to physical changes, chiefly thermal expansion, as material densities and physical dimensions are not meaningful in such cases. For the heterogeneous cases, the pin pitch can be changed in order to adjust the moderator to fuel ratio; however, such dimensional changes are likely to be excessively large with respect to the variation in pin pitch that would be observed in a real-world fuel assembly.

In addition to the above, all cases were duplicated with a high concentration of boron being added to the moderator to act as a neutron absorber. The details of this are given in Section 3.2.2.

Table 3-1 provides the general characteristics of the systems modelled, such as the range of temperatures and moderator ratios modelled. Table 3-2 provides the specific details of each system, such as fissile isotopic ratios and choice of moderator. For the heterogeneous systems, the fuel pin dimensions are given. In total, 15 different cases are considered (Table 3-2), with a variety of analyses for each to investigate the effects of temperature changes to system reactivity presented in this report, including detailed results in the appendices.

Figure 3-1 displays representative cell geometries of the heterogeneous systems. Geometry 'A' represents Cases 5, 6 and 8; the rod diameter is different for each case and the cell pitch varies with moderator ratio. Geometry 'B' represents Case 7. Here, the pin diameter, pin spacing, graphite sleeve diameter and the size of the cell are all fixed, but the moderator density is varied.

[1] The Mixed Oxide cases also contain a small fraction of U-234.

The uniform temperature of each model was varied in order to determine the effect of the Doppler broadening of resonances on k-infinity. This was done for each moderation level detailed in the tables below. In addition, k-infinity was calculated for two further variants of the models;

- Free gas scattering. Rather than use the appropriate bound thermal scattering data, neutron scattering in the moderator (including the graphite sleeve in Case 7) was modelled as free gas scattering (as used for other nuclides in the model). The intention here was to quantify the importance of using appropriate bound scattering data.
- Doppler Broadening Rejection Correction (DBRC) model. These cases used MONK's DBRC method to more accurately model the in-resonance scattering for U-238 (see Section 2.2.3). The intention here was to determine the temperature range over which this correction is important. This was only done for cases containing U-238 (i.e. Cases 4-10 and 12-15).

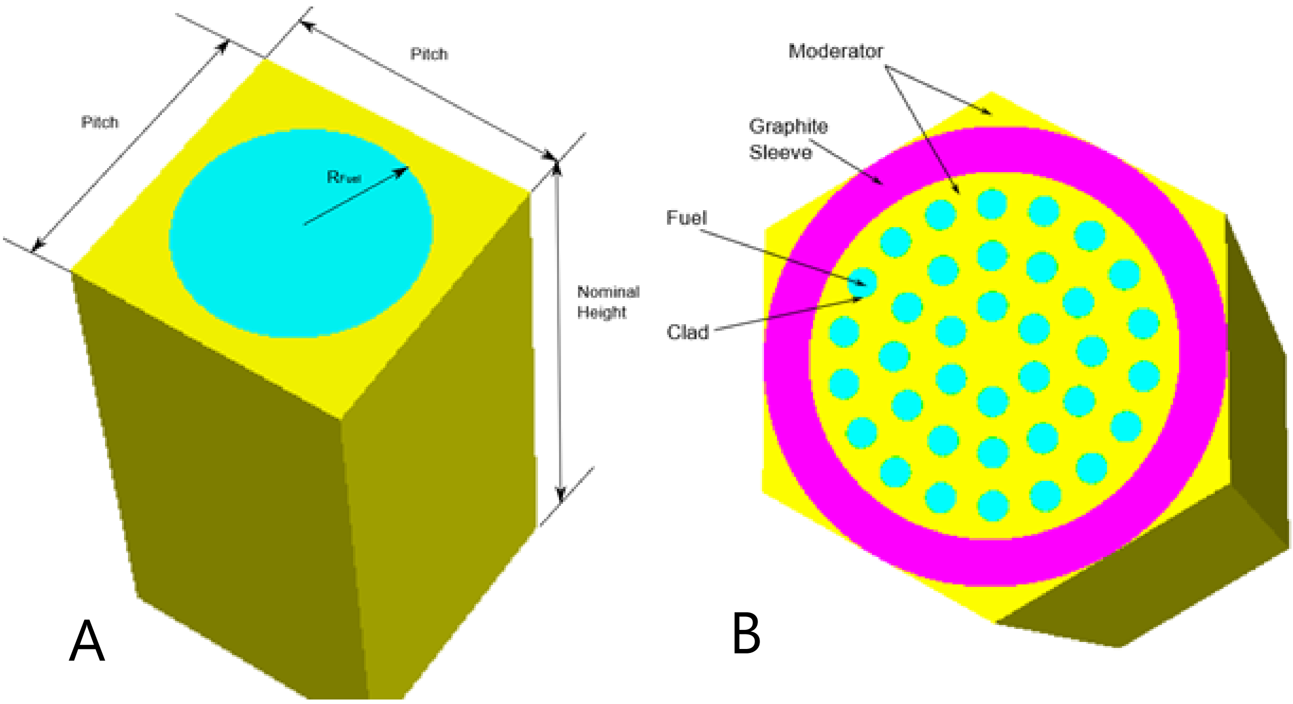

Figure 3-1: Representative cell geometries of heterogeneous systems

Table 3-1: General specification of fissile systems modelled

Specification	Comment
Boundary conditions	All models are infinite extent in all three dimensions, so no neutron leakage. There is periodic reflection at the boundaries; i.e. a neutron exiting one face of the unit cell is modelled as re-entering the opposite face.
Temperatures	193, 233, 263, 273.15, 293.6, 313, 373, 500, 800, 1073 Kelvin For systems with a water moderator, the 273.15 K cases were performed twice; with nuclear data corresponding to liquid water and that corresponding to ice[2].
Neutron absorber	Boron (B-10 19.8 atom%, B-11 80.2 atom%) homogeneously mixed with moderator. Boron density of 0.023 g/cc (as specified by ONR).
Moderators: homogeneous mixtures	Material densities are irrelevant for infinite homogeneous mixtures with a defined moderator to fuel ratio. Moderator to fuel (i.e. hydrogen to fissile material atom) ratios; ► 0, 0.5, 1, 3, 5, 7.5, 10, 15, 20, 35, 50, 75, 100, 150, 200, 350, 500, 750, 1000, 1500, 2000. For this work, the number of fissile material atoms is specifically the total number of U-235 and Pu-239 atoms. It does not include any other U or Pu isotopes. The moderator to fuel ratio is often labelled H:fissile in subsequent discussion.
Moderators: heterogeneous rods	Material densities; ► Light water 1.00 g/cc (only at and above 273.15 K) ► Ice 0.92 g/cc (only at and below 273.15 K) (taken from [3][3]) ► Graphite 2.30 g/cc ► Polythene 0.96 g/cc Moderator to fuel ratios - see specifics in Table 3-2.

[2] The interaction of thermal neutrons in water and in ice has been shown to be significantly different, even at similar temperatures. The crystalline structure that forms as water freezes not only leads to the reduction in density but a change to the nature of the interactions between the atomic bonds within a single H_2O molecule and between adjacent molecules. Therefore, the bound thermal scattering data is fundamentally different between water and ice.

[3] The reference quotes ice densities of 0.9162 g/cc at 273.15 K, 0.9200 g/cc at 243 K and 0.9208 g/cc at 233 K. Therefore, a rounded average of the ice density over this temperature range of 0.92 g/cc has been used.

Table 3-2: Specific characteristics of fissile systems modelled

#	Fissile Material	Isotopics (weight fraction)	Moderator	Details
1	Plutonium oxide	Pu-239 1.000	Polythene	Homogeneous system Fuel material; atom ratios = Pu 1.0, O 2.0
2	Plutonium oxide	Pu-239 0.900 Pu-240 0.100	Polythene	Homogeneous system Fuel material; atom ratios = Pu 1.0, O 2.0
3	Plutonium oxide	Pu-239 1.000	Light water	Homogeneous system Fuel material; atom ratios = Pu 1.0, O 2.0
4	LEU(1.6%) uranium metal	U-235 0.016 U-238 0.984	Light water	Homogeneous system
5	LEU(1.3%) uranium metal rods	U-235 0.013 U-238 0.987	Light water	Fuel rod and moderator Rod diameter = 2.54 cm, no cladding Fuel material U 1.0, density = 18.96 g/cc Moderator/fuel volume ratios, V_{H_2O}/V_{Umetal} = 1, 1.25, 1.5, 1.75, 2, 2.25, 2.5, 2.75, 3. V_{H_2O}/V_{Umetal} varied by adjusting the size of the unit cell surrounding the fuel rod.
6	LEU(1.3%) uranium metal rods	U-235 0.013 U-238 0.987	Graphite	Fuel rod and moderator Rod diameter = 2.54 cm, no cladding Fuel material; U metal, density = 18.96 g/cc Moderator/fuel volume ratios, $V_{graphite}/V_{Umetal}$ = 30, 35, 40, 45, 50, 55, 60, 65, 70. $V_{graphite}/V_{Umetal}$ varied by adjusting the size of the unit cell surrounding the fuel rod.

#	Fissile Material	Isotopics (weight fraction)	Moderator	Details
7	LEU(3%) uranium oxide rods	U-235 0.030 U-238 0.970	Light water	Fuel rod (AGR-like) cluster and moderator Rod diameter = 1.54 cm Fuel material; atom ratios = U 1.0, O 2.0 density = 10.96 g/cc Cladding; wall thickness = 0.03 cm density = 7.96g/cc weight ratios; Fe 0.55, Cr 0.20, Ni 0.25 Cluster; inner annulus; 6 rods, diameter = 2.464 cm middle annulus; 12 rods, diameter = 5.08 cm outer annulus; 18 rods, diameter = 7.8 cm graphite sleeve; internal diameter = 19.0 cm external diameter = 23.8 cm No additional structural elements. Changing the moderator/fuel volume ratio is not feasible for this model. Therefore, a close-packed array of clusters was modelled with the moderator density increased from 10^{-20} g/cc to 1.0 g/cc in sufficient steps to show under, near-optimum and over-moderated situations.
8	LEU(5%) uranium oxide rods	U-235 0.050 U-238 0.950	Light water	Fuel rod and moderator Rod diameter = 0.82 cm, no cladding Fuel material; atom ratios = U 1.0, O 2.0 density = 10.96 g/cc Moderator/fuel volume ratios, V_{H_2O}/V_{UO_2} = 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 9 V_{H_2O}/V_{UO_2} varied by adjusting the size of the unit cell surrounding the fuel rod.
9	LEU(5%) uranium oxide	U-235 0.050 U-238 0.950	Light water	Homogeneous system Fuel material; atom ratios = U 1.0, O 2.0
10	MEU(20%) uranium oxide	U-235 0.200 U-238 0.800	Light water	Homogeneous system Fuel material; atom ratios = U 1.0, O 2.0
11	HEU(100%) uranium oxide	U-235 1.000	Polythene	Homogeneous system Fuel material; atom ratios = U 1.0, O 2.0

#	Fissile Material	Isotopics (weight fraction)	Moderator	Details
12	Mixed oxide (MOX)	U-234 0.00005 U-235 0.00675 U-238 0.9432 Pu-239 0.0475 Pu-240 0.0025	Polythene	Homogeneous system Fuel material; atom ratios = U/Pu 1.0, O 2.0
13	LEU(1.6%) uranium metal	U-235 0.016 U-238 0.984	Polythene	Homogeneous system
14	LEU(5%) uranium oxide	U-235 0.050 U-238 0.950	Polythene	Homogeneous system Fuel material; atom ratios = U 1.0, O 2.0
15	MEU(20%) uranium oxide	U-235 0.200 U-238 0.800	Polythene	Homogeneous system Fuel material; atom ratios = U 1.0, O 2.0

3.2.2 Neutron Absorber Cases

The 15 sets of calculations above were repeated with the boron neutron absorber mixed in the moderator. It was necessary to take two different approaches to determining the boron number densities for the homogeneous and heterogeneous cases as density and volume are not meaningful in a homogeneous infinite system. As such, for the cases where the moderator is changed from ice to water and therefore the density changes, there is an impact on the boron concentration which differs for the homogeneous and heterogeneous cases. These inconsistent approaches are considered when analysing the reported results for the cases where the absorber is present.

For the homogeneous mixtures, the density of the moderator, for the cases without the boron absorber, does not affect the calculated reactivity because the proportion of moderator atoms to fuel atoms is fixed regardless of the density. However, in the absorber cases, the mass of boron is based on the volume of moderator that exists in the mixture (grams per cc of moderator). This volume of moderator must be calculated using a supplied moderator density so there is inevitably a difference in the boron content between the 273.15 K cases at ice or water density (0.92 or 1.00 g/cc). What actually happens in the calculation is that the boron concentration in water (or other moderator), is retained at 0.023 g/cc, even when the density changes. Therefore, as moderation changes (via the pre-defined H:fissile ratio), the ratio of boron to water is constant but the boron to fissile ratio changes. However, when the density changes at 273.15 K, the ratio of boron to water atoms changes. Consequentially, for the 273.15 K cases, one with density 0.92 g/cc and one with 1.0 g/cc, not only will the calculations show a change in k-infinity due to the change from ice to water bound scattering data (see footnote 2) but also the change in boron content as well. This is the correct physical effect but makes the results more complicated to interpret.

For the heterogeneous cases, the mass of boron is also based on the concentration 0.023 g/cc. However, the number density of boron is calculated based on a fixed volume of 1 cc, rather than the volume of moderator present in the case (which varies with rod pitch, determined by the H:fissile ratio). For the water/ice moderator cases, when the density changes this is clearly not correct because as moderator volume changes the mass of boron in 1 cc will not change. Boron is an additive to the moderator so, as the mass (and volume) of water changes, so should the boron mass. Hence, rather than the ratio of atoms of boron to moderator being fixed, it may vary with moderation. It is stated "may vary" here because different heterogeneous cases deal with changing moderation differently. For Case 7 (LEU fuel rod clusters), the boron content is incorrect because the moderator density changes from 10^{-20} g/cc to 1.0 g/cc but over this water density range the boron content stays the same. For the other heterogeneous cases with water (Cases 5, 8, 9), the volume the water occupies changes, via a pitch size change, to affect the moderation ratio so for fixed density cases this error should not be significant. When the water density changes for these cases, the boron content will not change when it should. For Case 6 (graphite moderator), the same fixed boron concentration is used but the graphite density does not change (the rod pitch is changed instead), so this issue does not affect Case 6.

3.2.3 Criticality Code

All the calculations for the fissile systems described were performed using the MONK10B_RU0 nuclear criticality code, which is the current ANSWERS® Software Service Quality-Assured (QA) Release version of MONK® [1], released in August 2017.

3.2.4 Nuclear Data

Two nuclear data libraries were used in the MONK calculations. Firstly, the current ANSWERS QA Release of the JEFF-3.1.2 BINGO library was used for the reference calculations at a temperature of 293.6 K as well as the calculations at the temperatures 313 K, 373 K, 500 K, 800 K and 1073 K.

No current QA Release BINGO libraries contain data for temperatures below 293.6 K. This is primarily due to the historical lack of bound thermal scattering data below 293.6 K, Therefore, a development version of the JEFF-3.1.2 BINGO library containing data for temperatures down to 193 K was used for the calculations at and below 293.6 K. This development library includes bound thermal scattering data extended to lower temperatures for water (273.15 K to 1073 K), ice (193 K to 273.15 K), polythene (as CH_2) (193 K to 350 K) and graphite (193 K to 3000 K). Some calculations for temperatures above 293.6 K were repeated with the development library to give assurance that the results were consistent with the QA Release JEFF-3.1.2 BINGO library.

Calculations at 193 K, 233 K, 263 K, 273.15 K, 293.6 K, 500 K and 1073 K used the neutron cross sections tabulated on the BINGO libraries. Calculations at 313 K, 373 K and 800 K employed the run-time Doppler broadening in MONK to determine the neutron cross sections at these temperatures from the cross sections tabulated on the libraries.

3.2.5 Run Procedure and Quality Assurance

The MONK input files were commented and all key parameters defined using the MONK parameterisation scheme, for clarity. This, coupled with the provision of formulae in the MONK input files to calculate derived parameters, avoided the need for external calculations. Appropriate values were assumed for any parameters not explicitly stated in Table 3-1 and Table 3-2.

All calculations were run with adequate sampling and settling to ensure that they were converged and that the Monte Carlo stochastic uncertainty is sufficiently small such that the desired temperature effects could be resolved.

The stochastic uncertainty on all k-infinity results is 20 pcm (per cent mille, i.e. 0.0002). The summation in quadrature gives the stochastic uncertainty on the difference between two k-infinity values as ~28 pcm. Therefore, where the difference in two k-infinity values is less than around 90 pcm (0.0009), i.e. three standard deviations, it is generally considered to be statistically insignificant.

The MONK looping and summary output table facilities were used to create results tables that directly relate the calculated k-infinities to the relevant input parameters without the need to rely on other records or external scripts.

3.3 Generalised Temperature Trends

This section summarises the trends found in the MONK k-infinity calculations. It directly relates to Appendix A which discusses the results of each case in detail. The trends are derived from the MONK results plotted in Appendix B and tabulated in Appendix C.

Given the large number of MONK calculations undertaken in support of this study it is not possible to provide a concise set of observations that universally describe the trends in the results. Therefore, this section must not be considered in isolation; cognisance must be taken of the content of Appendix A.

With the above caveat, the following observations apply to the majority of cases, in the temperature range of 193 K to 1073 K, unless stated otherwise.

- The homogeneous infinite systems modelled with only Pu-239, Pu-240 or U-235 as the fissile material (Cases 1, 2, 3 and 11) and with no moderator are insensitive to temperature changes as they only have a fast neutron spectrum.
- Otherwise, for the homogeneous infinite systems, k-infinity almost always monotonically decreases with increasing temperature. This is due to the Doppler broadening of the capture cross section resonances in the intermediate neutron energy range because Doppler broadening is the dominant temperature-dependent phenomenon for these modelled systems.
- The major exception to the above is for high-moderation Pu-239 systems, k-infinity monotonically increases with increasing temperature. This is due to the Doppler broadening of the fission cross section resonances at lower energies (particularly the 0.3 eV resonance). An additional exception is that for a limited number of low-moderation U-235 systems, there is a small increase in k-infinity between 373 K and 500 K.
- For the heterogeneous infinite systems which are under-moderated, k-infinity generally decreases with increasing temperatures, noting the effect of changing from ice to water below. The major factor in the decrease in k-infinity with increased temperature is the increased Doppler broadening of the U-238 capture cross section resonances at intermediate neutron energies.
- For the heterogeneous infinite systems which are over-moderated, k-infinity generally increases with increasing temperatures, noting the effect of changing from ice to water below. The cause of this increase in k-infinity with increased temperature is the increased Doppler broadening of the U-235 fission cross section resonances at low neutron energies. As the system is over-moderated, this increase in U-235 fission dominates over the increase in U-238 neutron capture at

intermediate neutron energies (as seen in the under-moderated cases).

- The observations above were generally true for the homogeneous and heterogeneous cases with the boron neutron absorber, though for higher moderation for several cases, the k-infinity become very low and insensitive to temperature change because of the high concentration of neutron absorber.
- There is no significant effect on k-infinity when changing from ice to water bound scattering data for water moderated cases without the absorber. This can be expected for homogeneous infinite models as in a homogeneous mixture, the change to the scattering cross section relative to the magnitude of the fission and capture cross sections has less significance than for a pure moderator material. Also, there is no neutron leakage (which is sensitive to the choice of scattering data). There are some significant changes in k-infinity for cases with the absorber when moving from ice to water. These are principally due to the change in the moderator density used to derive the boron concentration, as discussed in Section 3.2.2.
- For the heterogeneous cases without the absorber, there can be a significant decrease in k-infinity when using the water data. This is due to the change in scattering data reducing the neutron interaction between the fuel pins as the water data increases the neutron energy loss per collision. For the heterogeneous cases with the absorber, there appears to be little sensitivity. This is because the change in scattering data is not significant compared to the capture cross section of the moderator/boron mixture. It is also likely that presence of boron in the moderator significantly reduces the thermal neutron flux so the system is insensitive to the choice of bound thermal scattering data.
- For the polythene moderated cases (all are homogeneous), there is a step-change in the variation of k-infinity with temperature between 313 K and 373 K for some moderation levels. This change is relatively small so is observable when the overall change in k-infinity with temperature is small. It is likely caused by the discrepancy between the model temperature and the temperature at which bound thermal scattering data are tabulated. As detailed in Section 4.1.2, these data cannot be interpolated when determining the energy and direction of the outgoing neutrons and therefore the data at the nearest tabulated temperature are used. For the 313 K calculations, the data are tabulated at 293.6 K and for 373 K (and above), it is 350 K; so there is a large change in the temperature at which the data are tabulated. Furthermore, all calculations above 350 K use the data tabulated at 350 K as no data are tabulated above this temperature as polythene melts above 350 K.
- The effect of in-resonance scattering and, therefore, the importance of the Doppler Broadening Rejection Correction (DBRC) method, is most significant for systems containing U-238 where intermediate levels of moderation produce a significant neutron flux around the largest U-238 capture cross section resonances. The application of DBRC tends to reduce k-infinity and this effect increases with temperature, typically becoming significant at and above 500 K.
- Overall, for all the cases modelled, there are no “cliff edges effects”, i.e. large, discontinuous changes in k-infinity, purely due to a change in temperature. Whilst different moderation levels produce either a positive or negative change in k-infinity due to change in temperature, there are no examples of a large change in k-infinity for a small change in moderation level. This is inclusive of water-moderated cases where the change from ice to water in fact represents a large change in the moderator density. There are some cases showing a small discontinuity in k-infinity due to the tabulations of the bound scattering data, as highlighted for polythene above.

The fissile systems, as specified and modelled in this work, were not suitable for showing the effect on the neutron multiplication factor due to the change in material densities and physical dimensions that result from changes in the system temperature;

- For the homogeneous cases, material densities and physical dimensions are not meaningful in such cases.
- For the heterogeneous cases, the pin pitch is changed in order to adjust the moderator to fuel ratio, however such dimensional changes are likely to be excessively large with respect to those that would occur through thermal expansion.

There is a subtle exception to this; for the water moderated systems, two densities were used. At and below 273.15 K, 0.92 g/cc was use to represent the density of ice and at and above 273.15 K, 1.00 g/cc was used to represent the density of liquid water. However, this neglects both the effect of water density decreasing between 273.15 K and 373 K as well as the vaporisation of water at 373 K. Similarly, for the polythene moderated systems, the effect of polythene melting at around 350 K is neglected.

In addition, as the modelled systems were infinite in extent, the change in neutron leakage due to the temperature-dependent changes in the neutron cross sections could not be investigated.

3.4 Further Investigations

This report has considered the effects of temperature on the criticality of a number of idealised fissile systems. All the modelled systems are infinite in extent and the majority are homogeneous mixtures of fissile and moderator materials. Some of the models have simple heterogeneous geometries.

A potential extension of this study would include development of the models considered here to include the following features;

- Temperature dependent density of fluid materials (chiefly liquid water, and by association, ice)
- Temperature dependent density and dimensions of solid materials (i.e. fuel and structural materials)
- Heterogeneity of all models, based on generic configurations of real-world fissile material packages
- Finite dimensions of all models, based on generic sizes of real-world fissile material packages

These features would allow the validity of the temperature trends given here to be evaluated for models which more closely approximate real-world fissile material packages.

4 Code Capabilities and Developments

This section provides commentary on the capabilities of a number of internationally available codes used for criticality safety, with particular emphasis on modelling cases at temperatures other than room temperature. The codes considered are MONK, MCNP and SCALE-KENO. It is noted that these codes all use Monte Carlo methods. Whilst criticality calculations are sometimes performed using deterministic codes, this is generally for scoping studies with definitive results being performed with Monte Carlo codes. Scoping exercises can be performed in deterministic codes much quicker than in Monte Carlo codes, but it is necessary to accept the inherent approximations in such methods. Monte Carlo largely removes all of the deterministic approximations in the essential physics of criticality, as discussed in Section 2.2. These codes were selected on the basis that the codes and data were currently available to, and have been used by, Wood staff. The use of MCNP and KENO by one of the authors has been in the area of cross-code comparisons. Although one of the authors received training in SCALE during the 1990's this was for a much earlier version of the code. All MCNP experience has been gained on-the-job.

Where information concerning proposed developments to the codes have been made available, these have been highlighted.

4.1 MONK code

The current version of the MONK code, MONK10B RU0, using the BINGO collision processor and nuclear data library, is able to perform run-time Doppler broadening to any required temperature between the lowest and highest temperatures at which data is tabulated (as detailed in Sections 4.1.1 and 4.1.2) on the supplied BINGO nuclear data library.

4.1.1 Nuclear Data Libraries

Currently QA releases of BINGO libraries have a base temperature of 293.6 K. In order perform the calculations for this work down to 193 K, the Wood nuclear data specialists generated a BINGO library with a base temperature of 193 K. This used the validated methodologies and tools which are used to generate production-status BINGO nuclear data libraries.

This new library is based on the nuclear data evaluations in the production-status JEFF-3.1.2 BINGO library which has been validated for use with MONK10B RU0 at 293.6 K. Additional bound thermal scattering data were sourced for hydrogen in ice, hydrogen in polythene and oxygen in ice from the recently published ENDF/B-VIII nuclear data evaluation. Bound scattering data for hydrogen in water at 273.15 K as well as carbon in graphite and hydrogen in zirconium hydride down to 193 K were derived from the experimental data that underpins the bound scattering data in the production-status JEFF-3.1.2 BINGO library.

This new library has undergone a verification process to ensure the processed data is correct and provides physically reasonable results from MONK calculations. It has development status on the grounds that is has not undergone the full validation required by the ANSWERS Software Service QA procedures.

4.1.2 Utilising Temperature Data

MONK can utilise data in the BINGO continuous energy format, the DICE hyperfine group scheme or the WIMS 172 group scheme. The utilisation of temperature data is different in each of these, but here the discussion is restricted to the methods employed in the BINGO approach.

In MONK, each defined material has a temperature associated with it, although this does not have to be explicitly defined and defaults to room temperature (specifically 293.6 K). The BINGO nuclear data library contains cross section data for each nuclide which have been Doppler broadened to a series of discrete temperatures. For current QA status BINGO libraries these temperatures are: 293.6 K, 500 K, 1000 K, 1500 K, 2000 K, 3500 K, 5000 K, 10,000 K, 20,000 K, 40,000 K and 80,000 K. For nuclides present in any material whose temperature is within 0.5 K of one of these library temperatures MONK will use these pre-broadened cross section data. For any other temperature the BINGO collision processor in MONK version 10A and later will use run-time Doppler broadening (also known as on-the-fly Doppler broadening) to broaden the resonances to the exact temperature required.

No special user input or expert judgement is required to utilise the run-time Doppler broadening capability in MONK. All that is necessary is for the user to define the temperature of each material, and use a recent BINGO nuclear data library (the JEF-2.2 BINGO library does not support run-time Doppler broadening but JEFF-3.1 and later all do).

The full Doppler broadening treatment as performed by NJOY-BROADR can be computationally expensive for nuclides with complex resonance structures so is not practical to perform during the MONK calculation. Instead BINGO employs an approximate broadening methodology. This method introduces cumulative errors which increase as the temperature moves further away from a tabulated library temperature. For this reason, the BINGO library must contain Doppler broadened (by NJOY-BROADR) cross section data at a sufficient number of tabulated temperatures to ensure that the approximate broadening method remains sufficiently accurate.

The run-time Doppler broadening method is used in the resolved resonance range for all nuclides. However, it is not suitable for use where the BINGO unresolved resonance subgroup treatment is used in the unresolved resonance range or where bound thermal scattering data are used. For so-called subgroup nuclides the BINGO library contains subgroup data at a range in intermediate temperatures to allow for interpolation with minimal error.

For neutrons with energies below a few eV the thermal motions of scattering nuclides profoundly affect the outcome of collisions. Thermal scattering in most nuclides is treated by applying a monatomic free-gas model, in which the speed of the target nucleus is sampled from a Maxwellian distribution for the requested temperature. For certain nuclides for which bound thermal scattering effects are important the necessary data are provided in the form of a tabulated $S(\alpha,\beta)$ function. These data are contained within the nuclear data library at a small number of discrete temperatures, and no interpolation in temperature is attempted. Instead the collision processor simply picks the tabulated $S(\alpha,\beta)$ data at the temperature which is closest to the requested temperature. In the next QA release of MONK (version 11A) it is planned to include a stochastic mixing approach to interpolate the $S(\alpha,\beta)$ data in temperature.

4.2 MCNP code

The MCNP code, current version MCNP 6.20, is designed and developed by Los Alamos National Laboratory (LANL) under contract with the US Department of Energy (USDoE). Parts of the code also utilise work performed at and copyrighted by Lawrence Livermore National Laboratory. The US Radiation Safety Information Computational Center [sic] (RSICC), a Department of Energy Specialized Information Analysis Center, based at Oak Ridge National Laboratory (ORNL), is the sole supplier of the code. The current version of MCNP has the capability to perform 'on-the-fly' Doppler broadening to any required temperature. However, as the 'on-the-fly' approach has only recently been developed there are a number of ways of dealing with temperature in MCNP that will be discussed below.

4.2.1 Nuclear Data Libraries

The nuclear data available for use with MCNP is in the form of ACE format files. The files can be individual nuclide or as a compiled library of individual ACE files. The underlying source of the data varies. The main libraries provided are based on ENDF/B data files and incorporates data for individual isotope for various releases of ENDF/B-V and -VI, as well as ENDF/B-VII.0 and ENDF/B-VII.1. These ACE files are supplied with the code package obtained from RSICC and have been generated using the NJOY code. The set of libraries are generally issued with variants at five specific temperatures, namely; 293.6 K, 600 K, 900 K, 1200 K and 2500 K. Thermal scattering data in the form of S(α,β) data is available at various temperatures with data for water being available at 293.6 K, 350 K to 650 K in 50 K increments and 800 K.

Following issue of MCNP 6.20 to RSICC for distribution a new set of ACE files based on ENDF/B-VIII.0 have been released by the LANL Nuclear Data Team. This data was for the same temperatures as defined above but added ACE files at 0.1 K and 250 K. This library also contains S(α,β) data at more temperatures. Therefore, bound water data is available at 284, 294, 300, 324, 350, 374, 400, 424, 450, 474, 500, 524, 550, 574, 600, 650 and 800 K. Also included in the library is the bound ice data for hydrogen and oxygen at temperatures 115, 188, 208, 228, 233, 248, 253, 268 and 273 K.

4.2.2 Utilising Temperature Data

For a conventional MCNP calculation temperatures are assigned to cells, which are geometrical regions. Materials are assigned to cells. When the ACE libraries are prepared, Doppler broadening for the specific temperatures is performed on nuclides and the materials are composed of nuclides. Nuclides are specified in MCNP inputs using an identifier denoting the nuclides atomic number and atomic mass number, followed by a suffix that identifies the basic nuclear data library and finally a digit to identify which temperature file should be used. So in a conventional calculation the nuclide temperature can only be that available on one of the supplied libraries unless the code user utilises NJOY, or some other package, to prepare additional ACE files at the required temperatures. It should also be noted that specifying the temperature on the cell is achieved using a 'TMP=' card but this only causes the code to apply a temperature correction to the thermal scattering cross sections of those nuclides that do not have bound S(α,β) data. In such cases, only the scattering cross section is affected and not the capture, etc.

Rather than utilising NJOY to produce new ACE files at specific temperatures, the RSICC distributed MCNP package includes a code called MAKXSF which has the capability to perform Doppler broadening of the resolved resonance data to a higher temperature, interpolate any unresolved resonance probability data and interpolate S(α,β) data scattering kernel data to a new temperature. This code supplied in the MCNP package incorporated several of the routines from NJOY and the DOPPLER codes.

In addition, MCNP offered an alternative approach known as stochastic interpolation. This is not interpolation but a simple mixing process. MCNP has the capability of including the same nuclide in a material if it has a different identifier suffix. Therefore it is possible to approximate a nuclide at 500 K say by including a two-thirds proportion of the nuclide with the 300 K suffix and one-third proportion of the nuclide with the 600 K suffix. However, this approach cannot be adopted for the bound thermal scattering data, where a separate identifier, without suffix, is used. A technique that has previously been used is to run calculations with the stochastic interpolation material composition with the two nearest S(α,β) data files (one above and one below the required temperature) and a simple linear interpolation of the calculated values of reactivity has been performed to approximate the reactivity at the required temperature.

Clearly this represents substantially more effort for an analyst to perform calculations with this conventional approach for specific non-library temperatures. Therefore, as part of MCNP 6.20 development an 'on-the-fly' approach to Doppler broadening was developed.

The on-the-fly Doppler broadening (OTFDB) approach adopted is different to the MONK technique in that MCNP requires prior compilation and execution of a supplied Fortran program 'FIT_OTF'. This program is designed to perform high precision fits to Doppler broadened cross sections over a wide temperature range. The temperature dependent fits are then used within MCNP during neutron transport.

Therefore, to include the effects of temperature in MCNP the user has the following options:

- Use NJOY to create ACE files for each nuclide at the desired temperatures, and then explicitly use those ACE files in MCNP;
- Use MAKXSF to create ACE files for each nuclide at the desired temperatures. This method would result in approximations in the interpolation of unresolved resonance tables and the interpolation of discrete S(α,β) data. It should also be noted that modern MCNP libraries include continuous S(α,β) data which cannot be handled by the current version of MAKXSF;
- Use the "stochastic mixing" technique to mix together hot and cold ACE data for each isotope in a material, in the proper proportions to preserve the average temperature. It should be noted that again this cannot be done for S(α,β) data. This would, of course, only be appropriate if ACE files that bound the required temperature exist;
- Perform simulations using available higher and lower temperature ACE files, and utilise the results that produce the bounding k-effective result. As with the "stochastic mixing" technique this would only be appropriate if ACE files that bound the required temperature exist;
- Compile and execute the FIT_OTF Fortran code and produce nuclide specific temperature dependent fits to the nuclear data. It is understood that this process has largely been used for multiphysics reactor applications, where neutronics and thermal hydraulics codes are coupled together.

4.2.3 Concluding remarks

Clearly the way that temperature is incorporated into an MCNP criticality calculation is very much dependent on user choice, based on the amount of effort they wish to expend, and their technical capabilities in potentially producing ACE nuclear data files from NJOY or with MAKXSF, or potentially the FIT_OTF program. It is therefore considered difficult to quantify the effect of temperature on the calculated neutron multiplication as a result of these various choices. Also, it should be borne in mind that the effects of changes in temperature may vary significantly with system type and moderation level, as has been shown in this report. It is concluded that great care would need to be taken in stating the route adopted and quantifying the potential bias and uncertainties associated with the approximations associated with the chosen route.

4.3 SCALE-KENO code

The SCALE code suite, incorporating the criticality code KENO, current version SCALE 6.2.3, is designed and developed by ORNL under contract with the US Nuclear Regulatory Commission (USNRC), USDoE and the National Nuclear Security Administration. RSICC is again the main supplier of the code, but with the same package available from OECD/NEA Data Bank. It is stated in the SCALE documentation that the current version of SCALE has the capability to perform 'on-the-fly' Doppler broadening to any required temperature; although this should be qualified as any temperature above 293.6 K.

4.3.1 Nuclear Data Libraries

Various nuclear data libraries are available for use in SCALE-KENO. These are either multi-group or point-wise continuous energy (CE) format. Although the current version of the SCALE package contains libraries derived from ENDF/B-VII.0 and ENDF/B-VII.1 nuclear data, libraries from earlier releases of the code are still compatible. Specific libraries available are:

- v7-238 238-group ENDF/B-VII.0,
- v7-252 252-group ENDF/B-VII.1,
- v7-56 56-group ENDF/B-VII.1,
- test-8grp 8-group ENDF/B-VII.1 test library,
- ce_v7.1_endf CE ENDF/B-VII.1,
- ce_v7 CE ENDF/B-VII.0.

Earlier compatible library versions are:

- 44GROUPNDF5 44-group ENDF/B-V,
- 238GROUPNDF5 238-group ENDF/B-V,
- V6-238 238-group ENDF/B-VI.8,
- CE_V6_ENDF Continuous Energy ENDF/B-VI.8.

Both the multi-group and continuous energy libraries have been produced using the AMPX-2000 nuclear data processing suite of codes. This software is an independent, 'state-of-the-art' cross section processing system, which has been developed by ORNL with funding from the USNRC and USDoE. This code was produced to provide a cross section processing route independent of NJOY.

The continuous energy data libraries distributed with SCALE are provided with only about five temperatures per nuclide, namely 293.6 K, 600 K, 900 K, 1200 K and 2500 K. The Doppler broadening temperature corrections using only a few temperatures may not match the required temperature of the calculation. When temperatures of the KENO model are different from those present on the library, KENO selects the nearest temperature, which can be several hundred degrees from the desired temperature, producing results that can vary significantly from those that would be produced at the correct temperature. New methods have been developed and implemented in SCALE 6.2 to provide problem-dependent temperature corrections by Doppler broadening the point-wise data in the resolved resonance region and the probability tables in the unresolved resonance region when the cross sections are loaded for the calculation. The thermal scattering data are also updated to the requested temperature. The SCALE user guide states that these corrections are interpolations, with the lowest temperature available in the S(α,β) tables being 293.6 K. It is not explicitly stated as to what happens if a temperature is requested below this value.

Until such time as an ENDF/B-VIII-based SCALE library is produced 293.6 K is the minimum temperature that can be utilised with the current version of SCALE-KENO.

5 References

[1] The ANSWERS Software Service, “MONK® Version 10B – "A Monte Carlo Program for Nuclear Criticality Safety and Reactor Physics Analyses, User Guide for Version 10B",” ANSWERS/MONK/REPORT/013 Issue 2, June 2018.

[2] S. Richards, M. Shepherd, A. Bird, D. Long, C. Murphy and T. Fry, “Recent Developments to MONK for Criticality Safety and Burn-up Credit Applications,” in *M&C 2017 - International Conference on Mathematics & Computational Methods Applied to Nuclear Science & Engineering*, Jeju, Korea, April 16-20, 2017.

[3] “The Engineering Toolbox,” [Online]. Available: www.engineeringtoolbox.com. [Accessed August 2018].

A Details of Temperature Trends

Section 3.3 presented generalised trends across all the cases considered, noting that it is not possible to provide a concise set of observations that universally describe the trends in the results. This appendix discusses the results of the k-infinity calculations in detail.

The discussion in this appendix relates to the plotted and tabulated results included in Appendices B and C. These results include the absolute k-infinity values for many of the calculations undertaken, alongside some results for Δk (= $k_T - k_{293K}$) and Δk/k (= $(k_T - k_{293K})/k_{293K}$). In some cases alternative comparisons of k-infinity values are made. For example, for the DBRC calculations the k-infinity values are compared to those without use of DBRC at each moderation level and temperature.

This appendix seeks to relate the trends in k-infinity seen in the plots/tables to the physics effects discussed in Section 2. Strictly speaking, the trends described are valid in the temperature range of the MONK calculations (193 K to 1073 K). It is noted that wherever changes in k-infinity values (or relative changes in k-infinity values) are given then these are presented in pcm (i.e. Δk (or Δk/k) multiplied by 10^5).

The sub-headings below give the material composition of the fissile system modelled. The percentage in brackets gives the weight percent of the Pu-239 (in Pu) or U-235 (in U) included.

A.1 Reference Cases without Absorber

This section discusses the trends shown in Figure B-1 through Figure B-15. These figures are derived from the k-infinity values given in Table C-1 as well as the differences in k-infinity values given in Table C-3 and Table C-5.

A.1.1 Case 1: Homogeneous Pu(100%)O_2-CH_2

A negative temperature effect is observed for all moderation levels up to H:fissile of 1000:1 except for there being no temperature dependence at the oxide density (no moderator). At and above H:fissile = 1500:1 positive temperature effects are seen. For these higher moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). Therefore, for H:fissile ≤ 1000:1, the maximum k-infinity is achieved at lowest temperature. For H:fissile ≥ 1500:1, the maximum k-infinity is achieved at elevated temperature. These trends can be seen in Figure B-1 and Table C-1.

A.1.2 Case 2: Homogeneous Pu(90%)O2-CH2

This shows the same temperature effect and maximum k-infinity trends as for Case 1, but there is an increase in the magnitude of the negative temperature effect for H:fissile at around 100:1. This is due to the increase in the epi-thermal neutron spectrum at this level of moderation which makes the system most sensitive to the Doppler broadening effect of the large Pu-240 resonance capture cross section near 1 eV. These trends can be seen in Figure B-2 and Table C-1.

A.1.3 Case 3: Homogeneous Pu(100%)O_2-H_2O

This shows the same temperature effect and maximum k-infinity trends as for Case 1. The magnitude of effect of using ice rather than water bound scattering data are only observable in cases with H:fissile greater than 75:1. Water data give a higher k-infinity up to H:fissile of 1000:1, above which the ice data give a higher k-infinity. These trends can be seen in Figure B-3 and Table C-1.

A.1.4 Case 4: Homogeneous U(1.6%)-H_2O

A negative temperature effect is observed for all moderation levels. Therefore, a maximum k-infinity is achieved at lowest temperature regardless of moderation. The effect of using ice rather than water bound scattering data is not significant. These trends can be seen in Figure B-4 and Table C-1.

A.1.5 Case 5: Heterogeneous U(1.3%)-H_2O

For under-moderated cases, V_{mod}:V_{fuel} <2:1, negative temperature effects are seen except at 273.15 K where the change from ice to water results in an increase in k-infinity due to the changes in moderator density and the bound scattering data. A maximum k-infinity is achieved at 273.15 K with water data. At higher moderation levels, positive temperature effects are seen below 800 K. In some cases, k-infinity reduces when the temperature increases to 1073 K. A reduction in k-infinity is seen at 273.15 K when changing from ice to water data and increasing the water density. A maximum k-infinity is achieved at high temperature (800 K or 1073 K). These trends can be seen in Figure B-5 and Table C-1.

A.1.6 Case 6: Heterogeneous U(1.3%)-Graphite

For most moderation levels, negative temperature effects are seen for all temperatures. Maximum k-infinity is achieved at the lowest temperature. For V_{mod}:V_{fuel} ≥ 65, there is a small positive temperature effect for the lowest temperatures, with k-infinity reaching a maximum at 263 K. These trends can be seen in Figure B-6 and Table C-1.

A.1.7 Case 7: Heterogeneous U(3%)O_2-H_2O

This model is complicated by the presence of graphite which means that a zero density of the interstitial moderator does not imply zero moderation. However, for an interstitial moderator density of ≤ 0.3 g/cc, negative temperature effects are seen for all temperatures. At 0.4 g/cc, only at the extremes of temperature change are changes in k-infinity due to temperature observed. For higher moderation levels, positive temperature effects are seen below 800 K. Above 800 K, k-infinity decreases for intermediate moderation levels, but increases further for the highest moderation. For the lower moderation levels, maximum k-infinity is observed for the lowest temperatures. For the higher moderation levels, maximum k-infinity is observed at 800 K or in some cases 1073 K. These trends can be seen in Figure B-7 and Table C-1.

A.1.8 Case 8: Heterogeneous U(5%)O_2-H_2O

For moderation levels of V_{mod}/V_{fuel} < 3, negative temperature effects are seen for all temperatures with the exception of 273.15 K where k-infinity increases due to the change from ice to water, due to the changes in moderator density and the bound scattering data. At V_{mod}/V_{fuel} = 3, negative temperature effects are seen for all temperatures and there is no sensitivity to the change in bound data and density at 273.15 K. Above V_{mod}/V_{fuel} = 3, positive temperature effects are seen below 800 K, though there is a significant decrease in k-infinity at 273.15 K due to the change from ice to water bound data and increase in moderator density. Between 800 and 1073 K, k-infinity decreases or changes insignificantly. These trends can be seen in Figure B-8 and Table C-1.

A.1.9 Case 9: Homogeneous U(5%)O_2-H_2O

A negative temperature effect is observed for all moderation levels. Therefore, a maximum k-infinity is achieved at lowest temperature regardless of moderation. The use of ice rather than water bound scattering data does produce a lower k-infinity and this effect appears to increase with increased moderation. However, the effect is not statistically significant at lower moderation levels and the difference is only just statistically significant for higher moderation levels. These trends can be seen in Figure B-9 and Table C-1.

A.1.10 Case 10: Homogeneous U(20%)O_2-H_2O

A negative temperature effect is observed for all moderation levels. Therefore, a maximum k-infinity is achieved at lowest temperature regardless of moderation. At 273.15 K, the change from ice to water tends to produce a lower k-infinity but the difference is not statistically significant. These trends can be seen in Figure B-10 and Table C-1.

A.1.11 Case 11: Homogeneous U(100%)O_2-CH_2

At zero moderation there is no change in k-infinity with respect to temperature. There is a negative temperature effect for all temperatures at non-zero moderation. For higher moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). Maximum k-infinity is seen at the lowest temperature for a given moderation level. The magnitude of the negative temperature effect increases with moderation level below H:fissile of 10:1 before decreasing to a minimum (but still negative) at 150:1. It then increases again for higher moderation levels. These trends can be seen in Figure B-11 and Table C-1.

A.1.12 Case 12: Homogeneous Mixed Oxide (U-nat + 5% Pu, Pu-239 95 wt.% in Pu)-CH_2

Negative temperature effects are seen for all temperatures for moderation levels below H:fissile = 1500:1. At and above H:fissile = 1500:1, there is a positive temperature effect for temperatures below 373 K. For these higher moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). Therefore, if under-moderated, the maximum k-infinity is achieved at lowest temperature. If over-moderated maximum k-infinity is seen at 373 K. When under-moderated, the U-238 resonance capture cross section is important and the Doppler broadening of this cross section is the major factor in the negative temperature effect. However, when over-moderated, there are several competing temperature-dependent effects governing k-infinity such as the U-235 and Pu-239 fission cross sections and the Pu-240 capture cross section. These trends can be seen in Figure B-12 and Table C-1.

A.1.13 Case 13: Homogeneous U(1.6%)-CH_2

Negative temperature effects are seen for all temperatures at all moderation levels above H:fissile = 1:1. At low moderation levels (≤1:1), there is a positive temperature effect between 373 K and 500 K, however, the k-infinity at 500 K is lower than temperatures below 293 K and the k-infinities for all temperatures at these low moderation levels is less than 0.56. For some moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). For all moderation levels, the maximum k-infinity is seen at the lowest temperature. These trends can be seen in Figure B-13 and Table C-1.

A.1.14 Case 14: Homogeneous U(5%)O_2-CH_2

Negative temperature effects are seen for all temperatures at all moderation levels. For some moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). For all moderation levels, the maximum k-infinity is seen at the lowest temperature. These trends can be seen in Figure B-14 and Table C-1.

A.1.15 Case 15: Homogeneous U(20%)O_2-CH_2

Negative temperature effects are seen for all temperatures at all moderation levels. A single exception is a small positive temperature effect between 373 K and 500 K for the unmoderated case. For some moderation levels, there is a step change in k-infinity between 313 K and 373 K, due to the polythene data (see Section 3.3). For all moderation levels, the maximum k-infinity is seen at the lowest temperature. These trends can be seen in Figure B-15 and Table C-1.

A.2 Reference Cases with Absorber

This section discusses the trends shown in Figure B-16 through Figure B-30. These figures are derived from the k-infinity values given in Table C-2 as well as the differences in k-infinity values given in Table C-4 and Table C-6.

Several of the modelled fissile systems have low or very low k-infinities due to the presence of the boron absorber. As such, the use of Δk/k can give misleading significance to results. Additionally, the stochastic uncertainty on the k-infinity values (20 pcm) is a large fractional uncertainty for the very low k-infinity cases. Where a system has low k-infinities, these are indicated below.

A.2.1 Case 1: Homogeneous Pu(100%)O_2-CH_2

Negative temperature effects are seen for all temperatures for moderation levels below H:fissile = 35:1. Temperature has no effect on k-infinity for the zero moderator case. Above H:fissile = 35:1, positive temperature effects are seen. Therefore, for low moderation levels, the maximum k-infinity is seen at the lowest temperature and for high moderation levels, the maximum k-infinity is seen at the highest temperature. However, at and above H:fissile = 500:1, k-infinity falls below 0.5. The change from negative to positive temperature effects shifts from H:fissile = 1500:1 in the cases without the boron absorber to H:fissile = 35:1 here. This may be because the high boron concentration lowers the thermal neutron flux and therefore places more importance on the Doppler broadening of the Pu-239 resonance fission cross section. These trends can be seen in Figure B-16 and Table C-2.

A.2.2 Case 2: Homogeneous Pu(90%)O_2-CH_2

This shows the same temperature effect and maximum k-infinity trends as for Case 1. In these borated cases, the magnitude of the negative temperature effect is not as large as seen in the unboronated cases. This is because the boron cross section reduces the importance of the epi-thermal energy region, and therefore reduces the significance of the Doppler broadening effects of large Pu-240 resonance capture cross section near 1 eV. These trends can be seen in Figure B-17 and Table C-2.

A.2.3 Case 3: Homogeneous Pu(100%)O_2-H_2O

Temperature has no effect on k-infinity for the zero moderator case. Negative temperature effects are observed for all temperature for low moderation levels (H:fissile ≤ 1:1). For moderation levels at and above H:fissile = 35:1, positive temperature effects are seen. For moderation levels between H:fissile = 3:1 and H:fissile = 20:1, negative temperature effects occur between 193 K and 273.15 K, and separately between 273.15 K and 1000 K. There is an increase in k-infinity due to changing the bound scattering data and decreasing the boron concentration. These trends can be seen in Figure B-18 and Table C-2.

A.2.4 Case 4: Homogeneous U(1.6%)-H_2O

With the exception of the zero moderation case, negative temperature effects between 193 K and 273.15 K, and separately between 273.15 K and 1000 K. This is because there is an increase in k-infinity when changing the ice bound scattering data and decreasing the boron concentration. This is particularly significant for moderation levels at and above H:fissile = 35:1. However, k-infinity becomes very low for H:fissile greater than 100:1. These trends can be seen in Figure B-19 and Table C-2.

Note the reactivity of this system is always low, with k-infinity ranging from 0.68 to 0.05.

A.2.5 Case 5: Heterogeneous U(1.3%)-H_2O

At and below 273.15 K (using the ice bound scattering data), there is no statistically significant variation in k-infinity with temperature. Changing the bound scattering data as well as the moderator and boron densities results in a significant reduction in k-infinity. For temperatures above 273.15 K, positive temperature effects are observed for all moderation levels. For most moderation levels, the highest k-infinity is achieved at lowest temperatures (due to the effect of the ice data) rather than the highest temperatures. These trends can be seen in Figure B-20 and Table C-2.

Note the reactivity of this system is low, with k-infinity ranging from 0.49 to 0.26.

A.2.6 Case 6: Heterogeneous U(1.3%)-Graphite

These results show insignificant differences in k-infinity due to change in temperature. The difference between the maximum and minimum k-infinity for any given moderation level is 140 pcm. As noted above, the uncertainty on the difference is 28 pcm, so the maximum difference is barely significant. These trends can be seen in Figure B-21 and Table C-2.

Note the reactivity of this system is very low, with k-infinity ranging from 0.12 to 0.09.

A.2.7 Case 7: Heterogeneous $U(3\%)O_2$-H_2O

With an interstitial moderator density, $\rho_{mod} \leq 0.4$ g/cc, negative temperature effects are seen. In the region of 0.2-0.3 g/cc the differences are mostly insignificant with respect to the calculation uncertainty. At 0.4 g/cc and 0.5 g/cc, no statistically significant change in k-infinity with temperature occurs. At ≥0.6 g/cc, positive temperature effects are seen, although these changes are not statistically significant. These trends can be seen in Figure B-22 and Table C-2.

Note the reactivity of this system is low, with k-infinity ranging from 0.41 to 0.22.

A.2.8 Case 8: Heterogeneous $U(5\%)O_2$-H_2O

For moderation levels $V_{mod}/V_{fuel} \leq 2$, negative temperature effects are seen. There is a significant reduction in k-infinity when changing the bound scattering data as well as the moderator and boron densities at 273.15 K. Therefore, the highest k-infinity is seen at low temperature. For higher moderation levels, there are positive temperature effects at most temperatures. However, there is still a significant reduction in k-infinity at the transition at 273.15 K, such that the highest k-infinity is still seen at low temperatures. Furthermore, these positive temperature effects occur where k-infinity is very low (<0.5). These trends can be seen in Figure B-23 and Table C-2.

Note the reactivity of this system is low, with k-infinity ranging from 0.74 to 0.16.

A.2.9 Case 9: Homogeneous $U(5\%)O_2$-H_2O

Negative temperature effects are seen for all temperatures at moderation levels of H:fissile ≤10:1. There is a decrease in k-infinity due to changing the bound scattering data and boron concentration. For these moderation levels, the highest k-infinity is observed at the lowest temperature. Above H:fissile = 10:1, negative temperature effects occur between 193 K and 273.15 K, and separately between 273.15 K and 1000 K. There is an increase in k-infinity due to changing the bound scattering data and boron concentration. For these moderation levels, the highest k-infinity is observed at 273.15 K with water density. These trends can be seen in Figure B-24 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 0.95 to 0.04.

A.2.10 Case 10: Homogeneous $U(20\%)O_2$-H_2O

This system shows similar trends to Case 9 above. The moderation level at which the trends change is lower than Case 9 at around H:fissile = 5:1. There is a slight increase in k-infinity due to changing the bound scattering data and boron concentration but this is not statistically significant. Above H:fissile = 5:1, the trends are the same as for Case 9 when H:fissile > 10:1. These trends can be seen in Figure B-25 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 1.52 to 0.04.

A.2.11 Case 11: Homogeneous $U(100\%)O_2-CH_2$

This system shows no sensitivity to temperature at zero moderation and there is no statistically meaningful changes in k-infinity due to temperature for moderation levels of H:fissile ≥35:1. Between H:fissile = 0.5:1 and H:fissile = 20:1 negative temperature effects are seen. Therefore, maximum k-infinity seen at 193 K. These trends can be seen in Figure B-26 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 2.20 to 0.05.

A.2.12 Case 12: Homogeneous Mixed Oxide (U-nat, 5% Pu, Pu-239 95 wt.% in Pu)-CH_2

Negative temperature effects seen for all moderation levels at and below H:fissile = 200:1. Therefore, the maximum k-infinity is achieved at the lowest temperature. For moderation levels H:fissile = 350:1 to H:fissile = 750:1, k-infinity tends to decrease with increase in temperature, however, there is a peak in k-infinity at 373 K. For higher moderation level, there is a positive temperature effect so the highest k-infinity is observed at the highest temperature. However, due to the high boronation in these latter moderation levels, k-infinity is very low. These trends can be seen in Figure B-27 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 1.02 to 0.14.

A.2.13 Case 13: Homogeneous U(1.6%)-CH_2

Negative temperature effects are seen for all moderation levels. At low moderation levels (H:fissile ≤1:1), there is a positive temperature effect at 500 K but these are much smaller effects than from reduced temperature cases. Therefore, maximum k-infinity is observed at the lowest temperature. These trends can be seen in Figure B-28 and Table C-2.

Note the reactivity of this system can be very low, with k-infinity ranging from 0.69 to 0.06.

A.2.14 Case 14: Homogeneous $U(5\%)O_2-CH_2$

Negative temperature effects are seen for all moderation levels. Therefore, maximum k-infinity is observed at the lowest temperature. These trends can be seen in Figure B-29 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 0.97 to 0.06.

A.2.15 Case 15: Homogeneous $U(20\%)O_2-CH_2$

Negative temperature effects are seen for all moderation levels. Therefore, maximum k-infinity is observed at the lowest temperature. These trends can be seen in Figure B-30 and Table C-2.

Note the reactivity of this system is variable and can be very low, with k-infinity from 1.52 to 0.05.

A.3 Free Gas Scattering Cases without Absorber

Table C-7 provides the k-infinities calculated where no bound thermal scattering data were used. Table C-9 gives the difference (in pcm) of these results compared to those in Table C-1 where the appropriate bound thermal scattering data were used for the moderator material (water, ice, polythene or graphite). A positive value indicates that using a free gas scattering model for these materials gives a higher k-infinity whereas a negative value indicates that using the appropriate bound thermal scattering data gives a higher calculated k-infinity.

The general observation over all the cases is that the free gas scatter model gives a higher k-infinity at lower temperatures than the bound scatter model. The difference between the two models decreases with increasing temperature. At the highest temperatures, the free gas scatter gives the highest k-infinity for the heterogeneous water cases (Cases 5, 7 and 8), there is no statistically significant difference between the two methods for the heterogeneous graphite case (Case 6) and the bound scatter gives the highest k-infinity for all the homogeneous cases (Cases 1-4 and 9-15).

For cases where over-moderation occurs, this will tend to give a higher k-infinity for the bound scatter model at low temperatures and a higher k-infinity for the free gas scatter model at high temperatures.

For the majority of cases, there is no statistically significant difference between the models for the lowest moderation cases.

A.3.1 Case 1: Homogeneous Pu(100%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 5:1. Then, for the majority of the H:fissile ratios, at low temperatures, k-infinity is highest with free gas scatter. However, the difference decreases with increasing temperature until there is no significant difference at around 500 K. At higher temperatures, k-infinity is highest with bound scattering. When H:fissile ≥ 1000:1, the trend reverses.

A.3.2 Case 2: Homogeneous Pu(90%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 3:1. Otherwise, the trends are similar to Case 1.

A.3.3 Case 3: Homogeneous Pu(100%)O_2-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 10:1. Otherwise, the trends are similar to Case 1.

A.3.4 Case 4: Homogeneous U(1.6%)-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 15:1. At low temperatures, k-infinity is highest with free gas scatter. This difference decreases with increasing temperature until there is no significant difference at around 800 K. At higher temperatures, k-infinity is highest with bound scattering (though the difference is not always statistically significant).

A.3.5 Case 5: Heterogeneous U(1.3%)-H_2O

At all temperatures, k-infinity is highest with free gas scatter for each of the moderation levels. The difference tends to decrease with increasing temperature.

A.3.6 Case 6: Heterogeneous U(1.3%)-Graphite

Note that this is the only case with graphite as the only moderator. The trend in the difference between the scattering treatments is complex. The free gas scatter model generally gives a higher k-infinity, with the greatest differences being around 373 – 800 K. The bound scatter model gives a higher k-infinity for lower temperatures with higher moderation levels. There is a region of intermediate temperatures and moderation levels where the difference is not statistically significant. At 1073 K, there is no statistically significant difference between the methods.

A.3.7 Case 7: Heterogeneous U(3%)O_2-H_2O

Note that for this case, the free gas scatter treatment is used for the graphite fuel sleeve as well as the water moderator. The free gas scatter treatment always produces a higher k-infinity than the bound scatter treatment. For low moderation levels ($\rho_{mod} \leq 0.2$ g/cc), there is no clear trend in the differences with change in temperature. For higher moderation levels, the difference between the treatments tends to decrease with increasing temperature.

A.3.8 Case 8: Heterogeneous U(5%)O_2-H_2O

The trends are similar to Case 7 with no clear trend in the differences with temperature below a moderation level of $V_{mod}/V_{fuel} \leq 2.5$.

A.3.9 Case 9: Homogeneous U(5%)O_2-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 10:1. Below 800 K, k-infinity is highest with free gas scatter model, with the difference decreasing with temperature. At 1000 K, k-infinity is highest with bound scattering, though the difference is not always statistically significant.

A.3.10 Case 10: Homogeneous U(20%)O_2-H_2O

The trends here are broadly similar to Case 9.

A.3.11 Case 11: Homogeneous U(100%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 7.5:1. Below around 500 K, k-infinity is highest with the free gas scatter model. Above 500 K, k-infinity is highest with the bound scatter model.

A.3.12 Case 12: Homogeneous Mixed Oxide (U-nat, 5% Pu, 95.0 wt.% Pu-239 in Pu)-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 7.5:1. Below around 500 K, k-infinity is highest with the free gas scatter model. Above 500 K, k-infinity is highest with the bound scatter model. For moderation levels of H:fissile > 500:1, this trend reverses.

A.3.13 Case 13: Homogeneous U(1.6%)-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 20:1. Below around 500 K, k-infinity is highest with the free gas scatter model. Above about 500 K, k-infinity is highest with the bound scatter model.

A.3.14 Case 14: Homogeneous U(5%)O_2-CH_2

The trends are broadly similar to Case 13 with no statistically significant differences in the treatments below H:fissile = 15:1.

A.3.15 Case 15: Homogeneous U(20%)O_2-CH_2

The trends are broadly similar to Case 13 with no statistically significant differences in the treatments below H:fissile = 10:1.

A.4 Free Gas Scattering Cases with Absorber

Table C-8 provides the k-infinities calculated where no bound thermal scattering data were used. Table C-10 gives the absolute difference (in pcm) of these results compared to those in Table C-2 where the appropriate bound thermal scattering data were used for the moderator material (water, ice, polythene or graphite). A positive value indicates that using a free gas scattering model for these materials gives a higher k-infinity whereas a negative value indicates that using the appropriate bound thermal scattering data gives a higher calculated k-infinity.

The general observations made for the free scatter cases without the absorber broadly apply for these cases with the absorber. However, the presence of the boron absorber does change some of the trends. In some cases the difference between the two models becomes statistically insignificant for some moderation levels and temperatures. There are other changes to the temperature trends between the two scattering models to specific systems which are difficult to generalise. These are described under the relevant sub-sections below.

A.4.1 Case 1: Homogeneous Pu(100%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 5:1. At low temperatures, k-infinity is highest with free gas scatter. This difference decreases with increasing temperature until there is no significant difference at around 800 K. At 1073 K, k-infinity is highest with bound scattering. When H:fissile ≥ 50:1, the trend reverses.

A.4.2 Case 2: Homogeneous Pu(90%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 3:1. For some larger moderation levels then at low temperatures, k-infinity is highest with free gas scatter. This difference decreases with increasing temperature, until k-infinity becomes larger with bound scattering at the highest temperature. When H:fissile ≥ 75:1, the trend reverses with k-infinity being highest with free gas scatter above about 800 K and k-infinity being highest with bound scatter below this.

A.4.3 Case 3: Homogeneous Pu(100%)O_2-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 3:1. Between moderation levels H:fissile = 5:1 and H:fissile = 20:1, k-infinity tends to be higher with free gas scatter. For moderation levels above H:fissile = 35:1, k-infinity is always highest with bound scattering though the trend with increasing temperature is for the difference to generally reduce up to 500 K before increasing again.

A.4.4 Case 4: Homogeneous U(1.6%)-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 15:1 or above H:fissile = 1000:1. For other H:fissile ratios then at low temperatures, k-infinity is highest with free gas scatter. This difference decreases with increasing temperature until there is no significant difference above about 500 K.

A.4.5 Case 5: Heterogeneous U(1.3%)-H_2O

For all temperatures, k-infinity is highest with free gas scatter rather than the bound data. Below 273.15 K, these differences are only just statistically significant. Above 273.15 K, there is no clear trend in the differences with temperature.

A.4.6 Case 6: Heterogeneous U(1.3%)-Graphite

The difference between scattering treatments is not statistically significant.

A.4.7 Case 7: Heterogeneous U(3%)O_2-H_2O

Note that for this case, the free gas scatter treatment is used for the graphite fuel sleeve as well as the water moderator. The difference between scattering treatments is only statistically significant for high moderation levels (ρ_{mod} > 0.6 g/cc) with temperatures at and above 273.15 K. Under these conditions, k-infinity is higher with free gas scatter compared to the bound water and graphite data.

A.4.8 Case 8: Heterogeneous U(5%)O_2-H_2O

For moderation levels of V_{mod}/V_{fuel} > 1.5 and temperatures of 273.15 K and above, k-infinity is higher with free gas scatter compared to the bound water data. For other conditions, the difference in the methods tends to be statistically insignificant.

A.4.9 Case 9: Homogeneous U(5%)O_2-H_2O

The difference between scattering treatments is not statistically significant below H:fissile = 7.5:1 or above H:fissile = 1000:1. Otherwise, at low temperatures, k-infinity is highest with free gas scatter model, with the difference decreasing with temperature. At and above about 800 K, the difference is not statistically significant.

A.4.10 Case 10: Homogeneous U(20%)O_2-H_2O

The trends are broadly similar to those for Case 9.

A.4.11 Case 11: Homogeneous U(100%)O_2-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 7.5:1. At low temperatures, k-infinity is highest with the free gas scatter model. This difference decreases with temperature. Above 500 K, k-infinity is highest with the bound scatter model.

A.4.12 Case 12: Homogeneous Mixed Oxide (U-nat, 5% Pu, 95.0 wt.% Pu-239 in Pu)-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 7.5:1. For moderation levels between H:fissile = 7.5:1 and H:fissile = 35:1, k-infinity is higher with free gas scatter, though the difference decreases with temperature and is not statistically significant above 500 K. For moderation levels above H:fissile = 75:1, at low temperatures k-infinity is highest with bound scattering; the difference decreasing with increasing temperature. Above 500 K, k-infinity is highest with free gas scattering.

A.4.13 Case 13: Homogeneous U(1.6%)-CH_2

The difference between scattering treatments is not statistically significant below H:fissile = 20:1. Below around 500 K, k-infinity is highest with the free gas scatter model, with the difference decreasing with temperature. Above 500 K, k-infinity is highest with the bound scatter model.

A.4.14 Case 14: Homogeneous U(5%)O_2-CH_2

The trends are broadly similar to Case 13 with no statistically significant differences in the treatments below H:fissile = 10:1.

A.4.15 Case 15: Homogeneous U(20%)O_2-CH_2

The trends are broadly similar to Case 13 with no statistically significant differences in the treatments below H:fissile = 7.5:1.

A.5 DBRC Cases

This section discusses the results shown in Table C-11 through Table C-14. In general, differences in k-infinity using the DBRC method compared to the reference cases (without DBRC), tend to be within the statistical uncertainty of the difference.

Cases 1, 2, 3 and 11 have no U-238 content, so results are not tabulated. Otherwise some general observations from the tables of results are summarised below. It should be noted that some of the calculations with absorber present have low or very low k-infinity values, as discussed previously.

- Without absorber
  - Case 4: DBRC tends to decrease k-infinity for 500 K and above for H:fissile > 15:1.
  - Case 5: DBRC slightly decreases k-infinity for 1073 K.
  - Case 6: DBRC slightly decreases k-infinity for 1073 K for the lowest moderation levels.
  - Case 7: DBRC tends to decrease k-infinity for 800 K and above for density ≤ 0.9 g/cc.
  - Case 8: DBRC tends to decrease k-infinity for 800 K and above for V_{mod}/V_{fuel} ≤ 5.0.
  - Case 9: DBRC tends to decrease k-infinity for 500 K and above for 5 ≤ H:fissile ≤ 1000.
  - Case 10: DBRC tends to decrease k-infinity for 500 K and above for 1 ≤ H:fissile ≤ 350.
  - Case 12: DBRC tends to decrease k-infinity for 500 K and above for 5 ≤ H:fissile ≤ 1500.
  - Case 13: DBRC tends to decrease k-infinity for 500 K and above for H:fissile >10.
  - Case 14: DBRC tends to decrease k-infinity for 500 K and above for 3 < H:fissile ≤ 1000.
  - Case 15: DBRC tends to decrease k-infinity for 500 K and above for 3 < H:fissile ≤ 200.
- With absorber
  - Case 4; DBRC tends to decrease k-infinity for 800 K and above for 15 < H:fissile ≤ 350.
  - Cases 5, 6 and 7: Difference is not statistically significant.
  - Case 8: DBRC tends to decrease k-infinity for 1073 K for V_{mod}/V_{fuel} ≤ 5.0.
  - Case 9: DBRC tends to decrease k-infinity for 800 K and above, for 3 ≤ H:fissile ≤ 200.
  - Case 10: DBRC tends to decrease k-infinity for 800 K and above, for 3 ≤ H:fissile ≤ 200.
  - Case 12: DBRC tends to decrease k-infinity for 800 K and above, for H:fissile ≥ 3.
  - Case 13: DBRC tends to decrease k-infinity for 800 K and above, for 15≤ H:fissile ≤ 200.
  - Case 14: DBRC tends to decrease k-infinity for 800 K and above, for 5 ≤ H:fissile ≤ 150.
  - Case 15: DBRC tends to decrease k-infinity for 800 K and above, for 3 ≤ H:fissile ≤ 100.

An explanation for these observations is that the resonance scattering effect, accounted for by the DBRC method, has the most significant impact on k-infinity for the following conditions:

- Intermediate moderation levels produce a neutron spectrum with a larger flux around the large U-238 capture cross section resonances at neutron energies of 6, 20 and 37 eV.
- The significant Doppler broadening of these resonances at and above 500 K increases the impact of the DBRC method on the capture cross section.

The inclusion of the boron absorber reduces the impact of the DBRC method at higher moderation levels as the neutron flux is reduced. In terms of temperature, it is evident that the extent of the Doppler broadening at and above 800 K is sufficient to mean the DBRC method still has a significant effect whereas at 500 K, the Doppler broadening effect is not sufficient to balance the reduction in neutron flux.

A.6 Change in Bound Scattering Data

As described above, the cases with a water moderator were run with ice bound scattering data at and below 273.15 K and with the water bound scattering data at and above 273.15 K. Where it was relevant the density of the moderator was set at 0.92 g/cc or 1.00 g/cc to correspond with ice or water. As has already been observed, the change from ice to water not only changes the moderator density but also the boron concentration for the absorber cases.

Therefore, in order to isolate the effect of changing the bound scattering data alone, the reference cases were compared against the free gas scattering cases at 273.15 K. For the cases with and without the absorber the following differences were determined;

$\Delta k_{free\text{-}ice} = k_{free}\ (\rho=0.92\text{ g/cc}) - k_{ref}\ (\rho=0.92\text{ g/cc, ice data})$

$\Delta k_{free\text{-}water} = k_{free}\ (\rho=1.00\text{ g/cc}) - k_{ref}\ (\rho=1.00\text{ g/cc, water data})$

These two quantities estimate the difference in k-infinity due to using bound scattering data rather than the free gas scattering model, with the moderator and boron densities being equal. From this, the difference between the use of ice and water bound scattering data is estimated as;

$\Delta k_{ice\text{-}water} = k_{free\text{-}water} - k_{free\text{-}ice}$

As this quantity is a difference of two differences, it has a statistical uncertainty of 2σ, where σ = 20 pcm, the stochastic uncertainty on the k-infinities calculated by MONK. Therefore, to be statistically significant, $|\Delta k_{ice\text{-}water}|$ should be greater than 120 pcm.

For the cases without the absorber, the three Δk values are given in Table C-15 and Table C-16. For the cases with the absorber, the three Δk values are given in Table C-17 and Table C-18. The columns containing the key value, $\Delta k_{ice\text{-}water}$ are highlighted.

For the homogeneous cases (3, 4, 9 and 10), there was no statistically significant effect of changing from the ice to the water bound scattering data for either the cases with or without the absorber, with one exception. This is that for Case 3 without the absorber, the use of water data increased k-infinity by up to 190 pcm at medium moderation levels.

It is reasonable to expect the bound scattering data to be insignificant in these cases as, for a homogeneous mixture, the change to the scattering cross section relative to the magnitude of the fission and capture cross sections has less significance than for a pure moderator material. For an infinite system there is no neutron leakage, which could be sensitive to changes in the neutron spectrum that occur due to changes in the scattering data.

For the heterogeneous cases without the absorber, Cases 5 and 8 showed a significant decrease in k-infinity when using the water data. Case 7 also showed a decrease in k-infinity at higher moderation levels but this is barely significant. It is possible that the change in scattering data reduces the neutron interaction between the fuel pins in the infinite array of pins, thereby reducing k-infinity. For the heterogeneous cases with the absorber, there are some moderation levels that showed a decrease in k-infinity greater than 120 pcm but there is no clear trend in the results. Similar to the homogeneous cases, it is possible that the change in scattering data is not significant compared to the capture cross section of the moderator/boron mixture. Also, k-infinity is very low and it is likely that presence of boron in the moderator significantly reduces the thermal neutron flux thereby making the system insensitive to the choice of bound thermal scattering data.

B Trend Figures

This appendix provides the figures which demonstrate the reactivity trends discussed in Section 3 and Appendix A.

The results for one calculation case are presented one case per page, and consist of five individual figures;

1. Absolute k-infinity as a function of moderation. Each curve is a different temperature. This is the full-width plot at the top of the page.
2. Absolute difference in k-infinity ($k_{temp} - k_{293}$) as a function of moderation. Each curve is a different temperature. This is the left-hand half-width plot in the middle of the page.
3. Relative difference in k-infinity ($[k_{temp} - k_{293}]/k_{293}$) as a function of moderation. Each curve is a different temperature. This is the right-hand half-width plot in the middle of the page.
4. Absolute difference in k-infinity ($k_{temp} - k_{293}$) as a function of temperature. Each curve is a different moderation. This is the left-hand half-width plot at the bottom of the page.
5. Relative difference in k-infinity ($[k_{temp} - k_{293}]/k_{293}$) as a function of temperature. Each curve is a different moderation. This is the right-hand half-width plot at the bottom of the page.

The y-axis units for the latter four plots are 'pcm' (per cent mille = 0.00001).

For the homogeneous systems (Cases 1-4 and 9-15), the moderation is defined by the H:fissile ratio. For the heterogeneous systems, it is more physically sensible to define the moderation by volume ratios (V_{mod}/V_{fuel}) for Cases 5, 6 and 8 and by the moderator density (in g/cc) for Case 7.

In total 30 cases are presented here. In order they are;

- Figure B-1 to Figure B-15 are Cases 1 to 15, without the absorber, using bound thermal scattering treatment for the moderator, case number is suffixed 'b0', 15 figures in total.
- Figure B-16 to Figure B-30 are Cases 1 to 15, with the absorber, using bound thermal scattering treatment for the moderator, case number is suffixed 'ba', 15 figures in total.

Note that the text at the top of each figure refers to the MONK calculation name and has been embedded in the image for verification purposes.

The supporting data for these figures are given in Table C-1 through Table C-6.

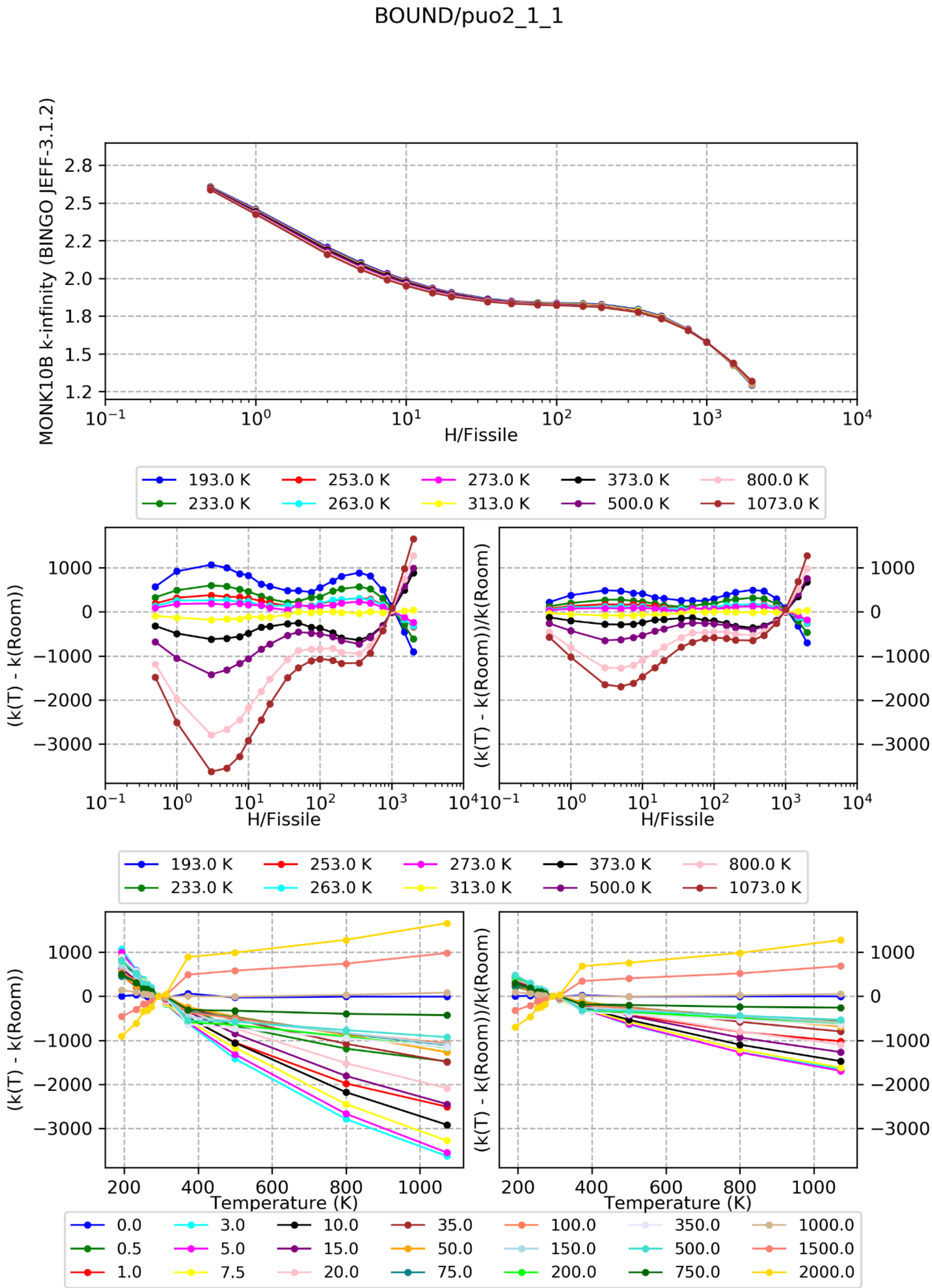

Figure B-1: Case 1b0: Pu 100% oxide / polythene mixture

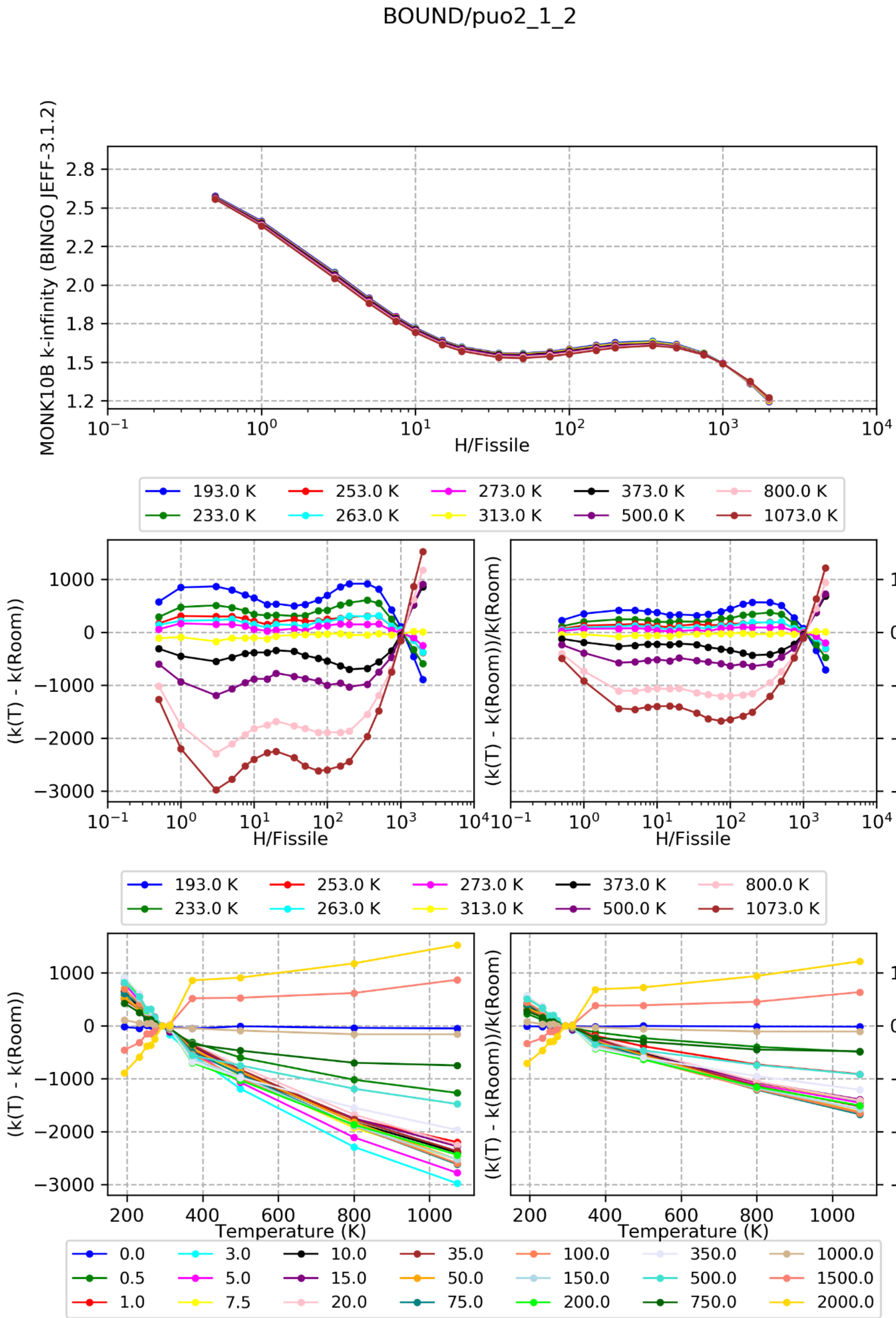

Figure B-2: Case 2b0: Pu 90% oxide / polythene mixture

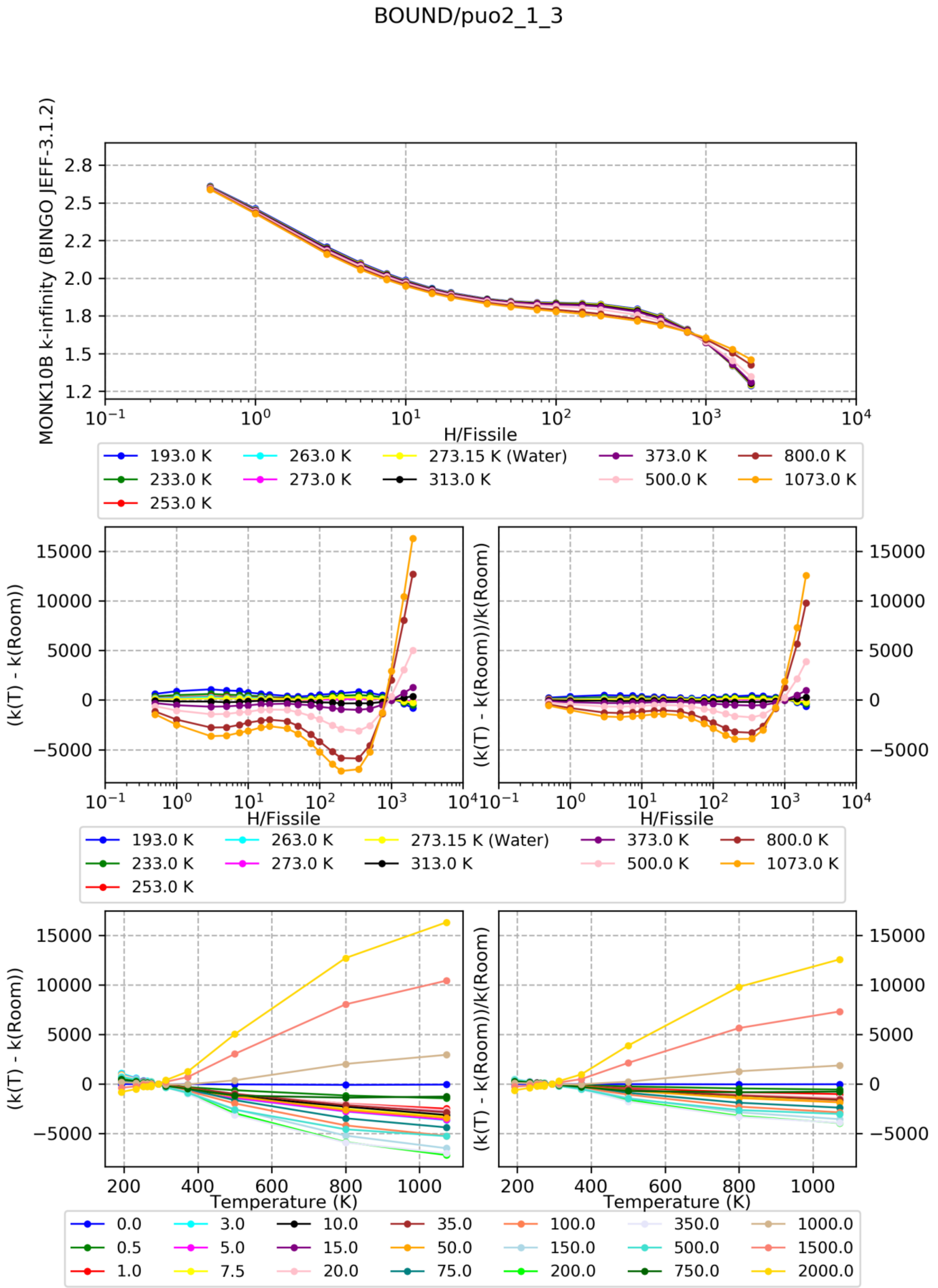

Figure B-3: Case 3b0: Pu 100% oxide / water mixture

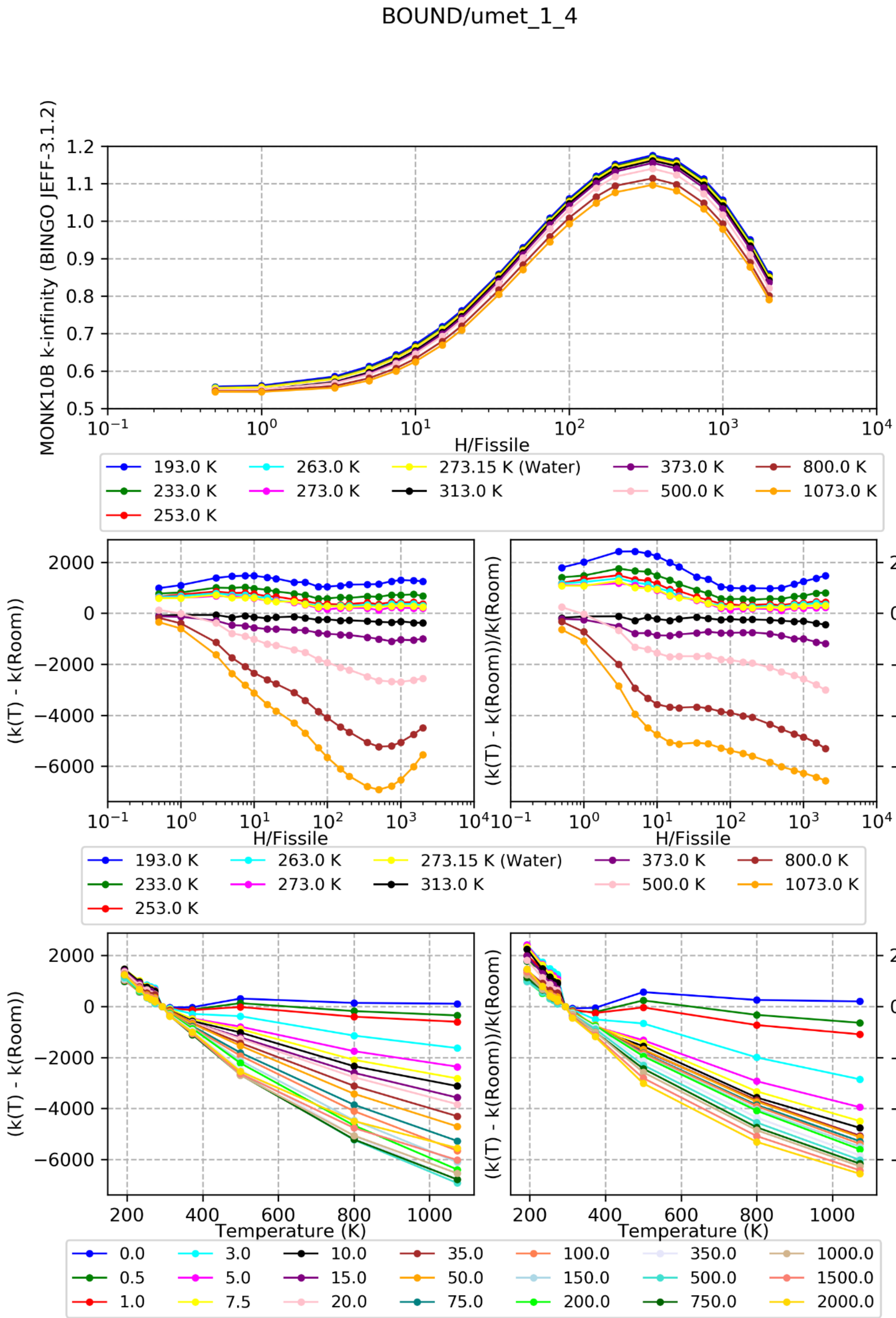

Figure B-4: Case 4b0: U 1.6% metal / water mixture

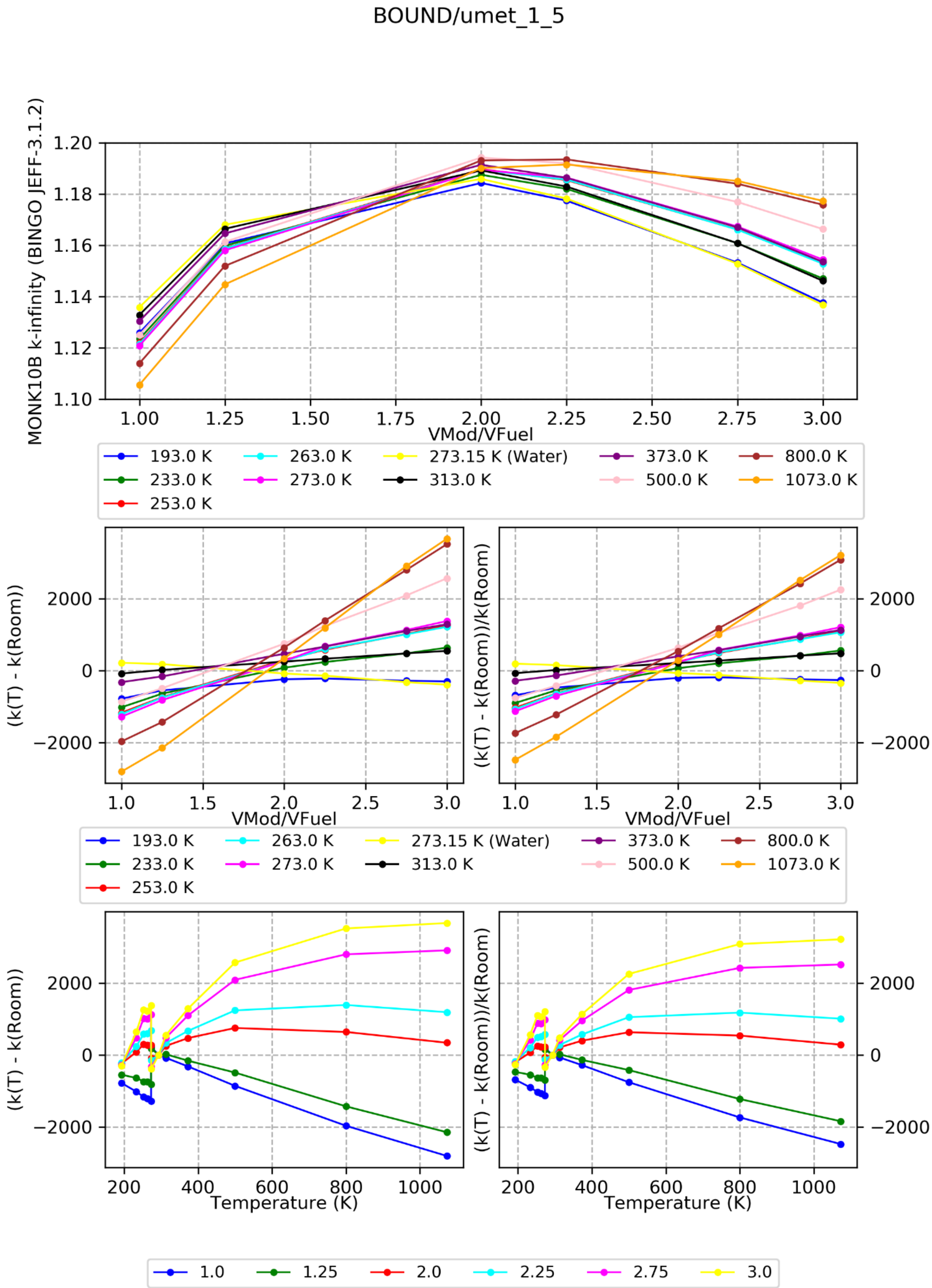

Figure B-5: Case 5b0: U 1.3% metal fuel rods in water

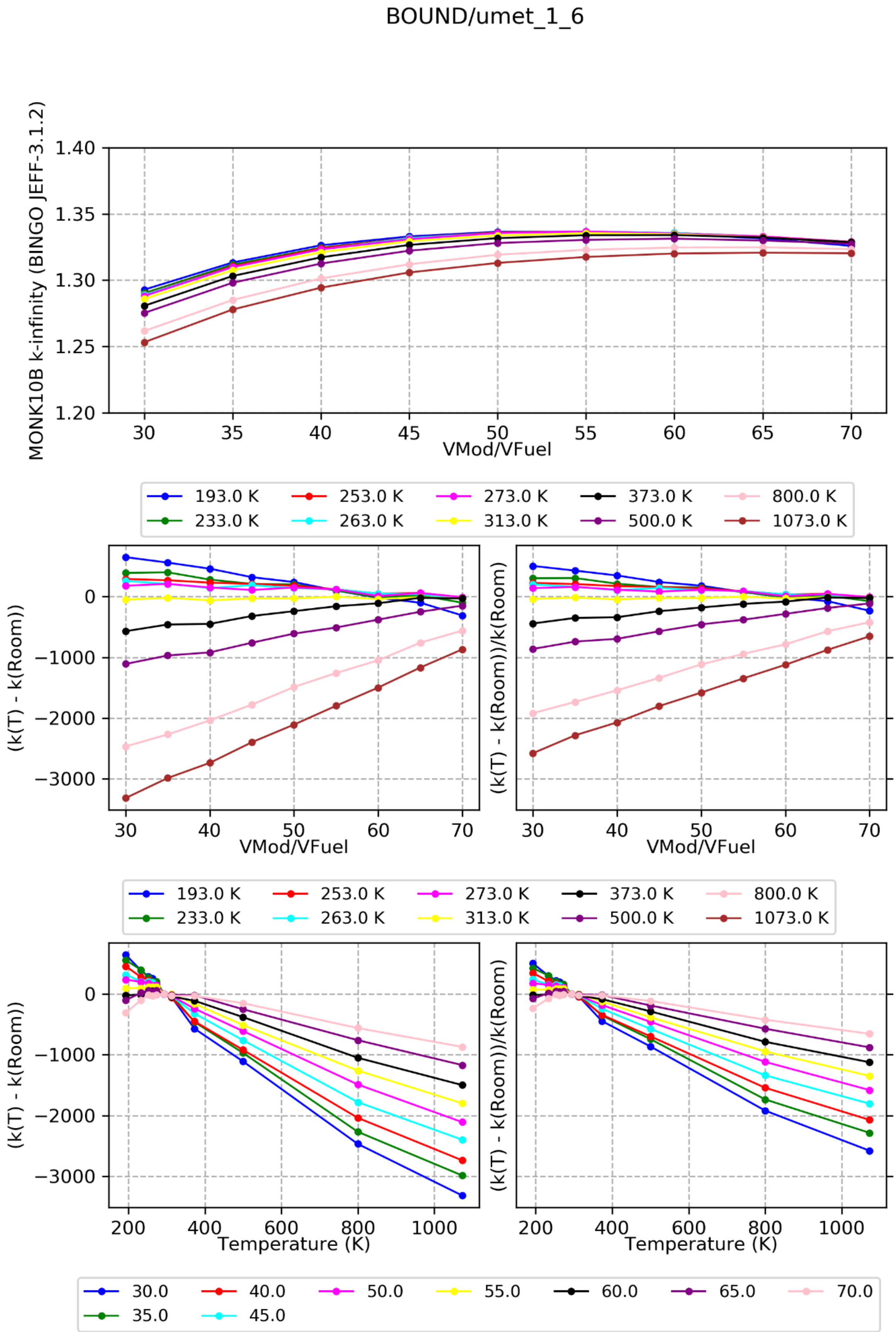

Figure B-6: Case 6b0: U 1.3% metal fuel rods in graphite

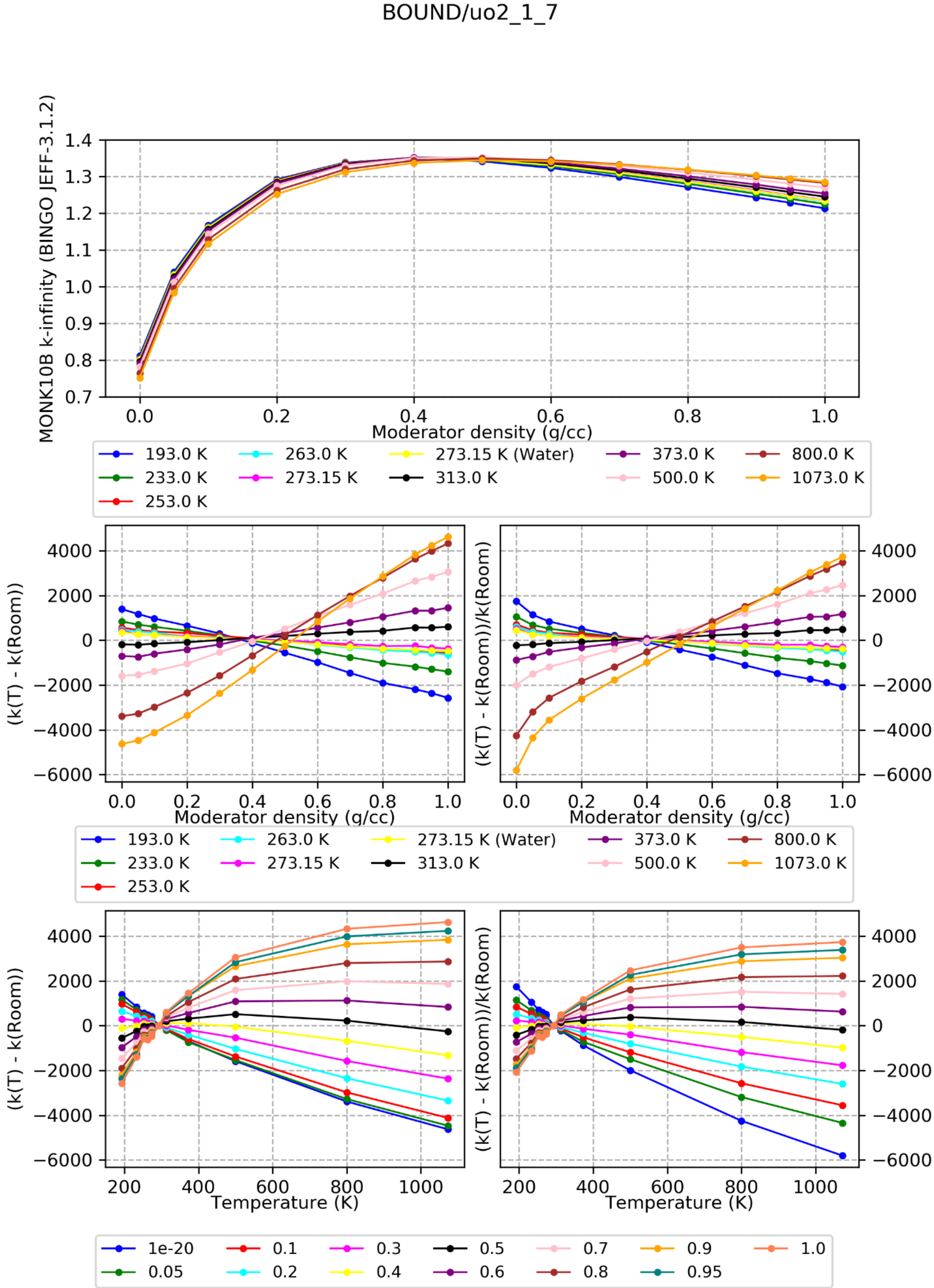

Figure B-7: Case 7b0: U 3% oxide fuel clusters in water

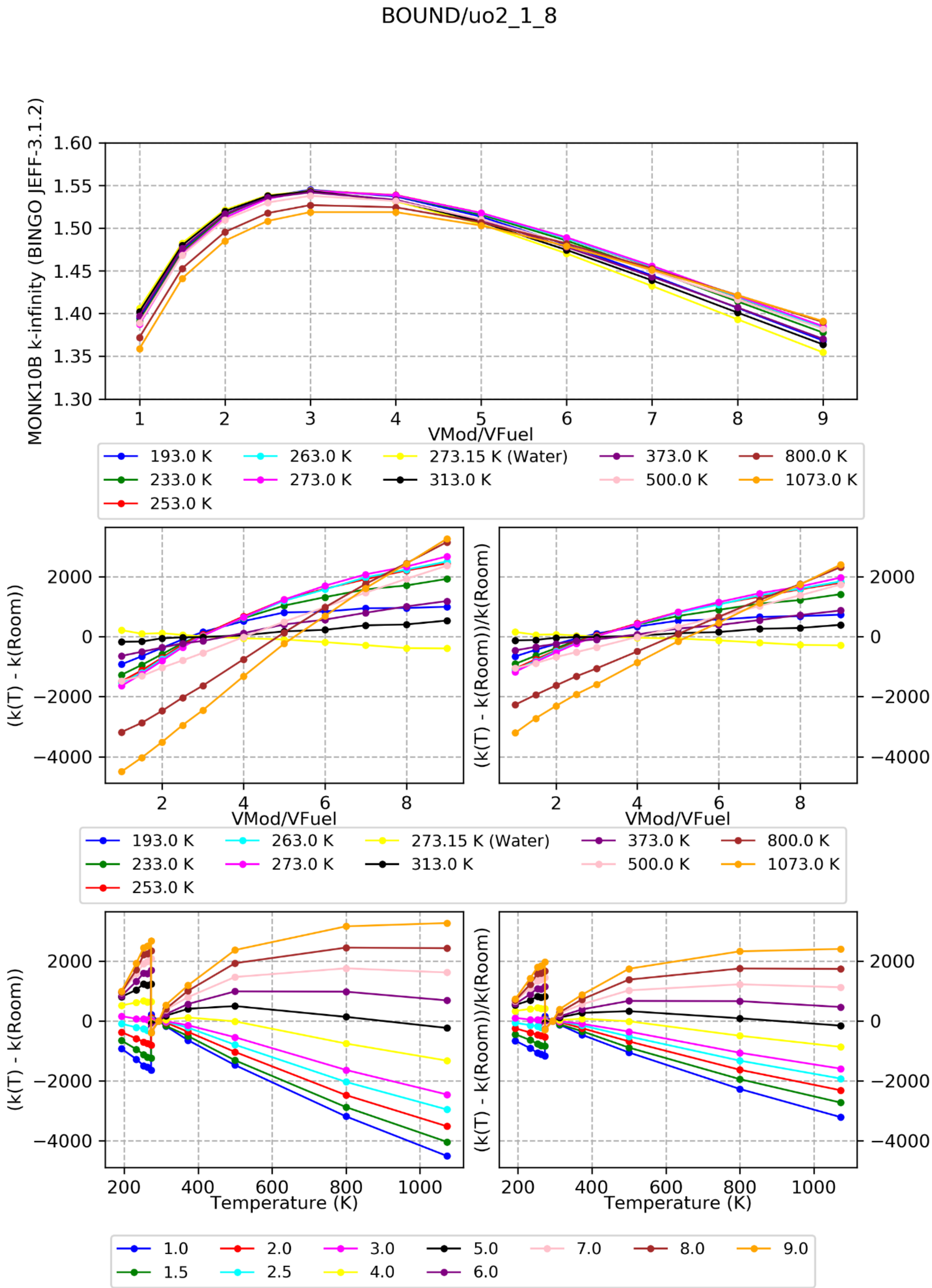

Figure B-8: Case 8b0: U 5% oxide fuel rods in water

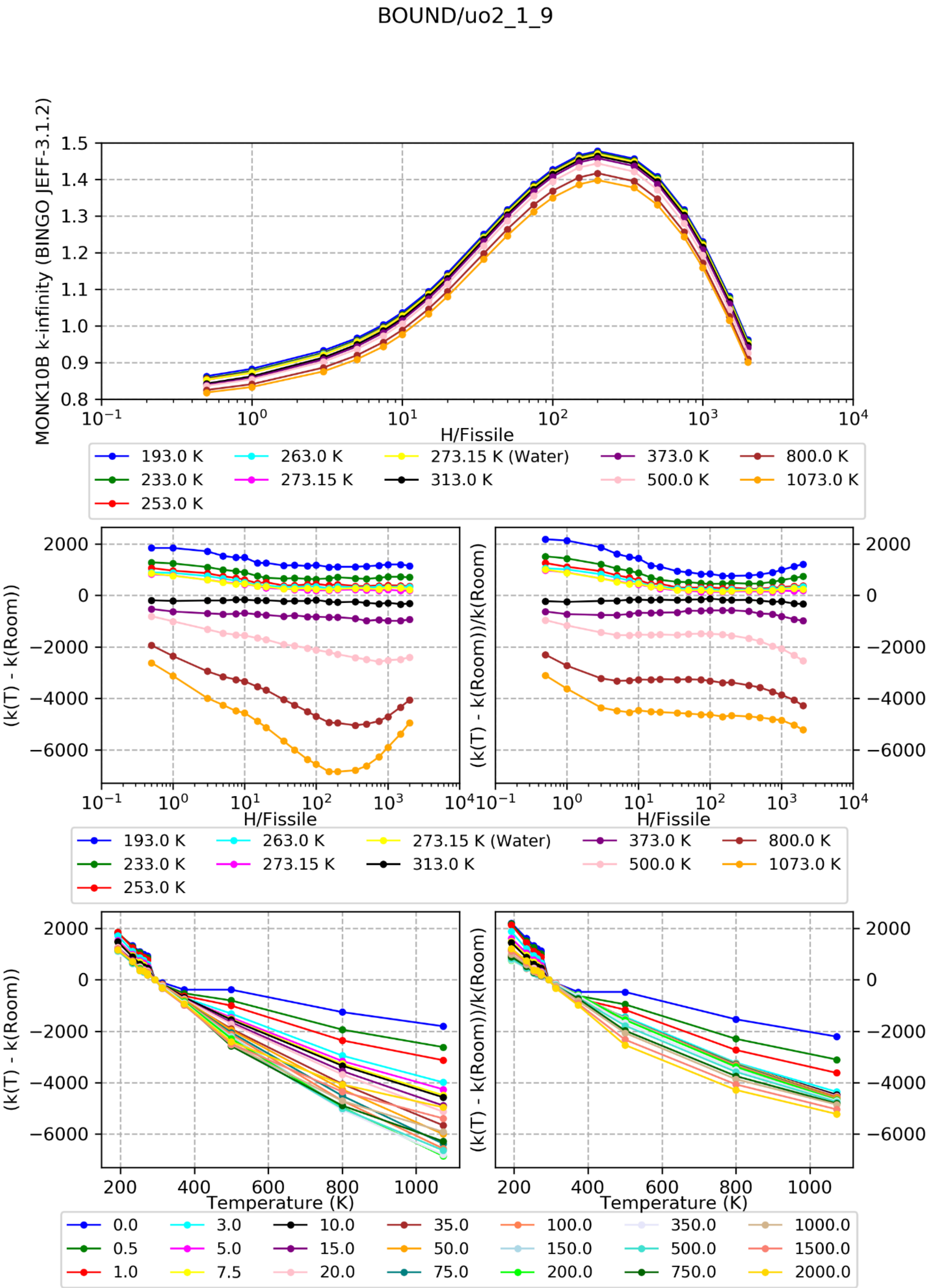

Figure B-9: Case 9b0: U 5% oxide / water mixture

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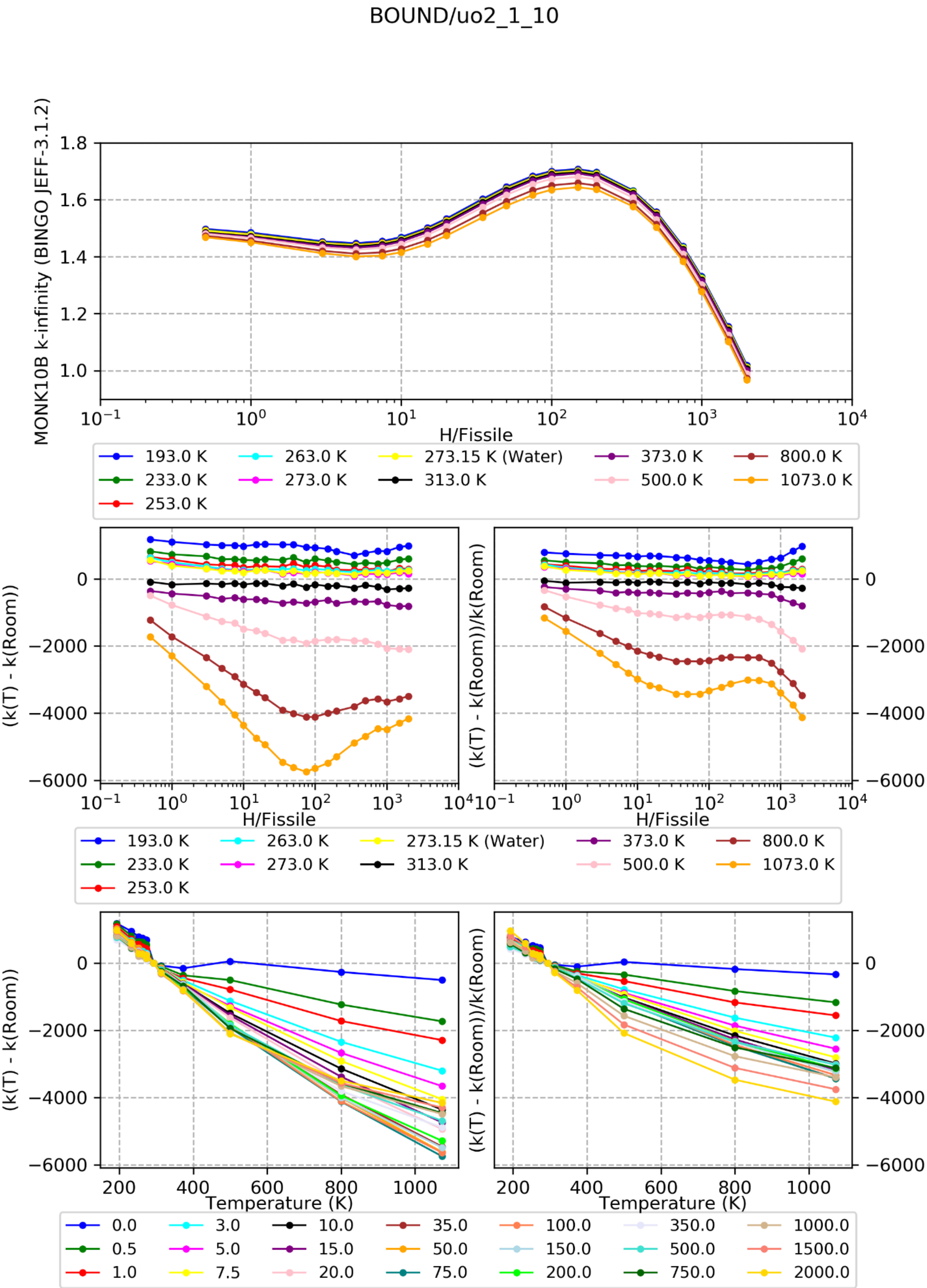

Figure B-10: Case 10b0: U 20% oxide / water mixture

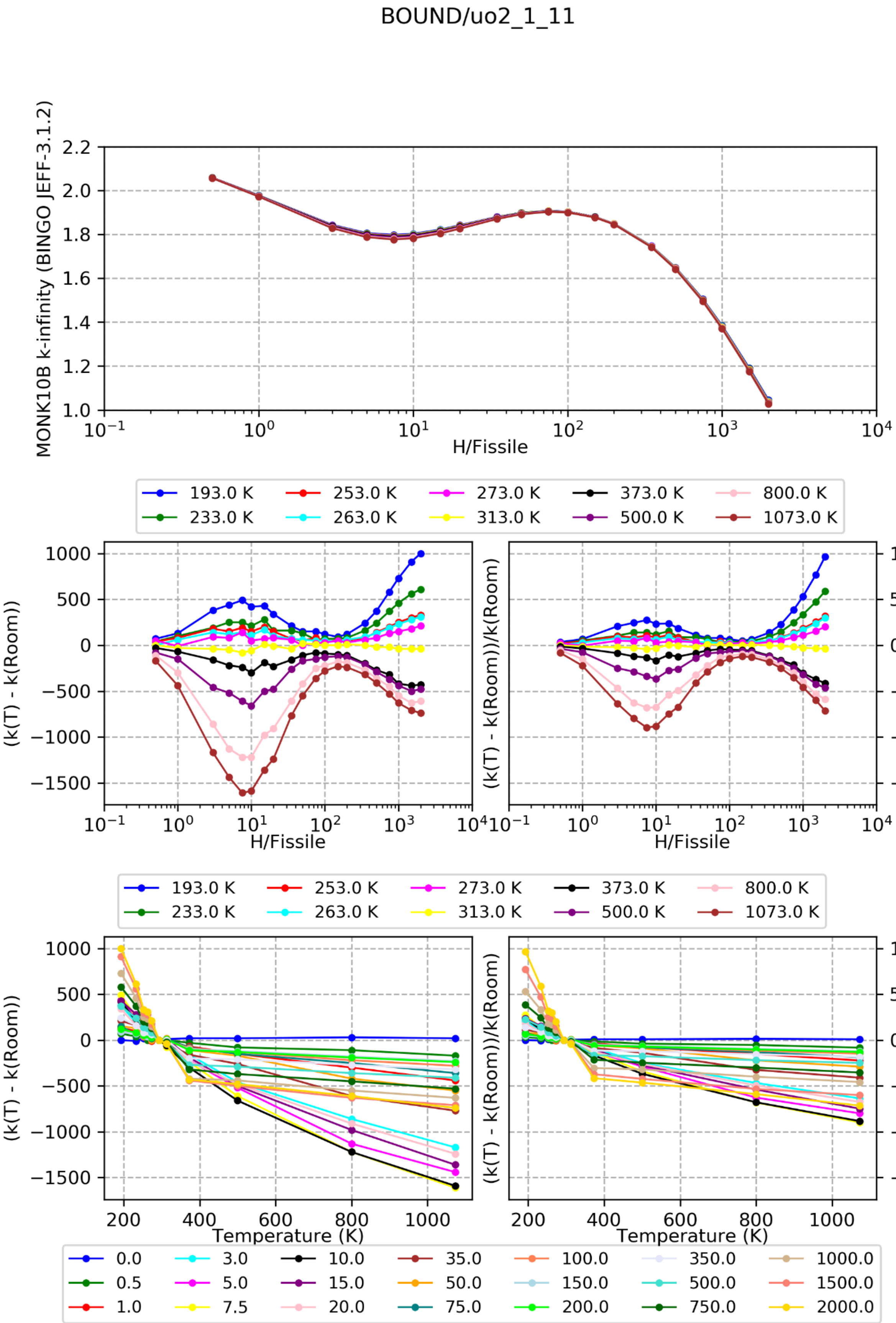

Figure B-11: Case 11b0: U 100% oxide / polythene mixture

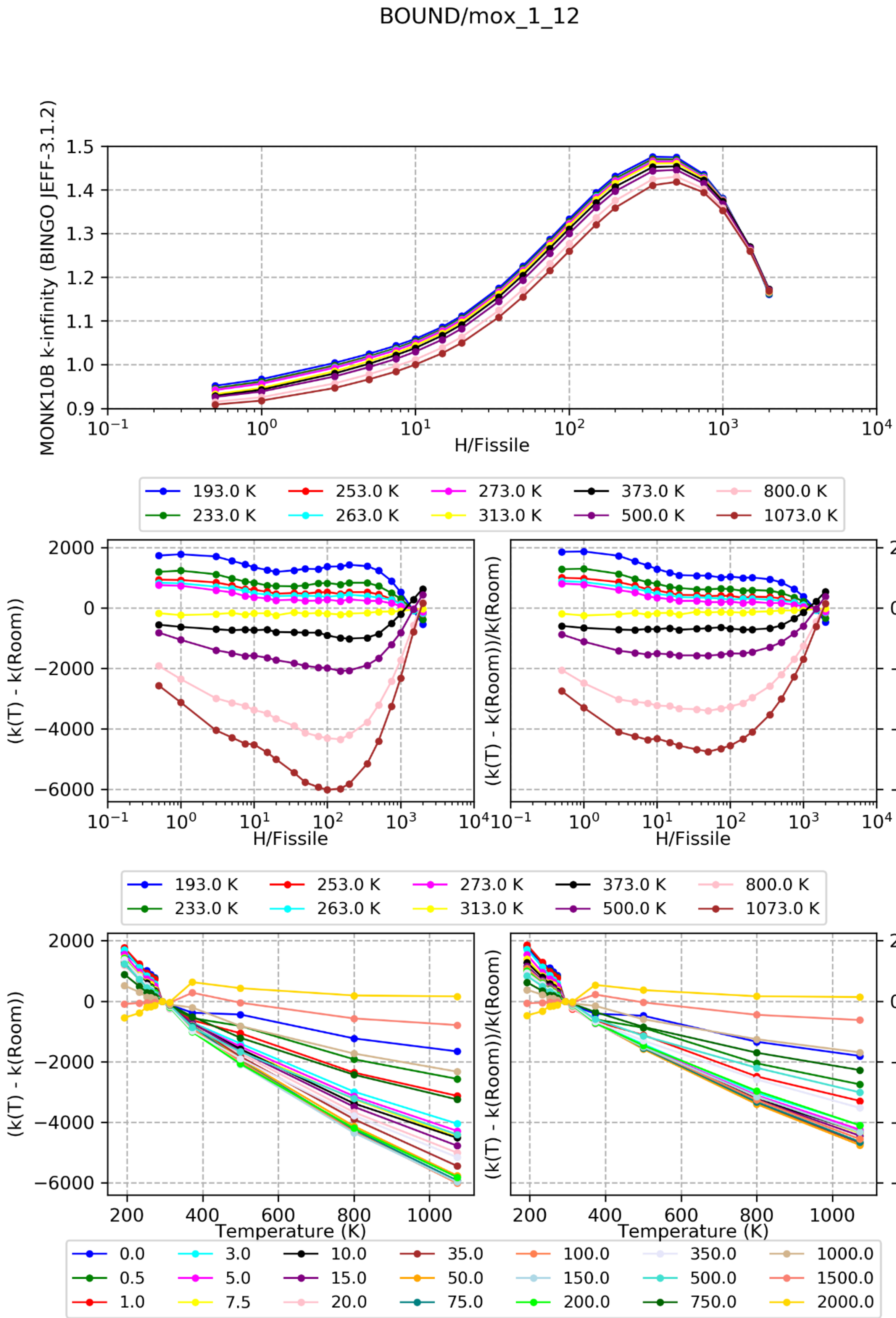

Figure B-12: Case 12b0: Mixed oxide / polythene mixture

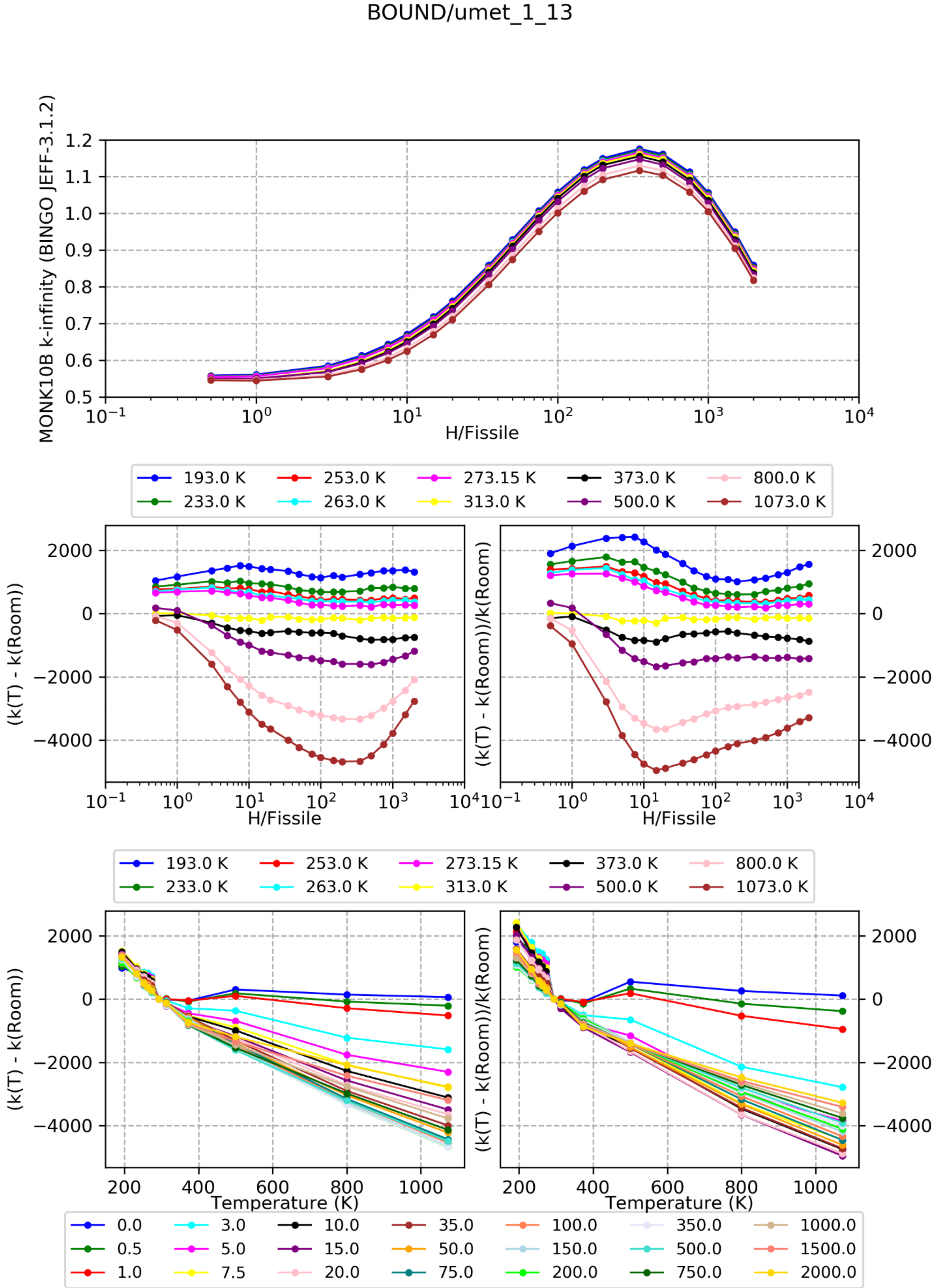

Figure B-13: Case 13b0: U 1.6% metal / polythene mixture

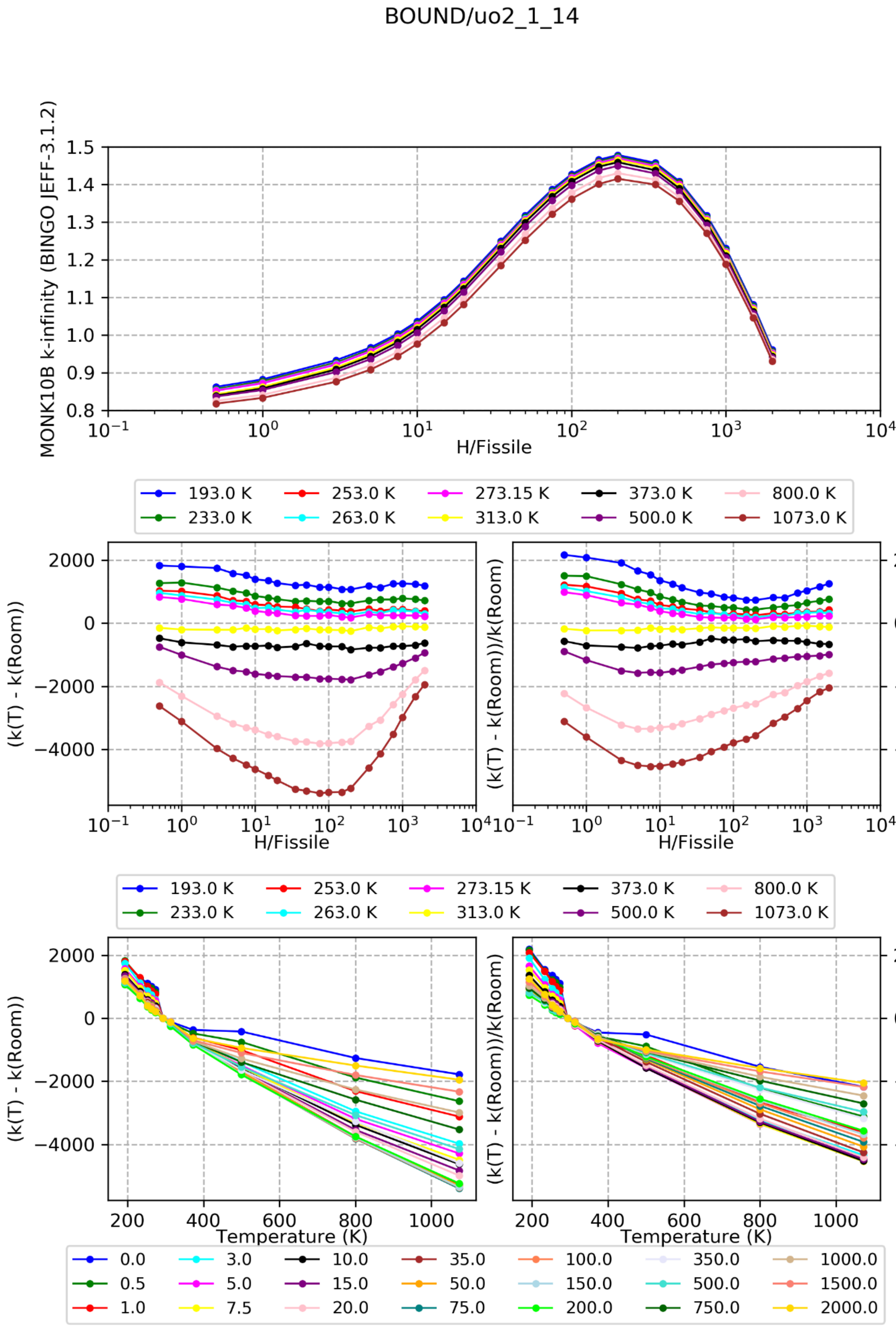

Figure B-14: Case 14b0: U 5% oxide / polythene mixture

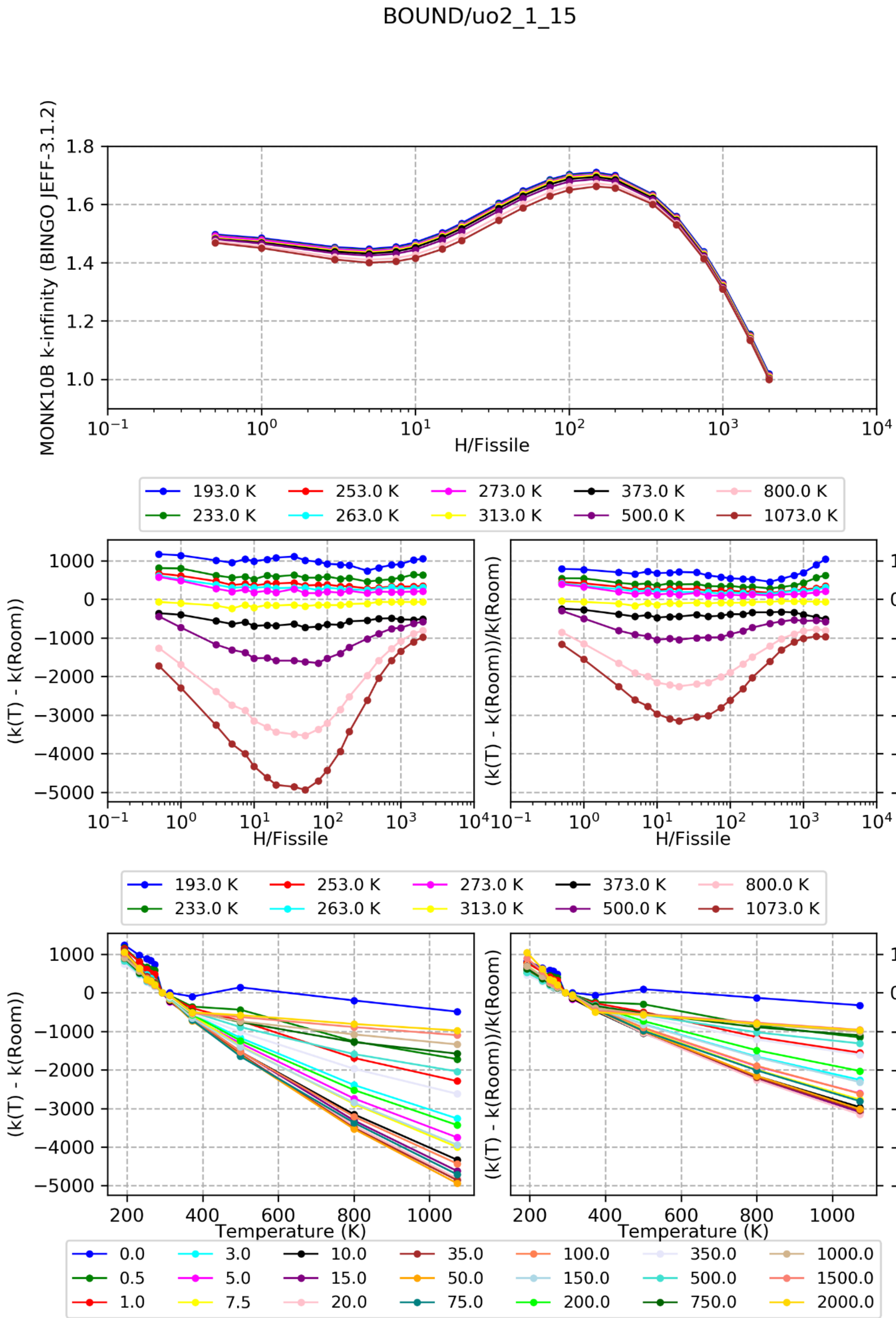

Figure B-15: Case 15b0: U 20% oxide / polythene mixture

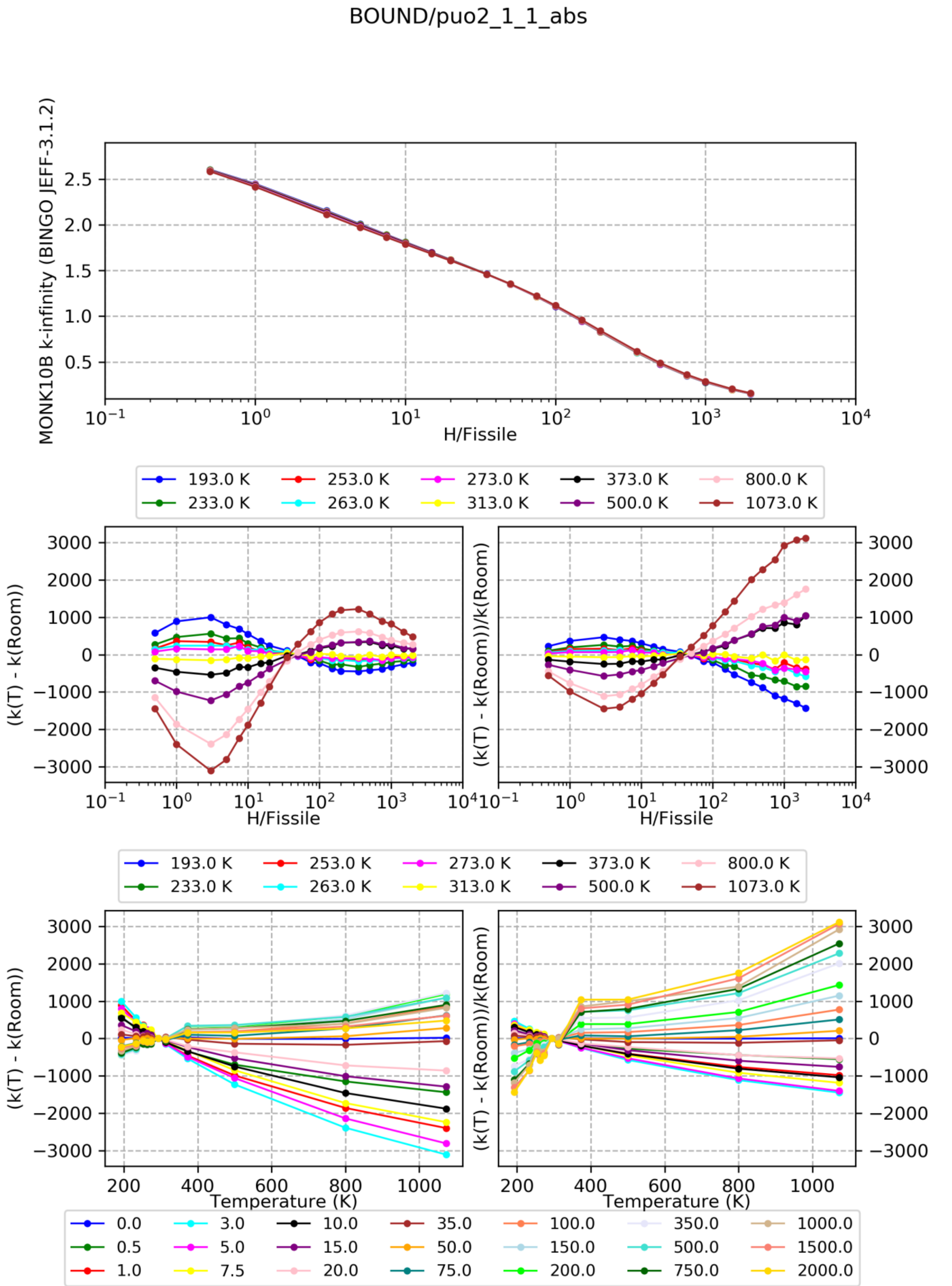

Figure B-16: Case 1ba: Pu 100% oxide / polythene mixture, with absorber

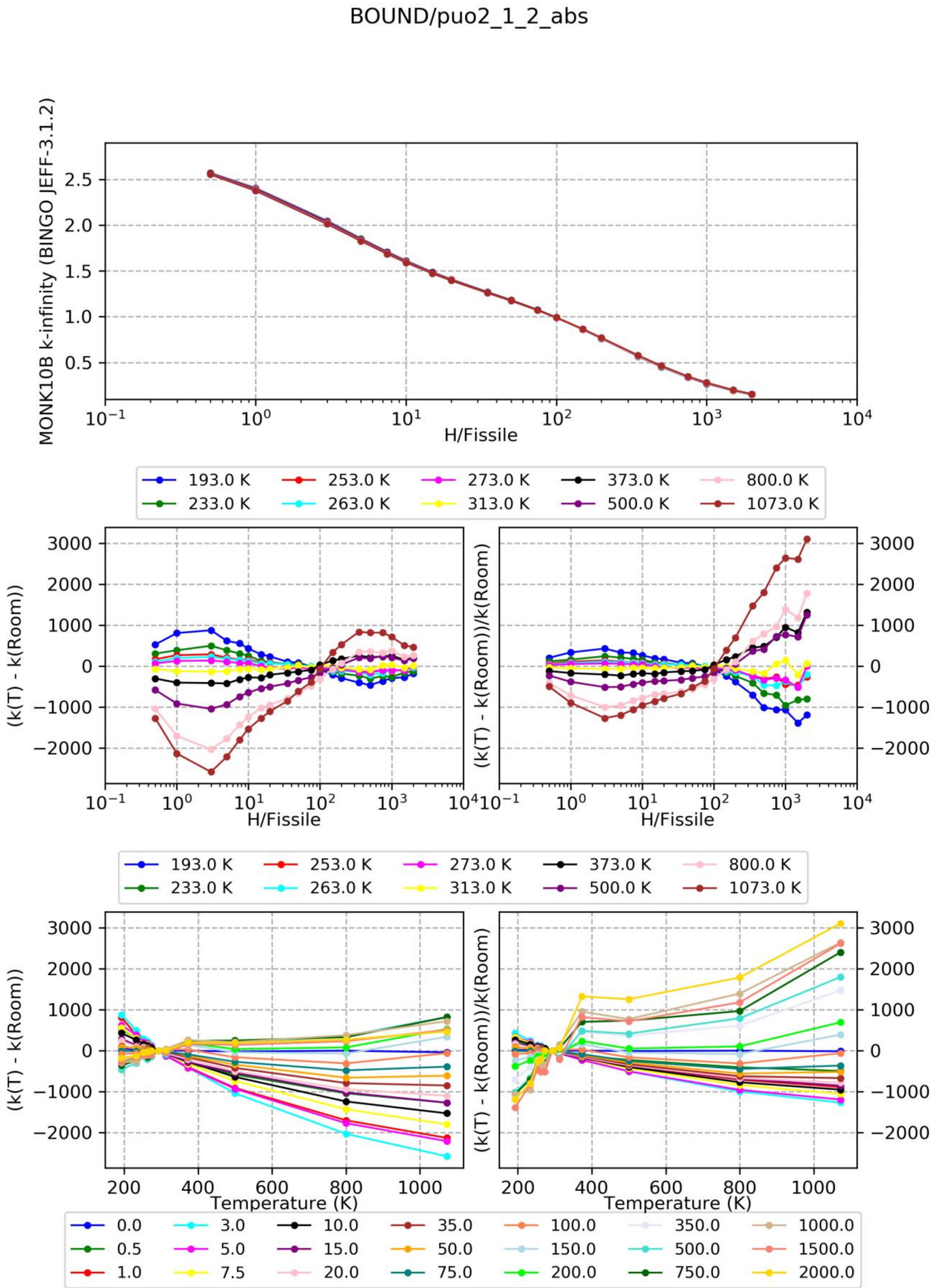

Figure B-17: Case 2ba: Pu 90% oxide / polythene mixture, with absorber

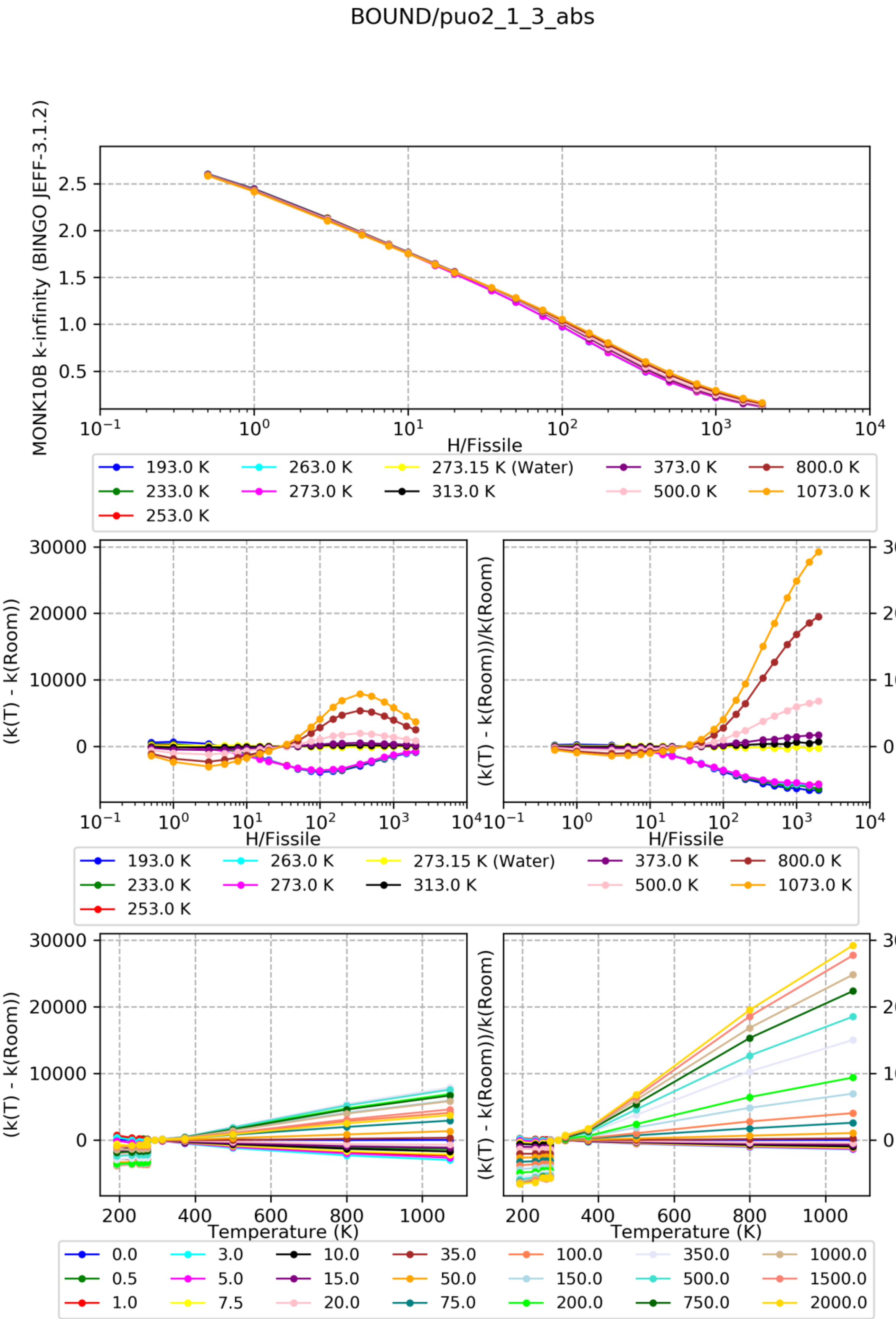

Figure B-18: Case 3ba: Pu 100% oxide / water mixture, with absorber

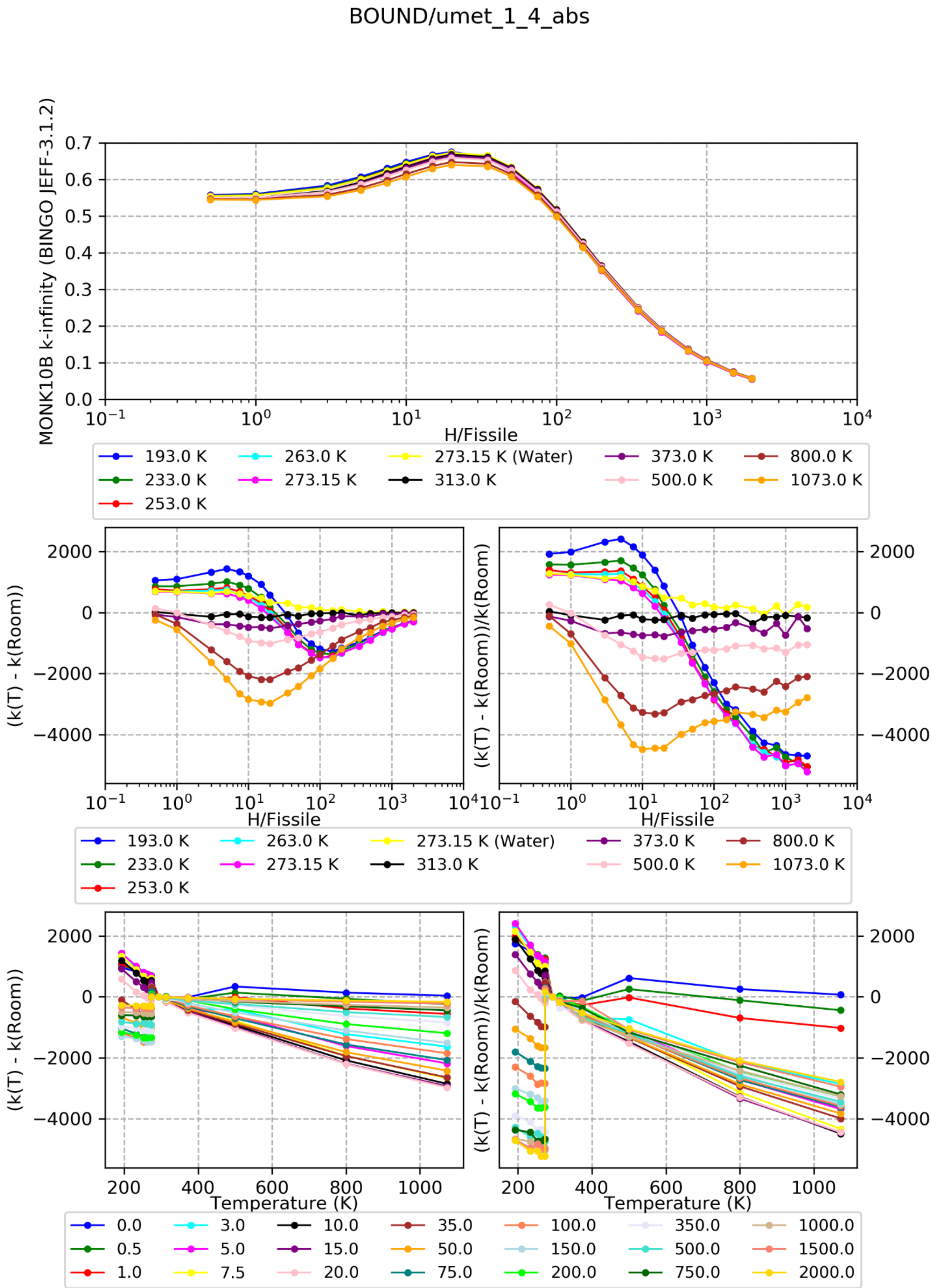

Figure B-19: Case 4ba: U 1.6% metal / water mixture, with absorber

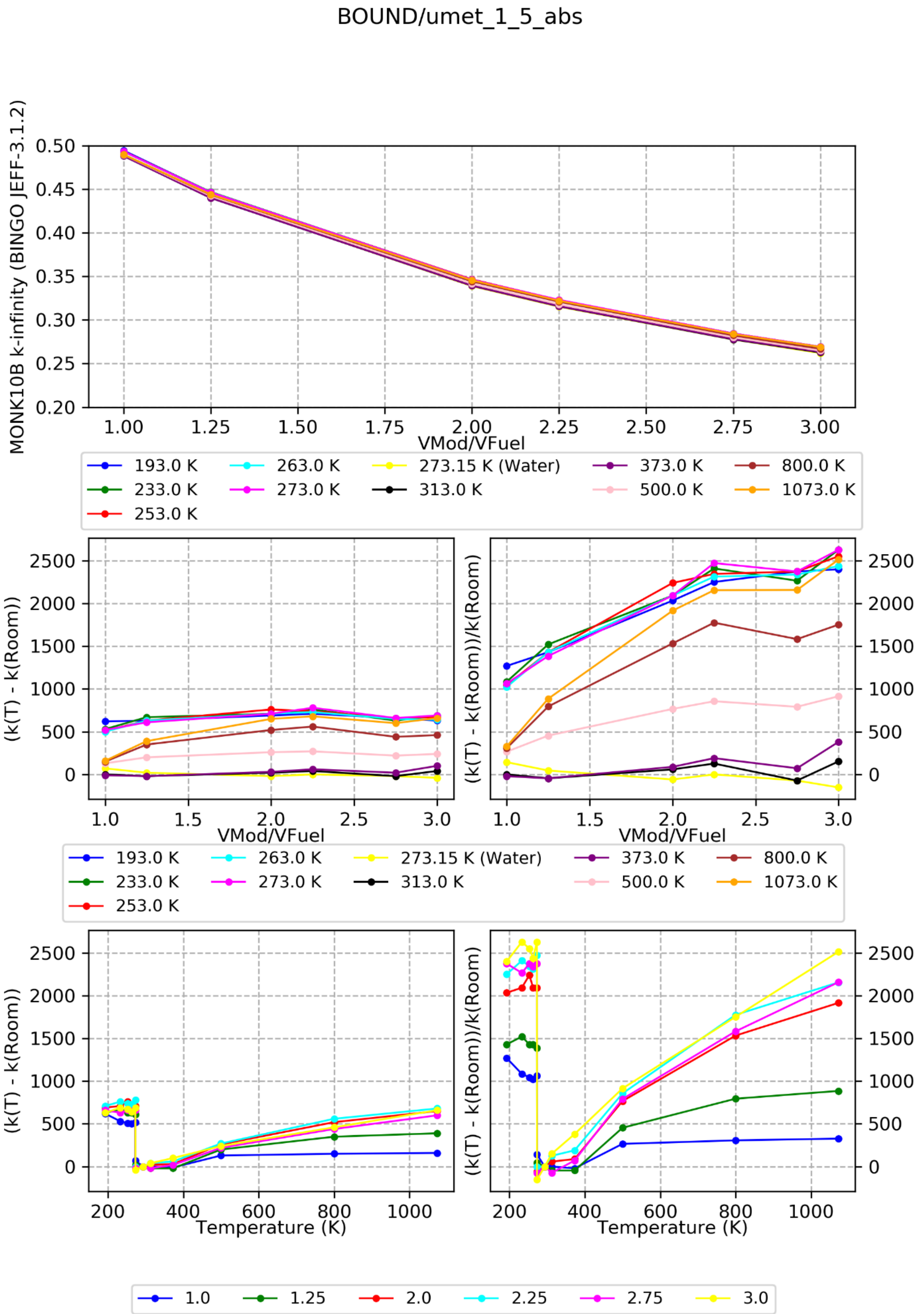

Figure B-20: Case 5ba: U 1.3% metal fuel rods in water, with absorber

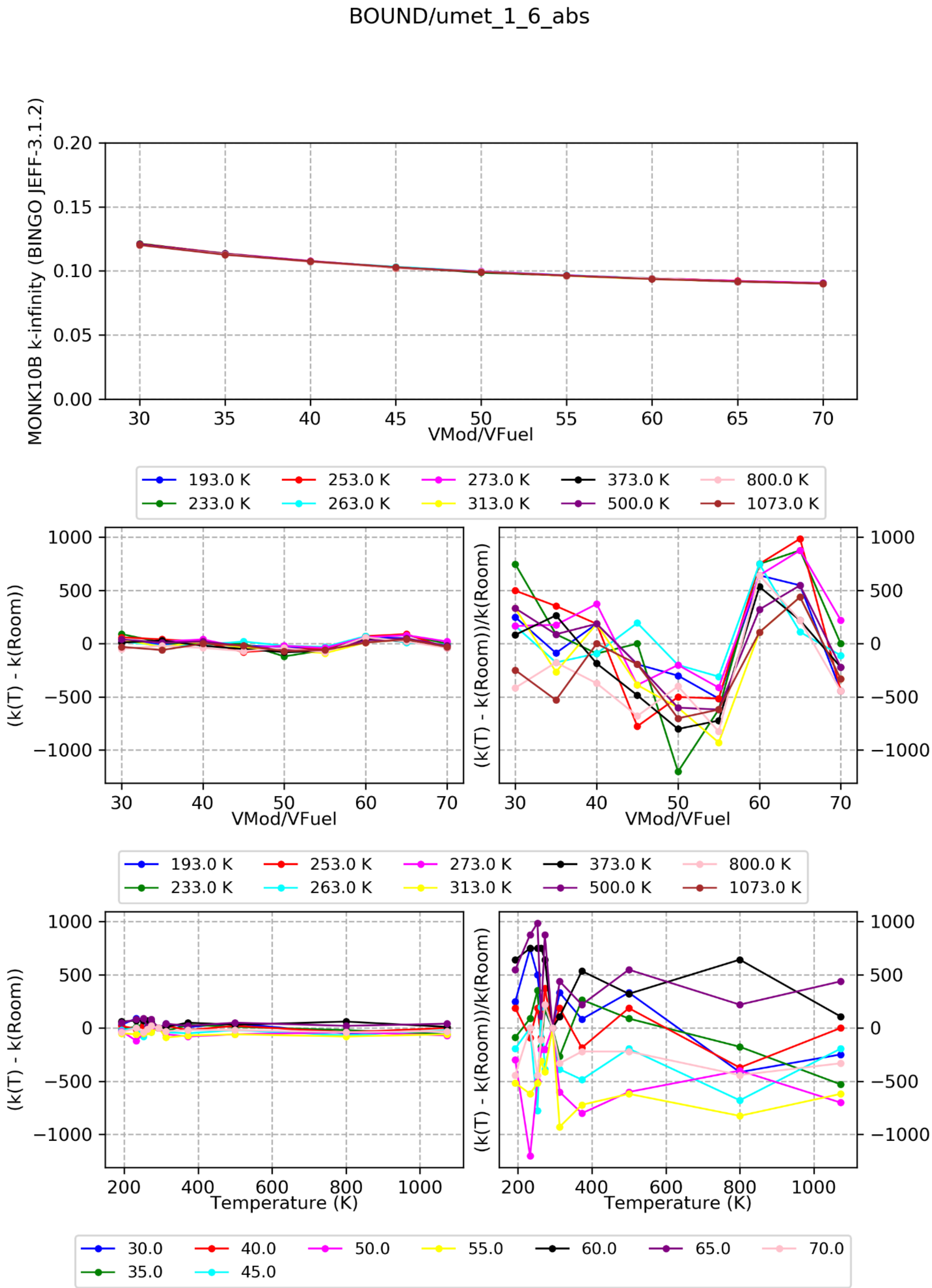

Figure B-21: Case 6ba: U 1.3% metal fuel rods in graphite, with absorber

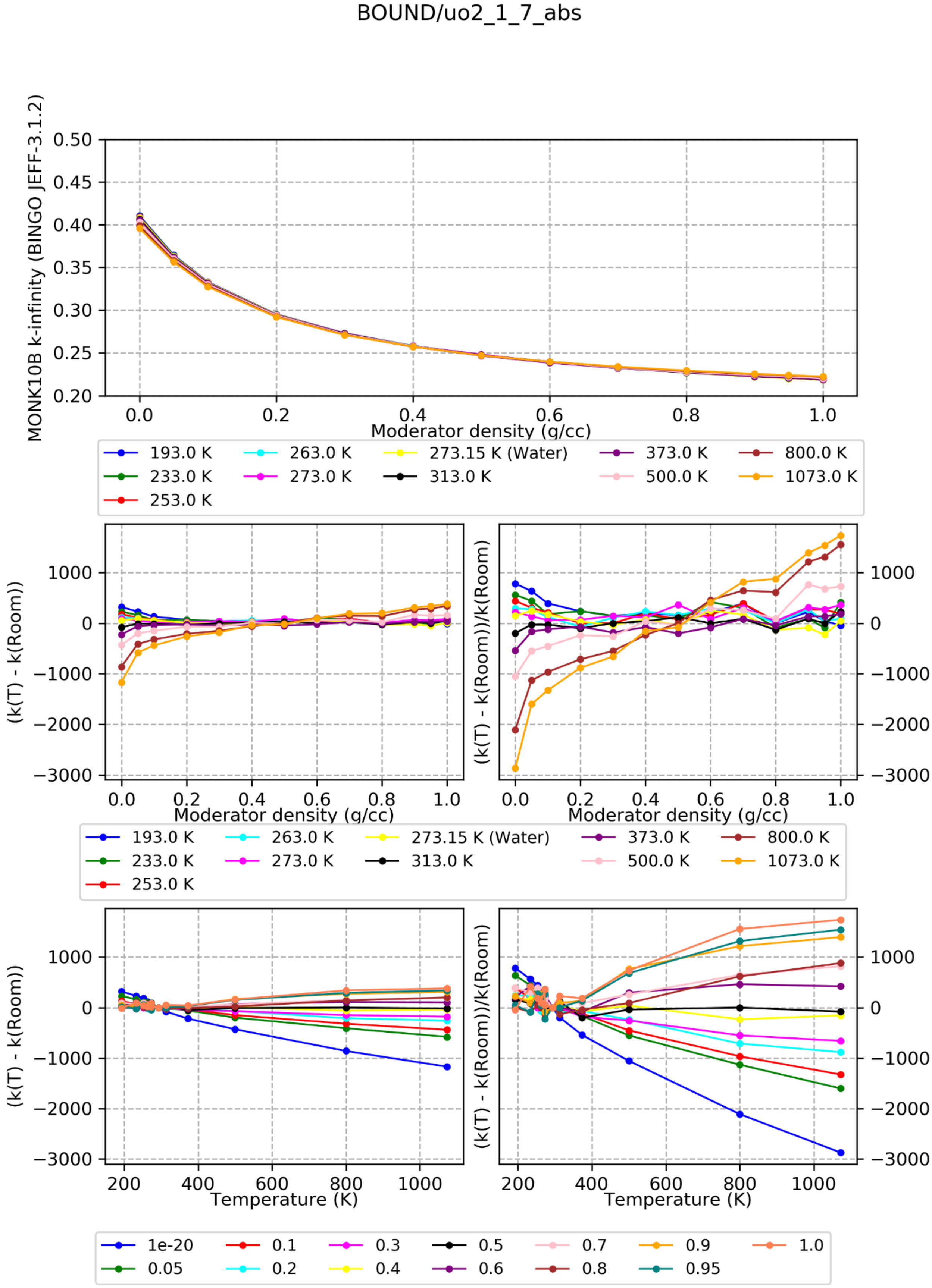

Figure B-22: Case 7ba: U 3% oxide fuel clusters in water, with absorber

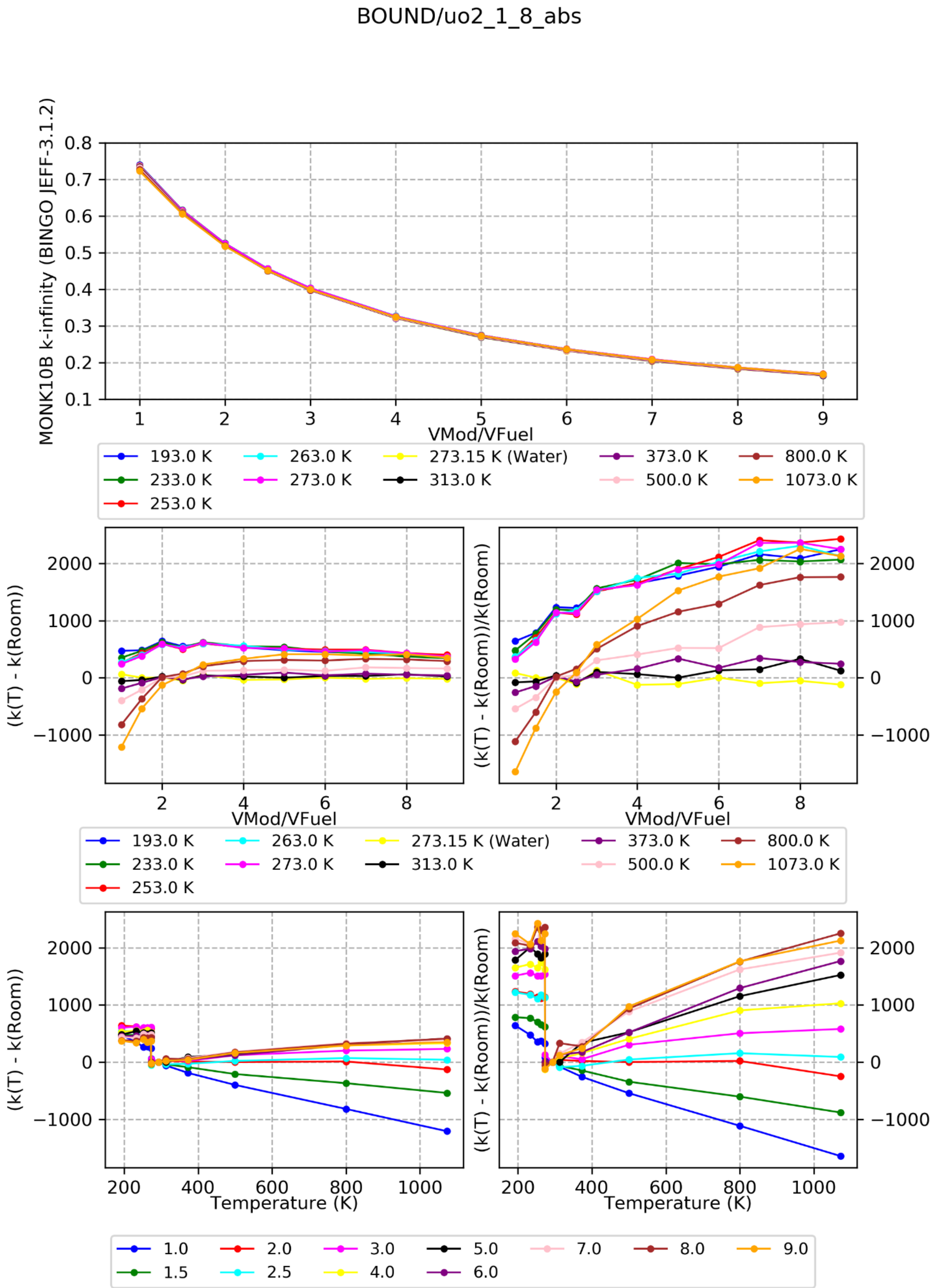

Figure B-23: Case 8ba: U 5% oxide fuel rods in water, with absorber

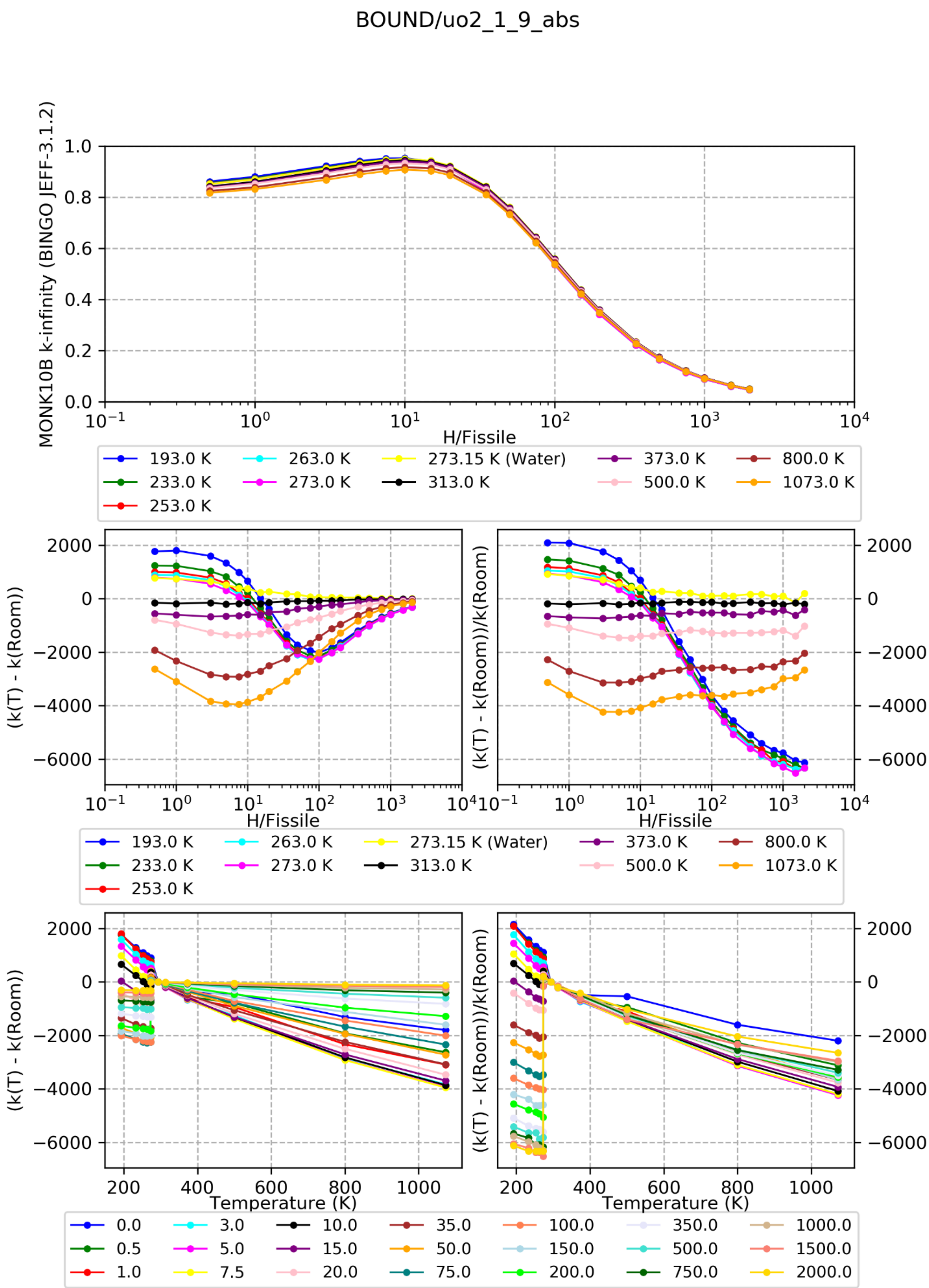

Figure B-24: Case 9ba: U 5% oxide / water mixture, with absorber

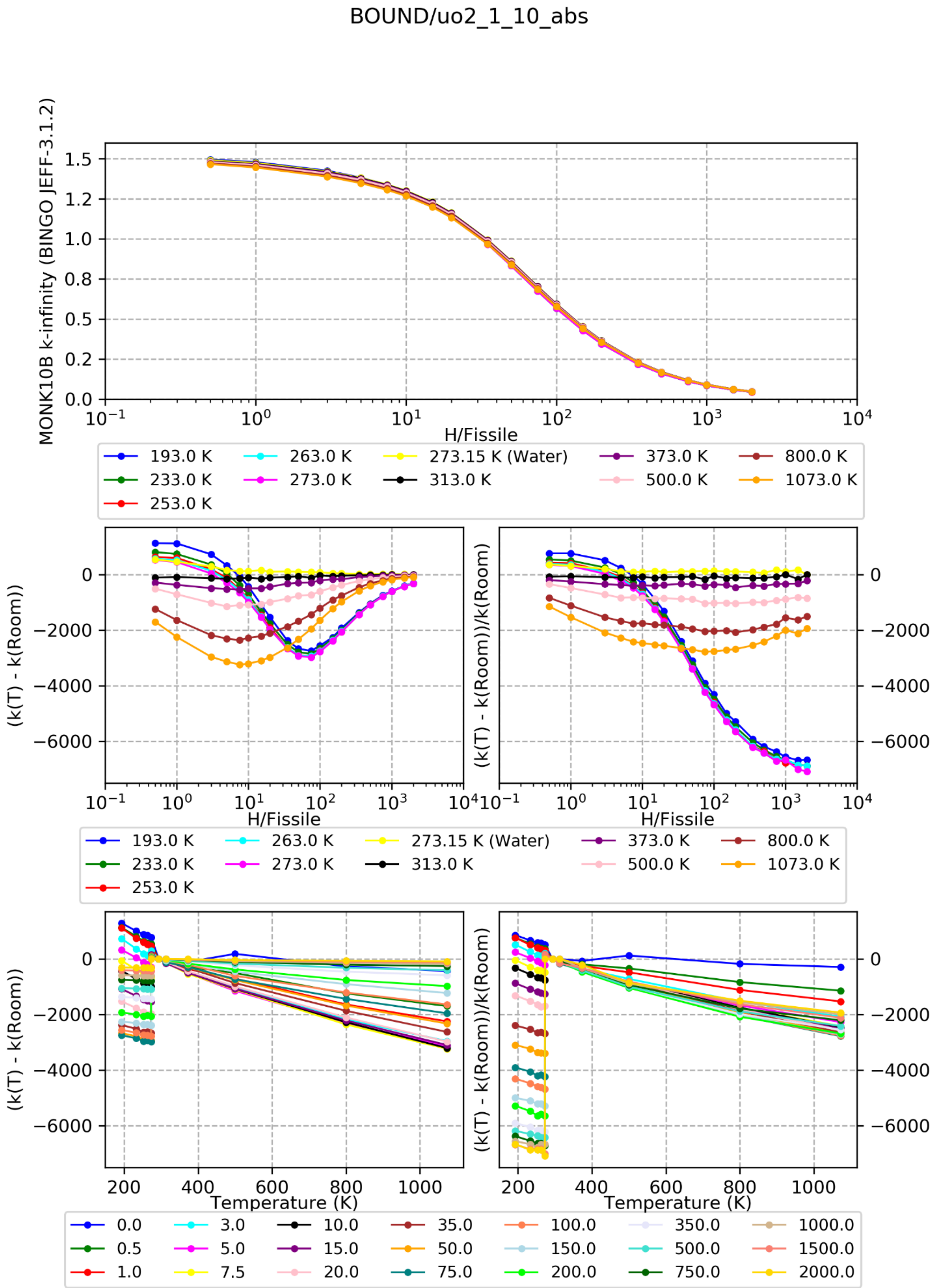

Figure B-25: Case 10ba: U 20% oxide / water mixture, with absorber

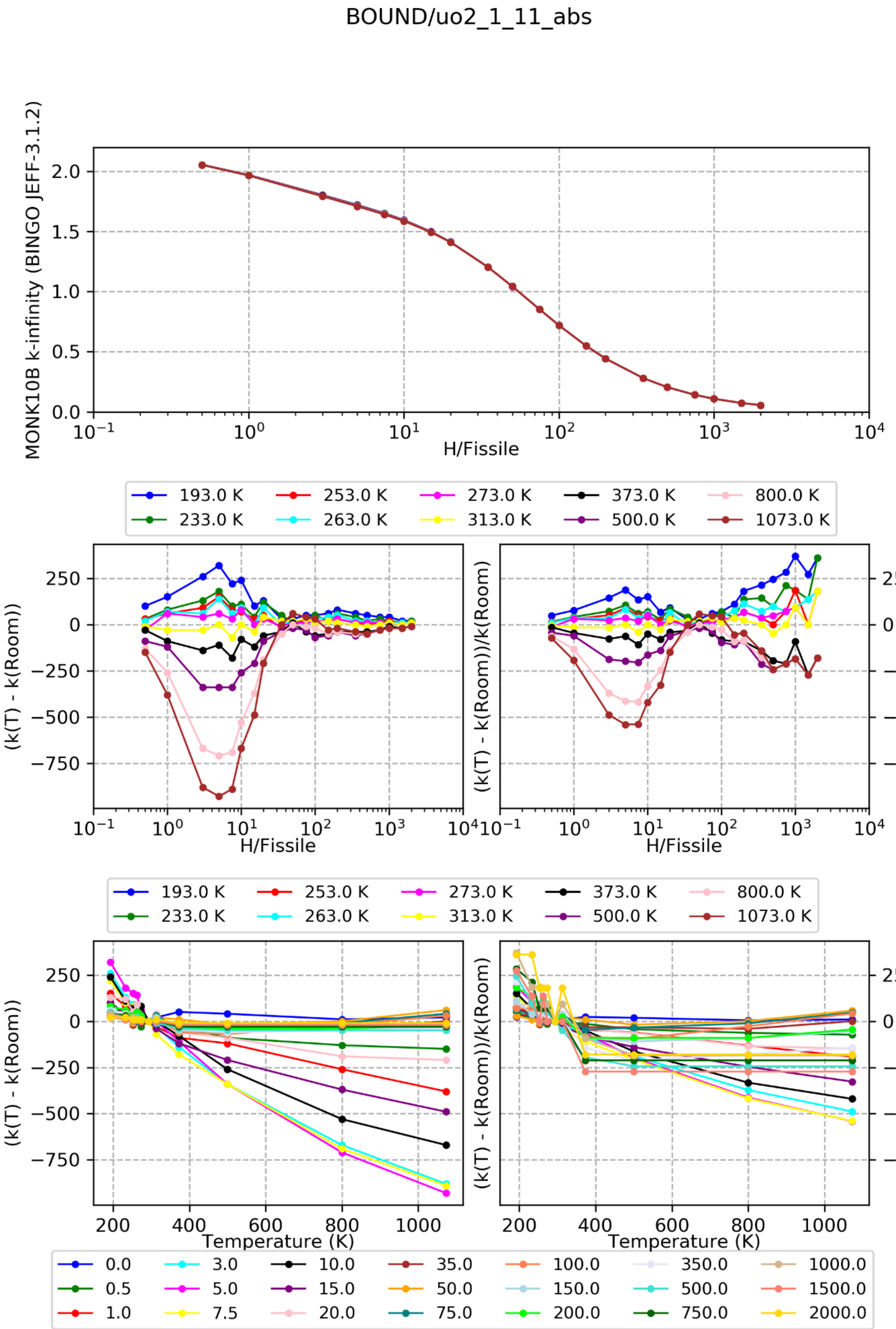

Figure B-26: Case 11ba: U 100% oxide / polythene mixture, with absorber

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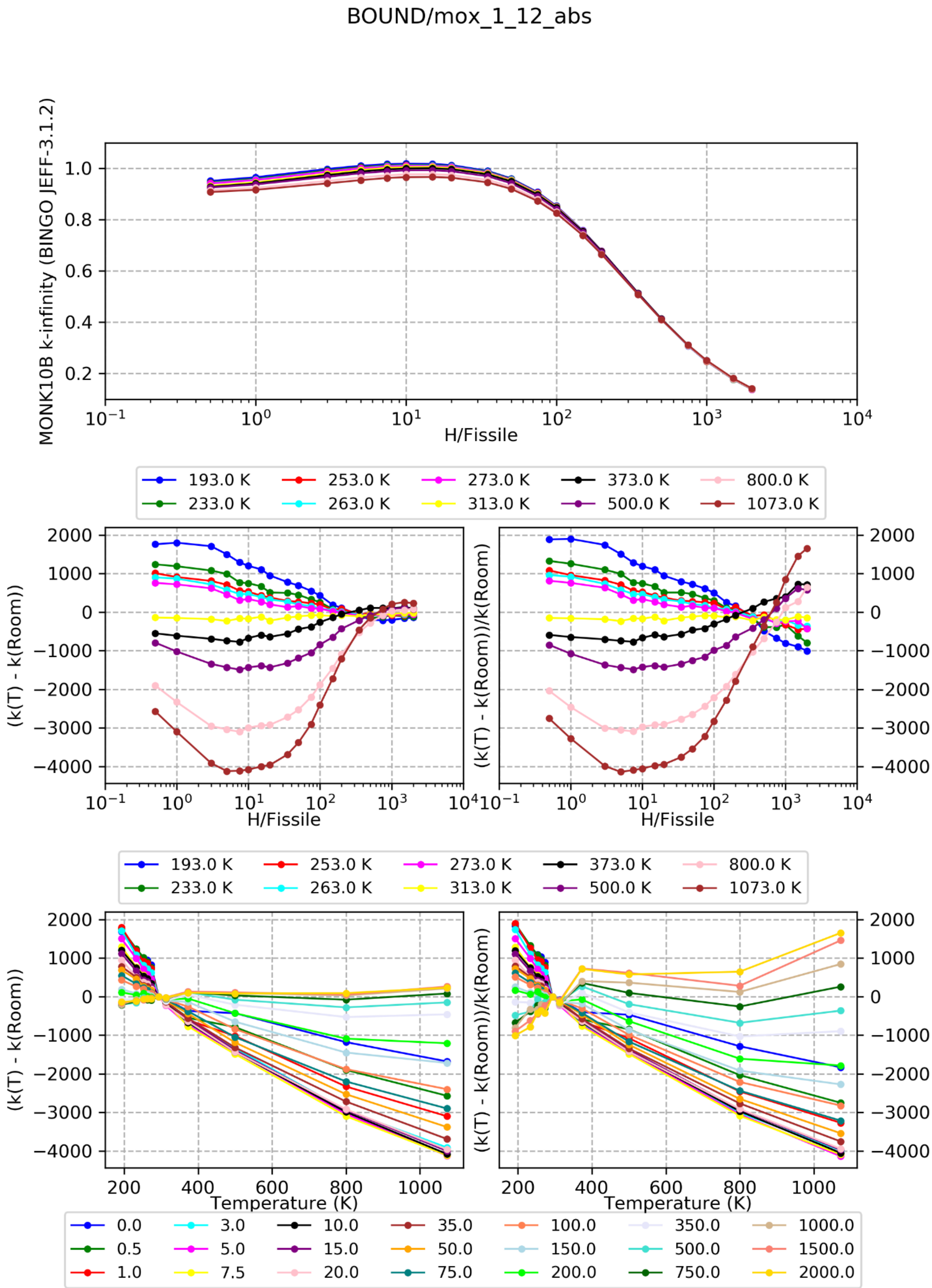

Figure B-27: Case 12ba: Mixed oxide / polythene mixture, with absorber

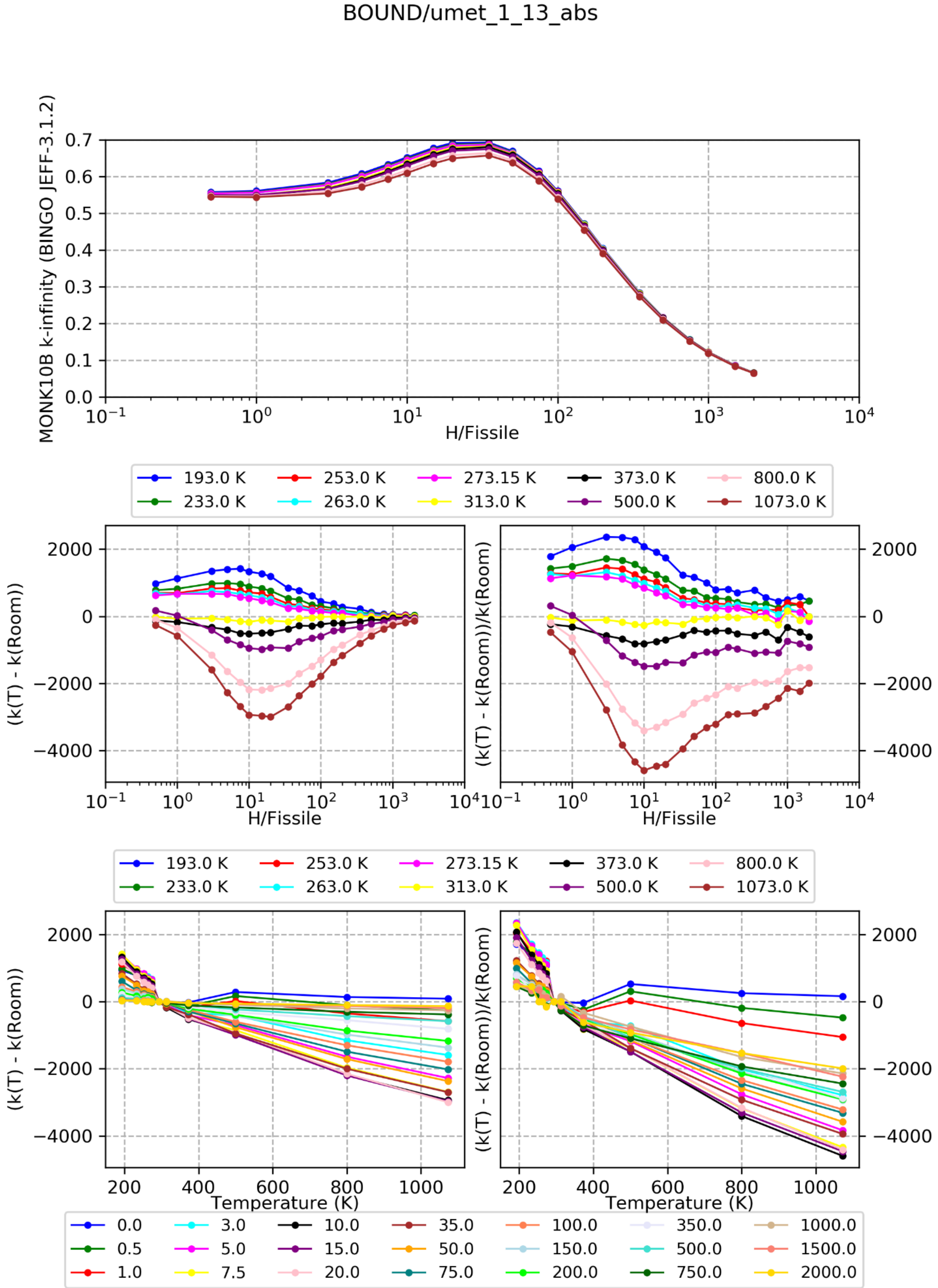

Figure B-28: Case 13ba: U 1.6% metal / polythene mixture, with absorber

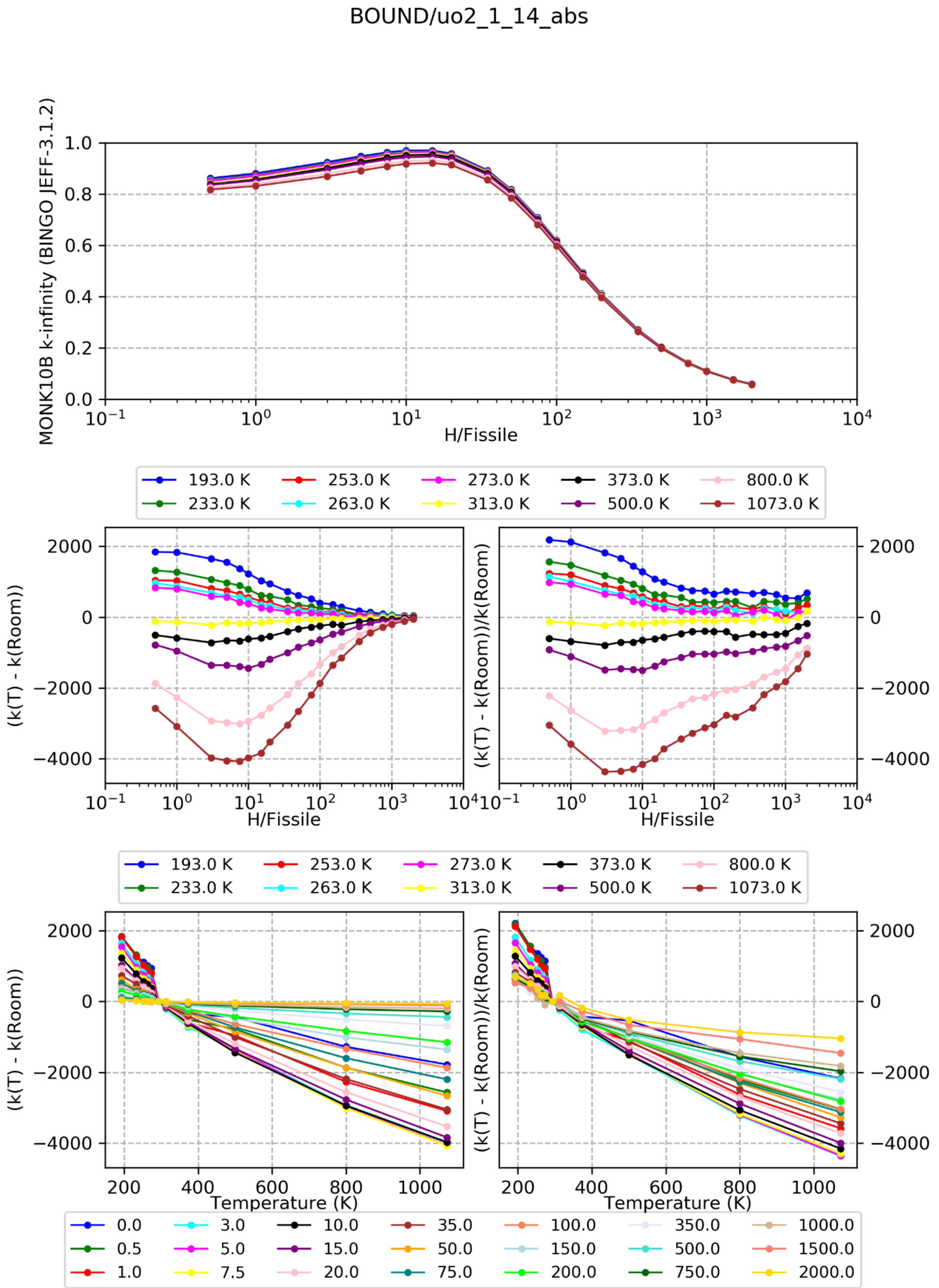

Figure B-29: Case 14ba: U 5% oxide / polythene mixture, with absorber

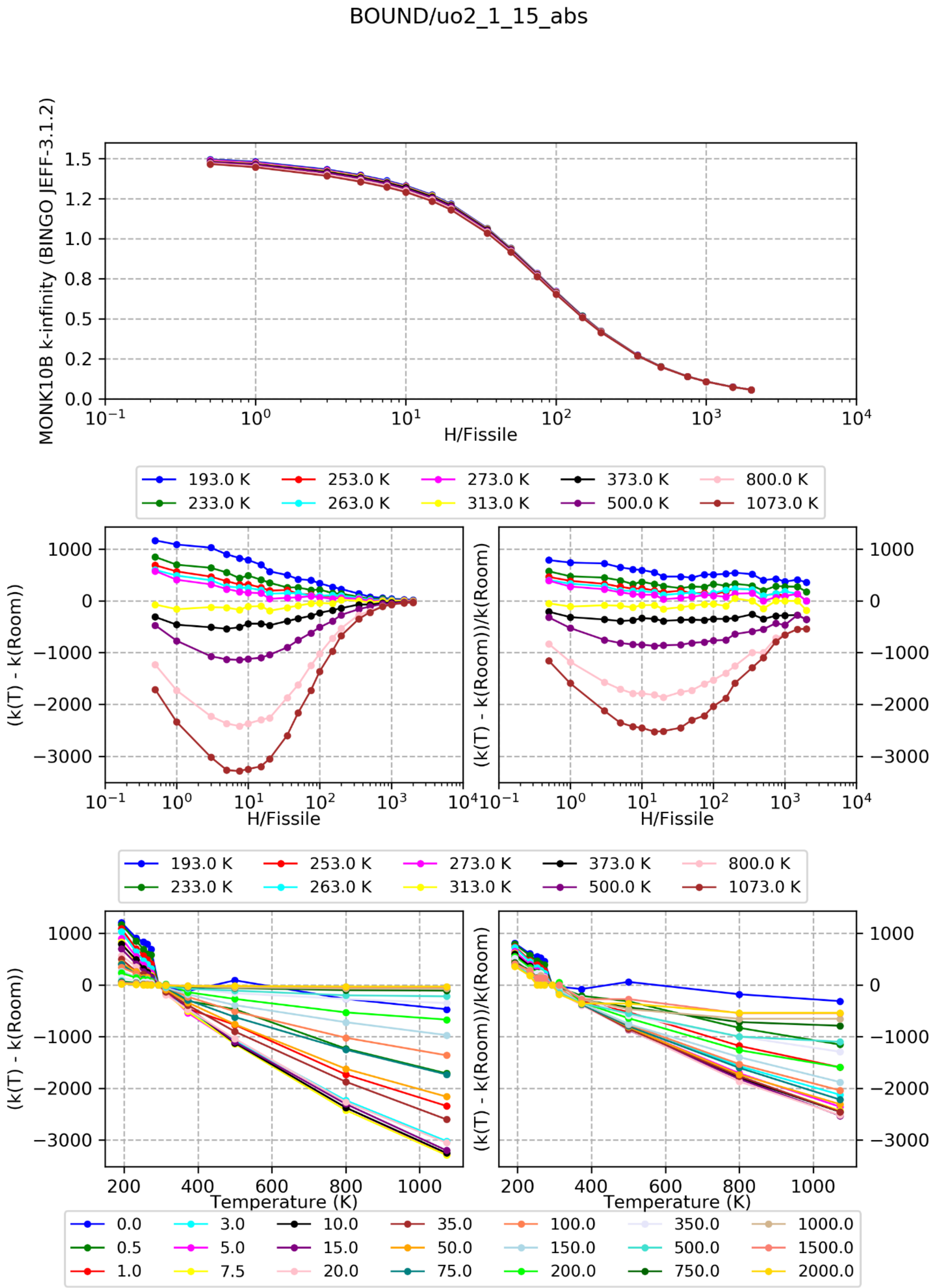

Figure B-30: Case 15ba: U 20% oxide / polythene mixture, with absorber

C Results Tables

The tables included in this appendix present the following:

1. Absolute k-infinity as a function of moderation and temperature.
2. Absolute difference in k-infinity ($k_{temp} – k_{293}$) as a function of moderation and temperature.
3. Relative difference in k-infinity ($[k_{temp} – k_{293}]/k_{293}$) as a function of moderation and temperature.
4. Further k-infinity values for use of free gas nuclear data and comparisons with the reference cases using bound scattering data.
5. For the DBRC cases the absolute difference in k-infinity ($k_{DBRC} – k_{ref}$) as a function of moderation and temperature.
6. For comparing the ice and water bound scattering data only; absolute differences in k-infinity ($k_{free} – k_{water}$), ($k_{free} – k_{ice}$) and ($k_{ice} – k_{water}$) as a function of moderation. These are all at a temperature of 273.15 K.

Each table is a concatenated set of results for all 15 fissile system cases (11 and 7 cases with respect to the comparisons for DBRC and bound scattering data where not all 15 cases are applicable).

Table C-1 through Table C-14 give the moderation level in the first column. This is either the H:fissile ratio (for Cases 1-4, 9-15), V_{mod}/V_{fiss} (Cases 5, 6, 8) or moderator density in g/cc (Case 7). The temperatures are given in the header row of each table. The column headed "273Kw" is the result where the moderator was water rather than ice, as given in the column header "273K" – this is not applicable to the cases with a polythene or graphite moderator.

The layout of Table C-15 through Table C-18 is slightly different. The moderation level is given in the first column of Table C-15 and Table C-17 (the homogeneous systems) and the first, fifth and ninth columns of Table C-16 and Table C-18 (as the heterogeneous systems have different moderation metrics). The remaining columns give the results for each case; "Δk_{f-I}", "Δk_{f-w}" and "Δk_{i-w}" refer to the three quantities $\Delta k_{free-ice}$, $\Delta k_{free-water}$ and $\Delta k_{ice-water}$ defined in Section A.6. The key result here is "Δk_{i-w}" and these columns have been highlighted.

Tables B-1 and Table C-2 also include 'heat maps' – colour-coded values to illustrate the variation in k-infinity. These heat maps have been produced for each moderation level such that for a specific moderation level, the highest k-infinity is highlighted in red and the lowest k-infinity is highlighted in green. For example, a colour trend from red on the left through yellow to green on the right means k-infinity decreases with temperature. A step change in colour at 273.15 K typically indicates a significant effect of changing from ice to water properties (both density, nuclear data and (for absorber cases) boron concentration) for the water moderated systems. No clear trend in the colours for a given moderation generally indicates no effect of temperature on k-infinity; the scatter in colour is due to the stochastic variation in the k-infinity values.

The specific tables are;

Table C-1: k-infinity for reference cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	2.8804	2.8807	2.8808	2.8805	-	2.8804	2.8801	2.8810	2.8801	2.8803	2.8803
0.5	2.6084	2.6060	2.6046	2.6036	-	2.6027	2.6018	2.5995	2.5959	2.5908	2.5879
1	2.4605	2.4562	2.4545	2.4531	-	2.4513	2.4500	2.4464	2.4408	2.4315	2.4262
3	2.2076	2.2029	2.2007	2.1988	-	2.1969	2.1951	2.1907	2.1827	2.1690	2.1606
5	2.1039	2.0997	2.0973	2.0955	-	2.0939	2.0923	2.0879	2.0807	2.0672	2.0584
7.5	2.0325	2.0289	2.0272	2.0257	-	2.0238	2.0222	2.0182	2.0121	1.9993	1.9910
10	1.9889	1.9852	1.9837	1.9822	-	1.9806	1.9795	1.9758	1.9700	1.9588	1.9514
15	1.9361	1.9334	1.9323	1.9313	-	1.9298	1.9286	1.9263	1.9213	1.9117	1.9053
20	1.9066	1.9037	1.9028	1.9017	-	1.9008	1.8996	1.8975	1.8935	1.8856	1.8799
35	1.8656	1.8629	1.8622	1.8612	-	1.8608	1.8602	1.8581	1.8555	1.8500	1.8459
50	1.8501	1.8477	1.8467	1.8469	-	1.8453	1.8453	1.8428	1.8407	1.8365	1.8326
75	1.8402	1.8390	1.8371	1.8368	-	1.8357	1.8356	1.8322	1.8309	1.8272	1.8246
100	1.8372	1.8351	1.8335	1.8330	-	1.8317	1.8317	1.8280	1.8267	1.8233	1.8210
150	1.8335	1.8312	1.8290	1.8280	-	1.8265	1.8265	1.8218	1.8209	1.8182	1.8155
200	1.8281	1.8252	1.8228	1.8220	-	1.8200	1.8199	1.8141	1.8135	1.8108	1.8083
350	1.7956	1.7924	1.7898	1.7890	-	1.7867	1.7864	1.7803	1.7794	1.7772	1.7751
500	1.7500	1.7470	1.7447	1.7438	-	1.7418	1.7418	1.7363	1.7360	1.7341	1.7325
750	1.6645	1.6626	1.6612	1.6606	-	1.6595	1.6594	1.6564	1.6562	1.6555	1.6552
1000	1.5790	1.5785	1.5781	1.5778	-	1.5776	1.5775	1.5776	1.5775	1.5779	1.5784
1500	1.4238	1.4254	1.4267	1.4272	-	1.4284	1.4286	1.4333	1.4342	1.4358	1.4382
2000	1.2922	1.2952	1.2979	1.2989	-	1.3013	1.3017	1.3102	1.3112	1.3141	1.3179
Case 2											
0	2.8506	2.8503	2.8509	2.8503	-	2.8508	2.8506	2.8503	2.8507	2.8504	2.8503
0.5	2.5759	2.5730	2.5718	2.5707	-	2.5701	2.5690	2.5670	2.5641	2.5599	2.5574
1	2.4141	2.4104	2.4087	2.4073	-	2.4056	2.4047	2.4011	2.3963	2.3880	2.3836
3	2.0818	2.0782	2.0761	2.0746	-	2.0731	2.0714	2.0676	2.0612	2.0502	2.0433
5	1.9167	1.9134	1.9117	1.9102	-	1.9087	1.9076	1.9040	1.8980	1.8876	1.8809
7.5	1.7966	1.7936	1.7921	1.7907	-	1.7895	1.7884	1.7855	1.7800	1.7702	1.7642
10	1.7230	1.7199	1.7186	1.7171	-	1.7165	1.7155	1.7127	1.7077	1.6983	1.6925
15	1.6407	1.6386	1.6369	1.6357	-	1.6354	1.6342	1.6316	1.6266	1.6179	1.6126
20	1.5996	1.5975	1.5962	1.5946	-	1.5942	1.5935	1.5908	1.5865	1.5774	1.5717
35	1.5588	1.5569	1.5562	1.5545	-	1.5538	1.5533	1.5502	1.5455	1.5361	1.5301
50	1.5563	1.5542	1.5531	1.5513	-	1.5510	1.5506	1.5466	1.5423	1.5328	1.5257
75	1.5690	1.5670	1.5651	1.5641	-	1.5629	1.5625	1.5580	1.5537	1.5440	1.5367
100	1.5850	1.5822	1.5805	1.5793	-	1.5780	1.5777	1.5726	1.5680	1.5591	1.5520
150	1.6106	1.6072	1.6047	1.6036	-	1.6020	1.6018	1.5957	1.5924	1.5831	1.5767
200	1.6264	1.6228	1.6201	1.6187	-	1.6172	1.6167	1.6102	1.6069	1.5985	1.5928

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	1.6361	1.6330	1.6300	1.6284	-	1.6269	1.6264	1.6201	1.6171	1.6114	1.6072
500	1.6167	1.6140	1.6116	1.6101	-	1.6085	1.6083	1.6029	1.6010	1.5966	1.5937
750	1.5597	1.5579	1.5566	1.5558	-	1.5554	1.5549	1.5519	1.5507	1.5484	1.5479
1000	1.4932	1.4926	1.4925	1.4921	-	1.4921	1.4917	1.4916	1.4912	1.4905	1.4905
1500	1.3617	1.3631	1.3648	1.3653	-	1.3663	1.3665	1.3715	1.3716	1.3725	1.3750
2000	1.2450	1.2480	1.2501	1.2514	-	1.2539	1.2540	1.2625	1.2630	1.2657	1.2692
Case 3											
0	2.8806	2.8808	2.8807	2.8807	2.8801	2.8807	2.8804	2.8806	2.8804	2.8799	2.8802
0.5	2.6099	2.6074	2.6060	2.6049	2.6046	2.6037	2.6031	2.6006	2.5975	2.5922	2.5893
1	2.4620	2.4581	2.4560	2.4543	2.4541	2.4531	2.4517	2.4479	2.4426	2.4334	2.4283
3	2.2080	2.2033	2.2008	2.1988	2.1988	2.1972	2.1957	2.1905	2.1829	2.1695	2.1608
5	2.1034	2.0992	2.0972	2.0954	2.0953	2.0938	2.0916	2.0874	2.0798	2.0663	2.0579
7.5	2.0318	2.0276	2.0253	2.0243	2.0241	2.0226	2.0208	2.0170	2.0101	1.9975	1.9896
10	1.9867	1.9835	1.9819	1.9800	1.9802	1.9791	1.9778	1.9737	1.9672	1.9563	1.9479
15	1.9338	1.9313	1.9299	1.9284	1.9285	1.9274	1.9267	1.9233	1.9176	1.9066	1.8997
20	1.9039	1.9013	1.9005	1.8992	1.8994	1.8984	1.8973	1.8944	1.8888	1.8785	1.8720
35	1.8629	1.8610	1.8600	1.8595	1.8597	1.8588	1.8579	1.8552	1.8489	1.8375	1.8302
50	1.8479	1.8463	1.8448	1.8451	1.8450	1.8444	1.8426	1.8400	1.8322	1.8183	1.8103
75	1.8399	1.8376	1.8360	1.8359	1.8367	1.8356	1.8336	1.8304	1.8194	1.8011	1.7919
100	1.8377	1.8352	1.8333	1.8325	1.8337	1.8323	1.8300	1.8254	1.8128	1.7906	1.7801
150	1.8338	1.8317	1.8289	1.8284	1.8299	1.8276	1.8250	1.8195	1.8022	1.7756	1.7629
200	1.8280	1.8255	1.8228	1.8219	1.8238	1.8211	1.8177	1.8118	1.7917	1.7626	1.7495
350	1.7953	1.7919	1.7890	1.7878	1.7895	1.7869	1.7836	1.7770	1.7557	1.7280	1.7171
500	1.7482	1.7453	1.7429	1.7421	1.7430	1.7409	1.7376	1.7321	1.7151	1.6953	1.6884
750	1.6618	1.6599	1.6584	1.6577	1.6581	1.6570	1.6551	1.6522	1.6454	1.6433	1.6444
1000	1.5758	1.5752	1.5747	1.5745	1.5743	1.5740	1.5737	1.5737	1.5778	1.5943	1.6035
1500	1.4203	1.4217	1.4231	1.4236	1.4227	1.4240	1.4262	1.4311	1.4544	1.5044	1.5283
2000	1.2888	1.2918	1.2943	1.2956	1.2944	1.2968	1.3007	1.3094	1.3471	1.4239	1.4599
Case 4											
0	0.5581	0.5565	0.5551	0.5547	0.5550	0.5483	0.5479	0.5480	0.5514	0.5497	0.5494
0.5	0.5577	0.5556	0.5544	0.5539	0.5538	0.5479	0.5469	0.5467	0.5492	0.5461	0.5444
1	0.5608	0.5579	0.5571	0.5558	0.5557	0.5498	0.5491	0.5484	0.5496	0.5458	0.5438
3	0.5849	0.5811	0.5796	0.5778	0.5783	0.5711	0.5704	0.5682	0.5673	0.5597	0.5548
5	0.6122	0.6076	0.6056	0.6042	0.6037	0.5977	0.5960	0.5930	0.5898	0.5802	0.5741
7.5	0.6426	0.6381	0.6359	0.6341	0.6340	0.6279	0.6269	0.6230	0.6190	0.6070	0.5997
10	0.6704	0.6654	0.6633	0.6616	0.6618	0.6557	0.6542	0.6500	0.6455	0.6323	0.6245
15	0.7189	0.7141	0.7115	0.7097	0.7098	0.7049	0.7029	0.6987	0.6928	0.6789	0.6692
20	0.7609	0.7558	0.7538	0.7521	0.7518	0.7473	0.7457	0.7411	0.7347	0.7196	0.7090
35	0.8590	0.8546	0.8523	0.8511	0.8515	0.8469	0.8456	0.8403	0.8326	0.8158	0.8039

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
50	0.9297	0.9246	0.9222	0.9209	0.9210	0.9175	0.9156	0.9108	0.9021	0.8833	0.8705
75	1.0080	1.0033	1.0013	0.9995	1.0000	0.9976	0.9950	0.9899	0.9795	0.9591	0.9449
100	1.0595	1.0549	1.0527	1.0506	1.0519	1.0491	1.0467	1.0410	1.0298	1.0081	0.9926
150	1.1202	1.1156	1.1128	1.1114	1.1121	1.1094	1.1065	1.1010	1.0882	1.0648	1.0484
200	1.1517	1.1465	1.1441	1.1426	1.1429	1.1405	1.1377	1.1319	1.1183	1.0939	1.0766
350	1.1758	1.1711	1.1686	1.1665	1.1672	1.1645	1.1614	1.1551	1.1397	1.1138	1.0965
500	1.1614	1.1564	1.1535	1.1512	1.1525	1.1500	1.1466	1.1399	1.1236	1.0977	1.0808
750	1.1126	1.1073	1.1044	1.1024	1.1029	1.1001	1.0965	1.0891	1.0733	1.0480	1.0323
1000	1.0567	1.0508	1.0479	1.0458	1.0466	1.0437	1.0405	1.0333	1.0168	0.9931	0.9783
1500	0.9499	0.9445	0.9414	0.9391	0.9399	0.9371	0.9334	0.9265	0.9108	0.8895	0.8769
2000	0.8586	0.8529	0.8498	0.8480	0.8486	0.8461	0.8423	0.8361	0.8206	0.8012	0.7906
Case 5											
1	1.1258	1.1234	1.1219	1.1208	1.1358	1.1336	1.1328	1.1304	1.1250	1.1139	1.1055
1.25	1.1607	1.1598	1.1588	1.1580	1.1680	1.1662	1.1664	1.1646	1.1613	1.1519	1.1447
2	1.1843	1.1875	1.1897	1.1894	1.1859	1.1867	1.1892	1.1914	1.1942	1.1931	1.1901
2.25	1.1774	1.1820	1.1854	1.1864	1.1782	1.1796	1.1829	1.1863	1.1920	1.1935	1.1915
2.75	1.1532	1.1608	1.1662	1.1673	1.1528	1.1560	1.1608	1.1670	1.1769	1.1840	1.1851
3	1.1376	1.1470	1.1532	1.1544	1.1367	1.1406	1.1461	1.1535	1.1663	1.1758	1.1773
Case 6											
30	1.2928	1.2902	1.2892	1.2881	-	1.2863	1.2858	1.2806	1.2752	1.2616	1.2531
35	1.3133	1.3117	1.3104	1.3098	-	1.3077	1.3075	1.3031	1.2980	1.2850	1.2778
40	1.3263	1.3245	1.3240	1.3232	-	1.3217	1.3211	1.3172	1.3125	1.3013	1.2943
45	1.3330	1.3319	1.3319	1.3309	-	1.3298	1.3295	1.3266	1.3222	1.3120	1.3058
50	1.3365	1.3361	1.3359	1.3356	-	1.3341	1.3338	1.3317	1.3280	1.3192	1.3130
55	1.3365	1.3365	1.3367	1.3367	-	1.3355	1.3355	1.3339	1.3304	1.3229	1.3175
60	1.3349	1.3350	1.3356	1.3352	-	1.3351	1.3347	1.3340	1.3313	1.3246	1.3201
65	1.3314	1.3326	1.3330	1.3330	-	1.3324	1.3323	1.3322	1.3299	1.3248	1.3207
70	1.3259	1.3280	1.3289	1.3289	-	1.3290	1.3287	1.3287	1.3275	1.3234	1.3203
Case 7											
1E-20	0.8115	0.8060	0.8032	0.8017	0.8012	0.7976	0.7958	0.7906	0.7817	0.7637	0.7513
0.05	1.0400	1.0353	1.0329	1.0310	1.0310	1.0283	1.0263	1.0209	1.0129	0.9955	0.9836
0.1	1.1674	1.1637	1.1616	1.1600	1.1600	1.1577	1.1562	1.1517	1.1439	1.1279	1.1165
0.2	1.2917	1.2894	1.2884	1.2871	1.2867	1.2852	1.2843	1.2811	1.2748	1.2617	1.2517
0.3	1.3382	1.3374	1.3372	1.3361	1.3360	1.3352	1.3353	1.3333	1.3298	1.3194	1.3115
0.4	1.3490	1.3500	1.3510	1.3506	1.3504	1.3502	1.3513	1.3513	1.3497	1.3434	1.3369
0.5	1.3412	1.3444	1.3464	1.3466	1.3461	1.3468	1.3487	1.3499	1.3519	1.3490	1.3442
0.6	1.3233	1.3282	1.3315	1.3322	1.3313	1.3331	1.3360	1.3387	1.3439	1.3443	1.3414
0.7	1.2988	1.3058	1.3108	1.3116	1.3105	1.3134	1.3171	1.3214	1.3292	1.3332	1.3320
0.8	1.2711	1.2800	1.2859	1.2875	1.2863	1.2901	1.2943	1.3006	1.3109	1.3180	1.3187

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
0.9	1.2427	1.2528	1.2597	1.2621	1.2603	1.2646	1.2703	1.2778	1.2911	1.3009	1.3029
0.95	1.2283	1.2390	1.2464	1.2486	1.2474	1.2519	1.2575	1.2651	1.2802	1.2917	1.2942
1	1.2133	1.2250	1.2333	1.2353	1.2342	1.2390	1.2450	1.2535	1.2695	1.2822	1.2852
Case 8											
1	1.3946	1.3911	1.3889	1.3874	1.4060	1.4038	1.4021	1.3974	1.3891	1.3720	1.3588
1.5	1.4750	1.4721	1.4703	1.4691	1.4825	1.4815	1.4799	1.4765	1.4684	1.4528	1.4412
2	1.5165	1.5144	1.5132	1.5122	1.5214	1.5202	1.5197	1.5166	1.5099	1.4955	1.4851
2.5	1.5370	1.5358	1.5353	1.5344	1.5385	1.5379	1.5377	1.5357	1.5300	1.5176	1.5084
3	1.5449	1.5441	1.5440	1.5436	1.5434	1.5433	1.5432	1.5419	1.5379	1.5270	1.5188
4	1.5372	1.5382	1.5388	1.5385	1.5315	1.5320	1.5325	1.5332	1.5319	1.5245	1.5188
5	1.5135	1.5158	1.5178	1.5178	1.5045	1.5054	1.5072	1.5095	1.5104	1.5068	1.5031
6	1.4806	1.4854	1.4882	1.4892	1.4704	1.4722	1.4745	1.4779	1.4821	1.4820	1.4791
7	1.4446	1.4509	1.4543	1.4559	1.4323	1.4351	1.4389	1.4431	1.4498	1.4527	1.4513
8	1.4067	1.4142	1.4192	1.4205	1.3933	1.3971	1.4012	1.4072	1.4164	1.4216	1.4214
9	1.3685	1.3778	1.3830	1.3853	1.3546	1.3585	1.3639	1.3704	1.3822	1.3901	1.3912
Case 9											
0	0.8363	0.8315	0.8292	0.8272	0.8275	0.8183	0.8172	0.8144	0.8144	0.8057	0.8002
0.5	0.8623	0.8567	0.8545	0.8521	0.8524	0.8439	0.8420	0.8386	0.8358	0.8245	0.8177
1	0.8823	0.8763	0.8735	0.8716	0.8715	0.8639	0.8617	0.8576	0.8538	0.8403	0.8326
3	0.9323	0.9262	0.9238	0.9212	0.9212	0.9152	0.9132	0.9082	0.9020	0.8857	0.8753
5	0.9661	0.9607	0.9582	0.9560	0.9558	0.9508	0.9488	0.9435	0.9361	0.9192	0.9082
7.5	1.0028	0.9975	0.9949	0.9927	0.9925	0.9881	0.9864	0.9809	0.9728	0.9554	0.9432
10	1.0364	1.0306	1.0278	1.0260	1.0263	1.0217	1.0200	1.0148	1.0061	0.9883	0.9760
15	1.0941	1.0890	1.0862	1.0851	1.0851	1.0815	1.0795	1.0741	1.0649	1.0460	1.0326
20	1.1436	1.1378	1.1361	1.1339	1.1344	1.1310	1.1291	1.1234	1.1138	1.0942	1.0797
35	1.2499	1.2448	1.2421	1.2408	1.2408	1.2383	1.2360	1.2301	1.2192	1.1978	1.1817
50	1.3178	1.3128	1.3100	1.3084	1.3087	1.3061	1.3039	1.2983	1.2865	1.2635	1.2461
75	1.3868	1.3818	1.3796	1.3774	1.3782	1.3754	1.3732	1.3671	1.3549	1.3303	1.3117
100	1.4272	1.4217	1.4198	1.4173	1.4178	1.4154	1.4136	1.4071	1.3942	1.3684	1.3498
150	1.4656	1.4612	1.4585	1.4565	1.4569	1.4546	1.4521	1.4461	1.4325	1.4052	1.3861
200	1.4775	1.4734	1.4707	1.4686	1.4689	1.4664	1.4637	1.4579	1.4435	1.4168	1.3979
350	1.4563	1.4518	1.4488	1.4475	1.4480	1.4452	1.4427	1.4362	1.4210	1.3947	1.3772
500	1.4079	1.4030	1.4002	1.3987	1.3993	1.3966	1.3937	1.3867	1.3717	1.3466	1.3303
750	1.3172	1.3124	1.3094	1.3075	1.3080	1.3056	1.3023	1.2961	1.2798	1.2567	1.2428
1000	1.2301	1.2253	1.2220	1.2203	1.2211	1.2181	1.2152	1.2082	1.1929	1.1710	1.1590
1500	1.0811	1.0763	1.0729	1.0709	1.0720	1.0691	1.0657	1.0592	1.0442	1.0256	1.0152
2000	0.9615	0.9570	0.9535	0.9518	0.9523	0.9500	0.9468	0.9406	0.9259	0.9093	0.9004

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 10											
0	1.5152	1.5128	1.5112	1.5103	1.5102	1.5033	1.5026	1.5018	1.5039	1.5007	1.4983
0.5	1.4973	1.4938	1.4921	1.4909	1.4912	1.4856	1.4847	1.4820	1.4806	1.4733	1.4683
1	1.4846	1.4809	1.4793	1.4780	1.4775	1.4736	1.4719	1.4692	1.4658	1.4564	1.4507
3	1.4541	1.4506	1.4482	1.4469	1.4469	1.4439	1.4425	1.4388	1.4327	1.4205	1.4119
5	1.4473	1.4431	1.4414	1.4399	1.4397	1.4373	1.4357	1.4313	1.4246	1.4106	1.4007
7.5	1.4544	1.4503	1.4485	1.4470	1.4468	1.4444	1.4431	1.4388	1.4312	1.4153	1.4039
10	1.4688	1.4647	1.4625	1.4613	1.4610	1.4591	1.4574	1.4530	1.4442	1.4277	1.4155
15	1.5023	1.4976	1.4958	1.4946	1.4946	1.4921	1.4908	1.4860	1.4766	1.4583	1.4447
20	1.5335	1.5291	1.5269	1.5258	1.5258	1.5232	1.5218	1.5167	1.5070	1.4878	1.4738
35	1.6031	1.5985	1.5965	1.5944	1.5946	1.5929	1.5908	1.5857	1.5746	1.5538	1.5383
50	1.6450	1.6411	1.6394	1.6367	1.6372	1.6348	1.6333	1.6279	1.6166	1.5947	1.5786
75	1.6835	1.6790	1.6775	1.6756	1.6756	1.6741	1.6716	1.6668	1.6549	1.6329	1.6166
100	1.7008	1.6975	1.6955	1.6935	1.6933	1.6915	1.6898	1.6847	1.6730	1.6504	1.6351
150	1.7077	1.7042	1.7024	1.7006	1.7007	1.6988	1.6966	1.6925	1.6807	1.6588	1.6439
200	1.6971	1.6939	1.6916	1.6905	1.6905	1.6889	1.6869	1.6816	1.6709	1.6495	1.6360
350	1.6325	1.6298	1.6281	1.6264	1.6267	1.6255	1.6228	1.6188	1.6071	1.5874	1.5766
500	1.5575	1.5546	1.5526	1.5513	1.5517	1.5498	1.5479	1.5429	1.5313	1.5135	1.5029
750	1.4373	1.4335	1.4320	1.4304	1.4309	1.4290	1.4266	1.4223	1.4096	1.3932	1.3844
1000	1.3304	1.3270	1.3243	1.3236	1.3239	1.3222	1.3190	1.3144	1.3015	1.2856	1.2773
1500	1.1549	1.1511	1.1486	1.1473	1.1477	1.1454	1.1425	1.1372	1.1245	1.1097	1.1024
2000	1.0189	1.0151	1.0120	1.0106	1.0115	1.0091	1.0063	1.0010	0.9881	0.9741	0.9675
Case 11											
0	2.1948	2.1947	2.1950	2.1948	-	2.1948	2.1949	2.1950	2.1950	2.1951	2.1950
0.5	2.0589	2.0586	2.0586	2.0587	-	2.0582	2.0582	2.0579	2.0574	2.0571	2.0565
1	1.9781	1.9778	1.9776	1.9767	-	1.9768	1.9765	1.9761	1.9753	1.9738	1.9724
3	1.8435	1.8416	1.8415	1.8406	-	1.8397	1.8393	1.8381	1.8351	1.8311	1.8280
5	1.8063	1.8044	1.8034	1.8027	-	1.8019	1.8014	1.7997	1.7967	1.7906	1.7875
7.5	1.7980	1.7956	1.7950	1.7945	-	1.7931	1.7923	1.7907	1.7870	1.7809	1.7770
10	1.8028	1.8007	1.8001	1.7991	-	1.7986	1.7980	1.7956	1.7920	1.7864	1.7827
15	1.8224	1.8209	1.8201	1.8188	-	1.8181	1.8182	1.8162	1.8131	1.8083	1.8045
20	1.8418	1.8400	1.8399	1.8392	-	1.8384	1.8383	1.8361	1.8336	1.8293	1.8260
35	1.8803	1.8798	1.8789	1.8788	-	1.8782	1.8778	1.8766	1.8756	1.8721	1.8705
50	1.8988	1.8986	1.8978	1.8973	-	1.8973	1.8975	1.8962	1.8956	1.8931	1.8918
75	1.9082	1.9073	1.9075	1.9069	-	1.9067	1.9068	1.9059	1.9052	1.9042	1.9031
100	1.9042	1.9037	1.9034	1.9033	-	1.9030	1.9030	1.9021	1.9017	1.9008	1.9002
150	1.8805	1.8803	1.8801	1.8801	-	1.8796	1.8796	1.8786	1.8784	1.8778	1.8773
200	1.8492	1.8488	1.8485	1.8483	-	1.8480	1.8481	1.8469	1.8467	1.8461	1.8456
350	1.7469	1.7461	1.7453	1.7451	-	1.7445	1.7445	1.7425	1.7424	1.7418	1.7413

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	1.6493	1.6480	1.6470	1.6464	-	1.6456	1.6454	1.6429	1.6427	1.6420	1.6415
750	1.5060	1.5039	1.5022	1.5015	-	1.5002	1.5000	1.4970	1.4965	1.4957	1.4949
1000	1.3846	1.3819	1.3798	1.3788	-	1.3773	1.3769	1.3731	1.3729	1.3718	1.3710
1500	1.1915	1.1880	1.1854	1.1842	-	1.1824	1.1820	1.1780	1.1774	1.1761	1.1753
2000	1.0454	1.0415	1.0387	1.0375	-	1.0354	1.0350	1.0311	1.0306	1.0293	1.0280
Case 12											
0	0.9331	0.9284	0.9270	0.9247	-	0.9169	0.9157	0.9131	0.9125	0.9046	0.9003
0.5	0.9517	0.9463	0.9437	0.9419	-	0.9344	0.9326	0.9288	0.9262	0.9152	0.9087
1	0.9667	0.9613	0.9582	0.9563	-	0.9490	0.9466	0.9427	0.9384	0.9254	0.9177
3	1.0041	0.9982	0.9955	0.9929	-	0.9871	0.9850	0.9800	0.9731	0.9572	0.9466
5	1.0248	1.0190	1.0167	1.0144	-	1.0093	1.0076	1.0019	0.9943	0.9779	0.9664
7.5	1.0435	1.0378	1.0354	1.0330	-	1.0291	1.0268	1.0219	1.0132	0.9967	0.9842
10	1.0587	1.0536	1.0513	1.0488	-	1.0453	1.0435	1.0379	1.0295	1.0115	1.0001
15	1.0864	1.0813	1.0792	1.0770	-	1.0739	1.0721	1.0667	1.0574	1.0390	1.0261
20	1.1116	1.1069	1.1044	1.1022	-	1.0997	1.0972	1.0917	1.0824	1.0630	1.0496
35	1.1755	1.1702	1.1680	1.1658	-	1.1631	1.1616	1.1550	1.1448	1.1241	1.1086
50	1.2257	1.2202	1.2175	1.2151	-	1.2128	1.2109	1.2046	1.1936	1.1715	1.1551
75	1.2872	1.2825	1.2795	1.2768	-	1.2744	1.2727	1.2662	1.2547	1.2319	1.2151
100	1.3332	1.3278	1.3248	1.3223	-	1.3196	1.3177	1.3105	1.2997	1.2765	1.2594
150	1.3942	1.3882	1.3851	1.3827	-	1.3805	1.3783	1.3705	1.3596	1.3370	1.3207
200	1.4316	1.4257	1.4226	1.4202	-	1.4174	1.4155	1.4072	1.3967	1.3754	1.3592
350	1.4759	1.4704	1.4673	1.4644	-	1.4621	1.4604	1.4522	1.4431	1.4243	1.4105
500	1.4746	1.4695	1.4668	1.4646	-	1.4623	1.4610	1.4537	1.4456	1.4301	1.4182
750	1.4358	1.4318	1.4298	1.4284	-	1.4269	1.4257	1.4218	1.4148	1.4026	1.3944
1000	1.3814	1.3792	1.3776	1.3768	-	1.3762	1.3751	1.3741	1.3680	1.3589	1.3529
1500	1.2665	1.2668	1.2669	1.2670	-	1.2674	1.2669	1.2702	1.2669	1.2617	1.2595
2000	1.1614	1.1630	1.1650	1.1655	-	1.1669	1.1666	1.1732	1.1712	1.1688	1.1685
Case 13											
0	0.5583	0.5565	0.5557	0.5549	-	0.5484	0.5482	0.5479	0.5514	0.5498	0.5490
0.5	0.5576	0.5557	0.5548	0.5538	-	0.5472	0.5473	0.5464	0.5490	0.5464	0.5451
1	0.5607	0.5581	0.5568	0.5559	-	0.5490	0.5490	0.5485	0.5500	0.5461	0.5438
3	0.5845	0.5811	0.5794	0.5781	-	0.5709	0.5704	0.5680	0.5672	0.5587	0.5550
5	0.6120	0.6073	0.6055	0.6043	-	0.5976	0.5962	0.5931	0.5907	0.5800	0.5746
7.5	0.6431	0.6382	0.6360	0.6342	-	0.6279	0.6265	0.6226	0.6190	0.6072	0.6000
10	0.6703	0.6650	0.6631	0.6611	-	0.6554	0.6540	0.6499	0.6455	0.6327	0.6243
15	0.7186	0.7138	0.7113	0.7095	-	0.7044	0.7023	0.6981	0.6926	0.6787	0.6695
20	0.7603	0.7555	0.7534	0.7513	-	0.7463	0.7452	0.7404	0.7340	0.7191	0.7099
35	0.8586	0.8536	0.8512	0.8494	-	0.8452	0.8442	0.8397	0.8321	0.8162	0.8053
50	0.9281	0.9231	0.9211	0.9191	-	0.9157	0.9140	0.9099	0.9018	0.8853	0.8735

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	1.0064	1.0018	0.9995	0.9974	-	0.9947	0.9928	0.9886	0.9806	0.9632	0.9504
100	1.0579	1.0533	1.0508	1.0493	-	1.0465	1.0447	1.0405	1.0317	1.0144	1.0011
150	1.1188	1.1136	1.1114	1.1093	-	1.1068	1.1055	1.1006	1.0917	1.0740	1.0604
200	1.1497	1.1451	1.1427	1.1405	-	1.1382	1.1368	1.1312	1.1223	1.1049	1.0915
350	1.1754	1.1701	1.1673	1.1656	-	1.1630	1.1610	1.1551	1.1471	1.1297	1.1164
500	1.1611	1.1563	1.1525	1.1503	-	1.1482	1.1467	1.1399	1.1321	1.1161	1.1033
750	1.1125	1.1071	1.1037	1.1019	-	1.0990	1.0978	1.0908	1.0836	1.0692	1.0577
1000	1.0563	1.0511	1.0477	1.0454	-	1.0427	1.0412	1.0346	1.0283	1.0151	1.0050
1500	0.9498	0.9440	0.9406	0.9388	-	0.9360	0.9347	0.9284	0.9226	0.9118	0.9041
2000	0.8580	0.8528	0.8497	0.8474	-	0.8448	0.8436	0.8374	0.8329	0.8239	0.8171
Case 14											
0	0.8362	0.8309	0.8294	0.8273	-	0.8182	0.8171	0.8145	0.8140	0.8056	0.8004
0.5	0.8620	0.8564	0.8540	0.8520	-	0.8437	0.8422	0.8389	0.8362	0.8249	0.8174
1	0.8818	0.8767	0.8739	0.8715	-	0.8638	0.8618	0.8577	0.8537	0.8407	0.8326
3	0.9329	0.9267	0.9241	0.9213	-	0.9154	0.9133	0.9085	0.9016	0.8859	0.8756
5	0.9665	0.9609	0.9579	0.9563	-	0.9507	0.9486	0.9432	0.9357	0.9188	0.9078
7.5	1.0030	0.9974	0.9948	0.9926	-	0.9878	0.9863	0.9806	0.9724	0.9547	0.9429
10	1.0357	1.0304	1.0277	1.0257	-	1.0218	1.0199	1.0145	1.0057	0.9880	0.9755
15	1.0944	1.0890	1.0866	1.0843	-	1.0809	1.0790	1.0738	1.0644	1.0455	1.0326
20	1.1433	1.1382	1.1359	1.1338	-	1.1306	1.1283	1.1229	1.1138	1.0946	1.0807
35	1.2495	1.2444	1.2426	1.2399	-	1.2375	1.2355	1.2301	1.2204	1.2000	1.1848
50	1.3174	1.3123	1.3097	1.3075	-	1.3052	1.3035	1.2988	1.2881	1.2675	1.2520
75	1.3864	1.3819	1.3788	1.3773	-	1.3750	1.3729	1.3677	1.3574	1.3368	1.3210
100	1.4266	1.4221	1.4194	1.4177	-	1.4151	1.4130	1.4077	1.3975	1.3770	1.3614
150	1.4653	1.4608	1.4585	1.4565	-	1.4545	1.4523	1.4471	1.4367	1.4167	1.4009
200	1.4780	1.4736	1.4710	1.4691	-	1.4673	1.4648	1.4589	1.4494	1.4298	1.4149
350	1.4571	1.4525	1.4498	1.4481	-	1.4453	1.4440	1.4375	1.4289	1.4126	1.3994
500	1.4083	1.4045	1.4009	1.3995	-	1.3970	1.3953	1.3892	1.3816	1.3663	1.3555
750	1.3178	1.3128	1.3097	1.3078	-	1.3053	1.3042	1.2980	1.2914	1.2795	1.2700
1000	1.2308	1.2261	1.2226	1.2207	-	1.2182	1.2172	1.2109	1.2054	1.1956	1.1883
1500	1.0809	1.0761	1.0724	1.0709	-	1.0685	1.0674	1.0615	1.0575	1.0505	1.0452
2000	0.9612	0.9565	0.9533	0.9515	-	0.9493	0.9481	0.9430	0.9399	0.9343	0.9298
Case 15											
0	1.5152	1.5125	1.5116	1.5101	-	1.5028	1.5028	1.5018	1.5042	1.5008	1.4979
0.5	1.4970	1.4934	1.4920	1.4911	-	1.4853	1.4846	1.4817	1.4809	1.4727	1.4681
1	1.4845	1.4811	1.4792	1.4779	-	1.4731	1.4721	1.4691	1.4658	1.4562	1.4502
3	1.4538	1.4499	1.4484	1.4465	-	1.4437	1.4421	1.4381	1.4320	1.4198	1.4111
5	1.4469	1.4430	1.4411	1.4394	-	1.4374	1.4350	1.4310	1.4243	1.4100	1.3999
7.5	1.4547	1.4502	1.4483	1.4468	-	1.4443	1.4429	1.4384	1.4305	1.4155	1.4043

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	1.4694	1.4647	1.4631	1.4613	-	1.4595	1.4574	1.4526	1.4442	1.4280	1.4162
15	1.5031	1.4990	1.4968	1.4950	-	1.4928	1.4913	1.4861	1.4776	1.4597	1.4466
20	1.5352	1.5303	1.5285	1.5262	-	1.5244	1.5228	1.5176	1.5085	1.4900	1.4763
35	1.6047	1.5999	1.5979	1.5963	-	1.5936	1.5922	1.5872	1.5777	1.5586	1.5450
50	1.6470	1.6425	1.6405	1.6385	-	1.6369	1.6351	1.6296	1.6207	1.6016	1.5875
75	1.6855	1.6814	1.6795	1.6774	-	1.6758	1.6744	1.6687	1.6593	1.6421	1.6287
100	1.7029	1.6996	1.6975	1.6957	-	1.6937	1.6922	1.6872	1.6784	1.6616	1.6494
150	1.7100	1.7063	1.7044	1.7027	-	1.7010	1.6995	1.6944	1.6870	1.6725	1.6616
200	1.6994	1.6961	1.6940	1.6928	-	1.6906	1.6894	1.6849	1.6782	1.6654	1.6563
350	1.6345	1.6317	1.6299	1.6287	-	1.6271	1.6260	1.6216	1.6169	1.6074	1.6009
500	1.5593	1.5560	1.5541	1.5531	-	1.5511	1.5504	1.5461	1.5422	1.5352	1.5307
750	1.4389	1.4352	1.4333	1.4319	-	1.4300	1.4293	1.4251	1.4224	1.4172	1.4142
1000	1.3315	1.3280	1.3257	1.3243	-	1.3224	1.3217	1.3172	1.3150	1.3116	1.3090
1500	1.1555	1.1517	1.1486	1.1473	-	1.1453	1.1446	1.1400	1.1390	1.1364	1.1343
2000	1.0192	1.0150	1.0122	1.0108	-	1.0087	1.0080	1.0036	1.0029	1.0006	0.9989

Table C-2: k-infinity for reference cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	2.8806	2.8805	2.8805	2.8806	-	2.8804	2.8807	2.8807	2.8803	2.8803	2.8806
0.5	2.6046	2.6015	2.6004	2.5996	-	2.5988	2.5977	2.5953	2.5918	2.5873	2.5844
1	2.4491	2.4449	2.4438	2.4418	-	2.4402	2.4389	2.4356	2.4303	2.4216	2.4162
3	2.1538	2.1494	2.1472	2.1452	-	2.1438	2.1423	2.1384	2.1315	2.1199	2.1127
5	2.0083	2.0046	2.0028	2.0017	-	2.0003	1.9990	1.9954	1.9897	1.9789	1.9722
7.5	1.8931	1.8906	1.8894	1.8885	-	1.8862	1.8854	1.8829	1.8777	1.8689	1.8638
10	1.8125	1.8100	1.8089	1.8080	-	1.8070	1.8060	1.8036	1.7995	1.7924	1.7882
15	1.6997	1.6980	1.6971	1.6970	-	1.6961	1.6956	1.6938	1.6908	1.6860	1.6832
20	1.6201	1.6188	1.6183	1.6179	-	1.6177	1.6174	1.6156	1.6140	1.6105	1.6091
35	1.4615	1.4610	1.4609	1.4604	-	1.4604	1.4608	1.4601	1.4590	1.4587	1.4597
50	1.3517	1.3522	1.3519	1.3518	-	1.3521	1.3523	1.3521	1.3520	1.3527	1.3549
75	1.2142	1.2151	1.2150	1.2154	-	1.2163	1.2159	1.2173	1.2170	1.2190	1.2225
100	1.1075	1.1082	1.1088	1.1091	-	1.1098	1.1100	1.1115	1.1117	1.1138	1.1184
150	0.9451	0.9461	0.9477	0.9478	-	0.9488	0.9489	0.9511	0.9514	0.9540	0.9597
200	0.8258	0.8276	0.8292	0.8292	-	0.8302	0.8298	0.8334	0.8334	0.8361	0.8421
350	0.6013	0.6025	0.6044	0.6048	-	0.6058	0.6052	0.6091	0.6092	0.6120	0.6180
500	0.4732	0.4746	0.4761	0.4763	-	0.4774	0.4774	0.4808	0.4810	0.4832	0.4883
750	0.3496	0.3511	0.3521	0.3520	-	0.3535	0.3529	0.3560	0.3563	0.3582	0.3625
1000	0.2770	0.2783	0.2797	0.2793	-	0.2803	0.2803	0.2827	0.2831	0.2842	0.2885
1500	0.1961	0.1970	0.1980	0.1979	-	0.1987	0.1984	0.2003	0.2005	0.2019	0.2048

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	0.1516	0.1525	0.1532	0.1531	-	0.1538	0.1536	0.1554	0.1554	0.1565	0.1586
Case 2											
0	2.8510	2.8508	2.8506	2.8508	-	2.8505	2.8505	2.8505	2.8503	2.8505	2.8501
0.5	2.5720	2.5698	2.5684	2.5674	-	2.5667	2.5660	2.5637	2.5609	2.5563	2.5540
1	2.4053	2.4011	2.3999	2.3985	-	2.3972	2.3960	2.3932	2.3881	2.3802	2.3759
3	2.0470	2.0432	2.0411	2.0396	-	2.0382	2.0369	2.0341	2.0278	2.0179	2.0124
5	1.8568	1.8545	1.8527	1.8517	-	1.8506	1.8494	1.8464	1.8413	1.8329	1.8285
7.5	1.7105	1.7080	1.7065	1.7057	-	1.7049	1.7042	1.7017	1.6975	1.6906	1.6869
10	1.6125	1.6108	1.6098	1.6090	-	1.6082	1.6076	1.6055	1.6018	1.5958	1.5929
15	1.4879	1.4863	1.4859	1.4850	-	1.4850	1.4842	1.4822	1.4796	1.4748	1.4723
20	1.4088	1.4074	1.4073	1.4060	-	1.4064	1.4058	1.4043	1.4014	1.3970	1.3954
35	1.2691	1.2685	1.2684	1.2674	-	1.2680	1.2677	1.2664	1.2638	1.2601	1.2595
50	1.1820	1.1817	1.1814	1.1808	-	1.1811	1.1812	1.1798	1.1777	1.1745	1.1750
75	1.0753	1.0753	1.0753	1.0747	-	1.0754	1.0751	1.0745	1.0727	1.0706	1.0715
100	0.9911	0.9913	0.9917	0.9915	-	0.9919	0.9922	0.9922	0.9903	0.9888	0.9913
150	0.8602	0.8610	0.8615	0.8615	-	0.8623	0.8623	0.8637	0.8619	0.8616	0.8657
200	0.7609	0.7620	0.7628	0.7631	-	0.7638	0.7634	0.7656	0.7642	0.7646	0.7691
350	0.5659	0.5676	0.5686	0.5685	-	0.5699	0.5692	0.5725	0.5720	0.5734	0.5783
500	0.4507	0.4523	0.4539	0.4538	-	0.4553	0.4545	0.4575	0.4572	0.4589	0.4635
750	0.3371	0.3383	0.3398	0.3397	-	0.3407	0.3409	0.3431	0.3432	0.3440	0.3489
1000	0.2694	0.2697	0.2711	0.2714	-	0.2723	0.2727	0.2749	0.2744	0.2761	0.2795
1500	0.1921	0.1932	0.1939	0.1938	-	0.1948	0.1944	0.1964	0.1962	0.1971	0.1999
2000	0.1493	0.1499	0.1507	0.1511	-	0.1511	0.1512	0.1531	0.1530	0.1538	0.1558
Case 3											
0	2.8808	2.8804	2.8801	2.8806	2.8807	2.8803	2.8802	2.8803	2.8806	2.8801	2.8803
0.5	2.6045	2.6019	2.6007	2.5994	2.6001	2.5988	2.5984	2.5965	2.5930	2.5878	2.5850
1	2.4465	2.4429	2.4416	2.4394	2.4407	2.4396	2.4382	2.4350	2.4296	2.4211	2.4163
3	2.1373	2.1335	2.1314	2.1297	2.1348	2.1333	2.1320	2.1278	2.1212	2.1102	2.1031
5	1.9794	1.9762	1.9742	1.9731	1.9817	1.9805	1.9790	1.9758	1.9701	1.9604	1.9538
7.5	1.8516	1.8484	1.8483	1.8464	1.8588	1.8576	1.8566	1.8539	1.8492	1.8408	1.8359
10	1.7604	1.7585	1.7573	1.7562	1.7717	1.7706	1.7702	1.7674	1.7642	1.7574	1.7533
15	1.6323	1.6314	1.6303	1.6295	1.6496	1.6489	1.6483	1.6465	1.6441	1.6395	1.6374
20	1.5414	1.5405	1.5402	1.5397	1.5626	1.5621	1.5619	1.5610	1.5593	1.5561	1.5551
35	1.3599	1.3599	1.3601	1.3596	1.3890	1.3887	1.3885	1.3885	1.3886	1.3905	1.3920
50	1.2369	1.2372	1.2377	1.2376	1.2703	1.2704	1.2705	1.2709	1.2732	1.2787	1.2837
75	1.0872	1.0882	1.0887	1.0890	1.1237	1.1241	1.1249	1.1266	1.1319	1.1437	1.1532
100	0.9752	0.9770	0.9776	0.9773	1.0130	1.0138	1.0150	1.0167	1.0241	1.0420	1.0547
150	0.8136	0.8151	0.8161	0.8166	0.8507	0.8510	0.8528	0.8553	0.8669	0.8921	0.9103
200	0.6999	0.7008	0.7023	0.7024	0.7346	0.7359	0.7374	0.7404	0.7534	0.7833	0.8050

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	0.4952	0.4969	0.4979	0.4981	0.5238	0.5244	0.5263	0.5297	0.5441	0.5784	0.6032
500	0.3843	0.3857	0.3866	0.3867	0.4073	0.4085	0.4100	0.4129	0.4272	0.4603	0.4842
750	0.2799	0.2807	0.2821	0.2823	0.2976	0.2985	0.2995	0.3025	0.3146	0.3442	0.3653
1000	0.2203	0.2215	0.2219	0.2223	0.2349	0.2351	0.2366	0.2386	0.2492	0.2747	0.2935
1500	0.1545	0.1553	0.1559	0.1559	0.1650	0.1654	0.1662	0.1681	0.1761	0.1961	0.2113
2000	0.1191	0.1194	0.1203	0.1202	0.1272	0.1275	0.1284	0.1297	0.1362	0.1524	0.1648
Case 4											
0	0.5579	0.5566	0.5555	0.5553	0.5550	0.5483	0.5481	0.5482	0.5517	0.5497	0.5487
0.5	0.5575	0.5556	0.5546	0.5538	0.5540	0.5470	0.5472	0.5463	0.5484	0.5464	0.5446
1	0.5603	0.5580	0.5566	0.5561	0.5562	0.5494	0.5489	0.5479	0.5493	0.5456	0.5438
3	0.5833	0.5795	0.5777	0.5763	0.5764	0.5701	0.5687	0.5662	0.5659	0.5579	0.5538
5	0.6070	0.6028	0.6008	0.5989	0.5995	0.5927	0.5921	0.5888	0.5865	0.5766	0.5709
7.5	0.6304	0.6261	0.6239	0.6221	0.6233	0.6171	0.6166	0.6127	0.6093	0.5978	0.5904
10	0.6475	0.6434	0.6410	0.6395	0.6409	0.6355	0.6341	0.6307	0.6262	0.6147	0.6070
15	0.6676	0.6634	0.6616	0.6598	0.6631	0.6584	0.6568	0.6536	0.6485	0.6365	0.6291
20	0.6751	0.6709	0.6698	0.6680	0.6726	0.6693	0.6677	0.6641	0.6591	0.6473	0.6396
35	0.6612	0.6580	0.6567	0.6557	0.6653	0.6622	0.6616	0.6579	0.6534	0.6428	0.6358
50	0.6260	0.6241	0.6225	0.6222	0.6343	0.6327	0.6315	0.6289	0.6244	0.6146	0.6085
75	0.5627	0.5609	0.5599	0.5596	0.5747	0.5730	0.5726	0.5698	0.5660	0.5574	0.5523
100	0.5058	0.5043	0.5029	0.5030	0.5186	0.5177	0.5174	0.5149	0.5113	0.5039	0.4992
150	0.4164	0.4156	0.4151	0.4147	0.4299	0.4293	0.4291	0.4272	0.4242	0.4183	0.4142
200	0.3533	0.3524	0.3516	0.3517	0.3658	0.3649	0.3648	0.3637	0.3609	0.3560	0.3530
350	0.2418	0.2413	0.2406	0.2405	0.2519	0.2516	0.2507	0.2503	0.2489	0.2453	0.2432
500	0.1838	0.1832	0.1834	0.1829	0.1919	0.1920	0.1917	0.1907	0.1897	0.1870	0.1854
750	0.1315	0.1314	0.1310	0.1311	0.1378	0.1375	0.1373	0.1370	0.1359	0.1344	0.1331
1000	0.1025	0.1024	0.1022	0.1021	0.1074	0.1075	0.1074	0.1067	0.1061	0.1049	0.1040
1500	0.0712	0.0710	0.0711	0.0710	0.0749	0.0747	0.0746	0.0746	0.0739	0.0731	0.0725
2000	0.0547	0.0545	0.0545	0.0544	0.0575	0.0574	0.0573	0.0571	0.0568	0.0562	0.0558
Case 5											
1	0.4945	0.4936	0.4934	0.4935	0.4890	0.4883	0.4883	0.4882	0.4896	0.4898	0.4899
1.25	0.4466	0.4470	0.4466	0.4464	0.4405	0.4403	0.4401	0.4401	0.4423	0.4438	0.4442
2	0.3460	0.3462	0.3467	0.3462	0.3389	0.3391	0.3393	0.3394	0.3417	0.3443	0.3456
2.25	0.3224	0.3229	0.3227	0.3231	0.3153	0.3153	0.3157	0.3159	0.3180	0.3209	0.3221
2.75	0.2845	0.2842	0.2845	0.2845	0.2777	0.2779	0.2777	0.2781	0.2801	0.2823	0.2839
3	0.2687	0.2693	0.2691	0.2693	0.2620	0.2624	0.2628	0.2634	0.2648	0.2670	0.2690
Case 6											
30	0.1208	0.1214	0.1211	0.1207	-	0.1205	0.1209	0.1206	0.1209	0.1200	0.1202
35	0.1131	0.1133	0.1136	0.1134	-	0.1132	0.1129	0.1135	0.1133	0.1130	0.1126
40	0.1076	0.1073	0.1076	0.1078	-	0.1074	0.1076	0.1072	0.1076	0.1070	0.1074

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
45	0.1028	0.1030	0.1022	0.1026	-	0.1030	0.1026	0.1025	0.1028	0.1023	0.1028
50	0.0995	0.0986	0.0993	0.0996	-	0.0998	0.0992	0.0990	0.0992	0.0994	0.0991
55	0.0964	0.0963	0.0964	0.0965	-	0.0969	0.0960	0.0962	0.0963	0.0961	0.0963
60	0.0941	0.0942	0.0942	0.0941	-	0.0935	0.0936	0.0940	0.0938	0.0941	0.0936
65	0.0918	0.0921	0.0922	0.0921	-	0.0913	0.0917	0.0915	0.0918	0.0915	0.0917
70	0.0900	0.0904	0.0900	0.0906	-	0.0904	0.0901	0.0902	0.0902	0.0900	0.0901
Case 7											
1E-20	0.4108	0.4099	0.4094	0.4085	0.4082	0.4076	0.4068	0.4054	0.4033	0.3990	0.3959
0.05	0.3646	0.3639	0.3634	0.3628	0.3632	0.3623	0.3622	0.3617	0.3603	0.3582	0.3565
0.1	0.3331	0.3324	0.3325	0.3320	0.3324	0.3318	0.3317	0.3314	0.3303	0.3286	0.3274
0.2	0.2953	0.2953	0.2946	0.2948	0.2947	0.2946	0.2943	0.2944	0.2939	0.2925	0.2920
0.3	0.2731	0.2731	0.2727	0.2731	0.2726	0.2727	0.2727	0.2722	0.2720	0.2712	0.2709
0.4	0.2583	0.2582	0.2583	0.2581	0.2580	0.2578	0.2579	0.2576	0.2579	0.2572	0.2574
0.5	0.2476	0.2474	0.2474	0.2481	0.2471	0.2472	0.2475	0.2467	0.2471	0.2472	0.2470
0.6	0.2392	0.2397	0.2391	0.2389	0.2393	0.2387	0.2387	0.2385	0.2394	0.2398	0.2397
0.7	0.2329	0.2327	0.2329	0.2327	0.2324	0.2320	0.2322	0.2322	0.2326	0.2335	0.2339
0.8	0.2274	0.2272	0.2275	0.2275	0.2271	0.2274	0.2271	0.2273	0.2276	0.2288	0.2294
0.9	0.2229	0.2226	0.2230	0.2231	0.2222	0.2224	0.2226	0.2227	0.2241	0.2251	0.2255
0.95	0.2207	0.2204	0.2212	0.2212	0.2201	0.2206	0.2206	0.2209	0.2221	0.2235	0.2240
1	0.2185	0.2195	0.2190	0.2194	0.2187	0.2186	0.2191	0.2190	0.2202	0.2220	0.2224
Case 8											
1	0.7399	0.7387	0.7378	0.7376	0.7358	0.7352	0.7346	0.7333	0.7312	0.7270	0.7231
1.5	0.6162	0.6161	0.6157	0.6152	0.6114	0.6114	0.6110	0.6105	0.6093	0.6077	0.6060
2	0.5254	0.5252	0.5249	0.5249	0.5190	0.5190	0.5192	0.5191	0.5190	0.5191	0.5177
2.5	0.4563	0.4561	0.4558	0.4559	0.4503	0.4508	0.4504	0.4505	0.4510	0.4515	0.4512
3	0.4029	0.4031	0.4029	0.4030	0.3974	0.3969	0.3973	0.3971	0.3981	0.3989	0.3992
4	0.3262	0.3264	0.3262	0.3261	0.3205	0.3209	0.3211	0.3214	0.3222	0.3238	0.3242
5	0.2738	0.2744	0.2741	0.2741	0.2687	0.2690	0.2690	0.2699	0.2704	0.2721	0.2731
6	0.2364	0.2365	0.2368	0.2365	0.2319	0.2319	0.2322	0.2323	0.2331	0.2349	0.2360
7	0.2081	0.2079	0.2086	0.2085	0.2035	0.2037	0.2040	0.2044	0.2055	0.2070	0.2076
8	0.1858	0.1857	0.1863	0.1863	0.1819	0.1820	0.1826	0.1825	0.1837	0.1852	0.1861
9	0.1683	0.1680	0.1686	0.1683	0.1644	0.1646	0.1648	0.1650	0.1662	0.1675	0.1681
Case 9											
0	0.8361	0.8313	0.8293	0.8275	0.8275	0.8184	0.8173	0.8144	0.8140	0.8053	0.8004
0.5	0.8612	0.8559	0.8535	0.8514	0.8513	0.8435	0.8420	0.8380	0.8356	0.8243	0.8172
1	0.8800	0.8743	0.8718	0.8695	0.8694	0.8620	0.8602	0.8560	0.8526	0.8387	0.8311
3	0.9222	0.9165	0.9141	0.9118	0.9127	0.9062	0.9047	0.8995	0.8936	0.8778	0.8679
5	0.9414	0.9363	0.9337	0.9312	0.9332	0.9280	0.9260	0.9215	0.9145	0.8989	0.8887
7.5	0.9515	0.9461	0.9437	0.9423	0.9456	0.9416	0.9398	0.9353	0.9278	0.9124	0.9021

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	0.9526	0.9484	0.9462	0.9446	0.9498	0.9460	0.9446	0.9401	0.9328	0.9178	0.9074
15	0.9402	0.9365	0.9344	0.9332	0.9422	0.9399	0.9381	0.9339	0.9268	0.9128	0.9030
20	0.9169	0.9134	0.9117	0.9110	0.9233	0.9207	0.9193	0.9157	0.9088	0.8957	0.8860
35	0.8275	0.8251	0.8243	0.8237	0.8428	0.8410	0.8400	0.8362	0.8304	0.8186	0.8102
50	0.7418	0.7398	0.7386	0.7383	0.7606	0.7590	0.7581	0.7553	0.7501	0.7396	0.7318
75	0.6257	0.6237	0.6227	0.6227	0.6458	0.6451	0.6442	0.6417	0.6373	0.6284	0.6217
100	0.5380	0.5366	0.5361	0.5356	0.5587	0.5581	0.5574	0.5552	0.5510	0.5437	0.5380
150	0.4192	0.4184	0.4174	0.4175	0.4381	0.4376	0.4368	0.4353	0.4319	0.4264	0.4216
200	0.3431	0.3423	0.3420	0.3413	0.3599	0.3595	0.3589	0.3574	0.3549	0.3499	0.3467
350	0.2221	0.2214	0.2212	0.2209	0.2344	0.2340	0.2337	0.2326	0.2310	0.2278	0.2258
500	0.1643	0.1639	0.1639	0.1636	0.1740	0.1737	0.1734	0.1729	0.1715	0.1693	0.1678
750	0.1148	0.1146	0.1143	0.1142	0.1218	0.1217	0.1215	0.1211	0.1202	0.1186	0.1177
1000	0.0883	0.0881	0.0880	0.0878	0.0938	0.0937	0.0935	0.0933	0.0926	0.0915	0.0909
1500	0.0605	0.0604	0.0603	0.0602	0.0643	0.0644	0.0643	0.0640	0.0635	0.0629	0.0625
2000	0.0460	0.0459	0.0459	0.0459	0.0491	0.0490	0.0489	0.0488	0.0485	0.0480	0.0477
Case 10											
0	1.5156	1.5127	1.5115	1.5104	1.5104	1.5027	1.5026	1.5016	1.5045	1.5000	1.4983
0.5	1.4949	1.4917	1.4899	1.4888	1.4890	1.4836	1.4825	1.4807	1.4785	1.4712	1.4666
1	1.4793	1.4755	1.4741	1.4726	1.4727	1.4681	1.4672	1.4644	1.4610	1.4517	1.4456
3	1.4254	1.4217	1.4200	1.4185	1.4210	1.4181	1.4168	1.4132	1.4079	1.3963	1.3885
5	1.3826	1.3797	1.3781	1.3763	1.3809	1.3793	1.3778	1.3741	1.3678	1.3562	1.3479
7.5	1.3373	1.3340	1.3325	1.3314	1.3392	1.3379	1.3365	1.3325	1.3269	1.3143	1.3055
10	1.2955	1.2926	1.2911	1.2899	1.3010	1.2998	1.2987	1.2948	1.2890	1.2770	1.2677
15	1.2181	1.2155	1.2143	1.2135	1.2305	1.2289	1.2274	1.2239	1.2182	1.2067	1.1979
20	1.1474	1.1450	1.1436	1.1430	1.1637	1.1627	1.1616	1.1583	1.1528	1.1416	1.1329
35	0.9690	0.9676	0.9664	0.9661	0.9939	0.9928	0.9919	0.9895	0.9841	0.9741	0.9665
50	0.8349	0.8337	0.8326	0.8323	0.8626	0.8616	0.8610	0.8586	0.8540	0.8448	0.8383
75	0.6763	0.6752	0.6742	0.6740	0.7047	0.7038	0.7026	0.7009	0.6965	0.6894	0.6842
100	0.5679	0.5669	0.5662	0.5657	0.5943	0.5935	0.5932	0.5914	0.5874	0.5814	0.5771
150	0.4292	0.4287	0.4282	0.4279	0.4523	0.4518	0.4512	0.4501	0.4472	0.4427	0.4395
200	0.3455	0.3448	0.3442	0.3442	0.3652	0.3648	0.3644	0.3631	0.3610	0.3572	0.3550
350	0.2177	0.2174	0.2171	0.2170	0.2316	0.2314	0.2311	0.2305	0.2291	0.2268	0.2255
500	0.1591	0.1589	0.1588	0.1587	0.1697	0.1696	0.1694	0.1689	0.1679	0.1664	0.1655
750	0.1100	0.1098	0.1097	0.1096	0.1177	0.1175	0.1174	0.1171	0.1164	0.1154	0.1149
1000	0.0840	0.0839	0.0838	0.0839	0.0900	0.0899	0.0899	0.0896	0.0891	0.0885	0.0881
1500	0.0572	0.0571	0.0571	0.0570	0.0614	0.0613	0.0612	0.0611	0.0608	0.0603	0.0600
2000	0.0434	0.0433	0.0433	0.0432	0.0465	0.0465	0.0465	0.0464	0.0461	0.0458	0.0456

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 11											
0	2.1952	2.1953	2.1952	2.1949	-	2.1947	2.1949	2.1952	2.1951	2.1948	2.1949
0.5	2.0562	2.0555	2.0555	2.0549	-	2.0552	2.0551	2.0549	2.0543	2.0539	2.0537
1	1.9706	1.9699	1.9697	1.9697	-	1.9691	1.9688	1.9682	1.9679	1.9665	1.9653
3	1.8035	1.8022	1.8018	1.8013	-	1.8009	1.8006	1.7995	1.7975	1.7942	1.7921
5	1.7220	1.7206	1.7203	1.7194	-	1.7188	1.7188	1.7177	1.7154	1.7117	1.7095
7.5	1.6523	1.6511	1.6509	1.6504	-	1.6501	1.6494	1.6483	1.6467	1.6432	1.6412
10	1.5963	1.5950	1.5946	1.5947	-	1.5939	1.5939	1.5931	1.5913	1.5886	1.5872
15	1.4993	1.4987	1.4986	1.4983	-	1.4983	1.4979	1.4971	1.4962	1.4946	1.4934
20	1.4138	1.4137	1.4130	1.4128	-	1.4125	1.4129	1.4119	1.4116	1.4106	1.4104
35	1.2033	1.2035	1.2028	1.2029	-	1.2030	1.2032	1.2026	1.2026	1.2025	1.2030
50	1.0440	1.0438	1.0436	1.0438	-	1.0437	1.0439	1.0438	1.0435	1.0437	1.0443
75	0.8533	0.8531	0.8531	0.8529	-	0.8528	0.8531	0.8524	0.8525	0.8527	0.8532
100	0.7205	0.7205	0.7201	0.7202	-	0.7200	0.7201	0.7194	0.7193	0.7198	0.7203
150	0.5489	0.5485	0.5485	0.5485	-	0.5483	0.5485	0.5478	0.5477	0.5478	0.5480
200	0.4432	0.4430	0.4427	0.4427	-	0.4424	0.4425	0.4420	0.4420	0.4420	0.4422
350	0.2807	0.2805	0.2802	0.2802	-	0.2801	0.2801	0.2797	0.2795	0.2796	0.2797
500	0.2054	0.2051	0.2049	0.2050	-	0.2049	0.2048	0.2045	0.2044	0.2044	0.2044
750	0.1419	0.1418	0.1416	0.1416	-	0.1415	0.1415	0.1412	0.1412	0.1412	0.1412
1000	0.1084	0.1082	0.1082	0.1081	-	0.1080	0.1081	0.1079	0.1078	0.1078	0.1078
1500	0.0736	0.0735	0.0734	0.0734	-	0.0734	0.0734	0.0732	0.0732	0.0732	0.0732
2000	0.0557	0.0557	0.0556	0.0556	-	0.0555	0.0556	0.0554	0.0554	0.0554	0.0554
Case 12											
0	0.9335	0.9286	0.9267	0.9249	-	0.9167	0.9160	0.9130	0.9124	0.9049	0.8999
0.5	0.9512	0.9460	0.9437	0.9412	-	0.9336	0.9322	0.9281	0.9257	0.9146	0.9079
1	0.9656	0.9595	0.9567	0.9548	-	0.9476	0.9461	0.9415	0.9374	0.9243	0.9166
3	0.9979	0.9916	0.9889	0.9870	-	0.9808	0.9790	0.9739	0.9674	0.9513	0.9417
5	1.0105	1.0054	1.0026	1.0001	-	0.9955	0.9932	0.9881	0.9812	0.9651	0.9543
7.5	1.0169	1.0117	1.0096	1.0071	-	1.0040	1.0024	0.9963	0.9891	0.9730	0.9629
10	1.0187	1.0142	1.0120	1.0101	-	1.0067	1.0050	1.0000	0.9924	0.9768	0.9659
15	1.0177	1.0133	1.0109	1.0093	-	1.0066	1.0054	1.0007	0.9927	0.9772	0.9666
20	1.0131	1.0087	1.0074	1.0056	-	1.0036	1.0014	0.9972	0.9893	0.9744	0.9640
35	0.9903	0.9875	0.9854	0.9838	-	0.9825	0.9811	0.9769	0.9693	0.9553	0.9456
50	0.9611	0.9587	0.9569	0.9558	-	0.9542	0.9531	0.9498	0.9423	0.9289	0.9204
75	0.9075	0.9053	0.9043	0.9030	-	0.9020	0.9012	0.8982	0.8915	0.8800	0.8730
100	0.8540	0.8523	0.8517	0.8506	-	0.8497	0.8489	0.8471	0.8413	0.8309	0.8257
150	0.7578	0.7567	0.7565	0.7561	-	0.7559	0.7549	0.7545	0.7494	0.7414	0.7387
200	0.6783	0.6776	0.6781	0.6771	-	0.6772	0.6764	0.6767	0.6729	0.6663	0.6651
350	0.5126	0.5125	0.5128	0.5124	-	0.5133	0.5122	0.5138	0.5112	0.5080	0.5087

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	0.4102	0.4106	0.4119	0.4116	-	0.4122	0.4117	0.4133	0.4114	0.4094	0.4107
750	0.3083	0.3092	0.3097	0.3095	-	0.3104	0.3098	0.3115	0.3107	0.3096	0.3112
1000	0.2469	0.2481	0.2481	0.2483	-	0.2489	0.2484	0.2499	0.2498	0.2492	0.2510
1500	0.1769	0.1774	0.1777	0.1781	-	0.1785	0.1783	0.1798	0.1796	0.1790	0.1811
2000	0.1379	0.1382	0.1387	0.1387	-	0.1393	0.1391	0.1403	0.1401	0.1402	0.1416
Case 13											
0	0.5579	0.5563	0.5558	0.5545	-	0.5485	0.5484	0.5483	0.5514	0.5499	0.5494
0.5	0.5573	0.5553	0.5545	0.5537	-	0.5475	0.5473	0.5462	0.5492	0.5465	0.5449
1	0.5608	0.5577	0.5564	0.5562	-	0.5495	0.5488	0.5478	0.5497	0.5460	0.5437
3	0.5835	0.5798	0.5783	0.5767	-	0.5700	0.5694	0.5667	0.5659	0.5585	0.5541
5	0.6079	0.6038	0.6023	0.6005	-	0.5939	0.5929	0.5899	0.5869	0.5775	0.5711
7.5	0.6334	0.6288	0.6269	0.6250	-	0.6192	0.6177	0.6141	0.6107	0.5995	0.5923
10	0.6522	0.6478	0.6460	0.6443	-	0.6389	0.6372	0.6337	0.6294	0.6171	0.6095
15	0.6778	0.6734	0.6719	0.6698	-	0.6651	0.6640	0.6601	0.6552	0.6431	0.6354
20	0.6914	0.6871	0.6853	0.6837	-	0.6795	0.6782	0.6747	0.6702	0.6580	0.6495
35	0.6925	0.6894	0.6878	0.6865	-	0.6841	0.6825	0.6803	0.6746	0.6641	0.6571
50	0.6690	0.6663	0.6646	0.6635	-	0.6613	0.6607	0.6585	0.6537	0.6442	0.6376
75	0.6149	0.6122	0.6112	0.6104	-	0.6088	0.6084	0.6059	0.6023	0.5939	0.5886
100	0.5606	0.5592	0.5583	0.5576	-	0.5562	0.5560	0.5538	0.5502	0.5432	0.5383
150	0.4714	0.4700	0.4693	0.4686	-	0.4676	0.4675	0.4656	0.4633	0.4578	0.4539
200	0.4044	0.4033	0.4026	0.4026	-	0.4016	0.4014	0.3995	0.3977	0.3930	0.3899
350	0.2827	0.2815	0.2810	0.2806	-	0.2805	0.2805	0.2789	0.2774	0.2750	0.2724
500	0.2166	0.2162	0.2158	0.2156	-	0.2154	0.2153	0.2144	0.2131	0.2111	0.2096
750	0.1562	0.1559	0.1558	0.1553	-	0.1555	0.1551	0.1544	0.1538	0.1525	0.1517
1000	0.1220	0.1218	0.1219	0.1216	-	0.1214	0.1216	0.1210	0.1205	0.1194	0.1188
1500	0.0854	0.0852	0.0852	0.0850	-	0.0849	0.0848	0.0845	0.0842	0.0836	0.0830
2000	0.0656	0.0656	0.0653	0.0652	-	0.0653	0.0653	0.0649	0.0647	0.0643	0.0640
Case 14											
0	0.8363	0.8310	0.8293	0.8276	-	0.8182	0.8171	0.8147	0.8138	0.8054	0.8004
0.5	0.8616	0.8564	0.8536	0.8515	-	0.8432	0.8421	0.8381	0.8354	0.8245	0.8175
1	0.8805	0.8749	0.8725	0.8702	-	0.8622	0.8609	0.8563	0.8526	0.8395	0.8313
3	0.9250	0.9192	0.9166	0.9144	-	0.9085	0.9063	0.9013	0.8949	0.8792	0.8688
5	0.9473	0.9415	0.9393	0.9375	-	0.9318	0.9303	0.9252	0.9182	0.9020	0.8912
7.5	0.9626	0.9578	0.9554	0.9531	-	0.9489	0.9471	0.9422	0.9349	0.9188	0.9082
10	0.9699	0.9654	0.9632	0.9614	-	0.9576	0.9559	0.9514	0.9432	0.9282	0.9178
15	0.9701	0.9659	0.9643	0.9624	-	0.9598	0.9583	0.9539	0.9465	0.9321	0.9214
20	0.9581	0.9546	0.9528	0.9510	-	0.9487	0.9475	0.9433	0.9368	0.9231	0.9134
35	0.8926	0.8902	0.8879	0.8869	-	0.8853	0.8842	0.8812	0.8752	0.8634	0.8548
50	0.8181	0.8154	0.8146	0.8132	-	0.8120	0.8113	0.8087	0.8035	0.7933	0.7854

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	0.7084	0.7062	0.7053	0.7044	-	0.7032	0.7025	0.7004	0.6959	0.6872	0.6812
100	0.6202	0.6187	0.6175	0.6170	-	0.6162	0.6155	0.6137	0.6098	0.6029	0.5975
150	0.4944	0.4930	0.4925	0.4917	-	0.4908	0.4904	0.4888	0.4860	0.4807	0.4772
200	0.4105	0.4094	0.4087	0.4078	-	0.4076	0.4073	0.4053	0.4034	0.3993	0.3961
350	0.2714	0.2703	0.2702	0.2700	-	0.2696	0.2693	0.2683	0.2670	0.2645	0.2627
500	0.2028	0.2023	0.2020	0.2018	-	0.2014	0.2014	0.2004	0.1996	0.1980	0.1970
750	0.1429	0.1426	0.1423	0.1421	-	0.1420	0.1419	0.1413	0.1408	0.1398	0.1392
1000	0.1104	0.1102	0.1099	0.1097	-	0.1098	0.1097	0.1093	0.1089	0.1082	0.1078
1500	0.0759	0.0758	0.0757	0.0756	-	0.0755	0.0755	0.0753	0.0750	0.0747	0.0744
2000	0.0580	0.0579	0.0578	0.0577	-	0.0576	0.0577	0.0575	0.0573	0.0571	0.0570
Case 15											
0	1.5153	1.5123	1.5115	1.5101	-	1.5032	1.5027	1.5020	1.5041	1.5005	1.4985
0.5	1.4953	1.4921	1.4905	1.4894	-	1.4836	1.4829	1.4805	1.4789	1.4713	1.4665
1	1.4804	1.4765	1.4752	1.4736	-	1.4695	1.4679	1.4649	1.4618	1.4522	1.4461
3	1.4324	1.4285	1.4268	1.4253	-	1.4221	1.4209	1.4170	1.4114	1.3998	1.3919
5	1.3974	1.3939	1.3922	1.3907	-	1.3884	1.3871	1.3830	1.3771	1.3647	1.3557
7.5	1.3629	1.3590	1.3578	1.3564	-	1.3546	1.3529	1.3495	1.3432	1.3304	1.3217
10	1.3318	1.3288	1.3271	1.3255	-	1.3239	1.3228	1.3195	1.3127	1.3002	1.2914
15	1.2736	1.2707	1.2692	1.2681	-	1.2666	1.2656	1.2622	1.2556	1.2436	1.2346
20	1.2173	1.2151	1.2136	1.2120	-	1.2116	1.2097	1.2069	1.2012	1.1890	1.1811
35	1.0656	1.0632	1.0627	1.0612	-	1.0606	1.0593	1.0567	1.0516	1.0419	1.0346
50	0.9410	0.9394	0.9382	0.9375	-	0.9368	0.9359	0.9334	0.9292	0.9206	0.9152
75	0.7843	0.7824	0.7815	0.7812	-	0.7803	0.7798	0.7774	0.7741	0.7678	0.7630
100	0.6705	0.6693	0.6680	0.6678	-	0.6671	0.6667	0.6648	0.6620	0.6569	0.6535
150	0.5191	0.5179	0.5173	0.5168	-	0.5164	0.5159	0.5146	0.5125	0.5092	0.5067
200	0.4232	0.4223	0.4219	0.4215	-	0.4209	0.4211	0.4195	0.4182	0.4156	0.4142
350	0.2725	0.2719	0.2717	0.2715	-	0.2711	0.2711	0.2704	0.2695	0.2684	0.2676
500	0.2011	0.2007	0.2005	0.2003	-	0.2003	0.2000	0.1996	0.1992	0.1983	0.1981
750	0.1401	0.1399	0.1397	0.1396	-	0.1395	0.1395	0.1391	0.1389	0.1385	0.1384
1000	0.1075	0.1074	0.1072	0.1072	-	0.1071	0.1071	0.1068	0.1066	0.1064	0.1064
1500	0.0735	0.0734	0.0733	0.0733	-	0.0732	0.0732	0.0730	0.0730	0.0728	0.0728
2000	0.0559	0.0558	0.0557	0.0557	-	0.0557	0.0556	0.0555	0.0555	0.0554	0.0554

Table C-3: (k_T-k_{room}) for reference cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	0	30	40	10	-	0	-30	60	-30	-10	-10
0.5	570	330	190	90	-	0	-90	-320	-680	-1190	-1480
1	920	490	320	180	-	0	-130	-490	-1050	-1980	-2510
3	1070	600	380	190	-	0	-180	-620	-1420	-2790	-3630
5	1000	580	340	160	-	0	-160	-600	-1320	-2670	-3550
7.5	870	510	340	190	-	0	-160	-560	-1170	-2450	-3280
10	830	460	310	160	-	0	-110	-480	-1060	-2180	-2920
15	630	360	250	150	-	0	-120	-350	-850	-1810	-2450
20	580	290	200	90	-	0	-120	-330	-730	-1520	-2090
35	480	210	140	40	-	0	-60	-270	-530	-1080	-1490
50	480	240	140	160	-	0	0	-250	-460	-880	-1270
75	450	330	140	110	-	0	-10	-350	-480	-850	-1110
100	550	340	180	130	-	0	0	-370	-500	-840	-1070
150	700	470	250	150	-	0	0	-470	-560	-830	-1100
200	810	520	280	200	-	0	-10	-590	-650	-920	-1170
350	890	570	310	230	-	0	-30	-640	-730	-950	-1160
500	820	520	290	200	-	0	0	-550	-580	-770	-930
750	500	310	170	110	-	0	-10	-310	-330	-400	-430
1000	140	90	50	20	-	0	-10	0	-10	30	80
1500	-460	-300	-170	-120	-	0	20	490	580	740	980
2000	-910	-610	-340	-240	-	0	40	890	990	1280	1660
Case 2											
0	-20	-50	10	-50	-	0	-20	-50	-10	-40	-50
0.5	580	290	170	60	-	0	-110	-310	-600	-1020	-1270
1	850	480	310	170	-	0	-90	-450	-930	-1760	-2200
3	870	510	300	150	-	0	-170	-550	-1190	-2290	-2980
5	800	470	300	150	-	0	-110	-470	-1070	-2110	-2780
7.5	710	410	260	120	-	0	-110	-400	-950	-1930	-2530
10	650	340	210	60	-	0	-100	-380	-880	-1820	-2400
15	530	320	150	30	-	0	-120	-380	-880	-1750	-2280
20	540	330	200	40	-	0	-70	-340	-770	-1680	-2250
35	500	310	240	70	-	0	-50	-360	-830	-1770	-2370
50	530	320	210	30	-	0	-40	-440	-870	-1820	-2530
75	610	410	220	120	-	0	-40	-490	-920	-1890	-2620
100	700	420	250	130	-	0	-30	-540	-1000	-1890	-2600
150	860	520	270	160	-	0	-20	-630	-960	-1890	-2530
200	920	560	290	150	-	0	-50	-700	-1030	-1870	-2440

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	920	610	310	150	-	0	-50	-680	-980	-1550	-1970
500	820	550	310	160	-	0	-20	-560	-750	-1190	-1480
750	430	250	120	40	-	0	-50	-350	-470	-700	-750
1000	110	50	40	0	-	0	-40	-50	-90	-160	-160
1500	-460	-320	-150	-100	-	0	20	520	530	620	870
2000	-890	-590	-380	-250	-	0	10	860	910	1180	1530
Case 3											
0	-10	10	0	0	-60	0	-30	-10	-30	-80	-50
0.5	620	370	230	120	90	0	-60	-310	-620	-1150	-1440
1	890	500	290	120	100	0	-140	-520	-1050	-1970	-2480
3	1080	610	360	160	160	0	-150	-670	-1430	-2770	-3640
5	960	540	340	160	150	0	-220	-640	-1400	-2750	-3590
7.5	920	500	270	170	150	0	-180	-560	-1250	-2510	-3300
10	760	440	280	90	110	0	-130	-540	-1190	-2280	-3120
15	640	390	250	100	110	0	-70	-410	-980	-2080	-2770
20	550	290	210	80	100	0	-110	-400	-960	-1990	-2640
35	410	220	120	70	90	0	-90	-360	-990	-2130	-2860
50	350	190	40	70	60	0	-180	-440	-1220	-2610	-3410
75	430	200	40	30	110	0	-200	-520	-1620	-3450	-4370
100	540	290	100	20	140	0	-230	-690	-1950	-4170	-5220
150	620	410	130	80	230	0	-260	-810	-2540	-5200	-6470
200	690	440	170	80	270	0	-340	-930	-2940	-5850	-7160
350	840	500	210	90	260	0	-330	-990	-3120	-5890	-6980
500	730	440	200	120	210	0	-330	-880	-2580	-4560	-5250
750	480	290	140	70	110	0	-190	-480	-1160	-1370	-1260
1000	180	120	70	50	30	0	-30	-30	380	2030	2950
1500	-370	-230	-90	-40	-130	0	220	710	3040	8040	10430
2000	-800	-500	-250	-120	-240	0	390	1260	5030	12710	16310
Case 4											
0	980	820	680	640	670	0	-40	-30	310	140	110
0.5	980	770	650	600	590	0	-100	-120	130	-180	-350
1	1100	810	730	600	590	0	-70	-140	-20	-400	-600
3	1380	1000	850	670	720	0	-70	-290	-380	-1140	-1630
5	1450	990	790	650	600	0	-170	-470	-790	-1750	-2360
7.5	1470	1020	800	620	610	0	-100	-490	-890	-2090	-2820
10	1470	970	760	590	610	0	-150	-570	-1020	-2340	-3120
15	1400	920	660	480	490	0	-200	-620	-1210	-2600	-3570
20	1360	850	650	480	450	0	-160	-620	-1260	-2770	-3830
35	1210	770	540	420	460	0	-130	-660	-1430	-3110	-4300

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
50	1220	710	470	340	350	0	-190	-670	-1540	-3420	-4700
75	1040	570	370	190	240	0	-260	-770	-1810	-3850	-5270
100	1040	580	360	150	280	0	-240	-810	-1930	-4100	-5650
150	1080	620	340	200	270	0	-290	-840	-2120	-4460	-6100
200	1120	600	360	210	240	0	-280	-860	-2220	-4660	-6390
350	1130	660	410	200	270	0	-310	-940	-2480	-5070	-6800
500	1140	640	350	120	250	0	-340	-1010	-2640	-5230	-6920
750	1250	720	430	230	280	0	-360	-1100	-2680	-5210	-6780
1000	1300	710	420	210	290	0	-320	-1040	-2690	-5060	-6540
1500	1280	740	430	200	280	0	-370	-1060	-2630	-4760	-6020
2000	1250	680	370	190	250	0	-380	-1000	-2550	-4490	-5550
Case 5											
1	-780	-1020	-1170	-1280	220	0	-80	-320	-860	-1970	-2810
1.25	-550	-640	-740	-820	180	0	20	-160	-490	-1430	-2150
2	-240	80	300	270	-80	0	250	470	750	640	340
2.25	-220	240	580	680	-140	0	330	670	1240	1390	1190
2.75	-280	480	1020	1130	-320	0	480	1100	2090	2800	2910
3	-300	640	1260	1380	-390	0	550	1290	2570	3520	3670
Case 6											
30	650	390	290	180	-	0	-50	-570	-1110	-2470	-3320
35	560	400	270	210	-	0	-20	-460	-970	-2270	-2990
40	460	280	230	150	-	0	-60	-450	-920	-2040	-2740
45	320	210	210	110	-	0	-30	-320	-760	-1780	-2400
50	240	200	180	150	-	0	-30	-240	-610	-1490	-2110
55	100	100	120	120	-	0	0	-160	-510	-1260	-1800
60	-20	-10	50	10	-	0	-40	-110	-380	-1050	-1500
65	-100	20	60	60	-	0	-10	-20	-250	-760	-1170
70	-310	-100	-10	-10	-	0	-30	-30	-150	-560	-870
Case 7											
1E-20	1390	840	560	410	360	0	-180	-700	-1590	-3390	-4630
0.05	1170	700	460	270	270	0	-200	-740	-1540	-3280	-4470
0.1	970	600	390	230	230	0	-150	-600	-1380	-2980	-4120
0.2	650	420	320	190	150	0	-90	-410	-1040	-2350	-3350
0.3	300	220	200	90	80	0	10	-190	-540	-1580	-2370
0.4	-120	-20	80	40	20	0	110	110	-50	-680	-1330
0.5	-560	-240	-40	-20	-70	0	190	310	510	220	-260
0.6	-980	-490	-160	-90	-180	0	290	560	1080	1120	830
0.7	-1460	-760	-260	-180	-290	0	370	800	1580	1980	1860
0.8	-1900	-1010	-420	-260	-380	0	420	1050	2080	2790	2860

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
0.9	-2190	-1180	-490	-250	-430	0	570	1320	2650	3630	3830
0.95	-2360	-1290	-550	-330	-450	0	560	1320	2830	3980	4230
1	-2570	-1400	-570	-370	-480	0	600	1450	3050	4320	4620
Case 8											
1	-920	-1270	-1490	-1640	220	0	-170	-640	-1470	-3180	-4500
1.5	-650	-940	-1120	-1240	100	0	-160	-500	-1310	-2870	-4030
2	-370	-580	-700	-800	120	0	-50	-360	-1030	-2470	-3510
2.5	-90	-210	-260	-350	60	0	-20	-220	-790	-2030	-2950
3	160	80	70	30	10	0	-10	-140	-540	-1630	-2450
4	520	620	680	650	-50	0	50	120	-10	-750	-1320
5	810	1040	1240	1240	-90	0	180	410	500	140	-230
6	840	1320	1600	1700	-180	0	230	570	990	980	690
7	950	1580	1920	2080	-280	0	380	800	1470	1760	1620
8	960	1710	2210	2340	-380	0	410	1010	1930	2450	2430
9	1000	1930	2450	2680	-390	0	540	1190	2370	3160	3270
Case 9											
0	1800	1320	1090	890	920	0	-110	-390	-390	-1260	-1810
0.5	1840	1280	1060	820	850	0	-190	-530	-810	-1940	-2620
1	1840	1240	960	770	760	0	-220	-630	-1010	-2360	-3130
3	1710	1100	860	600	600	0	-200	-700	-1320	-2950	-3990
5	1530	990	740	520	500	0	-200	-730	-1470	-3160	-4260
7.5	1470	940	680	460	440	0	-170	-720	-1530	-3270	-4490
10	1470	890	610	430	460	0	-170	-690	-1560	-3340	-4570
15	1260	750	470	360	360	0	-200	-740	-1660	-3550	-4890
20	1260	680	510	290	340	0	-190	-760	-1720	-3680	-5130
35	1160	650	380	250	250	0	-230	-820	-1910	-4050	-5660
50	1170	670	390	230	260	0	-220	-780	-1960	-4260	-6000
75	1140	640	420	200	280	0	-220	-830	-2050	-4510	-6370
100	1180	630	440	190	240	0	-180	-830	-2120	-4700	-6560
150	1100	660	390	190	230	0	-250	-850	-2210	-4940	-6850
200	1110	700	430	220	250	0	-270	-850	-2290	-4960	-6850
350	1110	660	360	230	280	0	-250	-900	-2420	-5050	-6800
500	1130	640	360	210	270	0	-290	-990	-2490	-5000	-6630
750	1160	680	380	190	240	0	-330	-950	-2580	-4890	-6280
1000	1200	720	390	220	300	0	-290	-990	-2520	-4710	-5910
1500	1200	720	380	180	290	0	-340	-990	-2490	-4350	-5390
2000	1150	700	350	180	230	0	-320	-940	-2410	-4070	-4960

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 10											
0	1190	950	790	700	690	0	-70	-150	60	-260	-500
0.5	1170	820	650	530	560	0	-90	-360	-500	-1230	-1730
1	1100	730	570	440	390	0	-170	-440	-780	-1720	-2290
3	1020	670	430	300	300	0	-140	-510	-1120	-2340	-3200
5	1000	580	410	260	240	0	-160	-600	-1270	-2670	-3660
7.5	1000	590	410	260	240	0	-130	-560	-1320	-2910	-4050
10	970	560	340	220	190	0	-170	-610	-1490	-3140	-4360
15	1020	550	370	250	250	0	-130	-610	-1550	-3380	-4740
20	1030	590	370	260	260	0	-140	-650	-1620	-3540	-4940
35	1020	560	360	150	170	0	-210	-720	-1830	-3910	-5460
50	1020	630	460	190	240	0	-150	-690	-1820	-4010	-5620
75	940	490	340	150	150	0	-250	-730	-1920	-4120	-5750
100	930	600	400	200	180	0	-170	-680	-1850	-4110	-5640
150	890	540	360	180	190	0	-220	-630	-1810	-4000	-5490
200	820	500	270	160	160	0	-200	-730	-1800	-3940	-5290
350	700	430	260	90	120	0	-270	-670	-1840	-3810	-4890
500	770	480	280	150	190	0	-190	-690	-1850	-3630	-4690
750	830	450	300	140	190	0	-240	-670	-1940	-3580	-4460
1000	820	480	210	140	170	0	-320	-780	-2070	-3660	-4490
1500	950	570	320	190	230	0	-290	-820	-2090	-3570	-4300
2000	980	600	290	150	240	0	-280	-810	-2100	-3500	-4160
Case 11											
0	0	-10	20	0	-	0	10	20	20	30	20
0.5	70	40	40	50	-	0	0	-30	-80	-110	-170
1	130	100	80	-10	-	0	-30	-70	-150	-300	-440
3	380	190	180	90	-	0	-40	-160	-460	-860	-1170
5	440	250	150	80	-	0	-50	-220	-520	-1130	-1440
7.5	490	250	190	140	-	0	-80	-240	-610	-1220	-1610
10	420	210	150	50	-	0	-60	-300	-660	-1220	-1590
15	430	280	200	70	-	0	10	-190	-500	-980	-1360
20	340	160	150	80	-	0	-10	-230	-480	-910	-1240
35	210	160	70	60	-	0	-40	-160	-260	-610	-770
50	150	130	50	0	-	0	20	-110	-170	-420	-550
75	150	60	80	20	-	0	10	-80	-150	-250	-360
100	120	70	40	30	-	0	0	-90	-130	-220	-280
150	90	70	50	50	-	0	0	-100	-120	-180	-230
200	120	80	50	30	-	0	10	-110	-130	-190	-240
350	240	160	80	60	-	0	0	-200	-210	-270	-320

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	370	240	140	80	-	0	-20	-270	-290	-360	-410
750	580	370	200	130	-	0	-20	-320	-370	-450	-530
1000	730	460	250	150	-	0	-40	-420	-440	-550	-630
1500	910	560	300	180	-	0	-40	-440	-500	-630	-710
2000	1000	610	330	210	-	0	-40	-430	-480	-610	-740
Case 12											
0	1620	1150	1010	780	-	0	-120	-380	-440	-1230	-1660
0.5	1730	1190	930	750	-	0	-180	-560	-820	-1920	-2570
1	1770	1230	920	730	-	0	-240	-630	-1060	-2360	-3130
3	1700	1110	840	580	-	0	-210	-710	-1400	-2990	-4050
5	1550	970	740	510	-	0	-170	-740	-1500	-3140	-4290
7.5	1440	870	630	390	-	0	-230	-720	-1590	-3240	-4490
10	1340	830	600	350	-	0	-180	-740	-1580	-3380	-4520
15	1250	740	530	310	-	0	-180	-720	-1650	-3490	-4780
20	1190	720	470	250	-	0	-250	-800	-1730	-3670	-5010
35	1240	710	490	270	-	0	-150	-810	-1830	-3900	-5450
50	1290	740	470	230	-	0	-190	-820	-1920	-4130	-5770
75	1280	810	510	240	-	0	-170	-820	-1970	-4250	-5930
100	1360	820	520	270	-	0	-190	-910	-1990	-4310	-6020
150	1370	770	460	220	-	0	-220	-1000	-2090	-4350	-5980
200	1420	830	520	280	-	0	-190	-1020	-2070	-4200	-5820
350	1380	830	520	230	-	0	-170	-990	-1900	-3780	-5160
500	1230	720	450	230	-	0	-130	-860	-1670	-3220	-4410
750	890	490	290	150	-	0	-120	-510	-1210	-2430	-3250
1000	520	300	140	60	-	0	-110	-210	-820	-1730	-2330
1500	-90	-60	-50	-40	-	0	-50	280	-50	-570	-790
2000	-550	-390	-190	-140	-	0	-30	630	430	190	160
Case 13											
0	990	810	730	650	-	0	-20	-50	300	140	60
0.5	1040	850	760	660	-	0	10	-80	180	-80	-210
1	1170	910	780	690	-	0	0	-50	100	-290	-520
3	1360	1020	850	720	-	0	-50	-290	-370	-1220	-1590
5	1440	970	790	670	-	0	-140	-450	-690	-1760	-2300
7.5	1520	1030	810	630	-	0	-140	-530	-890	-2070	-2790
10	1490	960	770	570	-	0	-140	-550	-990	-2270	-3110
15	1420	940	690	510	-	0	-210	-630	-1180	-2570	-3490
20	1400	920	710	500	-	0	-110	-590	-1230	-2720	-3640
35	1340	840	600	420	-	0	-100	-550	-1310	-2900	-3990
50	1240	740	540	340	-	0	-170	-580	-1390	-3040	-4220

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	1170	710	480	270	-	0	-190	-610	-1410	-3150	-4430
100	1140	680	430	280	-	0	-180	-600	-1480	-3210	-4540
150	1200	680	460	250	-	0	-130	-620	-1510	-3280	-4640
200	1150	690	450	230	-	0	-140	-700	-1590	-3330	-4670
350	1240	710	430	260	-	0	-200	-790	-1590	-3330	-4660
500	1290	810	430	210	-	0	-150	-830	-1610	-3210	-4490
750	1350	810	470	290	-	0	-120	-820	-1540	-2980	-4130
1000	1360	840	500	270	-	0	-150	-810	-1440	-2760	-3770
1500	1380	800	460	280	-	0	-130	-760	-1340	-2420	-3190
2000	1320	800	490	260	-	0	-120	-740	-1190	-2090	-2770
Case 14											
0	1800	1270	1120	910	-	0	-110	-370	-420	-1260	-1780
0.5	1830	1270	1030	830	-	0	-150	-480	-750	-1880	-2630
1	1800	1290	1010	770	-	0	-200	-610	-1010	-2310	-3120
3	1750	1130	870	590	-	0	-210	-690	-1380	-2950	-3980
5	1580	1020	720	560	-	0	-210	-750	-1500	-3190	-4290
7.5	1520	960	700	480	-	0	-150	-720	-1540	-3310	-4490
10	1390	860	590	390	-	0	-190	-730	-1610	-3380	-4630
15	1350	810	570	340	-	0	-190	-710	-1650	-3540	-4830
20	1270	760	530	320	-	0	-230	-770	-1680	-3600	-4990
35	1200	690	510	240	-	0	-200	-740	-1710	-3750	-5270
50	1220	710	450	230	-	0	-170	-640	-1710	-3770	-5320
75	1140	690	380	230	-	0	-210	-730	-1760	-3820	-5400
100	1150	700	430	260	-	0	-210	-740	-1760	-3810	-5370
150	1080	630	400	200	-	0	-220	-740	-1780	-3780	-5360
200	1070	630	370	180	-	0	-250	-840	-1790	-3750	-5240
350	1180	720	450	280	-	0	-130	-780	-1640	-3270	-4590
500	1130	750	390	250	-	0	-170	-780	-1540	-3070	-4150
750	1250	750	440	250	-	0	-110	-730	-1390	-2580	-3530
1000	1260	790	440	250	-	0	-100	-730	-1280	-2260	-2990
1500	1240	760	390	240	-	0	-110	-700	-1100	-1800	-2330
2000	1190	720	400	220	-	0	-120	-630	-940	-1500	-1950
Case 15											
0	1240	970	880	730	-	0	0	-100	140	-200	-490
0.5	1170	810	670	580	-	0	-70	-360	-440	-1260	-1720
1	1140	800	610	480	-	0	-100	-400	-730	-1690	-2290
3	1010	620	470	280	-	0	-160	-560	-1170	-2390	-3260
5	950	560	370	200	-	0	-240	-640	-1310	-2740	-3750
7.5	1040	590	400	250	-	0	-140	-590	-1380	-2880	-4000

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	990	520	360	180	-	0	-210	-690	-1530	-3150	-4330
15	1030	620	400	220	-	0	-150	-670	-1520	-3310	-4620
20	1080	590	410	180	-	0	-160	-680	-1590	-3440	-4810
35	1110	630	430	270	-	0	-140	-640	-1590	-3500	-4860
50	1010	560	360	160	-	0	-180	-730	-1620	-3530	-4940
75	970	560	370	160	-	0	-140	-710	-1650	-3370	-4710
100	920	590	380	200	-	0	-150	-650	-1530	-3210	-4430
150	900	530	340	170	-	0	-150	-660	-1400	-2850	-3940
200	880	550	340	220	-	0	-120	-570	-1240	-2520	-3430
350	740	460	280	160	-	0	-110	-550	-1020	-1970	-2620
500	820	490	300	200	-	0	-70	-500	-890	-1590	-2040
750	890	520	330	190	-	0	-70	-490	-760	-1280	-1580
1000	910	560	330	190	-	0	-70	-520	-740	-1080	-1340
1500	1020	640	330	200	-	0	-70	-530	-630	-890	-1100
2000	1050	630	350	210	-	0	-70	-510	-580	-810	-980

Table C-4: $(k_T - k_{room})$ for reference cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	20	10	10	20	-	0	30	30	-10	-10	20
0.5	580	270	160	80	-	0	-110	-350	-700	-1150	-1440
1	890	470	360	160	-	0	-130	-460	-990	-1860	-2400
3	1000	560	340	140	-	0	-150	-540	-1230	-2390	-3110
5	800	430	250	140	-	0	-130	-490	-1060	-2140	-2810
7.5	690	440	320	230	-	0	-80	-330	-850	-1730	-2240
10	550	300	190	100	-	0	-100	-340	-750	-1460	-1880
15	360	190	100	90	-	0	-50	-230	-530	-1010	-1290
20	240	110	60	20	-	0	-30	-210	-370	-720	-860
35	110	60	50	0	-	0	40	-30	-140	-170	-70
50	-40	10	-20	-30	-	0	20	0	-10	60	280
75	-210	-120	-130	-90	-	0	-40	100	70	270	620
100	-230	-160	-100	-70	-	0	20	170	190	400	860
150	-370	-270	-110	-100	-	0	10	230	260	520	1090
200	-440	-260	-100	-100	-	0	-40	320	320	590	1190
350	-450	-330	-140	-100	-	0	-60	330	340	620	1220
500	-420	-280	-130	-110	-	0	0	340	360	580	1090
750	-390	-240	-140	-150	-	0	-60	250	280	470	900
1000	-330	-200	-60	-100	-	0	0	240	280	390	820
1500	-260	-170	-70	-80	-	0	-30	160	180	320	610

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	-220	-130	-60	-70	-	0	-20	160	160	270	480
Case 2											
0	50	30	10	30	-	0	0	0	-20	0	-40
0.5	530	310	170	70	-	0	-70	-300	-580	-1040	-1270
1	810	390	270	130	-	0	-120	-400	-910	-1700	-2130
3	880	500	290	140	-	0	-130	-410	-1040	-2030	-2580
5	620	390	210	110	-	0	-120	-420	-930	-1770	-2210
7.5	560	310	160	80	-	0	-70	-320	-740	-1430	-1800
10	430	260	160	80	-	0	-60	-270	-640	-1240	-1530
15	290	130	90	0	-	0	-80	-280	-540	-1020	-1270
20	240	100	90	-40	-	0	-60	-210	-500	-940	-1100
35	110	50	40	-60	-	0	-30	-160	-420	-790	-850
50	90	60	30	-30	-	0	10	-130	-340	-660	-610
75	-10	-10	-10	-70	-	0	-30	-90	-270	-480	-390
100	-80	-60	-20	-40	-	0	30	30	-160	-310	-60
150	-210	-130	-80	-80	-	0	0	140	-40	-70	340
200	-290	-180	-100	-70	-	0	-40	180	40	80	530
350	-400	-230	-130	-140	-	0	-70	260	210	350	840
500	-460	-300	-140	-150	-	0	-80	220	190	360	820
750	-360	-240	-90	-100	-	0	20	240	250	330	820
1000	-290	-260	-120	-90	-	0	40	260	210	380	720
1500	-270	-160	-90	-100	-	0	-40	160	140	230	510
2000	-180	-120	-40	0	-	0	10	200	190	270	470
Case 3											
0	50	10	-20	30	40	0	-10	0	30	-20	0
0.5	570	310	190	60	130	0	-40	-230	-580	-1100	-1380
1	690	330	200	-20	110	0	-140	-460	-1000	-1850	-2330
3	400	20	-190	-360	150	0	-130	-550	-1210	-2310	-3020
5	-110	-430	-630	-740	120	0	-150	-470	-1040	-2010	-2670
7.5	-600	-920	-930	-1120	120	0	-100	-370	-840	-1680	-2170
10	-1020	-1210	-1330	-1440	110	0	-40	-320	-640	-1320	-1730
15	-1660	-1750	-1860	-1940	70	0	-60	-240	-480	-940	-1150
20	-2070	-2160	-2190	-2240	50	0	-20	-110	-280	-600	-700
35	-2880	-2880	-2860	-2910	30	0	-20	-20	-10	180	330
50	-3350	-3320	-3270	-3280	-10	0	10	50	280	830	1330
75	-3690	-3590	-3540	-3510	-40	0	80	250	780	1960	2910
100	-3860	-3680	-3620	-3650	-80	0	120	290	1030	2820	4090
150	-3740	-3590	-3490	-3440	-30	0	180	430	1590	4110	5930
200	-3600	-3510	-3360	-3350	-130	0	150	450	1750	4740	6910

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	-2920	-2750	-2650	-2630	-60	0	190	530	1970	5400	7880
500	-2420	-2280	-2190	-2180	-120	0	150	440	1870	5180	7570
750	-1860	-1780	-1640	-1620	-90	0	100	400	1610	4570	6680
1000	-1480	-1360	-1320	-1280	-20	0	150	350	1410	3960	5840
1500	-1090	-1010	-950	-950	-40	0	80	270	1070	3070	4590
2000	-840	-810	-720	-730	-30	0	90	220	870	2490	3730
Case 4											
0	960	830	720	700	670	0	-20	-10	340	140	40
0.5	1050	860	760	680	700	0	20	-70	140	-60	-240
1	1090	860	720	670	680	0	-50	-150	-10	-380	-560
3	1320	940	760	620	630	0	-140	-390	-420	-1220	-1630
5	1430	1010	810	620	680	0	-60	-390	-620	-1610	-2180
7.5	1330	900	680	500	620	0	-50	-440	-780	-1930	-2670
10	1200	790	550	400	540	0	-140	-480	-930	-2080	-2850
15	920	500	320	140	470	0	-160	-480	-990	-2190	-2930
20	580	160	50	-130	330	0	-160	-520	-1020	-2200	-2970
35	-100	-420	-550	-650	310	0	-60	-430	-880	-1940	-2640
50	-670	-860	-1020	-1050	160	0	-120	-380	-830	-1810	-2420
75	-1030	-1210	-1310	-1340	170	0	-40	-320	-700	-1560	-2070
100	-1190	-1340	-1480	-1470	90	0	-30	-280	-640	-1380	-1850
150	-1290	-1370	-1420	-1460	60	0	-20	-210	-510	-1100	-1510
200	-1160	-1250	-1330	-1320	90	0	-10	-120	-400	-890	-1190
350	-980	-1030	-1100	-1110	30	0	-90	-130	-270	-630	-840
500	-820	-880	-860	-910	-10	0	-30	-130	-230	-500	-660
750	-600	-610	-650	-640	30	0	-20	-50	-160	-310	-440
1000	-500	-510	-530	-540	-10	0	-10	-80	-140	-260	-350
1500	-350	-370	-360	-370	20	0	-10	-10	-80	-160	-220
2000	-270	-290	-290	-300	10	0	-10	-30	-60	-120	-160
Case 5											
1	620	530	510	520	70	0	0	-10	130	150	160
1.25	630	670	630	610	20	0	-20	-20	200	350	390
2	690	710	760	710	-20	0	20	30	260	520	650
2.25	710	760	740	780	0	0	40	60	270	560	680
2.75	660	630	660	660	-20	0	-20	20	220	440	600
3	630	690	670	690	-40	0	40	100	240	460	660
Case 6											
30	30	90	60	20	-	0	40	10	40	-50	-30
35	-10	10	40	20	-	0	-30	30	10	-20	-60
40	20	-10	20	40	-	0	20	-20	20	-40	0

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
45	-20	0	-80	-40	-	0	-40	-50	-20	-70	-20
50	-30	-120	-50	-20	-	0	-60	-80	-60	-40	-70
55	-50	-60	-50	-40	-	0	-90	-70	-60	-80	-60
60	60	70	70	60	-	0	10	50	30	60	10
65	50	80	90	80	-	0	40	20	50	20	40
70	-40	0	-40	20	-	0	-30	-20	-20	-40	-30
Case 7											
1E-20	320	230	180	90	60	0	-80	-220	-430	-860	-1170
0.05	230	160	110	50	90	0	-10	-60	-200	-410	-580
0.1	130	60	70	20	60	0	-10	-40	-150	-320	-440
0.2	70	70	0	20	10	0	-30	-20	-70	-210	-260
0.3	40	40	0	40	-10	0	0	-50	-70	-150	-180
0.4	50	40	50	30	20	0	10	-20	10	-60	-40
0.5	40	20	20	90	-10	0	30	-50	-10	0	-20
0.6	50	100	40	20	60	0	0	-20	70	110	100
0.7	90	70	90	70	40	0	20	20	60	150	190
0.8	0	-20	10	10	-30	0	-30	-10	20	140	200
0.9	50	20	60	70	-20	0	20	30	170	270	310
0.95	10	-20	60	60	-50	0	0	30	150	290	340
1	-10	90	40	80	10	0	50	40	160	340	380
Case 8											
1	470	350	260	240	60	0	-60	-190	-400	-820	-1210
1.5	480	470	430	380	0	0	-40	-90	-210	-370	-540
2	640	620	590	590	0	0	20	10	0	10	-130
2.5	550	530	500	510	-50	0	-40	-30	20	70	40
3	600	620	600	610	50	0	40	20	120	200	230
4	530	550	530	520	-40	0	20	50	130	290	330
5	480	540	510	510	-30	0	0	90	140	310	410
6	450	460	490	460	0	0	30	40	120	300	410
7	440	420	490	480	-20	0	30	70	180	330	390
8	380	370	430	430	-10	0	60	50	170	320	410
9	370	340	400	370	-20	0	20	40	160	290	350
Case 9											
0	1770	1290	1090	910	910	0	-110	-400	-440	-1310	-1800
0.5	1770	1240	1000	790	780	0	-150	-550	-790	-1920	-2630
1	1800	1230	980	750	740	0	-180	-600	-940	-2330	-3090
3	1600	1030	790	560	650	0	-150	-670	-1260	-2840	-3830
5	1340	830	570	320	520	0	-200	-650	-1350	-2910	-3930
7.5	990	450	210	70	400	0	-180	-630	-1380	-2920	-3950

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	660	240	20	-140	380	0	-140	-590	-1320	-2820	-3860
15	30	-340	-550	-670	230	0	-180	-600	-1310	-2710	-3690
20	-380	-730	-900	-970	260	0	-140	-500	-1190	-2500	-3470
35	-1350	-1590	-1670	-1730	180	0	-100	-480	-1060	-2240	-3080
50	-1720	-1920	-2040	-2070	160	0	-90	-370	-890	-1940	-2720
75	-1940	-2140	-2240	-2240	70	0	-90	-340	-780	-1670	-2340
100	-2010	-2150	-2200	-2250	60	0	-70	-290	-710	-1440	-2010
150	-1840	-1920	-2020	-2010	50	0	-80	-230	-570	-1120	-1600
200	-1640	-1720	-1750	-1820	40	0	-60	-210	-460	-960	-1280
350	-1190	-1260	-1280	-1310	40	0	-30	-140	-300	-620	-820
500	-940	-980	-980	-1010	30	0	-30	-80	-220	-440	-590
750	-690	-710	-740	-750	10	0	-20	-60	-150	-310	-400
1000	-540	-560	-570	-590	10	0	-20	-40	-110	-220	-280
1500	-390	-400	-410	-420	-10	0	-10	-40	-90	-150	-190
2000	-300	-310	-310	-310	10	0	-10	-20	-50	-100	-130
Case 10											
0	1290	1000	880	770	770	0	-10	-110	180	-270	-440
0.5	1130	810	630	520	540	0	-110	-290	-510	-1240	-1700
1	1120	740	600	450	460	0	-90	-370	-710	-1640	-2250
3	730	360	190	40	290	0	-130	-490	-1020	-2180	-2960
5	330	40	-120	-300	160	0	-150	-520	-1150	-2310	-3140
7.5	-60	-390	-540	-650	130	0	-140	-540	-1100	-2360	-3240
10	-430	-720	-870	-990	120	0	-110	-500	-1080	-2280	-3210
15	-1080	-1340	-1460	-1540	160	0	-150	-500	-1070	-2220	-3100
20	-1530	-1770	-1910	-1970	100	0	-110	-440	-990	-2110	-2980
35	-2380	-2520	-2640	-2670	110	0	-90	-330	-870	-1870	-2630
50	-2670	-2790	-2900	-2930	100	0	-60	-300	-760	-1680	-2330
75	-2750	-2860	-2960	-2980	90	0	-120	-290	-730	-1440	-1960
100	-2560	-2660	-2730	-2780	80	0	-30	-210	-610	-1210	-1640
150	-2260	-2310	-2360	-2390	50	0	-60	-170	-460	-910	-1230
200	-1930	-2000	-2060	-2060	40	0	-40	-170	-380	-760	-980
350	-1370	-1400	-1430	-1440	20	0	-30	-90	-230	-460	-590
500	-1050	-1070	-1080	-1090	10	0	-20	-70	-170	-320	-410
750	-750	-770	-780	-790	20	0	-10	-40	-110	-210	-260
1000	-590	-600	-610	-600	10	0	0	-30	-80	-140	-180
1500	-410	-420	-420	-430	10	0	-10	-20	-50	-100	-130
2000	-310	-320	-320	-330	0	0	0	-10	-40	-70	-90

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 11											
0	50	60	50	20	-	0	20	50	40	10	20
0.5	100	30	30	-30	-	0	-10	-30	-90	-130	-150
1	150	80	60	60	-	0	-30	-90	-120	-260	-380
3	260	130	90	40	-	0	-30	-140	-340	-670	-880
5	320	180	150	60	-	0	0	-110	-340	-710	-930
7.5	220	100	80	30	-	0	-70	-180	-340	-690	-890
10	240	110	70	80	-	0	0	-80	-260	-530	-670
15	100	40	30	0	-	0	-40	-120	-210	-370	-490
20	130	120	50	30	-	0	40	-60	-90	-190	-210
35	30	50	-20	-10	-	0	20	-40	-40	-50	0
50	30	10	-10	10	-	0	20	10	-20	0	60
75	50	30	30	10	-	0	30	-40	-30	-10	40
100	50	50	10	20	-	0	10	-60	-70	-20	30
150	60	20	20	20	-	0	20	-50	-60	-50	-30
200	80	60	30	30	-	0	10	-40	-40	-40	-20
350	60	40	10	10	-	0	0	-40	-60	-50	-40
500	50	20	0	10	-	0	-10	-40	-50	-50	-50
750	40	30	10	10	-	0	0	-30	-30	-30	-30
1000	40	20	20	10	-	0	10	-10	-20	-20	-20
1500	20	10	0	0	-	0	0	-20	-20	-20	-20
2000	20	20	10	10	-	0	10	-10	-10	-10	-10
Case 12											
0	1680	1190	1000	820	-	0	-70	-370	-430	-1180	-1680
0.5	1760	1240	1010	760	-	0	-140	-550	-790	-1900	-2570
1	1800	1190	910	720	-	0	-150	-610	-1020	-2330	-3100
3	1710	1080	810	620	-	0	-180	-690	-1340	-2950	-3910
5	1500	990	710	460	-	0	-230	-740	-1430	-3040	-4120
7.5	1290	770	560	310	-	0	-160	-770	-1490	-3100	-4110
10	1200	750	530	340	-	0	-170	-670	-1430	-2990	-4080
15	1110	670	430	270	-	0	-120	-590	-1390	-2940	-4000
20	950	510	380	200	-	0	-220	-640	-1430	-2920	-3960
35	780	500	290	130	-	0	-140	-560	-1320	-2720	-3690
50	690	450	270	160	-	0	-110	-440	-1190	-2530	-3380
75	550	330	230	100	-	0	-80	-380	-1050	-2200	-2900
100	430	260	200	90	-	0	-80	-260	-840	-1880	-2400
150	190	80	60	20	-	0	-100	-140	-650	-1450	-1720
200	110	40	90	-10	-	0	-80	-50	-430	-1090	-1210
350	-70	-80	-50	-90	-	0	-110	50	-210	-530	-460

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	-200	-160	-30	-60	-	0	-50	110	-80	-280	-150
750	-210	-120	-70	-90	-	0	-60	110	30	-80	80
1000	-200	-80	-80	-60	-	0	-50	100	90	30	210
1500	-160	-110	-80	-40	-	0	-20	130	110	50	260
2000	-140	-110	-60	-60	-	0	-20	100	80	90	230
Case 13											
0	940	780	730	600	-	0	-10	-20	290	140	90
0.5	980	780	700	620	-	0	-20	-130	170	-100	-260
1	1130	820	690	670	-	0	-70	-170	20	-350	-580
3	1350	980	830	670	-	0	-60	-330	-410	-1150	-1590
5	1400	990	840	660	-	0	-100	-400	-700	-1640	-2280
7.5	1420	960	770	580	-	0	-150	-510	-850	-1970	-2690
10	1330	890	710	540	-	0	-170	-520	-950	-2180	-2940
15	1270	830	680	470	-	0	-110	-500	-990	-2200	-2970
20	1190	760	580	420	-	0	-130	-480	-930	-2150	-3000
35	840	530	370	240	-	0	-160	-380	-950	-2000	-2700
50	770	500	330	220	-	0	-60	-280	-760	-1710	-2370
75	610	340	240	160	-	0	-40	-290	-650	-1490	-2020
100	440	300	210	140	-	0	-20	-240	-600	-1300	-1790
150	380	240	170	100	-	0	-10	-200	-430	-980	-1370
200	280	170	100	100	-	0	-20	-210	-390	-860	-1170
350	220	100	50	10	-	0	0	-160	-310	-550	-810
500	120	80	40	20	-	0	-10	-100	-230	-430	-580
750	70	40	30	-20	-	0	-40	-110	-170	-300	-380
1000	60	40	50	20	-	0	20	-40	-90	-200	-260
1500	50	30	30	10	-	0	-10	-40	-70	-130	-190
2000	30	30	0	-10	-	0	0	-40	-60	-100	-130
Case 14											
0	1810	1280	1110	940	-	0	-110	-350	-440	-1280	-1780
0.5	1840	1320	1040	830	-	0	-110	-510	-780	-1870	-2570
1	1830	1270	1030	800	-	0	-130	-590	-960	-2270	-3090
3	1650	1070	810	590	-	0	-220	-720	-1360	-2930	-3970
5	1550	970	750	570	-	0	-150	-660	-1360	-2980	-4060
7.5	1370	890	650	420	-	0	-180	-670	-1400	-3010	-4070
10	1230	780	560	380	-	0	-170	-620	-1440	-2940	-3980
15	1030	610	450	260	-	0	-150	-590	-1330	-2770	-3840
20	940	590	410	230	-	0	-120	-540	-1190	-2560	-3530
35	730	490	260	160	-	0	-110	-410	-1010	-2190	-3050
50	610	340	260	120	-	0	-70	-330	-850	-1870	-2660

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	520	300	210	120	-	0	-70	-280	-730	-1600	-2200
100	400	250	130	80	-	0	-70	-250	-640	-1330	-1870
150	360	220	170	90	-	0	-40	-200	-480	-1010	-1360
200	290	180	110	20	-	0	-30	-230	-420	-830	-1150
350	180	70	60	40	-	0	-30	-130	-260	-510	-690
500	140	90	60	40	-	0	0	-100	-180	-340	-440
750	90	60	30	10	-	0	-10	-70	-120	-220	-280
1000	60	40	10	-10	-	0	-10	-50	-90	-160	-200
1500	40	30	20	10	-	0	0	-20	-50	-80	-110
2000	40	30	20	10	-	0	10	-10	-30	-50	-60
Case 15											
0	1210	910	830	690	-	0	-50	-120	90	-270	-470
0.5	1170	850	690	580	-	0	-70	-310	-470	-1230	-1710
1	1090	700	570	410	-	0	-160	-460	-770	-1730	-2340
3	1030	640	470	320	-	0	-120	-510	-1070	-2230	-3020
5	900	550	380	230	-	0	-130	-540	-1130	-2370	-3270
7.5	830	440	320	180	-	0	-170	-510	-1140	-2420	-3290
10	790	490	320	160	-	0	-110	-440	-1120	-2370	-3250
15	700	410	260	150	-	0	-100	-440	-1100	-2300	-3200
20	570	350	200	40	-	0	-190	-470	-1040	-2260	-3050
35	500	260	210	60	-	0	-130	-390	-900	-1870	-2600
50	420	260	140	70	-	0	-90	-340	-760	-1620	-2160
75	400	210	120	90	-	0	-50	-290	-620	-1250	-1730
100	340	220	90	70	-	0	-40	-230	-510	-1020	-1360
150	270	150	90	40	-	0	-50	-180	-390	-720	-970
200	230	140	100	60	-	0	20	-140	-270	-530	-670
350	140	80	60	40	-	0	0	-70	-160	-270	-350
500	80	40	20	0	-	0	-30	-70	-110	-200	-220
750	60	40	20	10	-	0	0	-40	-60	-100	-110
1000	40	30	10	10	-	0	0	-30	-50	-70	-70
1500	30	20	10	10	-	0	0	-20	-20	-40	-40
2000	20	10	0	0	-	0	-10	-20	-20	-30	-30

Table C-5: $(k_T-k_{room})/k_{room}$ for reference cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	0	10	14	3	-	0	-10	21	-10	-3	-3
0.5	219	127	73	35	-	0	-35	-123	-261	-457	-569
1	375	200	131	73	-	0	-53	-200	-428	-808	-1024
3	487	273	173	86	-	0	-82	-282	-646	-1270	-1652
5	478	277	162	76	-	0	-76	-287	-630	-1275	-1695
7.5	430	252	168	94	-	0	-79	-277	-578	-1211	-1621
10	419	232	157	81	-	0	-56	-242	-535	-1101	-1474
15	326	187	130	78	-	0	-62	-181	-440	-938	-1270
20	305	153	105	47	-	0	-63	-174	-384	-800	-1100
35	258	113	75	21	-	0	-32	-145	-285	-580	-801
50	260	130	76	87	-	0	0	-135	-249	-477	-688
75	245	180	76	60	-	0	-5	-191	-261	-463	-605
100	300	186	98	71	-	0	0	-202	-273	-459	-584
150	383	257	137	82	-	0	0	-257	-307	-454	-602
200	445	286	154	110	-	0	-5	-324	-357	-505	-643
350	498	319	174	129	-	0	-17	-358	-409	-532	-649
500	471	299	166	115	-	0	0	-316	-333	-442	-534
750	301	187	102	66	-	0	-6	-187	-199	-241	-259
1000	89	57	32	13	-	0	-6	0	-6	19	51
1500	-322	-210	-119	-84	-	0	14	343	406	518	686
2000	-699	-469	-261	-184	-	0	31	684	761	984	1276
Case 2											
0	-7	-18	4	-18	-	0	-7	-18	-4	-14	-18
0.5	226	113	66	23	-	0	-43	-121	-233	-397	-494
1	353	200	129	71	-	0	-37	-187	-387	-732	-915
3	420	246	145	72	-	0	-82	-265	-574	-1105	-1437
5	419	246	157	79	-	0	-58	-246	-561	-1105	-1456
7.5	397	229	145	67	-	0	-61	-224	-531	-1079	-1414
10	379	198	122	35	-	0	-58	-221	-513	-1060	-1398
15	324	196	92	18	-	0	-73	-232	-538	-1070	-1394
20	339	207	125	25	-	0	-44	-213	-483	-1054	-1411
35	322	200	154	45	-	0	-32	-232	-534	-1139	-1525
50	342	206	135	19	-	0	-26	-284	-561	-1173	-1631
75	390	262	141	77	-	0	-26	-314	-589	-1209	-1676
100	444	266	158	82	-	0	-19	-342	-634	-1198	-1648
150	537	325	169	100	-	0	-12	-393	-599	-1180	-1579
200	569	346	179	93	-	0	-31	-433	-637	-1156	-1509

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	565	375	191	92	-	0	-31	-418	-602	-953	-1211
500	510	342	193	99	-	0	-12	-348	-466	-740	-920
750	276	161	77	26	-	0	-32	-225	-302	-450	-482
1000	74	34	27	0	-	0	-27	-34	-60	-107	-107
1500	-337	-234	-110	-73	-	0	15	381	388	454	637
2000	-710	-471	-303	-199	-	0	8	686	726	941	1220
Case 3											
0	-3	3	0	0	-21	0	-10	-3	-10	-28	-17
0.5	238	142	88	46	35	0	-23	-119	-238	-442	-553
1	363	204	118	49	41	0	-57	-212	-428	-803	-1011
3	492	278	164	73	73	0	-68	-305	-651	-1261	-1657
5	458	258	162	76	72	0	-105	-306	-669	-1313	-1715
7.5	455	247	133	84	74	0	-89	-277	-618	-1241	-1632
10	384	222	141	45	56	0	-66	-273	-601	-1152	-1576
15	332	202	130	52	57	0	-36	-213	-508	-1079	-1437
20	290	153	111	42	53	0	-58	-211	-506	-1048	-1391
35	221	118	65	38	48	0	-48	-194	-533	-1146	-1539
50	190	103	22	38	33	0	-98	-239	-661	-1415	-1849
75	234	109	22	16	60	0	-109	-283	-883	-1879	-2381
100	295	158	55	11	76	0	-126	-377	-1064	-2276	-2849
150	339	224	71	44	126	0	-142	-443	-1390	-2845	-3540
200	379	242	93	44	148	0	-187	-511	-1614	-3212	-3932
350	470	280	118	50	146	0	-185	-554	-1746	-3296	-3906
500	419	253	115	69	121	0	-190	-505	-1482	-2619	-3016
750	290	175	84	42	66	0	-115	-290	-700	-827	-760
1000	114	76	44	32	19	0	-19	-19	241	1290	1874
1500	-260	-162	-63	-28	-91	0	154	499	2135	5646	7324
2000	-617	-386	-193	-93	-185	0	301	972	3879	9801	12577
Case 4											
0	1787	1496	1240	1167	1222	0	-73	-55	565	255	201
0.5	1789	1405	1186	1095	1077	0	-183	-219	237	-329	-639
1	2001	1473	1328	1091	1073	0	-127	-255	-36	-728	-1091
3	2416	1751	1488	1173	1261	0	-123	-508	-665	-1996	-2854
5	2426	1656	1322	1088	1004	0	-284	-786	-1322	-2928	-3948
7.5	2341	1624	1274	987	971	0	-159	-780	-1417	-3329	-4491
10	2242	1479	1159	900	930	0	-229	-869	-1556	-3569	-4758
15	1986	1305	936	681	695	0	-284	-880	-1717	-3688	-5065
20	1820	1137	870	642	602	0	-214	-830	-1686	-3707	-5125
35	1429	909	638	496	543	0	-154	-779	-1689	-3672	-5077

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
50	1330	774	512	371	381	0	-207	-730	-1678	-3728	-5123
75	1043	571	371	190	241	0	-261	-772	-1814	-3859	-5283
100	991	553	343	143	267	0	-229	-772	-1840	-3908	-5386
150	973	559	306	180	243	0	-261	-757	-1911	-4020	-5498
200	982	526	316	184	210	0	-246	-754	-1947	-4086	-5603
350	970	567	352	172	232	0	-266	-807	-2130	-4354	-5839
500	991	557	304	104	217	0	-296	-878	-2296	-4548	-6017
750	1136	654	391	209	255	0	-327	-1000	-2436	-4736	-6163
1000	1246	680	402	201	278	0	-307	-996	-2577	-4848	-6266
1500	1366	790	459	213	299	0	-395	-1131	-2807	-5080	-6424
2000	1477	804	437	225	295	0	-449	-1182	-3014	-5307	-6560
Case 5											
1	-688	-900	-1032	-1129	194	0	-71	-282	-759	-1738	-2479
1.25	-472	-549	-635	-703	154	0	17	-137	-420	-1226	-1844
2	-202	67	253	228	-67	0	211	396	632	539	287
2.25	-187	203	492	576	-119	0	280	568	1051	1178	1009
2.75	-242	415	882	978	-277	0	415	952	1808	2422	2517
3	-263	561	1105	1210	-342	0	482	1131	2253	3086	3218
Case 6											
30	505	303	225	140	-	0	-39	-443	-863	-1920	-2581
35	428	306	206	161	-	0	-15	-352	-742	-1736	-2286
40	348	212	174	113	-	0	-45	-340	-696	-1543	-2073
45	241	158	158	83	-	0	-23	-241	-572	-1339	-1805
50	180	150	135	112	-	0	-22	-180	-457	-1117	-1582
55	75	75	90	90	-	0	0	-120	-382	-943	-1348
60	-15	-7	37	7	-	0	-30	-82	-285	-786	-1124
65	-75	15	45	45	-	0	-8	-15	-188	-570	-878
70	-233	-75	-8	-8	-	0	-23	-23	-113	-421	-655
Case 7											
1E-20	1743	1053	702	514	451	0	-226	-878	-1993	-4250	-5805
0.05	1138	681	447	263	263	0	-194	-720	-1498	-3190	-4347
0.1	838	518	337	199	199	0	-130	-518	-1192	-2574	-3559
0.2	506	327	249	148	117	0	-70	-319	-809	-1829	-2607
0.3	225	165	150	67	60	0	7	-142	-404	-1183	-1775
0.4	-89	-15	59	30	15	0	81	81	-37	-504	-985
0.5	-416	-178	-30	-15	-52	0	141	230	379	163	-193
0.6	-735	-368	-120	-68	-135	0	218	420	810	840	623
0.7	-1112	-579	-198	-137	-221	0	282	609	1203	1508	1416
0.8	-1473	-783	-326	-202	-295	0	326	814	1612	2163	2217

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
0.9	-1732	-933	-387	-198	-340	0	451	1044	2096	2870	3029
0.95	-1885	-1030	-439	-264	-359	0	447	1054	2261	3179	3379
1	-2074	-1130	-460	-299	-387	0	484	1170	2462	3487	3729
Case 8											
1	-655	-905	-1061	-1168	157	0	-121	-456	-1047	-2265	-3206
1.5	-439	-634	-756	-837	67	0	-108	-337	-884	-1937	-2720
2	-243	-382	-460	-526	79	0	-33	-237	-678	-1625	-2309
2.5	-59	-137	-169	-228	39	0	-13	-143	-514	-1320	-1918
3	104	52	45	19	6	0	-6	-91	-350	-1056	-1588
4	339	405	444	424	-33	0	33	78	-7	-490	-862
5	538	691	824	824	-60	0	120	272	332	93	-153
6	571	897	1087	1155	-122	0	156	387	672	666	469
7	662	1101	1338	1449	-195	0	265	557	1024	1226	1129
8	687	1224	1582	1675	-272	0	293	723	1381	1754	1739
9	736	1421	1803	1973	-287	0	397	876	1745	2326	2407
Case 9											
0	2200	1613	1332	1088	1124	0	-134	-477	-477	-1540	-2212
0.5	2180	1517	1256	972	1007	0	-225	-628	-960	-2299	-3105
1	2130	1435	1111	891	880	0	-255	-729	-1169	-2732	-3623
3	1868	1202	940	656	656	0	-219	-765	-1442	-3223	-4360
5	1609	1041	778	547	526	0	-210	-768	-1546	-3324	-4480
7.5	1488	951	688	466	445	0	-172	-729	-1548	-3309	-4544
10	1439	871	597	421	450	0	-166	-675	-1527	-3269	-4473
15	1165	693	435	333	333	0	-185	-684	-1535	-3282	-4521
20	1114	601	451	256	301	0	-168	-672	-1521	-3254	-4536
35	937	525	307	202	202	0	-186	-662	-1542	-3271	-4571
50	896	513	299	176	199	0	-168	-597	-1501	-3262	-4594
75	829	465	305	145	204	0	-160	-603	-1490	-3279	-4631
100	834	445	311	134	170	0	-127	-586	-1498	-3321	-4635
150	756	454	268	131	158	0	-172	-584	-1519	-3396	-4709
200	757	477	293	150	170	0	-184	-580	-1562	-3382	-4671
350	768	457	249	159	194	0	-173	-623	-1675	-3494	-4705
500	809	458	258	150	193	0	-208	-709	-1783	-3580	-4747
750	888	521	291	146	184	0	-253	-728	-1976	-3745	-4810
1000	985	591	320	181	246	0	-238	-813	-2069	-3867	-4852
1500	1122	673	355	168	271	0	-318	-926	-2329	-4069	-5042
2000	1211	737	368	189	242	0	-337	-989	-2537	-4284	-5221

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 10											
0	792	632	526	466	459	0	-47	-100	40	-173	-333
0.5	788	552	438	357	377	0	-61	-242	-337	-828	-1165
1	746	495	387	299	265	0	-115	-299	-529	-1167	-1554
3	706	464	298	208	208	0	-97	-353	-776	-1621	-2216
5	696	404	285	181	167	0	-111	-417	-884	-1858	-2546
7.5	692	408	284	180	166	0	-90	-388	-914	-2015	-2804
10	665	384	233	151	130	0	-117	-418	-1021	-2152	-2988
15	684	369	248	168	168	0	-87	-409	-1039	-2265	-3177
20	676	387	243	171	171	0	-92	-427	-1064	-2324	-3243
35	640	352	226	94	107	0	-132	-452	-1149	-2455	-3428
50	624	385	281	116	147	0	-92	-422	-1113	-2453	-3438
75	561	293	203	90	90	0	-149	-436	-1147	-2461	-3435
100	550	355	236	118	106	0	-101	-402	-1094	-2430	-3334
150	524	318	212	106	112	0	-130	-371	-1065	-2355	-3232
200	486	296	160	95	95	0	-118	-432	-1066	-2333	-3132
350	431	265	160	55	74	0	-166	-412	-1132	-2344	-3008
500	497	310	181	97	123	0	-123	-445	-1194	-2342	-3026
750	581	315	210	98	133	0	-168	-469	-1358	-2505	-3121
1000	620	363	159	106	129	0	-242	-590	-1566	-2768	-3396
1500	829	498	279	166	201	0	-253	-716	-1825	-3117	-3754
2000	971	595	287	149	238	0	-277	-803	-2081	-3468	-4122
Case 11											
0	0	-5	9	0	-	0	5	9	9	14	9
0.5	34	19	19	24	-	0	0	-15	-39	-53	-83
1	66	51	40	-5	-	0	-15	-35	-76	-152	-223
3	207	103	98	49	-	0	-22	-87	-250	-467	-636
5	244	139	83	44	-	0	-28	-122	-289	-627	-799
7.5	273	139	106	78	-	0	-45	-134	-340	-680	-898
10	234	117	83	28	-	0	-33	-167	-367	-678	-884
15	237	154	110	39	-	0	6	-105	-275	-539	-748
20	185	87	82	44	-	0	-5	-125	-261	-495	-674
35	112	85	37	32	-	0	-21	-85	-138	-325	-410
50	79	69	26	0	-	0	11	-58	-90	-221	-290
75	79	31	42	10	-	0	5	-42	-79	-131	-189
100	63	37	21	16	-	0	0	-47	-68	-116	-147
150	48	37	27	27	-	0	0	-53	-64	-96	-122
200	65	43	27	16	-	0	5	-60	-70	-103	-130
350	138	92	46	34	-	0	0	-115	-120	-155	-183

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	225	146	85	49	-	0	-12	-164	-176	-219	-249
750	387	247	133	87	-	0	-13	-213	-247	-300	-353
1000	530	334	182	109	-	0	-29	-305	-319	-399	-457
1500	770	474	254	152	-	0	-34	-372	-423	-533	-600
2000	966	589	319	203	-	0	-39	-415	-464	-589	-715
Case 12											
0	1767	1254	1102	851	-	0	-131	-414	-480	-1341	-1810
0.5	1851	1274	995	803	-	0	-193	-599	-878	-2055	-2750
1	1865	1296	969	769	-	0	-253	-664	-1117	-2487	-3298
3	1722	1125	851	588	-	0	-213	-719	-1418	-3029	-4103
5	1536	961	733	505	-	0	-168	-733	-1486	-3111	-4250
7.5	1399	845	612	379	-	0	-223	-700	-1545	-3148	-4363
10	1282	794	574	335	-	0	-172	-708	-1512	-3234	-4324
15	1164	689	494	289	-	0	-168	-670	-1536	-3250	-4451
20	1082	655	427	227	-	0	-227	-727	-1573	-3337	-4556
35	1066	610	421	232	-	0	-129	-696	-1573	-3353	-4686
50	1064	610	388	190	-	0	-157	-676	-1583	-3405	-4758
75	1004	636	400	188	-	0	-133	-643	-1546	-3335	-4653
100	1031	621	394	205	-	0	-144	-690	-1508	-3266	-4562
150	992	558	333	159	-	0	-159	-724	-1514	-3151	-4332
200	1002	586	367	198	-	0	-134	-720	-1460	-2963	-4106
350	944	568	356	157	-	0	-116	-677	-1300	-2585	-3529
500	841	492	308	157	-	0	-89	-588	-1142	-2202	-3016
750	624	343	203	105	-	0	-84	-357	-848	-1703	-2278
1000	378	218	102	44	-	0	-80	-153	-596	-1257	-1693
1500	-71	-47	-39	-32	-	0	-39	221	-39	-450	-623
2000	-471	-334	-163	-120	-	0	-26	540	368	163	137
Case 13											
0	1805	1477	1331	1185	-	0	-36	-91	547	255	109
0.5	1901	1553	1389	1206	-	0	18	-146	329	-146	-384
1	2131	1658	1421	1257	-	0	0	-91	182	-528	-947
3	2382	1787	1489	1261	-	0	-88	-508	-648	-2137	-2785
5	2410	1623	1322	1121	-	0	-234	-753	-1155	-2945	-3849
7.5	2421	1640	1290	1003	-	0	-223	-844	-1417	-3297	-4443
10	2273	1465	1175	870	-	0	-214	-839	-1511	-3464	-4745
15	2016	1334	980	724	-	0	-298	-894	-1675	-3648	-4955
20	1876	1233	951	670	-	0	-147	-791	-1648	-3645	-4877
35	1585	994	710	497	-	0	-118	-651	-1550	-3431	-4721
50	1354	808	590	371	-	0	-186	-633	-1518	-3320	-4608

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	1176	714	483	271	-	0	-191	-613	-1418	-3167	-4454
100	1089	650	411	268	-	0	-172	-573	-1414	-3067	-4338
150	1084	614	416	226	-	0	-117	-560	-1364	-2963	-4192
200	1010	606	395	202	-	0	-123	-615	-1397	-2926	-4103
350	1066	610	370	224	-	0	-172	-679	-1367	-2863	-4007
500	1123	705	374	183	-	0	-131	-723	-1402	-2796	-3910
750	1228	737	428	264	-	0	-109	-746	-1401	-2712	-3758
1000	1304	806	480	259	-	0	-144	-777	-1381	-2647	-3616
1500	1474	855	491	299	-	0	-139	-812	-1432	-2585	-3408
2000	1563	947	580	308	-	0	-142	-876	-1409	-2474	-3279
Case 14											
0	2200	1552	1369	1112	-	0	-134	-452	-513	-1540	-2176
0.5	2169	1505	1221	984	-	0	-178	-569	-889	-2228	-3117
1	2084	1493	1169	891	-	0	-232	-706	-1169	-2674	-3612
3	1912	1234	950	645	-	0	-229	-754	-1508	-3223	-4348
5	1662	1073	757	589	-	0	-221	-789	-1578	-3355	-4512
7.5	1539	972	709	486	-	0	-152	-729	-1559	-3351	-4545
10	1360	842	577	382	-	0	-186	-714	-1576	-3308	-4531
15	1249	749	527	315	-	0	-176	-657	-1527	-3275	-4468
20	1123	672	469	283	-	0	-203	-681	-1486	-3184	-4414
35	970	558	412	194	-	0	-162	-598	-1382	-3030	-4259
50	935	544	345	176	-	0	-130	-490	-1310	-2888	-4076
75	829	502	276	167	-	0	-153	-531	-1280	-2778	-3927
100	813	495	304	184	-	0	-148	-523	-1244	-2692	-3795
150	743	433	275	138	-	0	-151	-509	-1224	-2599	-3685
200	729	429	252	123	-	0	-170	-572	-1220	-2556	-3571
350	816	498	311	194	-	0	-90	-540	-1135	-2263	-3176
500	809	537	279	179	-	0	-122	-558	-1102	-2198	-2971
750	958	575	337	192	-	0	-84	-559	-1065	-1977	-2704
1000	1034	648	361	205	-	0	-82	-599	-1051	-1855	-2454
1500	1161	711	365	225	-	0	-103	-655	-1029	-1685	-2181
2000	1254	758	421	232	-	0	-126	-664	-990	-1580	-2054
Case 15											
0	825	645	586	486	-	0	0	-67	93	-133	-326
0.5	788	545	451	390	-	0	-47	-242	-296	-848	-1158
1	774	543	414	326	-	0	-68	-272	-496	-1147	-1555
3	700	429	326	194	-	0	-111	-388	-810	-1655	-2258
5	661	390	257	139	-	0	-167	-445	-911	-1906	-2609
7.5	720	409	277	173	-	0	-97	-409	-955	-1994	-2770

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	678	356	247	123	-	0	-144	-473	-1048	-2158	-2967
15	690	415	268	147	-	0	-100	-449	-1018	-2217	-3095
20	708	387	269	118	-	0	-105	-446	-1043	-2257	-3155
35	697	395	270	169	-	0	-88	-402	-998	-2196	-3050
50	617	342	220	98	-	0	-110	-446	-990	-2157	-3018
75	579	334	221	95	-	0	-84	-424	-985	-2011	-2811
100	543	348	224	118	-	0	-89	-384	-903	-1895	-2616
150	529	312	200	100	-	0	-88	-388	-823	-1675	-2316
200	521	325	201	130	-	0	-71	-337	-733	-1491	-2029
350	455	283	172	98	-	0	-68	-338	-627	-1211	-1610
500	529	316	193	129	-	0	-45	-322	-574	-1025	-1315
750	622	364	231	133	-	0	-49	-343	-531	-895	-1105
1000	688	423	250	144	-	0	-53	-393	-560	-817	-1013
1500	891	559	288	175	-	0	-61	-463	-550	-777	-960
2000	1041	625	347	208	-	0	-69	-506	-575	-803	-972

Table C-6: $(k_T-k_{room})/k_{room}$ for reference cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	7	3	3	7	-	0	10	10	-3	-3	7
0.5	223	104	62	31	-	0	-42	-135	-269	-443	-554
1	365	193	148	66	-	0	-53	-189	-406	-762	-984
3	466	261	159	65	-	0	-70	-252	-574	-1115	-1451
5	400	215	125	70	-	0	-65	-245	-530	-1070	-1405
7.5	366	233	170	122	-	0	-42	-175	-451	-917	-1188
10	304	166	105	55	-	0	-55	-188	-415	-808	-1040
15	212	112	59	53	-	0	-29	-136	-312	-595	-761
20	148	68	37	12	-	0	-19	-130	-229	-445	-532
35	75	41	34	0	-	0	27	-21	-96	-116	-48
50	-30	7	-15	-22	-	0	15	0	-7	44	207
75	-173	-99	-107	-74	-	0	-33	82	58	222	510
100	-207	-144	-90	-63	-	0	18	153	171	360	775
150	-390	-285	-116	-105	-	0	11	242	274	548	1149
200	-530	-313	-120	-120	-	0	-48	385	385	711	1433
350	-743	-545	-231	-165	-	0	-99	545	561	1023	2014
500	-880	-587	-272	-230	-	0	0	712	754	1215	2283
750	-1103	-679	-396	-424	-	0	-170	707	792	1330	2546
1000	-1177	-714	-214	-357	-	0	0	856	999	1391	2925
1500	-1309	-856	-352	-403	-	0	-151	805	906	1610	3070

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	-1430	-845	-390	-455	-	0	-130	1040	1040	1756	3121
Case 2											
0	18	11	4	11	-	0	0	0	-7	0	-14
0.5	206	121	66	27	-	0	-27	-117	-226	-405	-495
1	338	163	113	54	-	0	-50	-167	-380	-709	-889
3	432	245	142	69	-	0	-64	-201	-510	-996	-1266
5	335	211	113	59	-	0	-65	-227	-503	-956	-1194
7.5	328	182	94	47	-	0	-41	-188	-434	-839	-1056
10	267	162	99	50	-	0	-37	-168	-398	-771	-951
15	195	88	61	0	-	0	-54	-189	-364	-687	-855
20	171	71	64	-28	-	0	-43	-149	-356	-668	-782
35	87	39	32	-47	-	0	-24	-126	-331	-623	-670
50	76	51	25	-25	-	0	8	-110	-288	-559	-516
75	-9	-9	-9	-65	-	0	-28	-84	-251	-446	-363
100	-81	-60	-20	-40	-	0	30	30	-161	-313	-60
150	-244	-151	-93	-93	-	0	0	162	-46	-81	394
200	-380	-236	-131	-92	-	0	-52	236	52	105	694
350	-702	-404	-228	-246	-	0	-123	456	368	614	1474
500	-1010	-659	-307	-329	-	0	-176	483	417	791	1801
750	-1057	-704	-264	-294	-	0	59	704	734	969	2407
1000	-1065	-955	-441	-331	-	0	147	955	771	1396	2644
1500	-1386	-821	-462	-513	-	0	-205	821	719	1181	2618
2000	-1191	-794	-265	0	-	0	66	1324	1257	1787	3111
Case 3											
0	17	3	-7	10	14	0	-3	0	10	-7	0
0.5	219	119	73	23	50	0	-15	-89	-223	-423	-531
1	283	135	82	-8	45	0	-57	-189	-410	-758	-955
3	188	9	-89	-169	70	0	-61	-258	-567	-1083	-1416
5	-56	-217	-318	-374	61	0	-76	-237	-525	-1015	-1348
7.5	-323	-495	-501	-603	65	0	-54	-199	-452	-904	-1168
10	-576	-683	-751	-813	62	0	-23	-181	-361	-746	-977
15	-1007	-1061	-1128	-1177	42	0	-36	-146	-291	-570	-697
20	-1325	-1383	-1402	-1434	32	0	-13	-70	-179	-384	-448
35	-2074	-2074	-2059	-2095	22	0	-14	-14	-7	130	238
50	-2637	-2613	-2574	-2582	-8	0	8	39	220	653	1047
75	-3283	-3194	-3149	-3122	-36	0	71	222	694	1744	2589
100	-3807	-3630	-3571	-3600	-79	0	118	286	1016	2782	4034
150	-4395	-4219	-4101	-4042	-35	0	212	505	1868	4830	6968
200	-4892	-4770	-4566	-4552	-177	0	204	611	2378	6441	9390

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	-5568	-5244	-5053	-5015	-114	0	362	1011	3757	10297	15027
500	-5924	-5581	-5361	-5337	-294	0	367	1077	4578	12681	18531
750	-6231	-5963	-5494	-5427	-302	0	335	1340	5394	15310	22379
1000	-6295	-5785	-5615	-5444	-85	0	638	1489	5997	16844	24840
1500	-6590	-6106	-5744	-5744	-242	0	484	1632	6469	18561	27751
2000	-6588	-6353	-5647	-5725	-235	0	706	1725	6824	19529	29255
Case 4											
0	1751	1514	1313	1277	1222	0	-36	-18	620	255	73
0.5	1920	1572	1389	1243	1280	0	37	-128	256	-110	-439
1	1984	1565	1311	1220	1238	0	-91	-273	-18	-692	-1019
3	2315	1649	1333	1088	1105	0	-246	-684	-737	-2140	-2859
5	2413	1704	1367	1046	1147	0	-101	-658	-1046	-2716	-3678
7.5	2155	1458	1102	810	1005	0	-81	-713	-1264	-3128	-4327
10	1888	1243	865	629	850	0	-220	-755	-1463	-3273	-4485
15	1397	759	486	213	714	0	-243	-729	-1504	-3326	-4450
20	867	239	75	-194	493	0	-239	-777	-1524	-3287	-4437
35	-151	-634	-831	-982	468	0	-91	-649	-1329	-2930	-3987
50	-1059	-1359	-1612	-1660	253	0	-190	-601	-1312	-2861	-3825
75	-1798	-2112	-2286	-2339	297	0	-70	-558	-1222	-2723	-3613
100	-2299	-2588	-2859	-2839	174	0	-58	-541	-1236	-2666	-3573
150	-3005	-3191	-3308	-3401	140	0	-47	-489	-1188	-2562	-3517
200	-3179	-3426	-3645	-3617	247	0	-27	-329	-1096	-2439	-3261
350	-3895	-4094	-4372	-4412	119	0	-358	-517	-1073	-2504	-3339
500	-4271	-4583	-4479	-4740	-52	0	-156	-677	-1198	-2604	-3438
750	-4364	-4436	-4727	-4655	218	0	-145	-364	-1164	-2255	-3200
1000	-4651	-4744	-4930	-5023	-93	0	-93	-744	-1302	-2419	-3256
1500	-4685	-4953	-4819	-4953	268	0	-134	-134	-1071	-2142	-2945
2000	-4704	-5052	-5052	-5226	174	0	-174	-523	-1045	-2091	-2787
Case 5											
1	1270	1085	1044	1065	143	0	0	-20	266	307	328
1.25	1431	1522	1431	1385	45	0	-45	-45	454	795	886
2	2035	2094	2241	2094	-59	0	59	88	767	1533	1917
2.25	2252	2410	2347	2474	0	0	127	190	856	1776	2157
2.75	2375	2267	2375	2375	-72	0	-72	72	792	1583	2159
3	2401	2630	2553	2630	-152	0	152	381	915	1753	2515
Case 6											
30	249	747	498	166	-	0	332	83	332	-415	-249
35	-88	88	353	177	-	0	-265	265	88	-177	-530
40	186	-93	186	372	-	0	186	-186	186	-372	0

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
45	-194	0	-777	-388	-	0	-388	-485	-194	-680	-194
50	-301	-1202	-501	-200	-	0	-601	-802	-601	-401	-701
55	-516	-619	-516	-413	-	0	-929	-722	-619	-826	-619
60	642	749	749	642	-	0	107	535	321	642	107
65	548	876	986	876	-	0	438	219	548	219	438
70	-442	0	-442	221	-	0	-332	-221	-221	-442	-332
Case 7											
1E-20	785	564	442	221	147	0	-196	-540	-1055	-2110	-2870
0.05	635	442	304	138	248	0	-28	-166	-552	-1132	-1601
0.1	392	181	211	60	181	0	-30	-121	-452	-964	-1326
0.2	238	238	0	68	34	0	-102	-68	-238	-713	-883
0.3	147	147	0	147	-37	0	0	-183	-257	-550	-660
0.4	194	155	194	116	78	0	39	-78	39	-233	-155
0.5	162	81	81	364	-40	0	121	-202	-40	0	-81
0.6	209	419	168	84	251	0	0	-84	293	461	419
0.7	388	302	388	302	172	0	86	86	259	647	819
0.8	0	-88	44	44	-132	0	-132	-44	88	616	880
0.9	225	90	270	315	-90	0	90	135	764	1214	1394
0.95	45	-91	272	272	-227	0	0	136	680	1315	1541
1	-46	412	183	366	46	0	229	183	732	1555	1738
Case 8											
1	639	476	354	326	82	0	-82	-258	-544	-1115	-1646
1.5	785	769	703	622	0	0	-65	-147	-343	-605	-883
2	1233	1195	1137	1137	0	0	39	19	0	19	-250
2.5	1220	1176	1109	1131	-111	0	-89	-67	44	155	89
3	1512	1562	1512	1537	126	0	101	50	302	504	579
4	1652	1714	1652	1620	-125	0	62	156	405	904	1028
5	1784	2007	1896	1896	-112	0	0	335	520	1152	1524
6	1940	1984	2113	1984	0	0	129	172	517	1294	1768
7	2160	2062	2405	2356	-98	0	147	344	884	1620	1915
8	2088	2033	2363	2363	-55	0	330	275	934	1758	2253
9	2248	2066	2430	2248	-122	0	122	243	972	1762	2126
Case 9											
0	2163	1576	1332	1112	1112	0	-134	-489	-538	-1601	-2199
0.5	2098	1470	1186	937	925	0	-178	-652	-937	-2276	-3118
1	2088	1427	1137	870	858	0	-209	-696	-1090	-2703	-3585
3	1766	1137	872	618	717	0	-166	-739	-1390	-3134	-4226
5	1444	894	614	345	560	0	-216	-700	-1455	-3136	-4235
7.5	1051	478	223	74	425	0	-191	-669	-1466	-3101	-4195

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	698	254	21	-148	402	0	-148	-624	-1395	-2981	-4080
15	32	-362	-585	-713	245	0	-192	-638	-1394	-2883	-3926
20	-413	-793	-978	-1054	282	0	-152	-543	-1292	-2715	-3769
35	-1605	-1891	-1986	-2057	214	0	-119	-571	-1260	-2663	-3662
50	-2266	-2530	-2688	-2727	211	0	-119	-487	-1173	-2556	-3584
75	-3007	-3317	-3472	-3472	109	0	-140	-527	-1209	-2589	-3627
100	-3602	-3852	-3942	-4032	108	0	-125	-520	-1272	-2580	-3602
150	-4205	-4388	-4616	-4593	114	0	-183	-526	-1303	-2559	-3656
200	-4562	-4784	-4868	-5063	111	0	-167	-584	-1280	-2670	-3561
350	-5085	-5385	-5470	-5598	171	0	-128	-598	-1282	-2650	-3504
500	-5412	-5642	-5642	-5815	173	0	-173	-461	-1267	-2533	-3397
750	-5670	-5834	-6081	-6163	82	0	-164	-493	-1233	-2547	-3287
1000	-5763	-5977	-6083	-6297	107	0	-213	-427	-1174	-2348	-2988
1500	-6056	-6211	-6366	-6522	-155	0	-155	-621	-1398	-2329	-2950
2000	-6122	-6327	-6327	-6327	204	0	-204	-408	-1020	-2041	-2653
Case 10											
0	858	665	586	512	512	0	-7	-73	120	-180	-293
0.5	762	546	425	350	364	0	-74	-195	-344	-836	-1146
1	763	504	409	307	313	0	-61	-252	-484	-1117	-1533
3	515	254	134	28	204	0	-92	-346	-719	-1537	-2087
5	239	29	-87	-218	116	0	-109	-377	-834	-1675	-2277
7.5	-45	-292	-404	-486	97	0	-105	-404	-822	-1764	-2422
10	-331	-554	-669	-762	92	0	-85	-385	-831	-1754	-2470
15	-879	-1090	-1188	-1253	130	0	-122	-407	-871	-1806	-2523
20	-1316	-1522	-1643	-1694	86	0	-95	-378	-851	-1815	-2563
35	-2397	-2538	-2659	-2689	111	0	-91	-332	-876	-1884	-2649
50	-3099	-3238	-3366	-3401	116	0	-70	-348	-882	-1950	-2704
75	-3907	-4064	-4206	-4234	128	0	-171	-412	-1037	-2046	-2785
100	-4313	-4482	-4600	-4684	135	0	-51	-354	-1028	-2039	-2763
150	-5002	-5113	-5224	-5290	111	0	-133	-376	-1018	-2014	-2722
200	-5291	-5482	-5647	-5647	110	0	-110	-466	-1042	-2083	-2686
350	-5920	-6050	-6180	-6223	86	0	-130	-389	-994	-1988	-2550
500	-6191	-6309	-6368	-6427	59	0	-118	-413	-1002	-1887	-2417
750	-6383	-6553	-6638	-6723	170	0	-85	-340	-936	-1787	-2213
1000	-6563	-6674	-6785	-6674	111	0	0	-334	-890	-1557	-2002
1500	-6688	-6852	-6852	-7015	163	0	-163	-326	-816	-1631	-2121
2000	-6667	-6882	-6882	-7097	0	0	0	-215	-860	-1505	-1935

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 11											
0	23	27	23	9	-	0	9	23	18	5	9
0.5	49	15	15	-15	-	0	-5	-15	-44	-63	-73
1	76	41	30	30	-	0	-15	-46	-61	-132	-193
3	144	72	50	22	-	0	-17	-78	-189	-372	-489
5	186	105	87	35	-	0	0	-64	-198	-413	-541
7.5	133	61	48	18	-	0	-42	-109	-206	-418	-539
10	151	69	44	50	-	0	0	-50	-163	-333	-420
15	67	27	20	0	-	0	-27	-80	-140	-247	-327
20	92	85	35	21	-	0	28	-42	-64	-135	-149
35	25	42	-17	-8	-	0	17	-33	-33	-42	0
50	29	10	-10	10	-	0	19	10	-19	0	57
75	59	35	35	12	-	0	35	-47	-35	-12	47
100	69	69	14	28	-	0	14	-83	-97	-28	42
150	109	36	36	36	-	0	36	-91	-109	-91	-55
200	181	136	68	68	-	0	23	-90	-90	-90	-45
350	214	143	36	36	-	0	0	-143	-214	-179	-143
500	244	98	0	49	-	0	-49	-195	-244	-244	-244
750	283	212	71	71	-	0	0	-212	-212	-212	-212
1000	370	185	185	93	-	0	93	-93	-185	-185	-185
1500	272	136	0	0	-	0	0	-272	-272	-272	-272
2000	360	360	180	180	-	0	180	-180	-180	-180	-180
Case 12											
0	1833	1298	1091	895	-	0	-76	-404	-469	-1287	-1833
0.5	1885	1328	1082	814	-	0	-150	-589	-846	-2035	-2753
1	1900	1256	960	760	-	0	-158	-644	-1076	-2459	-3271
3	1743	1101	826	632	-	0	-184	-704	-1366	-3008	-3987
5	1507	994	713	462	-	0	-231	-743	-1436	-3054	-4139
7.5	1285	767	558	309	-	0	-159	-767	-1484	-3088	-4094
10	1192	745	526	338	-	0	-169	-666	-1420	-2970	-4053
15	1103	666	427	268	-	0	-119	-586	-1381	-2921	-3974
20	947	508	379	199	-	0	-219	-638	-1425	-2910	-3946
35	794	509	295	132	-	0	-142	-570	-1344	-2768	-3756
50	723	472	283	168	-	0	-115	-461	-1247	-2651	-3542
75	610	366	255	111	-	0	-89	-421	-1164	-2439	-3215
100	506	306	235	106	-	0	-94	-306	-989	-2213	-2825
150	251	106	79	26	-	0	-132	-185	-860	-1918	-2275
200	162	59	133	-15	-	0	-118	-74	-635	-1610	-1787
350	-136	-156	-97	-175	-	0	-214	97	-409	-1033	-896

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	-485	-388	-73	-146	-	0	-121	267	-194	-679	-364
750	-677	-387	-226	-290	-	0	-193	354	97	-258	258
1000	-804	-321	-321	-241	-	0	-201	402	362	121	844
1500	-896	-616	-448	-224	-	0	-112	728	616	280	1457
2000	-1005	-790	-431	-431	-	0	-144	718	574	646	1651
Case 13											
0	1714	1422	1331	1094	-	0	-18	-36	529	255	164
0.5	1790	1425	1279	1132	-	0	-37	-237	311	-183	-475
1	2056	1492	1256	1219	-	0	-127	-309	36	-637	-1056
3	2368	1719	1456	1175	-	0	-105	-579	-719	-2018	-2789
5	2357	1667	1414	1111	-	0	-168	-674	-1179	-2761	-3839
7.5	2293	1550	1244	937	-	0	-242	-824	-1373	-3182	-4344
10	2082	1393	1111	845	-	0	-266	-814	-1487	-3412	-4602
15	1909	1248	1022	707	-	0	-165	-752	-1488	-3308	-4465
20	1751	1118	854	618	-	0	-191	-706	-1369	-3164	-4415
35	1228	775	541	351	-	0	-234	-555	-1389	-2924	-3947
50	1164	756	499	333	-	0	-91	-423	-1149	-2586	-3584
75	1002	558	394	263	-	0	-66	-476	-1068	-2447	-3318
100	791	539	378	252	-	0	-36	-431	-1079	-2337	-3218
150	813	513	364	214	-	0	-21	-428	-920	-2096	-2930
200	697	423	249	249	-	0	-50	-523	-971	-2141	-2913
350	784	357	178	36	-	0	0	-570	-1105	-1961	-2888
500	557	371	186	93	-	0	-46	-464	-1068	-1996	-2693
750	450	257	193	-129	-	0	-257	-707	-1093	-1929	-2444
1000	494	329	412	165	-	0	165	-329	-741	-1647	-2142
1500	589	353	353	118	-	0	-118	-471	-824	-1531	-2238
2000	459	459	0	-153	-	0	0	-613	-919	-1531	-1991
Case 14											
0	2212	1564	1357	1149	-	0	-134	-428	-538	-1564	-2176
0.5	2182	1565	1233	984	-	0	-130	-605	-925	-2218	-3048
1	2122	1473	1195	928	-	0	-151	-684	-1113	-2633	-3584
3	1816	1178	892	649	-	0	-242	-793	-1497	-3225	-4370
5	1663	1041	805	612	-	0	-161	-708	-1460	-3198	-4357
7.5	1444	938	685	443	-	0	-190	-706	-1475	-3172	-4289
10	1284	815	585	397	-	0	-178	-647	-1504	-3070	-4156
15	1073	636	469	271	-	0	-156	-615	-1386	-2886	-4001
20	991	622	432	242	-	0	-126	-569	-1254	-2698	-3721
35	825	553	294	181	-	0	-124	-463	-1141	-2474	-3445
50	751	419	320	148	-	0	-86	-406	-1047	-2303	-3276

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	739	427	299	171	-	0	-100	-398	-1038	-2275	-3129
100	649	406	211	130	-	0	-114	-406	-1039	-2158	-3035
150	733	448	346	183	-	0	-81	-407	-978	-2058	-2771
200	711	442	270	49	-	0	-74	-564	-1030	-2036	-2821
350	668	260	223	148	-	0	-111	-482	-964	-1892	-2559
500	695	447	298	199	-	0	0	-497	-894	-1688	-2185
750	634	423	211	70	-	0	-70	-493	-845	-1549	-1972
1000	546	364	91	-91	-	0	-91	-455	-820	-1457	-1821
1500	530	397	265	132	-	0	0	-265	-662	-1060	-1457
2000	694	521	347	174	-	0	174	-174	-521	-868	-1042
Case 15											
0	805	605	552	459	-	0	-33	-80	60	-180	-313
0.5	789	573	465	391	-	0	-47	-209	-317	-829	-1153
1	742	476	388	279	-	0	-109	-313	-524	-1177	-1592
3	724	450	330	225	-	0	-84	-359	-752	-1568	-2124
5	648	396	274	166	-	0	-94	-389	-814	-1707	-2355
7.5	613	325	236	133	-	0	-125	-376	-842	-1787	-2429
10	597	370	242	121	-	0	-83	-332	-846	-1790	-2455
15	553	324	205	118	-	0	-79	-347	-868	-1816	-2526
20	470	289	165	33	-	0	-157	-388	-858	-1865	-2517
35	471	245	198	57	-	0	-123	-368	-849	-1763	-2451
50	448	278	149	75	-	0	-96	-363	-811	-1729	-2306
75	513	269	154	115	-	0	-64	-372	-795	-1602	-2217
100	510	330	135	105	-	0	-60	-345	-765	-1529	-2039
150	523	290	174	77	-	0	-97	-349	-755	-1394	-1878
200	546	333	238	143	-	0	48	-333	-641	-1259	-1592
350	516	295	221	148	-	0	0	-258	-590	-996	-1291
500	399	200	100	0	-	0	-150	-349	-549	-999	-1098
750	430	287	143	72	-	0	0	-287	-430	-717	-789
1000	373	280	93	93	-	0	0	-280	-467	-654	-654
1500	410	273	137	137	-	0	0	-273	-273	-546	-546
2000	359	180	0	0	-	0	-180	-359	-359	-539	-539

Table C-7: k-infinity for free gas scattering cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	2.8808	2.8805	2.8805	2.8806	-	2.8803	2.8804	2.8804	2.8801	2.8803	2.8802
0.5	2.6086	2.6057	2.6049	2.6033	-	2.6026	2.6020	2.5992	2.5960	2.5906	2.5878
1	2.4606	2.4563	2.4548	2.4529	-	2.4514	2.4502	2.4467	2.4407	2.4313	2.4263
3	2.2076	2.2029	2.2004	2.1982	-	2.1963	2.1951	2.1901	2.1820	2.1683	2.1590
5	2.1041	2.0997	2.0978	2.0956	-	2.0939	2.0921	2.0877	2.0801	2.0658	2.0550
7.5	2.0340	2.0299	2.0279	2.0259	-	2.0239	2.0226	2.0188	2.0121	1.9976	1.9865
10	1.9905	1.9871	1.9855	1.9837	-	1.9820	1.9806	1.9776	1.9711	1.9566	1.9452
15	1.9414	1.9383	1.9362	1.9351	-	1.9332	1.9322	1.9290	1.9233	1.9093	1.8968
20	1.9138	1.9107	1.9091	1.9080	-	1.9061	1.9049	1.9022	1.8967	1.8821	1.8699
35	1.8795	1.8764	1.8750	1.8731	-	1.8721	1.8706	1.8669	1.8601	1.8439	1.8291
50	1.8693	1.8655	1.8637	1.8620	-	1.8600	1.8587	1.8542	1.8464	1.8265	1.8106
75	1.8644	1.8603	1.8580	1.8562	-	1.8542	1.8522	1.8467	1.8360	1.8111	1.7937
100	1.8639	1.8593	1.8573	1.8547	-	1.8523	1.8497	1.8428	1.8297	1.8014	1.7827
150	1.8612	1.8559	1.8531	1.8507	-	1.8476	1.8444	1.8364	1.8195	1.7858	1.7666
200	1.8540	1.8489	1.8460	1.8430	-	1.8395	1.8368	1.8272	1.8084	1.7727	1.7534
350	1.8146	1.8094	1.8067	1.8038	-	1.8005	1.7977	1.7882	1.7688	1.7357	1.7207
500	1.7618	1.7578	1.7555	1.7531	-	1.7506	1.7482	1.7405	1.7248	1.7007	1.6916
750	1.6684	1.6662	1.6649	1.6635	-	1.6622	1.6607	1.6568	1.6502	1.6457	1.6467
1000	1.5781	1.5775	1.5771	1.5768	-	1.5765	1.5762	1.5759	1.5789	1.5943	1.6048
1500	1.4175	1.4196	1.4206	1.4218	-	1.4232	1.4247	1.4306	1.4498	1.5005	1.5280
2000	1.2837	1.2875	1.2895	1.2918	-	1.2944	1.2971	1.3072	1.3388	1.4172	1.4585
Case 2											
0	2.8509	2.8507	2.8505	2.8506	-	2.8506	2.8510	2.8506	2.8506	2.8502	2.8507
0.5	2.5758	2.5730	2.5720	2.5712	-	2.5701	2.5693	2.5670	2.5642	2.5597	2.5571
1	2.4144	2.4102	2.4090	2.4073	-	2.4058	2.4045	2.4015	2.3961	2.3883	2.3841
3	2.0840	2.0797	2.0777	2.0760	-	2.0743	2.0729	2.0689	2.0616	2.0503	2.0434
5	1.9202	1.9169	1.9150	1.9138	-	1.9122	1.9105	1.9069	1.8998	1.8879	1.8814
7.5	1.8032	1.7992	1.7979	1.7966	-	1.7945	1.7939	1.7903	1.7839	1.7712	1.7638
10	1.7313	1.7282	1.7270	1.7255	-	1.7236	1.7229	1.7192	1.7125	1.6997	1.6916
15	1.6534	1.6506	1.6486	1.6472	-	1.6459	1.6444	1.6408	1.6343	1.6192	1.6096
20	1.6149	1.6120	1.6106	1.6089	-	1.6077	1.6064	1.6026	1.5952	1.5783	1.5678
35	1.5811	1.5775	1.5755	1.5737	-	1.5719	1.5702	1.5656	1.5570	1.5352	1.5202
50	1.5820	1.5779	1.5763	1.5739	-	1.5717	1.5699	1.5645	1.5538	1.5288	1.5108
75	1.5988	1.5939	1.5911	1.5889	-	1.5867	1.5839	1.5780	1.5646	1.5345	1.5144
100	1.6161	1.6110	1.6080	1.6056	-	1.6023	1.6001	1.5928	1.5776	1.5446	1.5228
150	1.6420	1.6359	1.6329	1.6300	-	1.6267	1.6242	1.6153	1.5974	1.5611	1.5389
200	1.6561	1.6500	1.6473	1.6434	-	1.6405	1.6374	1.6276	1.6089	1.5718	1.5503

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	1.6580	1.6526	1.6496	1.6469	-	1.6438	1.6406	1.6320	1.6136	1.5817	1.5652
500	1.6318	1.6274	1.6251	1.6227	-	1.6206	1.6180	1.6112	1.5965	1.5748	1.5649
750	1.5665	1.5642	1.5632	1.5616	-	1.5602	1.5592	1.5556	1.5504	1.5483	1.5489
1000	1.4951	1.4940	1.4939	1.4936	-	1.4931	1.4928	1.4932	1.4972	1.5145	1.5246
1500	1.3577	1.3594	1.3605	1.3616	-	1.3630	1.3642	1.3706	1.3900	1.4417	1.4680
2000	1.2380	1.2417	1.2435	1.2456	-	1.2484	1.2507	1.2608	1.2924	1.3707	1.4110
Case 3											
0	2.8809	2.8810	2.8806	2.8805	2.8804	2.8807	2.8804	2.8799	2.8803	2.8803	2.8801
0.5	2.6099	2.6072	2.6058	2.6049	2.6049	2.6037	2.6030	2.6006	2.5972	2.5922	2.5894
1	2.4621	2.4579	2.4557	2.4541	2.4546	2.4527	2.4511	2.4477	2.4423	2.4332	2.4277
3	2.2076	2.2025	2.2005	2.1989	2.1988	2.1967	2.1949	2.1905	2.1823	2.1687	2.1593
5	2.1032	2.0988	2.0970	2.0949	2.0949	2.0933	2.0916	2.0870	2.0800	2.0649	2.0549
7.5	2.0322	2.0280	2.0262	2.0243	2.0240	2.0230	2.0212	2.0174	2.0105	1.9965	1.9850
10	1.9884	1.9850	1.9836	1.9814	1.9815	1.9798	1.9787	1.9752	1.9687	1.9547	1.9431
15	1.9386	1.9352	1.9334	1.9320	1.9321	1.9307	1.9295	1.9260	1.9204	1.9060	1.8941
20	1.9107	1.9074	1.9062	1.9046	1.9044	1.9030	1.9019	1.8989	1.8935	1.8787	1.8659
35	1.8751	1.8718	1.8705	1.8691	1.8692	1.8677	1.8662	1.8628	1.8567	1.8398	1.8252
50	1.8643	1.8608	1.8589	1.8572	1.8573	1.8555	1.8544	1.8497	1.8421	1.8218	1.8064
75	1.8596	1.8559	1.8532	1.8512	1.8510	1.8491	1.8472	1.8417	1.8313	1.8064	1.7890
100	1.8589	1.8546	1.8518	1.8496	1.8495	1.8471	1.8449	1.8378	1.8248	1.7965	1.7781
150	1.8559	1.8510	1.8478	1.8453	1.8452	1.8423	1.8395	1.8310	1.8143	1.7813	1.7615
200	1.8489	1.8437	1.8407	1.8375	1.8376	1.8346	1.8316	1.8223	1.8033	1.7677	1.7486
350	1.8096	1.8045	1.8018	1.7989	1.7987	1.7955	1.7927	1.7834	1.7640	1.7308	1.7159
500	1.7575	1.7532	1.7511	1.7487	1.7489	1.7462	1.7438	1.7359	1.7202	1.6961	1.6869
750	1.6646	1.6624	1.6612	1.6597	1.6597	1.6583	1.6571	1.6529	1.6462	1.6415	1.6423
1000	1.5749	1.5742	1.5738	1.5735	1.5735	1.5732	1.5730	1.5725	1.5753	1.5904	1.6007
1500	1.4152	1.4172	1.4183	1.4194	1.4195	1.4208	1.4222	1.4281	1.4471	1.4971	1.5242
2000	1.2821	1.2857	1.2878	1.2901	1.2901	1.2926	1.2953	1.3053	1.3366	1.4142	1.4551
Case 4											
0	0.5574	0.5562	0.5558	0.5548	0.5553	0.5479	0.5487	0.5481	0.5511	0.5500	0.5493
0.5	0.5577	0.5552	0.5543	0.5538	0.5536	0.5473	0.5466	0.5466	0.5489	0.5460	0.5445
1	0.5603	0.5578	0.5571	0.5561	0.5556	0.5496	0.5487	0.5488	0.5498	0.5458	0.5441
3	0.5853	0.5810	0.5796	0.5778	0.5779	0.5709	0.5707	0.5676	0.5674	0.5594	0.5547
5	0.6119	0.6074	0.6057	0.6042	0.6042	0.5974	0.5963	0.5933	0.5909	0.5804	0.5740
7.5	0.6431	0.6387	0.6361	0.6344	0.6341	0.6284	0.6269	0.6231	0.6194	0.6072	0.5998
10	0.6708	0.6662	0.6638	0.6618	0.6617	0.6560	0.6547	0.6501	0.6459	0.6326	0.6245
15	0.7198	0.7149	0.7124	0.7109	0.7110	0.7056	0.7033	0.6994	0.6938	0.6792	0.6696
20	0.7629	0.7574	0.7557	0.7533	0.7533	0.7485	0.7470	0.7417	0.7353	0.7200	0.7095
35	0.8625	0.8577	0.8553	0.8529	0.8528	0.8494	0.8472	0.8421	0.8338	0.8162	0.8038

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
50	0.9335	0.9283	0.9258	0.9235	0.9233	0.9201	0.9181	0.9123	0.9034	0.8838	0.8701
75	1.0127	1.0074	1.0055	1.0030	1.0029	0.9998	0.9974	0.9918	0.9813	0.9595	0.9443
100	1.0643	1.0593	1.0567	1.0543	1.0546	1.0516	1.0493	1.0430	1.0316	1.0088	0.9921
150	1.1248	1.1203	1.1173	1.1146	1.1148	1.1121	1.1099	1.1029	1.0909	1.0651	1.0479
200	1.1563	1.1512	1.1485	1.1466	1.1457	1.1438	1.1405	1.1337	1.1204	1.0940	1.0752
350	1.1805	1.1748	1.1725	1.1698	1.1698	1.1667	1.1640	1.1567	1.1417	1.1141	1.0947
500	1.1658	1.1600	1.1571	1.1545	1.1547	1.1516	1.1485	1.1406	1.1255	1.0977	1.0783
750	1.1166	1.1107	1.1079	1.1049	1.1050	1.1016	1.0991	1.0911	1.0753	1.0481	1.0297
1000	1.0606	1.0542	1.0514	1.0484	1.0484	1.0453	1.0427	1.0340	1.0187	0.9924	0.9756
1500	0.9534	0.9477	0.9447	0.9414	0.9414	0.9385	0.9358	0.9272	0.9125	0.8882	0.8737
2000	0.8616	0.8558	0.8528	0.8500	0.8494	0.8469	0.8445	0.8366	0.8225	0.8011	0.7875
Case 5											
1	1.1332	1.1306	1.1295	1.1282	1.1436	1.1411	1.1399	1.1360	1.1299	1.1159	1.1063
1.25	1.1706	1.1695	1.1682	1.1673	1.1791	1.1768	1.1760	1.1731	1.1671	1.1550	1.1465
2	1.2079	1.2088	1.2100	1.2092	1.2099	1.2090	1.2090	1.2081	1.2054	1.1984	1.1931
2.25	1.2068	1.2089	1.2095	1.2098	1.2064	1.2061	1.2070	1.2069	1.2051	1.1999	1.1956
2.75	1.1930	1.1968	1.1983	1.1995	1.1911	1.1911	1.1923	1.1935	1.1947	1.1929	1.1911
3	1.1830	1.1879	1.1899	1.1910	1.1795	1.1807	1.1812	1.1842	1.1862	1.1861	1.1850
Case 6											
30	1.2949	1.2932	1.2922	1.2916	-	1.2893	1.2882	1.2847	1.2772	1.2628	1.2531
35	1.3138	1.3135	1.3127	1.3118	-	1.3105	1.3092	1.3062	1.2997	1.2865	1.2775
40	1.3252	1.3255	1.3251	1.3246	-	1.3234	1.3228	1.3201	1.3145	1.3027	1.2948
45	1.3311	1.3323	1.3322	1.3320	-	1.3306	1.3308	1.3288	1.3239	1.3130	1.3056
50	1.3332	1.3349	1.3353	1.3353	-	1.3346	1.3347	1.3331	1.3292	1.3200	1.3134
55	1.3324	1.3353	1.3359	1.3363	-	1.3362	1.3355	1.3351	1.3319	1.3241	1.3179
60	1.3296	1.3333	1.3340	1.3346	-	1.3345	1.3349	1.3346	1.3322	1.3257	1.3203
65	1.3252	1.3295	1.3308	1.3315	-	1.3320	1.3320	1.3325	1.3311	1.3258	1.3215
70	1.3197	1.3247	1.3261	1.3274	-	1.3279	1.3286	1.3294	1.3286	1.3239	1.3203
Case 7											
1E-20	0.8140	0.8085	0.8059	0.8035	0.8037	0.7995	0.7978	0.7922	0.7834	0.7656	0.7537
0.05	1.0426	1.0375	1.0355	1.0337	1.0337	1.0307	1.0285	1.0245	1.0153	0.9978	0.9855
0.1	1.1695	1.1658	1.1642	1.1626	1.1626	1.1600	1.1589	1.1544	1.1463	1.1297	1.1171
0.2	1.2945	1.2922	1.2913	1.2903	1.2906	1.2883	1.2876	1.2840	1.2776	1.2632	1.2525
0.3	1.3433	1.3430	1.3426	1.3422	1.3421	1.3416	1.3407	1.3384	1.3332	1.3214	1.3125
0.4	1.3593	1.3606	1.3608	1.3607	1.3608	1.3602	1.3602	1.3588	1.3555	1.3458	1.3382
0.5	1.3577	1.3599	1.3612	1.3613	1.3616	1.3615	1.3616	1.3617	1.3597	1.3522	1.3460
0.6	1.3465	1.3502	1.3512	1.3526	1.3526	1.3531	1.3537	1.3542	1.3536	1.3488	1.3440
0.7	1.3300	1.3346	1.3358	1.3374	1.3374	1.3387	1.3396	1.3406	1.3417	1.3388	1.3360
0.8	1.3099	1.3155	1.3173	1.3191	1.3192	1.3208	1.3218	1.3241	1.3259	1.3255	1.3239

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
0.9	1.2876	1.2941	1.2968	1.2992	1.2985	1.3009	1.3022	1.3055	1.3083	1.3098	1.3092
0.95	1.2764	1.2834	1.2860	1.2883	1.2883	1.2902	1.2918	1.2952	1.2991	1.3014	1.3010
1	1.2646	1.2727	1.2752	1.2776	1.2777	1.2796	1.2810	1.2851	1.2891	1.2922	1.2931
Case 8											
1	1.3959	1.3928	1.3907	1.3892	1.4077	1.4054	1.4040	1.4001	1.3912	1.3730	1.3592
1.5	1.4757	1.4730	1.4720	1.4710	1.4850	1.4835	1.4824	1.4785	1.4708	1.4535	1.4411
2	1.5181	1.5162	1.5154	1.5144	1.5241	1.5232	1.5222	1.5192	1.5129	1.4971	1.4856
2.5	1.5387	1.5383	1.5378	1.5373	1.5429	1.5422	1.5415	1.5391	1.5336	1.5192	1.5089
3	1.5475	1.5478	1.5475	1.5475	1.5490	1.5486	1.5483	1.5464	1.5417	1.5291	1.5198
4	1.5433	1.5454	1.5454	1.5458	1.5410	1.5410	1.5414	1.5405	1.5373	1.5274	1.5199
5	1.5239	1.5270	1.5280	1.5286	1.5183	1.5191	1.5191	1.5195	1.5181	1.5107	1.5047
6	1.4963	1.5012	1.5022	1.5036	1.4884	1.4891	1.4904	1.4916	1.4910	1.4864	1.4822
7	1.4656	1.4710	1.4732	1.4745	1.4555	1.4570	1.4581	1.4598	1.4612	1.4582	1.4555
8	1.4328	1.4389	1.4419	1.4434	1.4212	1.4226	1.4236	1.4269	1.4283	1.4284	1.4265
9	1.3998	1.4067	1.4096	1.4115	1.3856	1.3883	1.3899	1.3933	1.3963	1.3975	1.3969
Case 9											
0	0.8361	0.8312	0.8291	0.8273	0.8271	0.8182	0.8176	0.8147	0.8143	0.8048	0.8000
0.5	0.8619	0.8569	0.8541	0.8519	0.8521	0.8439	0.8423	0.8382	0.8358	0.8245	0.8176
1	0.8820	0.8761	0.8737	0.8713	0.8707	0.8634	0.8621	0.8578	0.8537	0.8409	0.8325
3	0.9326	0.9265	0.9241	0.9217	0.9215	0.9155	0.9136	0.9080	0.9017	0.8855	0.8757
5	0.9666	0.9613	0.9585	0.9561	0.9557	0.9507	0.9496	0.9438	0.9361	0.9192	0.9081
7.5	1.0037	0.9980	0.9954	0.9934	0.9932	0.9891	0.9865	0.9815	0.9735	0.9555	0.9431
10	1.0372	1.0315	1.0294	1.0269	1.0271	1.0229	1.0210	1.0155	1.0064	0.9887	0.9757
15	1.0962	1.0908	1.0888	1.0865	1.0859	1.0827	1.0807	1.0754	1.0657	1.0464	1.0321
20	1.1456	1.1402	1.1380	1.1354	1.1358	1.1329	1.1307	1.1249	1.1154	1.0950	1.0798
35	1.2523	1.2472	1.2449	1.2428	1.2427	1.2403	1.2377	1.2321	1.2210	1.1984	1.1815
50	1.3200	1.3154	1.3132	1.3107	1.3106	1.3083	1.3062	1.2999	1.2883	1.2644	1.2458
75	1.3895	1.3844	1.3820	1.3794	1.3800	1.3777	1.3752	1.3691	1.3566	1.3310	1.3116
100	1.4295	1.4243	1.4221	1.4201	1.4199	1.4176	1.4155	1.4093	1.3965	1.3692	1.3494
150	1.4677	1.4634	1.4608	1.4589	1.4587	1.4563	1.4541	1.4477	1.4339	1.4063	1.3857
200	1.4800	1.4751	1.4730	1.4707	1.4705	1.4684	1.4662	1.4593	1.4453	1.4167	1.3970
350	1.4590	1.4544	1.4521	1.4497	1.4494	1.4471	1.4446	1.4377	1.4230	1.3949	1.3758
500	1.4108	1.4062	1.4032	1.4009	1.4009	1.3980	1.3958	1.3882	1.3735	1.3466	1.3283
750	1.3204	1.3153	1.3125	1.3098	1.3096	1.3072	1.3043	1.2968	1.2819	1.2569	1.2401
1000	1.2335	1.2281	1.2249	1.2223	1.2227	1.2199	1.2175	1.2096	1.1950	1.1706	1.1558
1500	1.0845	1.0784	1.0760	1.0726	1.0731	1.0703	1.0676	1.0602	1.0465	1.0249	1.0119
2000	0.9648	0.9589	0.9562	0.9534	0.9534	0.9509	0.9484	0.9413	0.9279	0.9082	0.8972

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 10											
0	1.5149	1.5127	1.5113	1.5105	1.5108	1.5031	1.5028	1.5019	1.5042	1.5005	1.4984
0.5	1.4972	1.4938	1.4922	1.4908	1.4909	1.4857	1.4846	1.4822	1.4809	1.4733	1.4682
1	1.4846	1.4812	1.4795	1.4778	1.4778	1.4740	1.4721	1.4694	1.4659	1.4565	1.4501
3	1.4550	1.4506	1.4488	1.4470	1.4473	1.4439	1.4429	1.4392	1.4327	1.4203	1.4118
5	1.4479	1.4438	1.4421	1.4402	1.4399	1.4376	1.4363	1.4317	1.4245	1.4104	1.4007
7.5	1.4555	1.4513	1.4495	1.4479	1.4476	1.4454	1.4436	1.4390	1.4314	1.4157	1.4042
10	1.4703	1.4659	1.4643	1.4616	1.4623	1.4598	1.4585	1.4540	1.4450	1.4282	1.4152
15	1.5043	1.5002	1.4975	1.4958	1.4957	1.4937	1.4923	1.4869	1.4776	1.4593	1.4443
20	1.5351	1.5313	1.5284	1.5267	1.5273	1.5247	1.5231	1.5178	1.5088	1.4885	1.4733
35	1.6044	1.6003	1.5985	1.5965	1.5962	1.5941	1.5921	1.5874	1.5769	1.5544	1.5379
50	1.6463	1.6417	1.6405	1.6386	1.6385	1.6364	1.6352	1.6294	1.6188	1.5956	1.5784
75	1.6844	1.6803	1.6787	1.6766	1.6767	1.6750	1.6731	1.6683	1.6568	1.6338	1.6163
100	1.7016	1.6984	1.6964	1.6945	1.6948	1.6926	1.6913	1.6857	1.6751	1.6512	1.6343
150	1.7083	1.7051	1.7034	1.7018	1.7017	1.7000	1.6988	1.6931	1.6824	1.6591	1.6434
200	1.6982	1.6949	1.6932	1.6917	1.6915	1.6898	1.6881	1.6830	1.6725	1.6501	1.6347
350	1.6341	1.6317	1.6297	1.6283	1.6282	1.6268	1.6250	1.6198	1.6087	1.5887	1.5746
500	1.5600	1.5571	1.5545	1.5535	1.5532	1.5515	1.5500	1.5447	1.5329	1.5137	1.5014
750	1.4402	1.4368	1.4348	1.4327	1.4328	1.4303	1.4288	1.4230	1.4121	1.3923	1.3814
1000	1.3338	1.3292	1.3275	1.3253	1.3252	1.3233	1.3212	1.3151	1.3034	1.2852	1.2744
1500	1.1581	1.1535	1.1509	1.1491	1.1490	1.1467	1.1446	1.1384	1.1265	1.1090	1.0993
2000	1.0218	1.0172	1.0148	1.0125	1.0126	1.0104	1.0081	1.0017	0.9900	0.9733	0.9642
Case 11											
0	2.1947	2.1949	2.1952	2.1951	-	2.1949	2.1948	2.1953	2.1949	2.1952	2.1953
0.5	2.0594	2.0588	2.0580	2.0585	-	2.0583	2.0580	2.0578	2.0576	2.0566	2.0562
1	1.9785	1.9779	1.9777	1.9769	-	1.9763	1.9766	1.9758	1.9751	1.9734	1.9730
3	1.8435	1.8419	1.8417	1.8408	-	1.8402	1.8394	1.8381	1.8358	1.8309	1.8277
5	1.8072	1.8051	1.8041	1.8033	-	1.8028	1.8022	1.8004	1.7966	1.7905	1.7864
7.5	1.7987	1.7968	1.7959	1.7952	-	1.7943	1.7934	1.7916	1.7879	1.7814	1.7756
10	1.8042	1.8026	1.8014	1.8006	-	1.7997	1.7985	1.7971	1.7935	1.7863	1.7810
15	1.8242	1.8226	1.8219	1.8208	-	1.8201	1.8195	1.8177	1.8145	1.8076	1.8016
20	1.8437	1.8420	1.8410	1.8408	-	1.8399	1.8394	1.8382	1.8348	1.8281	1.8227
35	1.8820	1.8817	1.8814	1.8808	-	1.8803	1.8803	1.8786	1.8763	1.8698	1.8639
50	1.9006	1.9003	1.9002	1.8997	-	1.8996	1.8993	1.8984	1.8961	1.8891	1.8834
75	1.9093	1.9093	1.9091	1.9089	-	1.9087	1.9088	1.9077	1.9054	1.8975	1.8917
100	1.9052	1.9055	1.9053	1.9052	-	1.9050	1.9049	1.9040	1.9012	1.8926	1.8865
150	1.8818	1.8821	1.8821	1.8820	-	1.8819	1.8815	1.8803	1.8769	1.8672	1.8604
200	1.8509	1.8509	1.8508	1.8506	-	1.8503	1.8500	1.8486	1.8443	1.8336	1.8264
350	1.7494	1.7487	1.7483	1.7477	-	1.7470	1.7462	1.7438	1.7376	1.7248	1.7166

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	1.6524	1.6511	1.6502	1.6492	-	1.6482	1.6471	1.6436	1.6362	1.6219	1.6133
750	1.5096	1.5071	1.5057	1.5043	-	1.5028	1.5013	1.4968	1.4877	1.4720	1.4629
1000	1.3882	1.3850	1.3834	1.3816	-	1.3797	1.3780	1.3728	1.3626	1.3463	1.3370
1500	1.1950	1.1910	1.1889	1.1868	-	1.1846	1.1826	1.1766	1.1655	1.1489	1.1398
2000	1.0486	1.0442	1.0420	1.0397	-	1.0375	1.0353	1.0291	1.0179	1.0017	0.9929
Case 12											
0	0.9334	0.9286	0.9266	0.9248	-	0.9168	0.9159	0.9133	0.9128	0.9049	0.9003
0.5	0.9513	0.9463	0.9442	0.9424	-	0.9339	0.9326	0.9290	0.9263	0.9147	0.9088
1	0.9667	0.9605	0.9586	0.9563	-	0.9488	0.9467	0.9427	0.9387	0.9258	0.9176
3	1.0044	0.9983	0.9958	0.9934	-	0.9874	0.9859	0.9800	0.9734	0.9569	0.9470
5	1.0261	1.0202	1.0176	1.0149	-	1.0101	1.0082	1.0029	0.9950	0.9776	0.9670
7.5	1.0454	1.0393	1.0373	1.0352	-	1.0305	1.0286	1.0227	1.0148	0.9965	0.9848
10	1.0618	1.0565	1.0539	1.0518	-	1.0477	1.0457	1.0402	1.0314	1.0123	0.9992
15	1.0917	1.0866	1.0838	1.0813	-	1.0779	1.0759	1.0704	1.0601	1.0395	1.0251
20	1.1189	1.1129	1.1103	1.1081	-	1.1052	1.1026	1.0969	1.0859	1.0634	1.0477
35	1.1866	1.1812	1.1784	1.1753	-	1.1728	1.1701	1.1631	1.1506	1.1235	1.1032
50	1.2395	1.2335	1.2306	1.2273	-	1.2240	1.2217	1.2140	1.1999	1.1689	1.1464
75	1.3052	1.2982	1.2951	1.2920	-	1.2884	1.2855	1.2768	1.2602	1.2255	1.2011
100	1.3523	1.3452	1.3415	1.3384	-	1.3346	1.3318	1.3219	1.3040	1.2666	1.2404
150	1.4142	1.4065	1.4028	1.3994	-	1.3957	1.3924	1.3819	1.3618	1.3217	1.2956
200	1.4507	1.4430	1.4395	1.4358	-	1.4316	1.4282	1.4177	1.3970	1.3568	1.3312
350	1.4892	1.4821	1.4790	1.4756	-	1.4722	1.4687	1.4587	1.4396	1.4057	1.3859
500	1.4824	1.4769	1.4738	1.4712	-	1.4684	1.4659	1.4577	1.4426	1.4189	1.4054
750	1.4377	1.4337	1.4319	1.4303	-	1.4284	1.4268	1.4221	1.4161	1.4120	1.4102
1000	1.3795	1.3775	1.3762	1.3751	-	1.3746	1.3740	1.3727	1.3754	1.3912	1.3989
1500	1.2611	1.2616	1.2618	1.2622	-	1.2629	1.2639	1.2681	1.2856	1.3346	1.3594
2000	1.1540	1.1561	1.1574	1.1587	-	1.1607	1.1631	1.1711	1.1990	1.2738	1.3127
Case 13											
0	0.5579	0.5563	0.5555	0.5548	-	0.5483	0.5484	0.5483	0.5516	0.5494	0.5491
0.5	0.5574	0.5553	0.5544	0.5540	-	0.5471	0.5469	0.5466	0.5494	0.5464	0.5447
1	0.5604	0.5584	0.5574	0.5559	-	0.5494	0.5492	0.5482	0.5496	0.5458	0.5437
3	0.5849	0.5810	0.5795	0.5778	-	0.5711	0.5704	0.5679	0.5675	0.5592	0.5550
5	0.6121	0.6075	0.6060	0.6037	-	0.5974	0.5964	0.5932	0.5906	0.5803	0.5743
7.5	0.6433	0.6383	0.6365	0.6346	-	0.6280	0.6267	0.6233	0.6192	0.6074	0.5995
10	0.6706	0.6656	0.6638	0.6619	-	0.6560	0.6547	0.6502	0.6461	0.6328	0.6240
15	0.7195	0.7148	0.7124	0.7105	-	0.7052	0.7033	0.6990	0.6932	0.6784	0.6692
20	0.7623	0.7575	0.7551	0.7528	-	0.7480	0.7465	0.7412	0.7354	0.7194	0.7088
35	0.8618	0.8567	0.8543	0.8521	-	0.8483	0.8462	0.8410	0.8331	0.8151	0.8031
50	0.9324	0.9274	0.9251	0.9228	-	0.9190	0.9174	0.9113	0.9021	0.8827	0.8691

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	1.0118	1.0067	1.0042	1.0021	-	0.9988	0.9970	0.9909	0.9799	0.9581	0.9427
100	1.0636	1.0587	1.0558	1.0538	-	1.0511	1.0483	1.0421	1.0308	1.0071	0.9911
150	1.1244	1.1196	1.1168	1.1147	-	1.1113	1.1093	1.1025	1.0895	1.0642	1.0466
200	1.1557	1.1508	1.1477	1.1456	-	1.1428	1.1403	1.1334	1.1195	1.0930	1.0746
350	1.1809	1.1751	1.1724	1.1700	-	1.1669	1.1641	1.1565	1.1418	1.1137	1.0943
500	1.1663	1.1602	1.1577	1.1547	-	1.1518	1.1491	1.1410	1.1258	1.0974	1.0785
750	1.1168	1.1111	1.1081	1.1052	-	1.1024	1.0994	1.0914	1.0756	1.0477	1.0297
1000	1.0606	1.0548	1.0521	1.0486	-	1.0454	1.0427	1.0346	1.0191	0.9924	0.9755
1500	0.9531	0.9472	0.9443	0.9413	-	0.9385	0.9357	0.9273	0.9124	0.8884	0.8737
2000	0.8619	0.8557	0.8527	0.8494	-	0.8465	0.8441	0.8361	0.8224	0.8003	0.7874
Case 14											
0	0.8363	0.8310	0.8288	0.8274	-	0.8186	0.8173	0.8145	0.8139	0.8055	0.8002
0.5	0.8619	0.8567	0.8544	0.8521	-	0.8436	0.8421	0.8385	0.8359	0.8244	0.8177
1	0.8821	0.8765	0.8734	0.8714	-	0.8636	0.8618	0.8574	0.8535	0.8401	0.8327
3	0.9326	0.9263	0.9241	0.9216	-	0.9152	0.9138	0.9082	0.9020	0.8854	0.8753
5	0.9671	0.9612	0.9585	0.9561	-	0.9513	0.9489	0.9439	0.9357	0.9191	0.9077
7.5	1.0035	0.9979	0.9956	0.9929	-	0.9883	0.9864	0.9810	0.9727	0.9549	0.9427
10	1.0370	1.0317	1.0288	1.0265	-	1.0226	1.0206	1.0155	1.0061	0.9878	0.9751
15	1.0959	1.0907	1.0878	1.0858	-	1.0823	1.0801	1.0744	1.0651	1.0455	1.0316
20	1.1458	1.1401	1.1378	1.1355	-	1.1321	1.1300	1.1246	1.1146	1.0942	1.0794
35	1.2529	1.2473	1.2448	1.2423	-	1.2400	1.2378	1.2317	1.2206	1.1981	1.1809
50	1.3207	1.3157	1.3132	1.3111	-	1.3078	1.3066	1.3003	1.2882	1.2643	1.2460
75	1.3902	1.3852	1.3833	1.3807	-	1.3782	1.3760	1.3700	1.3573	1.3311	1.3117
100	1.4300	1.4253	1.4233	1.4205	-	1.4186	1.4161	1.4101	1.3970	1.3696	1.3495
150	1.4693	1.4645	1.4622	1.4599	-	1.4580	1.4554	1.4486	1.4350	1.4067	1.3865
200	1.4817	1.4768	1.4745	1.4723	-	1.4699	1.4677	1.4605	1.4466	1.4178	1.3976
350	1.4604	1.4557	1.4537	1.4510	-	1.4483	1.4463	1.4390	1.4242	1.3962	1.3768
500	1.4124	1.4075	1.4047	1.4025	-	1.4000	1.3971	1.3900	1.3752	1.3476	1.3294
750	1.3217	1.3164	1.3140	1.3107	-	1.3081	1.3055	1.2976	1.2828	1.2575	1.2413
1000	1.2342	1.2292	1.2260	1.2234	-	1.2206	1.2180	1.2104	1.1960	1.1713	1.1569
1500	1.0846	1.0788	1.0763	1.0737	-	1.0707	1.0682	1.0605	1.0468	1.0247	1.0124
2000	0.9647	0.9588	0.9563	0.9539	-	0.9509	0.9488	0.9410	0.9280	0.9087	0.8973
Case 15											
0	1.5153	1.5126	1.5114	1.5102	-	1.5029	1.5030	1.5019	1.5041	1.5003	1.4982
0.5	1.4970	1.4938	1.4921	1.4912	-	1.4851	1.4847	1.4819	1.4804	1.4731	1.4681
1	1.4843	1.4812	1.4792	1.4778	-	1.4732	1.4724	1.4693	1.4658	1.4562	1.4500
3	1.4541	1.4502	1.4487	1.4469	-	1.4436	1.4424	1.4388	1.4323	1.4195	1.4110
5	1.4469	1.4432	1.4417	1.4396	-	1.4374	1.4358	1.4315	1.4244	1.4100	1.3995
7.5	1.4556	1.4512	1.4490	1.4474	-	1.4450	1.4436	1.4385	1.4309	1.4151	1.4032

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	1.4705	1.4660	1.4640	1.4626	-	1.4598	1.4582	1.4535	1.4451	1.4279	1.4147
15	1.5045	1.5005	1.4983	1.4964	-	1.4943	1.4925	1.4873	1.4785	1.4597	1.4446
20	1.5368	1.5327	1.5302	1.5283	-	1.5259	1.5246	1.5189	1.5092	1.4894	1.4738
35	1.6069	1.6024	1.6001	1.5982	-	1.5962	1.5942	1.5887	1.5785	1.5561	1.5394
50	1.6491	1.6452	1.6427	1.6411	-	1.6388	1.6372	1.6320	1.6210	1.5981	1.5803
75	1.6871	1.6836	1.6816	1.6795	-	1.6780	1.6761	1.6707	1.6598	1.6360	1.6188
100	1.7048	1.7015	1.6995	1.6981	-	1.6960	1.6938	1.6889	1.6778	1.6543	1.6370
150	1.7117	1.7085	1.7073	1.7052	-	1.7035	1.7016	1.6966	1.6854	1.6624	1.6459
200	1.7009	1.6984	1.6963	1.6949	-	1.6935	1.6915	1.6863	1.6759	1.6530	1.6380
350	1.6374	1.6346	1.6331	1.6311	-	1.6296	1.6279	1.6226	1.6119	1.5911	1.5772
500	1.5627	1.5594	1.5576	1.5556	-	1.5540	1.5521	1.5468	1.5358	1.5162	1.5036
750	1.4422	1.4389	1.4366	1.4345	-	1.4325	1.4310	1.4249	1.4137	1.3943	1.3833
1000	1.3351	1.3313	1.3289	1.3265	-	1.3246	1.3226	1.3164	1.3052	1.2864	1.2756
1500	1.1590	1.1544	1.1520	1.1497	-	1.1477	1.1457	1.1389	1.1273	1.1095	1.0999
2000	1.0223	1.0175	1.0153	1.0130	-	1.0107	1.0084	1.0019	0.9903	0.9737	0.9646

Table C-8: k-infinity for free gas scattering cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	2.8804	2.8804	2.8803	2.8804	-	2.8805	2.8807	2.8801	2.8804	2.8802	2.8802
0.5	2.6046	2.6016	2.6006	2.5996	-	2.5983	2.5978	2.5956	2.5921	2.5871	2.5840
1	2.4491	2.4454	2.4434	2.4416	-	2.4400	2.4388	2.4354	2.4300	2.4215	2.4163
3	2.1539	2.1495	2.1472	2.1460	-	2.1442	2.1425	2.1382	2.1317	2.1195	2.1115
5	2.0092	2.0057	2.0038	2.0023	-	2.0005	1.9996	1.9960	1.9898	1.9784	1.9706
7.5	1.8952	1.8924	1.8908	1.8898	-	1.8886	1.8872	1.8841	1.8789	1.8683	1.8617
10	1.8153	1.8125	1.8116	1.8105	-	1.8094	1.8083	1.8061	1.8011	1.7920	1.7861
15	1.7038	1.7016	1.7010	1.7005	-	1.6998	1.6985	1.6966	1.6928	1.6855	1.6812
20	1.6246	1.6229	1.6226	1.6220	-	1.6213	1.6209	1.6188	1.6160	1.6098	1.6079
35	1.4629	1.4626	1.4624	1.4619	-	1.4622	1.4618	1.4613	1.4591	1.4576	1.4618
50	1.3483	1.3492	1.3496	1.3494	-	1.3493	1.3499	1.3498	1.3493	1.3525	1.3626
75	1.2026	1.2048	1.2050	1.2058	-	1.2068	1.2076	1.2085	1.2099	1.2208	1.2396
100	1.0895	1.0918	1.0924	1.0940	-	1.0950	1.0959	1.0981	1.1014	1.1191	1.1448
150	0.9187	0.9218	0.9232	0.9247	-	0.9263	0.9281	0.9319	0.9389	0.9660	1.0006
200	0.7947	0.7987	0.7999	0.8017	-	0.8039	0.8056	0.8106	0.8198	0.8531	0.8927
350	0.5676	0.5711	0.5726	0.5749	-	0.5766	0.5785	0.5843	0.5957	0.6355	0.6804
500	0.4417	0.4446	0.4461	0.4484	-	0.4500	0.4520	0.4570	0.4685	0.5082	0.5513
750	0.3221	0.3250	0.3265	0.3277	-	0.3298	0.3313	0.3360	0.3462	0.3816	0.4199
1000	0.2540	0.2564	0.2577	0.2590	-	0.2605	0.2617	0.2653	0.2742	0.3059	0.3395
1500	0.1782	0.1801	0.1811	0.1820	-	0.1832	0.1838	0.1874	0.1940	0.2188	0.2456

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	0.1378	0.1389	0.1395	0.1405	-	0.1411	0.1419	0.1445	0.1504	0.1706	0.1925
Case 2											
0	2.8507	2.8507	2.8505	2.8507	-	2.8503	2.8505	2.8508	2.8506	2.8505	2.8510
0.5	2.5723	2.5695	2.5686	2.5679	-	2.5663	2.5662	2.5635	2.5607	2.5565	2.5543
1	2.4054	2.4017	2.3998	2.3983	-	2.3973	2.3964	2.3930	2.3878	2.3804	2.3758
3	2.0478	2.0443	2.0428	2.0411	-	2.0393	2.0382	2.0348	2.0286	2.0178	2.0127
5	1.8606	1.8572	1.8556	1.8548	-	1.8530	1.8521	1.8488	1.8432	1.8339	1.8285
7.5	1.7160	1.7132	1.7118	1.7106	-	1.7096	1.7085	1.7061	1.7012	1.6919	1.6875
10	1.6197	1.6171	1.6162	1.6153	-	1.6144	1.6133	1.6108	1.6068	1.5973	1.5935
15	1.4972	1.4955	1.4942	1.4932	-	1.4922	1.4918	1.4894	1.4849	1.4762	1.4733
20	1.4188	1.4169	1.4160	1.4153	-	1.4148	1.4138	1.4119	1.4072	1.3987	1.3969
35	1.2767	1.2760	1.2751	1.2749	-	1.2744	1.2742	1.2723	1.2679	1.2614	1.2630
50	1.1853	1.1855	1.1850	1.1844	-	1.1846	1.1843	1.1829	1.1792	1.1765	1.1824
75	1.0710	1.0715	1.0715	1.0716	-	1.0720	1.0724	1.0722	1.0702	1.0741	1.0868
100	0.9800	0.9814	0.9823	0.9827	-	0.9834	0.9838	0.9847	0.9851	0.9953	1.0139
150	0.8406	0.8422	0.8428	0.8445	-	0.8461	0.8468	0.8488	0.8536	0.8733	0.9012
200	0.7353	0.7384	0.7395	0.7410	-	0.7426	0.7443	0.7475	0.7539	0.7806	0.8144
350	0.5363	0.5390	0.5409	0.5424	-	0.5447	0.5462	0.5503	0.5604	0.5954	0.6352
500	0.4224	0.4250	0.4263	0.4284	-	0.4300	0.4317	0.4361	0.4464	0.4829	0.5224
750	0.3117	0.3141	0.3158	0.3169	-	0.3185	0.3201	0.3242	0.3339	0.3672	0.4034
1000	0.2472	0.2493	0.2511	0.2522	-	0.2531	0.2542	0.2581	0.2666	0.2970	0.3285
1500	0.1750	0.1765	0.1776	0.1783	-	0.1794	0.1805	0.1836	0.1905	0.2142	0.2399
2000	0.1355	0.1369	0.1376	0.1382	-	0.1391	0.1399	0.1423	0.1478	0.1676	0.1893
Case 3											
0	2.8805	2.8811	2.8803	2.8805	2.8807	2.8803	2.8804	2.8803	2.8800	2.8804	2.8803
0.5	2.6049	2.6023	2.6008	2.5996	2.6002	2.5989	2.5985	2.5961	2.5926	2.5878	2.5848
1	2.4468	2.4428	2.4411	2.4396	2.4408	2.4391	2.4380	2.4347	2.4291	2.4210	2.4157
3	2.1373	2.1331	2.1315	2.1298	2.1350	2.1334	2.1315	2.1276	2.1211	2.1098	2.1017
5	1.9806	1.9772	1.9755	1.9740	1.9829	1.9809	1.9797	1.9765	1.9708	1.9598	1.9522
7.5	1.8534	1.8510	1.8493	1.8485	1.8606	1.8597	1.8584	1.8553	1.8506	1.8411	1.8349
10	1.7635	1.7610	1.7598	1.7590	1.7742	1.7728	1.7722	1.7699	1.7657	1.7573	1.7522
15	1.6363	1.6343	1.6340	1.6333	1.6527	1.6523	1.6512	1.6494	1.6460	1.6396	1.6374
20	1.5454	1.5440	1.5437	1.5433	1.5656	1.5652	1.5655	1.5637	1.5606	1.5558	1.5559
35	1.3603	1.3601	1.3603	1.3602	1.3895	1.3900	1.3899	1.3887	1.3874	1.3876	1.3941
50	1.2326	1.2336	1.2342	1.2346	1.2675	1.2679	1.2679	1.2678	1.2675	1.2722	1.2849
75	1.0773	1.0786	1.0797	1.0805	1.1154	1.1167	1.1170	1.1186	1.1199	1.1316	1.1524
100	0.9607	0.9628	0.9640	0.9651	1.0008	1.0023	1.0029	1.0052	1.0085	1.0255	1.0519
150	0.7929	0.7961	0.7973	0.7987	0.8336	0.8356	0.8364	0.8399	0.8453	0.8697	0.9046
200	0.6773	0.6799	0.6817	0.6832	0.7160	0.7173	0.7190	0.7231	0.7303	0.7584	0.7971

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	0.4730	0.4755	0.4769	0.4783	0.5043	0.5063	0.5078	0.5123	0.5207	0.5523	0.5918
500	0.3637	0.3661	0.3672	0.3690	0.3904	0.3918	0.3933	0.3972	0.4057	0.4357	0.4732
750	0.2632	0.2652	0.2661	0.2673	0.2833	0.2847	0.2859	0.2892	0.2967	0.3230	0.3548
1000	0.2066	0.2080	0.2086	0.2095	0.2228	0.2238	0.2248	0.2278	0.2341	0.2570	0.2845
1500	0.1439	0.1453	0.1458	0.1466	0.1559	0.1568	0.1574	0.1599	0.1648	0.1824	0.2033
2000	0.1107	0.1117	0.1119	0.1126	0.1199	0.1206	0.1213	0.1232	0.1271	0.1413	0.1587
Case 4											
0	0.5580	0.5565	0.5556	0.5551	0.5551	0.5483	0.5481	0.5480	0.5516	0.5502	0.5487
0.5	0.5573	0.5560	0.5547	0.5539	0.5539	0.5473	0.5474	0.5466	0.5483	0.5463	0.5451
1	0.5607	0.5577	0.5568	0.5560	0.5560	0.5493	0.5488	0.5480	0.5497	0.5458	0.5437
3	0.5831	0.5795	0.5780	0.5766	0.5769	0.5698	0.5688	0.5666	0.5657	0.5586	0.5541
5	0.6068	0.6027	0.6006	0.5992	0.5998	0.5931	0.5922	0.5891	0.5873	0.5769	0.5702
7.5	0.6312	0.6260	0.6244	0.6227	0.6236	0.6173	0.6162	0.6129	0.6095	0.5977	0.5910
10	0.6481	0.6433	0.6418	0.6396	0.6412	0.6360	0.6342	0.6310	0.6267	0.6147	0.6070
15	0.6683	0.6644	0.6624	0.6607	0.6638	0.6593	0.6579	0.6539	0.6497	0.6371	0.6291
20	0.6765	0.6726	0.6708	0.6691	0.6742	0.6703	0.6687	0.6652	0.6600	0.6481	0.6401
35	0.6639	0.6604	0.6591	0.6578	0.6673	0.6644	0.6637	0.6598	0.6547	0.6432	0.6366
50	0.6298	0.6276	0.6263	0.6242	0.6375	0.6355	0.6342	0.6309	0.6257	0.6152	0.6089
75	0.5670	0.5646	0.5637	0.5628	0.5776	0.5763	0.5750	0.5723	0.5675	0.5584	0.5523
100	0.5102	0.5077	0.5070	0.5058	0.5223	0.5206	0.5199	0.5173	0.5130	0.5047	0.4993
150	0.4207	0.4190	0.4185	0.4177	0.4329	0.4322	0.4313	0.4295	0.4254	0.4183	0.4143
200	0.3571	0.3555	0.3550	0.3543	0.3691	0.3686	0.3671	0.3657	0.3618	0.3563	0.3527
350	0.2445	0.2435	0.2435	0.2431	0.2538	0.2534	0.2531	0.2517	0.2495	0.2452	0.2428
500	0.1861	0.1854	0.1851	0.1850	0.1936	0.1935	0.1930	0.1918	0.1905	0.1869	0.1851
750	0.1331	0.1327	0.1323	0.1321	0.1390	0.1386	0.1385	0.1376	0.1366	0.1342	0.1329
1000	0.1037	0.1035	0.1033	0.1031	0.1086	0.1082	0.1081	0.1077	0.1065	0.1048	0.1040
1500	0.0721	0.0720	0.0718	0.0717	0.0754	0.0753	0.0752	0.0749	0.0741	0.0732	0.0725
2000	0.0554	0.0550	0.0550	0.0549	0.0580	0.0579	0.0578	0.0574	0.0570	0.0562	0.0557
Case 5											
1	0.4935	0.4934	0.4937	0.4940	0.4902	0.4897	0.4900	0.4906	0.4907	0.4915	0.4918
1.25	0.4465	0.4468	0.4473	0.4474	0.4424	0.4420	0.4427	0.4433	0.4441	0.4453	0.4462
2	0.3466	0.3469	0.3471	0.3474	0.3412	0.3414	0.3418	0.3425	0.3438	0.3459	0.3473
2.25	0.3230	0.3235	0.3238	0.3235	0.3179	0.3177	0.3180	0.3186	0.3197	0.3223	0.3238
2.75	0.2847	0.2854	0.2857	0.2859	0.2801	0.2800	0.2805	0.2809	0.2823	0.2842	0.2861
3	0.2691	0.2697	0.2700	0.2705	0.2644	0.2645	0.2649	0.2650	0.2665	0.2685	0.2704
Case 6											
30	0.1207	0.1207	0.1209	0.1210	-	0.1206	0.1210	0.1205	0.1204	0.1207	0.1200
35	0.1134	0.1138	0.1132	0.1134	-	0.1132	0.1135	0.1131	0.1134	0.1131	0.1126
40	0.1072	0.1073	0.1070	0.1080	-	0.1075	0.1074	0.1075	0.1074	0.1076	0.1070

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
45	0.1033	0.1030	0.1026	0.1028	-	0.1031	0.1030	0.1030	0.1027	0.1029	0.1025
50	0.0997	0.0995	0.0995	0.0990	-	0.0993	0.0994	0.0995	0.0991	0.0996	0.0989
55	0.0962	0.0966	0.0964	0.0964	-	0.0962	0.0965	0.0965	0.0963	0.0967	0.0965
60	0.0938	0.0946	0.0940	0.0940	-	0.0936	0.0941	0.0940	0.0935	0.0937	0.0934
65	0.0919	0.0919	0.0918	0.0917	-	0.0917	0.0919	0.0920	0.0919	0.0916	0.0921
70	0.0907	0.0902	0.0904	0.0903	-	0.0903	0.0903	0.0899	0.0900	0.0902	0.0897
Case 7											
1E-20	0.4112	0.4098	0.4095	0.4087	0.4087	0.4076	0.4070	0.4054	0.4035	0.3989	0.3961
0.05	0.3649	0.3641	0.3634	0.3632	0.3632	0.3628	0.3625	0.3618	0.3605	0.3577	0.3559
0.1	0.3329	0.3330	0.3323	0.3325	0.3322	0.3318	0.3318	0.3316	0.3305	0.3286	0.3274
0.2	0.2952	0.2949	0.2952	0.2948	0.2948	0.2948	0.2948	0.2945	0.2940	0.2930	0.2919
0.3	0.2730	0.2727	0.2729	0.2730	0.2729	0.2732	0.2728	0.2726	0.2720	0.2714	0.2708
0.4	0.2585	0.2582	0.2578	0.2582	0.2579	0.2584	0.2579	0.2579	0.2577	0.2573	0.2571
0.5	0.2469	0.2477	0.2472	0.2474	0.2475	0.2472	0.2475	0.2472	0.2476	0.2473	0.2477
0.6	0.2392	0.2391	0.2395	0.2392	0.2390	0.2393	0.2390	0.2395	0.2400	0.2398	0.2405
0.7	0.2327	0.2328	0.2331	0.2330	0.2331	0.2330	0.2333	0.2334	0.2336	0.2344	0.2344
0.8	0.2273	0.2274	0.2280	0.2275	0.2279	0.2279	0.2283	0.2284	0.2288	0.2296	0.2303
0.9	0.2227	0.2231	0.2236	0.2235	0.2239	0.2238	0.2241	0.2243	0.2251	0.2260	0.2269
0.95	0.2211	0.2209	0.2219	0.2219	0.2216	0.2222	0.2223	0.2230	0.2234	0.2244	0.2249
1	0.2195	0.2196	0.2201	0.2202	0.2201	0.2205	0.2201	0.2209	0.2221	0.2231	0.2241
Case 8											
1	0.7388	0.7379	0.7374	0.7370	0.7361	0.7353	0.7349	0.7339	0.7319	0.7271	0.7241
1.5	0.6150	0.6154	0.6153	0.6153	0.6120	0.6116	0.6115	0.6109	0.6102	0.6080	0.6071
2	0.5241	0.5242	0.5247	0.5245	0.5204	0.5201	0.5204	0.5206	0.5204	0.5190	0.5188
2.5	0.4555	0.4557	0.4562	0.4560	0.4514	0.4516	0.4517	0.4522	0.4521	0.4519	0.4523
3	0.4022	0.4027	0.4034	0.4032	0.3981	0.3987	0.3990	0.3989	0.3993	0.3997	0.4006
4	0.3258	0.3264	0.3264	0.3271	0.3222	0.3225	0.3226	0.3232	0.3233	0.3244	0.3251
5	0.2735	0.2743	0.2748	0.2748	0.2703	0.2703	0.2709	0.2715	0.2720	0.2731	0.2740
6	0.2365	0.2365	0.2370	0.2373	0.2332	0.2336	0.2336	0.2340	0.2347	0.2358	0.2370
7	0.2080	0.2086	0.2088	0.2090	0.2053	0.2052	0.2058	0.2058	0.2069	0.2076	0.2087
8	0.1863	0.1867	0.1867	0.1868	0.1833	0.1836	0.1837	0.1844	0.1851	0.1856	0.1864
9	0.1685	0.1689	0.1690	0.1692	0.1658	0.1660	0.1661	0.1667	0.1675	0.1681	0.1693
Case 9											
0	0.8365	0.8312	0.8291	0.8275	0.8274	0.8183	0.8171	0.8147	0.8138	0.8057	0.8002
0.5	0.8612	0.8562	0.8533	0.8512	0.8516	0.8431	0.8416	0.8386	0.8353	0.8242	0.8170
1	0.8803	0.8743	0.8723	0.8693	0.8693	0.8617	0.8602	0.8562	0.8521	0.8393	0.8312
3	0.9227	0.9163	0.9142	0.9118	0.9126	0.9067	0.9047	0.9001	0.8936	0.8778	0.8679
5	0.9418	0.9360	0.9338	0.9320	0.9340	0.9287	0.9260	0.9217	0.9150	0.8983	0.8881
7.5	0.9521	0.9472	0.9451	0.9428	0.9463	0.9423	0.9407	0.9362	0.9289	0.9127	0.9022

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	0.9537	0.9498	0.9471	0.9454	0.9509	0.9470	0.9457	0.9410	0.9337	0.9179	0.9079
15	0.9427	0.9386	0.9366	0.9350	0.9443	0.9412	0.9398	0.9354	0.9283	0.9134	0.9031
20	0.9202	0.9162	0.9151	0.9131	0.9254	0.9231	0.9217	0.9176	0.9103	0.8964	0.8864
35	0.8327	0.8298	0.8283	0.8269	0.8461	0.8445	0.8430	0.8394	0.8326	0.8197	0.8114
50	0.7472	0.7448	0.7433	0.7424	0.7642	0.7631	0.7617	0.7584	0.7523	0.7400	0.7325
75	0.6311	0.6287	0.6278	0.6268	0.6505	0.6492	0.6479	0.6453	0.6394	0.6289	0.6223
100	0.5434	0.5420	0.5410	0.5398	0.5630	0.5620	0.5610	0.5582	0.5536	0.5437	0.5384
150	0.4246	0.4228	0.4218	0.4214	0.4417	0.4413	0.4401	0.4378	0.4337	0.4262	0.4220
200	0.3474	0.3464	0.3453	0.3448	0.3633	0.3625	0.3621	0.3601	0.3562	0.3497	0.3466
350	0.2254	0.2245	0.2237	0.2234	0.2370	0.2365	0.2358	0.2346	0.2321	0.2280	0.2258
500	0.1668	0.1661	0.1658	0.1653	0.1758	0.1755	0.1751	0.1741	0.1723	0.1694	0.1679
750	0.1167	0.1161	0.1159	0.1157	0.1231	0.1228	0.1227	0.1221	0.1208	0.1186	0.1178
1000	0.0898	0.0893	0.0892	0.0889	0.0949	0.0947	0.0945	0.0940	0.0930	0.0916	0.0908
1500	0.0615	0.0613	0.0611	0.0610	0.0651	0.0650	0.0649	0.0645	0.0639	0.0630	0.0625
2000	0.0468	0.0466	0.0466	0.0465	0.0496	0.0495	0.0495	0.0491	0.0487	0.0480	0.0477
Case 10											
0	1.5152	1.5127	1.5119	1.5106	1.5105	1.5027	1.5027	1.5019	1.5044	1.5003	1.4985
0.5	1.4950	1.4911	1.4902	1.4889	1.4888	1.4833	1.4828	1.4804	1.4788	1.4712	1.4664
1	1.4792	1.4758	1.4741	1.4724	1.4732	1.4685	1.4672	1.4645	1.4615	1.4520	1.4455
3	1.4258	1.4223	1.4201	1.4190	1.4215	1.4184	1.4170	1.4135	1.4080	1.3965	1.3886
5	1.3836	1.3804	1.3790	1.3773	1.3818	1.3794	1.3785	1.3749	1.3687	1.3568	1.3479
7.5	1.3394	1.3354	1.3343	1.3330	1.3406	1.3389	1.3373	1.3337	1.3272	1.3149	1.3061
10	1.2980	1.2952	1.2934	1.2922	1.3034	1.3014	1.3002	1.2962	1.2906	1.2777	1.2688
15	1.2219	1.2191	1.2179	1.2163	1.2330	1.2315	1.2300	1.2269	1.2202	1.2075	1.1987
20	1.1520	1.1497	1.1478	1.1470	1.1675	1.1661	1.1649	1.1617	1.1548	1.1426	1.1337
35	0.9756	0.9733	0.9725	0.9712	0.9986	0.9971	0.9961	0.9929	0.9864	0.9748	0.9673
50	0.8421	0.8398	0.8384	0.8379	0.8678	0.8665	0.8659	0.8624	0.8565	0.8456	0.8391
75	0.6836	0.6817	0.6806	0.6795	0.7097	0.7089	0.7080	0.7048	0.6996	0.6899	0.6846
100	0.5745	0.5724	0.5719	0.5709	0.5994	0.5985	0.5978	0.5952	0.5905	0.5815	0.5777
150	0.4351	0.4335	0.4330	0.4324	0.4568	0.4561	0.4554	0.4534	0.4492	0.4429	0.4398
200	0.3506	0.3489	0.3487	0.3482	0.3690	0.3684	0.3678	0.3663	0.3627	0.3575	0.3549
350	0.2212	0.2204	0.2201	0.2198	0.2343	0.2338	0.2335	0.2324	0.2302	0.2269	0.2254
500	0.1618	0.1612	0.1610	0.1607	0.1718	0.1716	0.1712	0.1704	0.1688	0.1665	0.1655
750	0.1119	0.1114	0.1113	0.1111	0.1190	0.1189	0.1186	0.1182	0.1170	0.1154	0.1149
1000	0.0856	0.0853	0.0851	0.0850	0.0912	0.0909	0.0909	0.0904	0.0896	0.0884	0.0880
1500	0.0582	0.0580	0.0580	0.0578	0.0621	0.0620	0.0619	0.0616	0.0611	0.0603	0.0600
2000	0.0441	0.0440	0.0439	0.0439	0.0471	0.0471	0.0470	0.0468	0.0464	0.0458	0.0456

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 11											
0	2.1950	2.1948	2.1947	2.1950	-	2.1950	2.1949	2.1947	2.1946	2.1948	2.1948
0.5	2.0561	2.0554	2.0554	2.0553	-	2.0552	2.0553	2.0548	2.0544	2.0536	2.0535
1	1.9707	1.9704	1.9700	1.9694	-	1.9690	1.9690	1.9687	1.9672	1.9661	1.9654
3	1.8041	1.8026	1.8023	1.8015	-	1.8010	1.8009	1.8000	1.7978	1.7943	1.7918
5	1.7232	1.7217	1.7208	1.7211	-	1.7200	1.7196	1.7185	1.7159	1.7121	1.7096
7.5	1.6546	1.6531	1.6530	1.6522	-	1.6520	1.6513	1.6500	1.6477	1.6436	1.6408
10	1.5995	1.5983	1.5974	1.5971	-	1.5968	1.5963	1.5951	1.5924	1.5886	1.5861
15	1.5043	1.5027	1.5027	1.5021	-	1.5017	1.5012	1.5003	1.4984	1.4941	1.4922
20	1.4196	1.4192	1.4186	1.4184	-	1.4177	1.4178	1.4165	1.4144	1.4104	1.4087
35	1.2124	1.2112	1.2109	1.2104	-	1.2103	1.2099	1.2083	1.2056	1.2006	1.1992
50	1.0544	1.0531	1.0528	1.0525	-	1.0517	1.0514	1.0498	1.0465	1.0415	1.0399
75	0.8639	0.8631	0.8624	0.8616	-	0.8610	0.8604	0.8587	0.8553	0.8496	0.8482
100	0.7312	0.7299	0.7292	0.7287	-	0.7279	0.7273	0.7255	0.7221	0.7166	0.7146
150	0.5585	0.5571	0.5565	0.5560	-	0.5553	0.5548	0.5530	0.5496	0.5447	0.5428
200	0.4515	0.4504	0.4498	0.4491	-	0.4485	0.4480	0.4464	0.4434	0.4389	0.4373
350	0.2865	0.2857	0.2853	0.2848	-	0.2843	0.2839	0.2827	0.2805	0.2772	0.2760
500	0.2098	0.2092	0.2088	0.2086	-	0.2081	0.2078	0.2068	0.2051	0.2026	0.2016
750	0.1451	0.1446	0.1443	0.1441	-	0.1438	0.1436	0.1429	0.1416	0.1398	0.1390
1000	0.1109	0.1104	0.1103	0.1100	-	0.1099	0.1096	0.1091	0.1081	0.1066	0.1062
1500	0.0754	0.0751	0.0749	0.0748	-	0.0746	0.0745	0.0741	0.0734	0.0724	0.0720
2000	0.0570	0.0568	0.0567	0.0566	-	0.0565	0.0564	0.0561	0.0556	0.0548	0.0545
Case 12											
0	0.9331	0.9284	0.9269	0.9251	-	0.9170	0.9157	0.9134	0.9129	0.9041	0.9002
0.5	0.9513	0.9462	0.9431	0.9413	-	0.9336	0.9322	0.9285	0.9259	0.9148	0.9080
1	0.9657	0.9596	0.9572	0.9553	-	0.9476	0.9455	0.9417	0.9373	0.9245	0.9164
3	0.9980	0.9919	0.9892	0.9867	-	0.9812	0.9794	0.9738	0.9676	0.9515	0.9416
5	1.0113	1.0061	1.0035	1.0009	-	0.9964	0.9939	0.9892	0.9817	0.9650	0.9547
7.5	1.0188	1.0133	1.0112	1.0091	-	1.0048	1.0028	0.9981	0.9902	0.9736	0.9625
10	1.0213	1.0163	1.0142	1.0123	-	1.0086	1.0071	1.0020	0.9936	0.9772	0.9662
15	1.0215	1.0169	1.0144	1.0126	-	1.0100	1.0081	1.0031	0.9950	0.9780	0.9671
20	1.0175	1.0132	1.0110	1.0089	-	1.0067	1.0051	1.0003	0.9922	0.9750	0.9643
35	0.9944	0.9905	0.9890	0.9870	-	0.9853	0.9842	0.9795	0.9706	0.9553	0.9475
50	0.9619	0.9589	0.9577	0.9563	-	0.9546	0.9541	0.9498	0.9423	0.9295	0.9251
75	0.9023	0.9002	0.8994	0.8991	-	0.8980	0.8971	0.8943	0.8883	0.8817	0.8840
100	0.8438	0.8427	0.8422	0.8417	-	0.8414	0.8411	0.8389	0.8354	0.8349	0.8427
150	0.7405	0.7403	0.7402	0.7409	-	0.7411	0.7412	0.7413	0.7408	0.7507	0.7673
200	0.6566	0.6567	0.6577	0.6579	-	0.6587	0.6595	0.6604	0.6629	0.6789	0.7019
350	0.4865	0.4883	0.4894	0.4897	-	0.4910	0.4922	0.4949	0.5010	0.5264	0.5565

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	0.3860	0.3878	0.3884	0.3895	-	0.3905	0.3919	0.3949	0.4023	0.4292	0.4605
750	0.2873	0.2885	0.2895	0.2900	-	0.2914	0.2923	0.2955	0.3027	0.3288	0.3577
1000	0.2287	0.2299	0.2307	0.2315	-	0.2326	0.2332	0.2366	0.2426	0.2661	0.2927
1500	0.1628	0.1635	0.1640	0.1649	-	0.1655	0.1663	0.1684	0.1739	0.1934	0.2144
2000	0.1263	0.1271	0.1275	0.1281	-	0.1289	0.1294	0.1311	0.1357	0.1521	0.1700
Case 13											
0	0.5584	0.5565	0.5558	0.5548	-	0.5484	0.5481	0.5484	0.5513	0.5502	0.5488
0.5	0.5576	0.5554	0.5548	0.5538	-	0.5476	0.5471	0.5465	0.5490	0.5462	0.5448
1	0.5600	0.5576	0.5562	0.5556	-	0.5495	0.5495	0.5480	0.5495	0.5460	0.5433
3	0.5834	0.5799	0.5785	0.5771	-	0.5701	0.5694	0.5673	0.5660	0.5588	0.5540
5	0.6084	0.6043	0.6022	0.6006	-	0.5943	0.5928	0.5898	0.5876	0.5773	0.5714
7.5	0.6336	0.6289	0.6271	0.6253	-	0.6192	0.6182	0.6145	0.6107	0.5993	0.5925
10	0.6532	0.6484	0.6460	0.6448	-	0.6389	0.6375	0.6342	0.6296	0.6176	0.6097
15	0.6789	0.6745	0.6722	0.6705	-	0.6663	0.6648	0.6606	0.6560	0.6429	0.6350
20	0.6928	0.6887	0.6867	0.6846	-	0.6810	0.6798	0.6755	0.6704	0.6576	0.6494
35	0.6961	0.6929	0.6910	0.6893	-	0.6860	0.6854	0.6815	0.6757	0.6637	0.6554
50	0.6732	0.6698	0.6682	0.6669	-	0.6652	0.6637	0.6601	0.6547	0.6431	0.6355
75	0.6197	0.6171	0.6160	0.6146	-	0.6133	0.6118	0.6086	0.6034	0.5927	0.5855
100	0.5669	0.5645	0.5628	0.5623	-	0.5604	0.5596	0.5565	0.5512	0.5414	0.5355
150	0.4776	0.4754	0.4739	0.4737	-	0.4721	0.4713	0.4692	0.4646	0.4552	0.4507
200	0.4100	0.4079	0.4074	0.4068	-	0.4059	0.4050	0.4026	0.3986	0.3914	0.3871
350	0.2866	0.2853	0.2848	0.2840	-	0.2837	0.2834	0.2816	0.2782	0.2730	0.2699
500	0.2204	0.2192	0.2189	0.2181	-	0.2175	0.2175	0.2162	0.2135	0.2098	0.2074
750	0.1589	0.1584	0.1576	0.1574	-	0.1570	0.1571	0.1559	0.1542	0.1512	0.1497
1000	0.1246	0.1237	0.1237	0.1232	-	0.1231	0.1227	0.1220	0.1209	0.1186	0.1174
1500	0.0869	0.0866	0.0864	0.0860	-	0.0862	0.0857	0.0853	0.0844	0.0829	0.0822
2000	0.0668	0.0666	0.0664	0.0664	-	0.0660	0.0660	0.0656	0.0649	0.0638	0.0634
Case 14											
0	0.8365	0.8313	0.8289	0.8278	-	0.8184	0.8171	0.8143	0.8142	0.8059	0.8004
0.5	0.8616	0.8560	0.8539	0.8512	-	0.8434	0.8414	0.8385	0.8357	0.8240	0.8177
1	0.8807	0.8750	0.8727	0.8700	-	0.8624	0.8610	0.8563	0.8528	0.8393	0.8313
3	0.9254	0.9195	0.9167	0.9143	-	0.9084	0.9061	0.9014	0.8948	0.8794	0.8692
5	0.9477	0.9419	0.9397	0.9377	-	0.9322	0.9302	0.9256	0.9184	0.9019	0.8913
7.5	0.9636	0.9584	0.9558	0.9537	-	0.9497	0.9476	0.9431	0.9353	0.9192	0.9083
10	0.9715	0.9667	0.9641	0.9624	-	0.9585	0.9573	0.9523	0.9447	0.9289	0.9174
15	0.9725	0.9683	0.9664	0.9645	-	0.9618	0.9602	0.9554	0.9475	0.9321	0.9215
20	0.9620	0.9574	0.9556	0.9538	-	0.9513	0.9496	0.9457	0.9377	0.9225	0.9123
35	0.8978	0.8948	0.8928	0.8915	-	0.8896	0.8879	0.8842	0.8769	0.8621	0.8529
50	0.8250	0.8218	0.8205	0.8189	-	0.8176	0.8161	0.8122	0.8048	0.7915	0.7823

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	0.7158	0.7129	0.7118	0.7101	-	0.7091	0.7075	0.7045	0.6975	0.6854	0.6778
100	0.6284	0.6256	0.6244	0.6232	-	0.6221	0.6214	0.6176	0.6115	0.6001	0.5937
150	0.5018	0.4997	0.4984	0.4977	-	0.4966	0.4956	0.4927	0.4876	0.4785	0.4733
200	0.4169	0.4151	0.4142	0.4132	-	0.4124	0.4114	0.4091	0.4048	0.3971	0.3922
350	0.2764	0.2751	0.2745	0.2738	-	0.2732	0.2727	0.2708	0.2679	0.2623	0.2597
500	0.2068	0.2057	0.2052	0.2048	-	0.2043	0.2039	0.2028	0.2001	0.1965	0.1943
750	0.1458	0.1451	0.1447	0.1444	-	0.1440	0.1437	0.1427	0.1412	0.1386	0.1373
1000	0.1126	0.1122	0.1118	0.1116	-	0.1113	0.1110	0.1105	0.1092	0.1072	0.1063
1500	0.0776	0.0773	0.0770	0.0769	-	0.0767	0.0765	0.0761	0.0753	0.0740	0.0734
2000	0.0592	0.0590	0.0589	0.0588	-	0.0586	0.0585	0.0582	0.0575	0.0565	0.0561
Case 15											
0	1.5152	1.5129	1.5112	1.5107	-	1.5027	1.5028	1.5019	1.5037	1.5003	1.4984
0.5	1.4955	1.4919	1.4904	1.4891	-	1.4839	1.4829	1.4804	1.4792	1.4714	1.4666
1	1.4803	1.4768	1.4756	1.4737	-	1.4695	1.4683	1.4649	1.4617	1.4527	1.4461
3	1.4326	1.4284	1.4266	1.4252	-	1.4227	1.4214	1.4176	1.4119	1.3999	1.3918
5	1.3980	1.3944	1.3929	1.3912	-	1.3895	1.3876	1.3840	1.3774	1.3644	1.3555
7.5	1.3647	1.3607	1.3593	1.3575	-	1.3556	1.3540	1.3504	1.3438	1.3303	1.3216
10	1.3341	1.3308	1.3293	1.3273	-	1.3262	1.3247	1.3209	1.3138	1.3004	1.2907
15	1.2773	1.2738	1.2726	1.2712	-	1.2697	1.2682	1.2641	1.2574	1.2436	1.2342
20	1.2225	1.2197	1.2178	1.2164	-	1.2150	1.2137	1.2096	1.2031	1.1890	1.1797
35	1.0732	1.0704	1.0686	1.0676	-	1.0663	1.0650	1.0613	1.0543	1.0406	1.0322
50	0.9499	0.9473	0.9460	0.9445	-	0.9436	0.9427	0.9387	0.9314	0.9190	0.9110
75	0.7936	0.7911	0.7900	0.7886	-	0.7875	0.7863	0.7825	0.7766	0.7647	0.7588
100	0.6799	0.6773	0.6768	0.6751	-	0.6740	0.6731	0.6703	0.6642	0.6539	0.6486
150	0.5275	0.5256	0.5246	0.5235	-	0.5224	0.5216	0.5191	0.5142	0.5062	0.5019
200	0.4309	0.4292	0.4286	0.4276	-	0.4270	0.4261	0.4236	0.4195	0.4129	0.4097
350	0.2781	0.2769	0.2765	0.2758	-	0.2753	0.2748	0.2733	0.2704	0.2662	0.2642
500	0.2053	0.2046	0.2041	0.2036	-	0.2032	0.2030	0.2017	0.1997	0.1967	0.1952
750	0.1433	0.1426	0.1423	0.1420	-	0.1418	0.1415	0.1407	0.1393	0.1371	0.1363
1000	0.1100	0.1096	0.1093	0.1091	-	0.1088	0.1087	0.1081	0.1070	0.1054	0.1048
1500	0.0752	0.0749	0.0748	0.0746	-	0.0745	0.0743	0.0739	0.0732	0.0721	0.0717
2000	0.0572	0.0569	0.0568	0.0567	-	0.0566	0.0565	0.0562	0.0556	0.0548	0.0545

Table C-9: (k_{free}-k_{ref}) for free gas scattering cases without absorber

	193K	233K	253K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	40	-20	-30	10	-	-10	30	-60	0	0	-10
0.5	20	-30	30	-30	-	-10	20	-30	10	-20	-10
1	10	10	30	-20	-	10	20	30	-10	-20	10
3	0	0	-30	-60	-	-60	0	-60	-70	-70	-160
5	20	0	50	10	-	0	-20	-20	-60	-140	-340
7.5	150	100	70	20	-	10	40	60	0	-170	-450
10	160	190	180	150	-	140	110	180	110	-220	-620
15	530	490	390	380	-	340	360	270	200	-240	-850
20	720	700	630	630	-	530	530	470	320	-350	-1000
35	1390	1350	1280	1190	-	1130	1040	880	460	-610	-1680
50	1920	1780	1700	1510	-	1470	1340	1140	570	-1000	-2200
75	2420	2130	2090	1940	-	1850	1660	1450	510	-1610	-3090
100	2670	2420	2380	2170	-	2060	1800	1480	300	-2190	-3830
150	2770	2470	2410	2270	-	2110	1790	1460	-140	-3240	-4890
200	2590	2370	2320	2100	-	1950	1690	1310	-510	-3810	-5490
350	1900	1700	1690	1480	-	1380	1130	790	-1060	-4150	-5440
500	1180	1080	1080	930	-	880	640	420	-1120	-3340	-4090
750	390	360	370	290	-	270	130	40	-600	-980	-850
1000	-90	-100	-100	-100	-	-110	-130	-170	140	1640	2640
1500	-630	-580	-610	-540	-	-520	-390	-270	1560	6470	8980
2000	-850	-770	-840	-710	-	-690	-460	-300	2760	10310	14060
Case 2											
0	30	40	-40	30	-	-20	40	30	-10	-20	40
0.5	-10	0	20	50	-	0	30	0	10	-20	-30
1	30	-20	30	0	-	20	-20	40	-20	30	50
3	220	150	160	140	-	120	150	130	40	10	10
5	350	350	330	360	-	350	290	290	180	30	50
7.5	660	560	580	590	-	500	550	480	390	100	-40
10	830	830	840	840	-	710	740	650	480	140	-90
15	1270	1200	1170	1150	-	1050	1020	920	770	130	-300
20	1530	1450	1440	1430	-	1350	1290	1180	870	90	-390
35	2230	2060	1930	1920	-	1810	1690	1540	1150	-90	-990
50	2570	2370	2320	2260	-	2070	1930	1790	1150	-400	-1490
75	2980	2690	2600	2480	-	2380	2140	2000	1090	-950	-2230
100	3110	2880	2750	2630	-	2430	2240	2020	960	-1450	-2920
150	3140	2870	2820	2640	-	2470	2240	1960	500	-2200	-3780
200	2970	2720	2720	2470	-	2330	2070	1740	200	-2670	-4250

	193K	233K	253K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	2190	1960	1960	1850	-	1690	1420	1190	-350	-2970	-4200
500	1510	1340	1350	1260	-	1210	970	830	-450	-2180	-2880
750	680	630	660	580	-	480	430	370	-30	-10	100
1000	190	140	140	150	-	100	110	160	600	2400	3410
1500	-400	-370	-430	-370	-	-330	-230	-90	1840	6920	9300
2000	-700	-630	-660	-580	-	-550	-330	-170	2940	10500	14180
Case 3											
0	30	20	-10	-20	30	0	0	-70	-10	40	-10
0.5	0	-20	-20	0	30	0	-10	0	-30	0	10
1	10	-20	-30	-20	50	-40	-60	-20	-30	-20	-60
3	-40	-80	-30	10	0	-50	-80	0	-60	-80	-150
5	-20	-40	-20	-50	-40	-50	0	-40	20	-140	-300
7.5	40	40	90	0	-10	40	40	40	40	-100	-460
10	170	150	170	140	130	70	90	150	150	-160	-480
15	480	390	350	360	360	330	280	270	280	-60	-560
20	680	610	570	540	500	460	460	450	470	20	-610
35	1220	1080	1050	960	950	890	830	760	780	230	-500
50	1640	1450	1410	1210	1230	1110	1180	970	990	350	-390
75	1970	1830	1720	1530	1430	1350	1360	1130	1190	530	-290
100	2120	1940	1850	1710	1580	1480	1490	1240	1200	590	-200
150	2210	1930	1890	1690	1530	1470	1450	1150	1210	570	-140
200	2090	1820	1790	1560	1380	1350	1390	1050	1160	510	-90
350	1430	1260	1280	1110	920	860	910	640	830	280	-120
500	930	790	820	660	590	530	620	380	510	80	-150
750	280	250	280	200	160	130	200	70	80	-180	-210
1000	-90	-100	-90	-100	-80	-80	-70	-120	-250	-390	-280
1500	-510	-450	-480	-420	-320	-320	-400	-300	-730	-730	-410
2000	-670	-610	-650	-550	-430	-420	-540	-410	-1050	-970	-480
Case 4											
0	-70	-30	70	10	30	-40	80	10	-30	30	-10
0.5	0	-40	-10	-10	-20	-60	-30	-10	-30	-10	10
1	-50	-10	0	30	-10	-20	-40	40	20	0	30
3	40	-10	0	0	-40	-20	30	-60	10	-30	-10
5	-30	-20	10	0	50	-30	30	30	110	20	-10
7.5	50	60	20	30	10	50	0	10	40	20	10
10	40	80	50	20	-10	30	50	10	40	30	0
15	90	80	90	120	120	70	40	70	100	30	40
20	200	160	190	120	150	120	130	60	60	40	50
35	350	310	300	180	130	250	160	180	120	40	-10

	193K	233K	253K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
50	380	370	360	260	230	260	250	150	130	50	-40
75	470	410	420	350	290	220	240	190	180	40	-60
100	480	440	400	370	270	250	260	200	180	70	-50
150	460	470	450	320	270	270	340	190	270	30	-50
200	460	470	440	400	280	330	280	180	210	10	-140
350	470	370	390	330	260	220	260	160	200	30	-180
500	440	360	360	330	220	160	190	70	190	0	-250
750	400	340	350	250	210	150	260	200	200	10	-260
1000	390	340	350	260	180	160	220	70	190	-70	-270
1500	350	320	330	230	150	140	240	70	170	-130	-320
2000	300	290	300	200	80	80	220	50	190	-10	-310
Case 5											
1	740	720	760	740	780	750	710	560	490	200	80
1.25	990	970	940	930	1110	1060	960	850	580	310	180
2	2360	2130	2030	1980	2400	2230	1980	1670	1120	530	300
2.25	2940	2690	2410	2340	2820	2650	2410	2060	1310	640	410
2.75	3980	3600	3210	3220	3830	3510	3150	2650	1780	890	600
3	4540	4090	3670	3660	4280	4010	3510	3070	1990	1030	770
Case 6											
30	210	300	300	350	-	300	240	410	200	120	0
35	50	180	230	200	-	280	170	310	170	150	-30
40	-110	100	110	140	-	170	170	290	200	140	50
45	-190	40	30	110	-	80	130	220	170	100	-20
50	-330	-120	-60	-30	-	50	90	140	120	80	40
55	-410	-120	-80	-40	-	70	0	120	150	120	40
60	-530	-170	-160	-60	-	-60	20	60	90	110	20
65	-620	-310	-220	-150	-	-40	-30	30	120	100	80
70	-620	-330	-280	-150	-	-110	-10	70	110	50	0
Case 7											
1E-20	250	250	270	180	250	190	200	160	170	190	240
0.05	260	220	260	270	270	240	220	360	240	230	190
0.1	210	210	260	260	260	230	270	270	240	180	60
0.2	280	280	290	320	390	310	330	290	280	150	80
0.3	510	560	540	610	610	640	540	510	340	200	100
0.4	1030	1060	980	1010	1040	1000	890	750	580	240	130
0.5	1650	1550	1480	1470	1550	1470	1290	1180	780	320	180
0.6	2320	2200	1970	2040	2130	2000	1770	1550	970	450	260
0.7	3120	2880	2500	2580	2690	2530	2250	1920	1250	560	400
0.8	3880	3550	3140	3160	3290	3070	2750	2350	1500	750	520

	193K	233K	253K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
0.9	4490	4130	3710	3710	3820	3630	3190	2770	1720	890	630
0.95	4810	4440	3960	3970	4090	3830	3430	3010	1890	970	680
1	5130	4770	4190	4230	4350	4060	3600	3160	1960	1000	790
Case 8											
1	130	170	180	180	170	160	190	270	210	100	40
1.5	70	90	170	190	250	200	250	200	240	70	-10
2	160	180	220	220	270	300	250	260	300	160	50
2.5	170	250	250	290	440	430	380	340	360	160	50
3	260	370	350	390	560	530	510	450	380	210	100
4	610	720	660	730	950	900	890	730	540	290	110
5	1040	1120	1020	1080	1380	1370	1190	1000	770	390	160
6	1570	1580	1400	1440	1800	1690	1590	1370	890	440	310
7	2100	2010	1890	1860	2320	2190	1920	1670	1140	550	420
8	2610	2470	2270	2290	2790	2550	2240	1970	1190	680	510
9	3130	2890	2660	2620	3100	2980	2600	2290	1410	740	570
Case 9											
0	-20	-30	-10	10	-40	-10	40	30	-10	-90	-20
0.5	-40	20	-40	-20	-30	0	30	-40	0	0	-10
1	-30	-20	20	-30	-80	-50	40	20	-10	60	-10
3	30	30	30	50	30	30	40	-20	-30	-20	40
5	50	60	30	10	-10	-10	80	30	0	0	-10
7.5	90	50	50	70	70	100	10	60	70	10	-10
10	80	90	160	90	80	120	100	70	30	40	-30
15	210	180	260	140	80	120	120	130	80	40	-50
20	200	240	190	150	140	190	160	150	160	80	10
35	240	240	280	200	190	200	170	200	180	60	-20
50	220	260	320	230	190	220	230	160	180	90	-30
75	270	260	240	200	180	230	200	200	170	70	-10
100	230	260	230	280	210	220	190	220	230	80	-40
150	210	220	230	240	180	170	200	160	140	110	-40
200	250	170	230	210	160	200	250	140	180	-10	-90
350	270	260	330	220	140	190	190	150	200	20	-140
500	290	320	300	220	160	140	210	150	180	0	-200
750	320	290	310	230	160	160	200	70	210	20	-270
1000	340	280	290	200	160	180	230	140	210	-40	-320
1500	340	210	310	170	110	120	190	100	230	-70	-330
2000	330	190	270	160	110	90	160	70	200	-110	-320

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 10											
0	-30	-10	10	20	60	-20	20	10	30	-20	10
0.5	-10	0	10	-10	-30	10	-10	20	30	0	-10
1	0	30	20	-20	30	40	20	20	10	10	-60
3	90	0	60	10	40	0	40	40	0	-20	-10
5	60	70	70	30	20	30	60	40	-10	-20	0
7.5	110	100	100	90	80	100	50	20	20	40	30
10	150	120	180	30	130	70	110	100	80	50	-30
15	200	260	170	120	110	160	150	90	100	100	-40
20	160	220	150	90	150	150	130	110	180	70	-50
35	130	180	200	210	160	120	130	170	230	60	-40
50	130	60	110	190	130	160	190	150	220	90	-20
75	90	130	120	100	110	90	150	150	190	90	-30
100	80	90	90	100	150	110	150	100	210	80	-80
150	60	90	100	120	100	120	220	60	170	30	-50
200	110	100	160	120	100	90	120	140	160	60	-130
350	160	190	160	190	150	130	220	100	160	130	-200
500	250	250	190	220	150	170	210	180	160	20	-150
750	290	330	280	230	190	130	220	70	250	-90	-300
1000	340	220	320	170	130	110	220	70	190	-40	-290
1500	320	240	230	180	130	130	210	120	200	-70	-310
2000	290	210	280	190	110	130	180	70	190	-80	-330
Case 11											
0	-10	20	20	30	-	10	-10	30	-10	10	30
0.5	50	20	-60	-20	-	10	-20	-10	20	-50	-30
1	40	10	10	20	-	-50	10	-30	-20	-40	60
3	0	30	20	20	-	50	10	0	70	-20	-30
5	90	70	70	60	-	90	80	70	-10	-10	-110
7.5	70	120	90	70	-	120	110	90	90	50	-140
10	140	190	130	150	-	110	50	150	150	-10	-170
15	180	170	180	200	-	200	130	150	140	-70	-290
20	190	200	110	160	-	150	110	210	120	-120	-330
35	170	190	250	200	-	210	250	200	70	-230	-660
50	180	170	240	240	-	230	180	220	50	-400	-840
75	110	200	160	200	-	200	200	180	20	-670	-1140
100	100	180	190	190	-	200	190	190	-50	-820	-1370
150	130	180	200	190	-	230	190	170	-150	-1060	-1690
200	170	210	230	230	-	230	190	170	-240	-1250	-1920
350	250	260	300	260	-	250	170	130	-480	-1700	-2470

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	310	310	320	280	-	260	170	70	-650	-2010	-2820
750	360	320	350	280	-	260	130	-20	-880	-2370	-3200
1000	360	310	360	280	-	240	110	-30	-1030	-2550	-3400
1500	350	300	350	260	-	220	60	-140	-1190	-2720	-3550
2000	320	270	330	220	-	210	30	-200	-1270	-2760	-3510
Case 12											
0	30	20	-40	10	-	-10	20	20	30	30	0
0.5	-40	0	50	50	-	-50	0	20	10	-50	10
1	0	-80	40	0	-	-20	10	0	30	40	-10
3	30	10	30	50	-	30	90	0	30	-30	40
5	130	120	90	50	-	80	60	100	70	-30	60
7.5	190	150	190	220	-	140	180	80	160	-20	60
10	310	290	260	300	-	240	220	230	190	80	-90
15	530	530	460	430	-	400	380	370	270	50	-100
20	730	600	590	590	-	550	540	520	350	40	-190
35	1110	1100	1040	950	-	970	850	810	580	-60	-540
50	1380	1330	1310	1220	-	1120	1080	940	630	-260	-870
75	1800	1570	1560	1520	-	1400	1280	1060	550	-640	-1400
100	1910	1740	1670	1610	-	1500	1410	1140	430	-990	-1900
150	2000	1830	1770	1670	-	1520	1410	1140	220	-1530	-2510
200	1910	1730	1690	1560	-	1420	1270	1050	30	-1860	-2800
350	1330	1170	1170	1120	-	1010	830	650	-350	-1860	-2460
500	780	740	700	660	-	610	490	400	-300	-1120	-1280
750	190	190	210	190	-	150	110	30	130	940	1580
1000	-190	-170	-140	-170	-	-160	-110	-140	740	3230	4600
1500	-540	-520	-510	-480	-	-450	-300	-210	1870	7290	9990
2000	-740	-690	-760	-680	-	-620	-350	-210	2780	10500	14420
Case 13											
0	-40	-20	-20	-10	-	-10	20	40	20	-40	10
0.5	-20	-40	-40	20	-	-10	-40	20	40	0	-40
1	-30	30	60	0	-	40	20	-30	-40	-30	-10
3	40	-10	10	-30	-	20	0	-10	30	50	0
5	10	20	50	-60	-	-20	20	10	-10	30	-30
7.5	20	10	50	40	-	10	20	70	20	20	-50
10	30	60	70	80	-	60	70	30	60	10	-30
15	90	100	110	100	-	80	100	90	60	-30	-30
20	200	200	170	150	-	170	130	80	140	30	-110
35	320	310	310	270	-	310	200	130	100	-110	-220
50	430	430	400	370	-	330	340	140	30	-260	-440

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	540	490	470	470	-	410	420	230	-70	-510	-770
100	570	540	500	450	-	460	360	160	-90	-730	-1000
150	560	600	540	540	-	450	380	190	-220	-980	-1380
200	600	570	500	510	-	460	350	220	-280	-1190	-1690
350	550	500	510	440	-	390	310	140	-530	-1600	-2210
500	520	390	520	440	-	360	240	110	-630	-1870	-2480
750	430	400	440	330	-	340	160	60	-800	-2150	-2800
1000	430	370	440	320	-	270	150	0	-920	-2270	-2950
1500	330	320	370	250	-	250	100	-110	-1020	-2340	-3040
2000	390	290	300	200	-	170	50	-130	-1050	-2360	-2970
Case 14											
0	10	10	-60	10	-	40	20	0	-10	-10	-20
0.5	-10	30	40	10	-	-10	-10	-40	-30	-50	30
1	30	-20	-50	-10	-	-20	0	-30	-20	-60	10
3	-30	-40	0	30	-	-20	50	-30	40	-50	-30
5	60	30	60	-20	-	60	30	70	0	30	-10
7.5	50	50	80	30	-	50	10	40	30	20	-20
10	130	130	110	80	-	80	70	100	40	-20	-40
15	150	170	120	150	-	140	110	60	70	0	-100
20	250	190	190	170	-	150	170	170	80	-40	-130
35	340	290	220	240	-	250	230	160	20	-190	-390
50	330	340	350	360	-	260	310	150	10	-320	-600
75	380	330	450	340	-	320	310	230	-10	-570	-930
100	340	320	390	280	-	350	310	240	-50	-740	-1190
150	400	370	370	340	-	350	310	150	-170	-1000	-1440
200	370	320	350	320	-	260	290	160	-280	-1200	-1730
350	330	320	390	290	-	300	230	150	-470	-1640	-2260
500	410	300	380	300	-	300	180	80	-640	-1870	-2610
750	390	360	430	290	-	280	130	-40	-860	-2200	-2870
1000	340	310	340	270	-	240	80	-50	-940	-2430	-3140
1500	370	270	390	280	-	220	80	-100	-1070	-2580	-3280
2000	350	230	300	240	-	160	70	-200	-1190	-2560	-3250
Case 15											
0	10	10	-20	10	-	10	20	10	-10	-50	30
0.5	0	40	10	10	-	-20	10	20	-50	40	0
1	-20	10	0	-10	-	10	30	20	0	0	-20
3	30	30	30	40	-	-10	30	70	30	-30	-10
5	0	20	60	20	-	0	80	50	10	0	-40
7.5	90	100	70	60	-	70	70	10	40	-40	-110

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	110	130	90	130	-	30	80	90	90	-10	-150
15	140	150	150	140	-	150	120	120	90	0	-200
20	160	240	170	210	-	150	180	130	70	-60	-250
35	220	250	220	190	-	260	200	150	80	-250	-560
50	210	270	220	260	-	190	210	240	30	-350	-720
75	160	220	210	210	-	220	170	200	50	-610	-990
100	190	190	200	240	-	230	160	170	-60	-730	-1240
150	170	220	290	250	-	250	210	220	-160	-1010	-1570
200	150	230	230	210	-	290	210	140	-230	-1240	-1830
350	290	290	320	240	-	250	190	100	-500	-1630	-2370
500	340	340	350	250	-	290	170	70	-640	-1900	-2710
750	330	370	330	260	-	250	170	-20	-870	-2290	-3090
1000	360	330	320	220	-	220	90	-80	-980	-2520	-3340
1500	350	270	340	240	-	240	110	-110	-1170	-2690	-3440
2000	310	250	310	220	-	200	40	-170	-1260	-2690	-3430

Table C-10: (k_{free}-k_{ref}) for free gas scattering cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 1											
0	-20	-10	-20	-20	-	10	0	-60	10	-10	-40
0.5	0	10	20	0	-	-50	10	30	30	-20	-40
1	0	50	-40	-20	-	-20	-10	-20	-30	-10	10
3	10	10	0	80	-	40	20	-20	20	-40	-120
5	90	110	100	60	-	20	60	60	10	-50	-160
7.5	210	180	140	130	-	240	180	120	120	-60	-210
10	280	250	270	250	-	240	230	250	160	-40	-210
15	410	360	390	350	-	370	290	280	200	-50	-200
20	450	410	430	410	-	360	350	320	200	-70	-120
35	140	160	150	150	-	180	100	120	10	-110	210
50	-340	-300	-230	-240	-	-280	-240	-230	-270	-20	770
75	-1160	-1030	-1000	-960	-	-950	-830	-880	-710	180	1710
100	-1800	-1640	-1640	-1510	-	-1480	-1410	-1340	-1030	530	2640
150	-2640	-2430	-2450	-2310	-	-2250	-2080	-1920	-1250	1200	4090
200	-3110	-2890	-2930	-2750	-	-2630	-2420	-2280	-1360	1700	5060
350	-3370	-3140	-3180	-2990	-	-2920	-2670	-2480	-1350	2350	6240
500	-3150	-3000	-3000	-2790	-	-2740	-2540	-2380	-1250	2500	6300
750	-2750	-2610	-2560	-2430	-	-2370	-2160	-2000	-1010	2340	5740
1000	-2300	-2190	-2200	-2030	-	-1980	-1860	-1740	-890	2170	5100
1500	-1790	-1690	-1690	-1590	-	-1550	-1460	-1290	-650	1690	4080

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	-1380	-1360	-1370	-1260	-	-1270	-1170	-1090	-500	1410	3390
Case 2											
0	-30	-10	-10	-10	-	-20	0	30	30	0	90
0.5	30	-30	20	50	-	-40	20	-20	-20	20	30
1	10	60	-10	-20	-	10	40	-20	-30	20	-10
3	80	110	170	150	-	110	130	70	80	-10	30
5	380	270	290	310	-	240	270	240	190	100	0
7.5	550	520	530	490	-	470	430	440	370	130	60
10	720	630	640	630	-	620	570	530	500	150	60
15	930	920	830	820	-	720	760	720	530	140	100
20	1000	950	870	930	-	840	800	760	580	170	150
35	760	750	670	750	-	640	650	590	410	130	350
50	330	380	360	360	-	350	310	310	150	200	740
75	-430	-380	-380	-310	-	-340	-270	-230	-250	350	1530
100	-1110	-990	-940	-880	-	-850	-840	-750	-520	650	2260
150	-1960	-1880	-1870	-1700	-	-1620	-1550	-1490	-830	1170	3550
200	-2560	-2360	-2330	-2210	-	-2120	-1910	-1810	-1030	1600	4530
350	-2960	-2860	-2770	-2610	-	-2520	-2300	-2220	-1160	2200	5690
500	-2830	-2730	-2760	-2540	-	-2530	-2280	-2140	-1080	2400	5890
750	-2540	-2420	-2400	-2280	-	-2220	-2080	-1890	-930	2320	5450
1000	-2220	-2040	-2000	-1920	-	-1920	-1850	-1680	-780	2090	4900
1500	-1710	-1670	-1630	-1550	-	-1540	-1390	-1280	-570	1710	4000
2000	-1380	-1300	-1310	-1290	-	-1200	-1130	-1080	-520	1380	3350
Case 3											
0	-30	70	20	-10	0	0	20	0	-60	30	0
0.5	40	40	10	20	10	10	10	-40	-40	0	-20
1	30	-10	-50	20	10	-50	-20	-30	-50	-10	-60
3	0	-40	10	10	20	10	-50	-20	-10	-40	-140
5	120	100	130	90	120	40	70	70	70	-60	-160
7.5	180	260	100	210	180	210	180	140	140	30	-100
10	310	250	250	280	250	220	200	250	150	-10	-110
15	400	290	370	380	310	340	290	290	190	10	0
20	400	350	350	360	300	310	360	270	130	-30	80
35	40	20	20	60	50	130	140	20	-120	-290	210
50	-430	-360	-350	-300	-280	-250	-260	-310	-570	-650	120
75	-990	-960	-900	-850	-830	-740	-790	-800	-1200	-1210	-80
100	-1450	-1420	-1360	-1220	-1220	-1150	-1210	-1150	-1560	-1650	-280
150	-2070	-1900	-1880	-1790	-1710	-1540	-1640	-1540	-2160	-2240	-570
200	-2260	-2090	-2060	-1920	-1860	-1860	-1840	-1730	-2310	-2490	-790

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
350	-2220	-2140	-2100	-1980	-1950	-1810	-1850	-1740	-2340	-2610	-1140
500	-2060	-1960	-1940	-1770	-1690	-1670	-1670	-1570	-2150	-2460	-1100
750	-1670	-1550	-1600	-1500	-1430	-1380	-1360	-1330	-1790	-2120	-1050
1000	-1370	-1350	-1330	-1280	-1210	-1130	-1180	-1080	-1510	-1770	-900
1500	-1060	-1000	-1010	-930	-910	-860	-880	-820	-1130	-1370	-800
2000	-840	-770	-840	-760	-730	-690	-710	-650	-910	-1110	-610
Case 4											
0	10	-10	10	-20	10	0	0	-20	-10	50	0
0.5	-20	40	10	10	-10	30	20	30	-10	-10	50
1	40	-30	20	-10	-20	-10	-10	10	40	20	-10
3	-20	0	30	30	50	-30	10	40	-20	70	30
5	-20	-10	-20	30	30	40	10	30	80	30	-70
7.5	80	-10	50	60	30	20	-40	20	20	-10	60
10	60	-10	80	10	30	50	10	30	50	0	0
15	70	100	80	90	70	90	110	30	120	60	0
20	140	170	100	110	160	100	100	110	90	80	50
35	270	240	240	210	200	220	210	190	130	40	80
50	380	350	380	200	320	280	270	200	130	60	40
75	430	370	380	320	290	330	240	250	150	100	0
100	440	340	410	280	370	290	250	240	170	80	10
150	430	340	340	300	300	290	220	230	120	0	10
200	380	310	340	260	330	370	230	200	90	30	-30
350	270	220	290	260	190	180	240	140	60	-10	-40
500	230	220	170	210	170	150	130	110	80	-10	-30
750	160	130	130	100	120	110	120	60	70	-20	-20
1000	120	110	110	100	120	70	70	100	40	-10	0
1500	90	100	70	70	50	60	60	30	20	10	0
2000	70	50	50	50	50	50	50	30	20	0	-10
Case 5											
1	-100	-20	30	50	120	140	170	240	110	170	190
1.25	-10	-20	70	100	190	170	260	320	180	150	200
2	60	70	40	120	230	230	250	310	210	160	170
2.25	60	60	110	40	260	240	230	270	170	140	170
2.75	20	120	120	140	240	210	280	280	220	190	220
3	40	40	90	120	240	210	210	160	170	150	140
Case 6											
30	-10	-70	-20	30	-	10	10	-10	-50	70	-20
35	30	50	-40	0	-	0	60	-40	10	10	0
40	-40	0	-60	20	-	10	-20	30	-20	60	-40

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
45	50	0	40	20	-	10	40	50	-10	60	-30
50	20	90	20	-60	-	-50	20	50	-10	20	-20
55	-20	30	0	-10	-	-70	50	30	0	60	20
60	-30	40	-20	-10	-	10	50	0	-30	-40	-20
65	10	-20	-40	-40	-	40	20	50	10	10	40
70	70	-20	40	-30	-	-10	20	-30	-20	20	-40
Case 7											
1E-20	40	-10	10	20	50	0	20	0	20	-10	20
0.05	30	20	0	40	0	50	30	10	20	-50	-60
0.1	-20	60	-20	50	-20	0	10	20	20	0	0
0.2	-10	-40	60	0	10	20	50	10	10	50	-10
0.3	-10	-40	20	-10	30	50	10	40	0	20	-10
0.4	20	0	-50	10	-10	60	0	30	-20	10	-30
0.5	-70	30	-20	-70	40	0	0	50	50	10	70
0.6	0	-60	40	30	-30	60	30	100	60	0	80
0.7	-20	10	20	30	70	100	110	120	100	90	50
0.8	-10	20	50	0	80	50	120	110	120	80	90
0.9	-20	50	60	40	170	140	150	160	100	90	140
0.95	40	50	70	70	150	160	170	210	130	90	90
1	100	10	110	80	140	190	100	190	190	110	170
Case 8											
1	-110	-80	-40	-60	30	10	30	60	70	10	100
1.5	-120	-70	-40	10	60	20	50	40	90	30	110
2	-130	-100	-20	-40	140	110	120	150	140	-10	110
2.5	-80	-40	40	10	110	80	130	170	110	40	110
3	-70	-40	50	20	70	180	170	180	120	80	140
4	-40	0	20	100	170	160	150	180	110	60	90
5	-30	-10	70	70	160	130	190	160	160	100	90
6	10	0	20	80	130	170	140	170	160	90	100
7	-10	70	20	50	180	150	180	140	140	60	110
8	50	100	40	50	140	160	110	190	140	40	30
9	20	90	40	90	140	140	130	170	130	60	120
Case 9											
0	40	-10	-20	0	-10	-10	-20	30	-20	40	-20
0.5	0	30	-20	-20	30	-40	-40	60	-30	-10	-20
1	30	0	50	-20	-10	-30	0	20	-50	60	10
3	50	-20	10	0	-10	50	0	60	0	0	0
5	40	-30	10	80	80	70	0	20	50	-60	-60
7.5	60	110	140	50	70	70	90	90	110	30	10

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	110	140	90	80	110	100	110	90	90	10	50
15	250	210	220	180	210	130	170	150	150	60	10
20	330	280	340	210	210	240	240	190	150	70	40
35	520	470	400	320	330	350	300	320	220	110	120
50	540	500	470	410	360	410	360	310	220	40	70
75	540	500	510	410	470	410	370	360	210	50	60
100	540	540	490	420	430	390	360	300	260	0	40
150	540	440	440	390	360	370	330	250	180	-20	40
200	430	410	330	350	340	300	320	270	130	-20	-10
350	330	310	250	250	260	250	210	200	110	20	0
500	250	220	190	170	180	180	170	120	80	10	10
750	190	150	160	150	130	110	120	100	60	0	10
1000	150	120	120	110	110	100	100	70	40	10	-10
1500	100	90	80	80	80	60	60	50	40	10	0
2000	80	70	70	60	50	50	60	30	20	0	0
Case 10											
0	-40	0	40	20	10	0	10	30	-10	30	20
0.5	10	-60	30	10	-20	-30	30	-30	30	0	-20
1	-10	30	0	-20	50	40	0	10	50	30	-10
3	40	60	10	50	50	30	20	30	10	20	10
5	100	70	90	100	90	10	70	80	90	60	0
7.5	210	140	180	160	140	100	80	120	30	60	60
10	250	260	230	230	240	160	150	140	160	70	110
15	380	360	360	280	250	260	260	300	200	80	80
20	460	470	420	400	380	340	330	340	200	100	80
35	660	570	610	510	470	430	420	340	230	70	80
50	720	610	580	560	520	490	490	380	250	80	80
75	730	650	640	550	500	510	540	390	310	50	40
100	660	550	570	520	510	500	460	380	310	10	60
150	590	480	480	450	450	430	420	330	200	20	30
200	510	410	450	400	380	360	340	320	170	30	-10
350	350	300	300	280	270	240	240	190	110	10	-10
500	270	230	220	200	210	200	180	150	90	10	0
750	190	160	160	150	130	140	120	110	60	0	0
1000	160	140	130	110	120	100	100	80	50	-10	-10
1500	100	90	90	80	70	70	70	50	30	0	0
2000	70	70	60	70	60	60	50	40	30	0	0

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 11											
0	-20	-50	-50	10	-	30	0	-50	-50	0	-10
0.5	-10	-10	-10	40	-	0	20	-10	10	-30	-20
1	10	50	30	-30	-	-10	20	50	-70	-40	10
3	60	40	50	20	-	10	30	50	30	10	-30
5	120	110	50	170	-	120	80	80	50	40	10
7.5	230	200	210	180	-	190	190	170	100	40	-40
10	320	330	280	240	-	290	240	200	110	0	-110
15	500	400	410	380	-	340	330	320	220	-50	-120
20	580	550	560	560	-	520	490	460	280	-20	-170
35	910	770	810	750	-	730	670	570	300	-190	-380
50	1040	930	920	870	-	800	750	600	300	-220	-440
75	1060	1000	930	870	-	820	730	630	280	-310	-500
100	1070	940	910	850	-	790	720	610	280	-320	-570
150	960	860	800	750	-	700	630	520	190	-310	-520
200	830	740	710	640	-	610	550	440	140	-310	-490
350	580	520	510	460	-	420	380	300	100	-240	-370
500	440	410	390	360	-	320	300	230	70	-180	-280
750	320	280	270	250	-	230	210	170	40	-140	-220
1000	250	220	210	190	-	190	150	120	30	-120	-160
1500	180	160	150	140	-	120	110	90	20	-80	-120
2000	130	110	110	100	-	100	80	70	20	-60	-90
Case 12											
0	-40	-20	20	20	-	30	-30	40	50	-80	30
0.5	10	20	-60	10	-	0	0	40	20	20	10
1	10	10	50	50	-	0	-60	20	-10	20	-20
3	10	30	30	-30	-	40	40	-10	20	20	-10
5	80	70	90	80	-	90	70	110	50	-10	40
7.5	190	160	160	200	-	80	40	180	110	60	-40
10	260	210	220	220	-	190	210	200	120	40	30
15	380	360	350	330	-	340	270	240	230	80	50
20	440	450	360	330	-	310	370	310	290	60	30
35	410	300	360	320	-	280	310	260	130	0	190
50	80	20	80	50	-	40	100	0	0	60	470
75	-520	-510	-490	-390	-	-400	-410	-390	-320	170	1100
100	-1020	-960	-950	-890	-	-830	-780	-820	-590	400	1700
150	-1730	-1640	-1630	-1520	-	-1480	-1370	-1320	-860	930	2860
200	-2170	-2090	-2040	-1920	-	-1850	-1690	-1630	-1000	1260	3680
350	-2610	-2420	-2340	-2270	-	-2230	-2000	-1890	-1020	1840	4780

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	-2420	-2280	-2350	-2210	-	-2170	-1980	-1840	-910	1980	4980
750	-2100	-2070	-2020	-1950	-	-1900	-1750	-1600	-800	1920	4650
1000	-1820	-1820	-1740	-1680	-	-1630	-1520	-1330	-720	1690	4170
1500	-1410	-1390	-1370	-1320	-	-1300	-1200	-1140	-570	1440	3330
2000	-1160	-1110	-1120	-1060	-	-1040	-970	-920	-440	1190	2840
Case 13											
0	50	20	0	30	-	-10	-30	10	-10	30	-60
0.5	30	10	30	10	-	10	-20	30	-20	-30	-10
1	-80	-10	-20	-60	-	0	70	20	-20	0	-40
3	-10	10	20	40	-	10	0	60	10	30	-10
5	50	50	-10	10	-	40	-10	-10	70	-20	30
7.5	20	10	20	30	-	0	50	40	0	-20	20
10	100	60	0	50	-	0	30	50	20	50	20
15	110	110	30	70	-	120	80	50	80	-20	-40
20	140	160	140	90	-	150	160	80	20	-40	-10
35	360	350	320	280	-	190	290	120	110	-40	-170
50	420	350	360	340	-	390	300	160	100	-110	-210
75	480	490	480	420	-	450	340	270	110	-120	-310
100	630	530	450	470	-	420	360	270	100	-180	-280
150	620	540	460	510	-	450	380	360	130	-260	-320
200	560	460	480	420	-	430	360	310	90	-160	-280
350	390	380	380	340	-	320	290	270	80	-200	-250
500	380	300	310	250	-	210	220	180	40	-130	-220
750	270	250	180	210	-	150	200	150	40	-130	-200
1000	260	190	180	160	-	170	110	100	40	-80	-140
1500	150	140	120	100	-	130	90	80	20	-70	-80
2000	120	100	110	120	-	70	70	70	20	-50	-60
Case 14											
0	20	30	-40	20	-	20	0	-40	40	50	0
0.5	0	-40	30	-30	-	20	-70	40	30	-50	20
1	20	10	20	-20	-	20	10	0	20	-20	0
3	40	30	10	-10	-	-10	-20	10	-10	20	40
5	40	40	40	20	-	40	-10	40	20	-10	10
7.5	100	60	40	60	-	80	50	90	40	40	10
10	160	130	90	100	-	90	140	90	150	70	-40
15	240	240	210	210	-	200	190	150	100	0	10
20	390	280	280	280	-	260	210	240	90	-60	-110
35	520	460	490	460	-	430	370	300	170	-130	-190
50	690	640	590	570	-	560	480	350	130	-180	-310

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	740	670	650	570	-	590	500	410	160	-180	-340
100	820	690	690	620	-	590	590	390	170	-280	-380
150	740	670	590	600	-	580	520	390	160	-220	-390
200	640	570	550	540	-	480	410	380	140	-220	-390
350	500	480	430	380	-	360	340	250	90	-220	-300
500	400	340	320	300	-	290	250	240	50	-150	-270
750	290	250	240	230	-	200	180	140	40	-120	-190
1000	220	200	190	190	-	150	130	120	30	-100	-150
1500	170	150	130	130	-	120	100	80	30	-70	-100
2000	120	110	110	110	-	100	80	70	20	-60	-90
Case 15											
0	-10	60	-30	60	-	-50	10	-10	-40	-20	-10
0.5	20	-20	-10	-30	-	30	0	-10	30	10	10
1	-10	30	40	10	-	0	40	0	-10	50	0
3	20	-10	-20	-10	-	60	50	60	50	10	-10
5	60	50	70	50	-	110	50	100	30	-30	-20
7.5	180	170	150	110	-	100	110	90	60	-10	-10
10	230	200	220	180	-	230	190	140	110	20	-70
15	370	310	340	310	-	310	260	190	180	0	-40
20	520	460	420	440	-	340	400	270	190	0	-140
35	760	720	590	640	-	570	570	460	270	-130	-240
50	890	790	780	700	-	680	680	530	220	-160	-420
75	930	870	850	740	-	720	650	510	250	-310	-420
100	940	800	880	730	-	690	640	550	220	-300	-490
150	840	770	730	670	-	600	570	450	170	-300	-480
200	770	690	670	610	-	610	500	410	130	-270	-450
350	560	500	480	430	-	420	370	290	90	-220	-340
500	420	390	360	330	-	290	300	210	50	-160	-290
750	320	270	260	240	-	230	200	160	40	-140	-210
1000	250	220	210	190	-	170	160	130	40	-100	-160
1500	170	150	150	130	-	130	110	90	20	-70	-110
2000	130	110	110	100	-	90	90	70	10	-60	-90

Table C-11: k-infinity for DBRC cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 4											
0	0.5577	0.5564	0.5560	0.5550	0.5551	0.5486	0.5485	0.5480	0.5517	0.5496	0.5489
0.5	0.5577	0.5554	0.5546	0.5538	0.5540	0.5476	0.5471	0.5464	0.5491	0.5461	0.5447
1	0.5613	0.5582	0.5567	0.5562	0.5560	0.5493	0.5492	0.5479	0.5500	0.5458	0.5436
3	0.5848	0.5811	0.5794	0.5778	0.5781	0.5714	0.5703	0.5682	0.5673	0.5596	0.5546
5	0.6120	0.6076	0.6058	0.6041	0.6042	0.5971	0.5963	0.5928	0.5902	0.5803	0.5744
7.5	0.6429	0.6380	0.6362	0.6343	0.6341	0.6282	0.6268	0.6228	0.6192	0.6070	0.5993
10	0.6706	0.6653	0.6632	0.6617	0.6611	0.6558	0.6542	0.6502	0.6453	0.6321	0.6238
15	0.7190	0.7140	0.7116	0.7100	0.7098	0.7045	0.7032	0.6988	0.6926	0.6789	0.6683
20	0.7610	0.7560	0.7537	0.7519	0.7522	0.7470	0.7452	0.7406	0.7344	0.7185	0.7076
35	0.8588	0.8545	0.8523	0.8503	0.8505	0.8470	0.8447	0.8398	0.8316	0.8137	0.8005
50	0.9291	0.9242	0.9216	0.9204	0.9207	0.9175	0.9149	0.9102	0.9005	0.8811	0.8659
75	1.0080	1.0029	1.0007	0.9986	0.9998	0.9963	0.9943	0.9886	0.9778	0.9562	0.9400
100	1.0591	1.0544	1.0521	1.0501	1.0509	1.0479	1.0460	1.0400	1.0281	1.0046	0.9881
150	1.1202	1.1151	1.1125	1.1107	1.1116	1.1090	1.1063	1.1002	1.0864	1.0613	1.0433
200	1.1514	1.1464	1.1439	1.1418	1.1431	1.1403	1.1378	1.1308	1.1168	1.0901	1.0716
350	1.1756	1.1710	1.1680	1.1661	1.1673	1.1640	1.1614	1.1547	1.1385	1.1108	1.0921
500	1.1614	1.1561	1.1532	1.1514	1.1523	1.1495	1.1462	1.1388	1.1222	1.0951	1.0765
750	1.1126	1.1075	1.1040	1.1021	1.1025	1.0999	1.0964	1.0890	1.0722	1.0458	1.0294
1000	1.0565	1.0512	1.0479	1.0458	1.0465	1.0437	1.0403	1.0327	1.0162	0.9912	0.9757
1500	0.9497	0.9443	0.9409	0.9391	0.9397	0.9372	0.9331	0.9266	0.9104	0.8882	0.8753
2000	0.8584	0.8534	0.8498	0.8480	0.8484	0.8457	0.8424	0.8355	0.8202	0.8006	0.7894
Case 5											
1	1.1257	1.1237	1.1225	1.1209	1.1360	1.1340	1.1328	1.1301	1.1250	1.1132	1.1043
1.25	1.1609	1.1602	1.1593	1.1579	1.1676	1.1661	1.1665	1.1647	1.1614	1.1515	1.1442
2	1.1844	1.1876	1.1897	1.1898	1.1860	1.1868	1.1891	1.1911	1.1945	1.1925	1.1890
2.25	1.1778	1.1824	1.1858	1.1862	1.1784	1.1802	1.1830	1.1865	1.1918	1.1931	1.1903
2.75	1.1528	1.1611	1.1662	1.1674	1.1529	1.1555	1.1606	1.1660	1.1769	1.1837	1.1840
3	1.1373	1.1470	1.1534	1.1547	1.1365	1.1407	1.1461	1.1535	1.1660	1.1755	1.1772
Case 6											
30	1.2926	1.2905	1.2889	1.2881	-	1.2865	1.2851	1.2807	1.2744	1.2609	1.2520
35	1.3133	1.3114	1.3102	1.3093	-	1.3076	1.3073	1.3025	1.2979	1.2845	1.2765
40	1.3258	1.3246	1.3240	1.3228	-	1.3218	1.3211	1.3175	1.3125	1.3010	1.2941
45	1.3329	1.3327	1.3315	1.3311	-	1.3300	1.3294	1.3265	1.3218	1.3117	1.3052
50	1.3359	1.3359	1.3354	1.3349	-	1.3344	1.3338	1.3316	1.3280	1.3185	1.3122
55	1.3366	1.3368	1.3371	1.3365	-	1.3358	1.3354	1.3337	1.3304	1.3231	1.3174
60	1.3344	1.3352	1.3356	1.3356	-	1.3349	1.3344	1.3330	1.3309	1.3240	1.3195
65	1.3312	1.3323	1.3330	1.3330	-	1.3321	1.3320	1.3320	1.3298	1.3242	1.3203

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
70	1.3257	1.3280	1.3289	1.3285	-	1.3284	1.3284	1.3288	1.3273	1.3229	1.3196
Case 7											
1E-20	0.8115	0.8059	0.8037	0.8012	0.8015	0.7975	0.7950	0.7902	0.7805	0.7621	0.7485
0.05	1.0394	1.0351	1.0326	1.0307	1.0307	1.0278	1.0257	1.0207	1.0122	0.9937	0.9803
0.1	1.1672	1.1636	1.1615	1.1600	1.1597	1.1574	1.1555	1.1516	1.1432	1.1261	1.1133
0.2	1.2918	1.2892	1.2877	1.2867	1.2869	1.2849	1.2838	1.2804	1.2743	1.2600	1.2491
0.3	1.3385	1.3375	1.3370	1.3368	1.3358	1.3353	1.3352	1.3329	1.3291	1.3185	1.3093
0.4	1.3493	1.3503	1.3511	1.3508	1.3499	1.3503	1.3507	1.3506	1.3493	1.3419	1.3354
0.5	1.3415	1.3439	1.3464	1.3465	1.3460	1.3469	1.3486	1.3501	1.3517	1.3477	1.3430
0.6	1.3229	1.3278	1.3314	1.3325	1.3314	1.3330	1.3354	1.3388	1.3438	1.3436	1.3399
0.7	1.2986	1.3055	1.3103	1.3119	1.3108	1.3132	1.3166	1.3213	1.3292	1.3323	1.3305
0.8	1.2712	1.2801	1.2857	1.2872	1.2865	1.2897	1.2944	1.3004	1.3113	1.3176	1.3175
0.9	1.2427	1.2531	1.2596	1.2621	1.2605	1.2646	1.2703	1.2776	1.2911	1.3005	1.3018
0.95	1.2276	1.2392	1.2462	1.2488	1.2472	1.2515	1.2576	1.2652	1.2803	1.2913	1.2935
1	1.2133	1.2253	1.2331	1.2355	1.2339	1.2386	1.2448	1.2534	1.2692	1.2818	1.2848
Case 8											
1	1.3947	1.3909	1.3890	1.3876	1.4055	1.4033	1.4023	1.3974	1.3884	1.3693	1.3556
1.5	1.4747	1.4716	1.4704	1.4688	1.4829	1.4809	1.4794	1.4763	1.4680	1.4509	1.4385
2	1.5167	1.5141	1.5133	1.5120	1.5212	1.5202	1.5188	1.5162	1.5093	1.4943	1.4829
2.5	1.5374	1.5357	1.5349	1.5344	1.5390	1.5380	1.5374	1.5353	1.5295	1.5163	1.5060
3	1.5445	1.5441	1.5438	1.5434	1.5438	1.5434	1.5431	1.5420	1.5374	1.5262	1.5168
4	1.5373	1.5382	1.5392	1.5385	1.5310	1.5317	1.5326	1.5329	1.5314	1.5240	1.5171
5	1.5131	1.5158	1.5177	1.5179	1.5040	1.5056	1.5071	1.5087	1.5106	1.5064	1.5010
6	1.4811	1.4855	1.4881	1.4889	1.4700	1.4720	1.4749	1.4776	1.4818	1.4811	1.4783
7	1.4447	1.4505	1.4548	1.4561	1.4328	1.4349	1.4386	1.4431	1.4500	1.4522	1.4504
8	1.4071	1.4146	1.4193	1.4211	1.3932	1.3970	1.4014	1.4071	1.4161	1.4207	1.4208
9	1.3688	1.3777	1.3835	1.3849	1.3547	1.3585	1.3635	1.3709	1.3818	1.3896	1.3911
Case 9											
0	0.8365	0.8317	0.8291	0.8273	0.8277	0.8185	0.8170	0.8147	0.8138	0.8056	0.8003
0.5	0.8622	0.8563	0.8543	0.8523	0.8520	0.8436	0.8425	0.8384	0.8359	0.8248	0.8176
1	0.8820	0.8765	0.8736	0.8714	0.8712	0.8631	0.8622	0.8581	0.8537	0.8404	0.8320
3	0.9324	0.9262	0.9238	0.9214	0.9210	0.9156	0.9132	0.9087	0.9012	0.8853	0.8746
5	0.9664	0.9609	0.9585	0.9560	0.9558	0.9510	0.9486	0.9436	0.9356	0.9182	0.9064
7.5	1.0029	0.9977	0.9951	0.9930	0.9929	0.9883	0.9862	0.9809	0.9724	0.9537	0.9412
10	1.0360	1.0305	1.0282	1.0259	1.0261	1.0223	1.0205	1.0144	1.0059	0.9865	0.9725
15	1.0941	1.0887	1.0863	1.0846	1.0848	1.0812	1.0795	1.0735	1.0637	1.0434	1.0281
20	1.1434	1.1379	1.1354	1.1337	1.1340	1.1305	1.1285	1.1229	1.1123	1.0911	1.0749
35	1.2496	1.2447	1.2419	1.2401	1.2407	1.2378	1.2358	1.2296	1.2178	1.1941	1.1760
50	1.3176	1.3126	1.3102	1.3080	1.3084	1.3058	1.3035	1.2975	1.2849	1.2596	1.2406

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	1.3866	1.3822	1.3796	1.3771	1.3773	1.3748	1.3726	1.3667	1.3529	1.3260	1.3059
100	1.4268	1.4219	1.4195	1.4171	1.4180	1.4148	1.4127	1.4064	1.3924	1.3646	1.3445
150	1.4654	1.4609	1.4581	1.4560	1.4563	1.4540	1.4517	1.4449	1.4305	1.4022	1.3816
200	1.4775	1.4729	1.4703	1.4681	1.4687	1.4661	1.4631	1.4571	1.4418	1.4136	1.3931
350	1.4564	1.4516	1.4492	1.4476	1.4478	1.4450	1.4422	1.4358	1.4201	1.3928	1.3742
500	1.4079	1.4031	1.4005	1.3987	1.3991	1.3962	1.3934	1.3865	1.3709	1.3450	1.3279
750	1.3174	1.3121	1.3093	1.3074	1.3079	1.3056	1.3024	1.2955	1.2796	1.2557	1.2411
1000	1.2302	1.2253	1.2221	1.2208	1.2208	1.2185	1.2154	1.2083	1.1924	1.1704	1.1578
1500	1.0806	1.0758	1.0729	1.0711	1.0721	1.0690	1.0654	1.0591	1.0438	1.0245	1.0145
2000	0.9617	0.9566	0.9535	0.9517	0.9526	0.9497	0.9463	0.9406	0.9263	0.9091	0.9002
Case 10											
0	1.5155	1.5126	1.5117	1.5107	1.5104	1.5031	1.5028	1.5018	1.5043	1.5003	1.4983
0.5	1.4976	1.4941	1.4922	1.4911	1.4908	1.4856	1.4843	1.4824	1.4806	1.4734	1.4683
1	1.4845	1.4808	1.4795	1.4778	1.4781	1.4733	1.4724	1.4691	1.4657	1.4565	1.4498
3	1.4543	1.4502	1.4490	1.4467	1.4467	1.4435	1.4425	1.4385	1.4324	1.4196	1.4103
5	1.4473	1.4435	1.4412	1.4394	1.4394	1.4372	1.4353	1.4310	1.4239	1.4090	1.3988
7.5	1.4546	1.4502	1.4481	1.4469	1.4470	1.4442	1.4425	1.4377	1.4297	1.4134	1.4017
10	1.4688	1.4645	1.4626	1.4610	1.4614	1.4589	1.4568	1.4520	1.4433	1.4255	1.4124
15	1.5023	1.4978	1.4961	1.4947	1.4941	1.4920	1.4902	1.4850	1.4753	1.4556	1.4411
20	1.5330	1.5290	1.5266	1.5254	1.5253	1.5231	1.5213	1.5158	1.5057	1.4851	1.4695
35	1.6031	1.5986	1.5964	1.5948	1.5947	1.5923	1.5904	1.5845	1.5737	1.5509	1.5339
50	1.6454	1.6410	1.6385	1.6367	1.6368	1.6346	1.6328	1.6274	1.6157	1.5920	1.5749
75	1.6838	1.6798	1.6776	1.6756	1.6753	1.6738	1.6719	1.6663	1.6538	1.6304	1.6134
100	1.7010	1.6971	1.6952	1.6934	1.6931	1.6914	1.6897	1.6841	1.6722	1.6490	1.6322
150	1.7077	1.7043	1.7024	1.7005	1.7004	1.6990	1.6969	1.6920	1.6802	1.6576	1.6421
200	1.6973	1.6935	1.6916	1.6907	1.6906	1.6889	1.6868	1.6819	1.6705	1.6492	1.6344
350	1.6321	1.6300	1.6277	1.6264	1.6263	1.6253	1.6237	1.6188	1.6072	1.5877	1.5757
500	1.5578	1.5546	1.5527	1.5516	1.5516	1.5501	1.5479	1.5430	1.5312	1.5132	1.5028
750	1.4375	1.4342	1.4324	1.4307	1.4311	1.4294	1.4268	1.4218	1.4098	1.3928	1.3837
1000	1.3307	1.3271	1.3249	1.3233	1.3239	1.3220	1.3193	1.3143	1.3018	1.2853	1.2768
1500	1.1550	1.1512	1.1482	1.1471	1.1477	1.1454	1.1428	1.1374	1.1243	1.1093	1.1022
2000	1.0190	1.0150	1.0122	1.0108	1.0113	1.0093	1.0060	1.0009	0.9878	0.9740	0.9676
Case 12											
0	0.9334	0.9284	0.9267	0.9246	-	0.9166	0.9162	0.9131	0.9127	0.9045	0.8996
0.5	0.9517	0.9465	0.9443	0.9419	-	0.9342	0.9327	0.9289	0.9264	0.9154	0.9087
1	0.9665	0.9609	0.9585	0.9562	-	0.9487	0.9472	0.9425	0.9385	0.9253	0.9170
3	1.0038	0.9979	0.9952	0.9929	-	0.9871	0.9851	0.9797	0.9726	0.9564	0.9457
5	1.0247	1.0189	1.0166	1.0141	-	1.0087	1.0070	1.0016	0.9936	0.9762	0.9647
7.5	1.0432	1.0377	1.0350	1.0330	-	1.0284	1.0265	1.0209	1.0131	0.9945	0.9822

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	1.0584	1.0531	1.0508	1.0485	-	1.0448	1.0428	1.0371	1.0284	1.0104	0.9968
15	1.0867	1.0811	1.0787	1.0769	-	1.0733	1.0712	1.0656	1.0563	1.0368	1.0227
20	1.1117	1.1066	1.1040	1.1018	-	1.0986	1.0970	1.0909	1.0817	1.0608	1.0458
35	1.1758	1.1703	1.1679	1.1649	-	1.1626	1.1609	1.1543	1.1431	1.1212	1.1041
50	1.2248	1.2198	1.2173	1.2149	-	1.2121	1.2101	1.2037	1.1923	1.1686	1.1506
75	1.2873	1.2820	1.2789	1.2767	-	1.2738	1.2719	1.2651	1.2535	1.2290	1.2104
100	1.3331	1.3271	1.3243	1.3220	-	1.3188	1.3171	1.3098	1.2982	1.2737	1.2548
150	1.3941	1.3883	1.3853	1.3824	-	1.3798	1.3781	1.3696	1.3580	1.3346	1.3159
200	1.4318	1.4259	1.4222	1.4200	-	1.4167	1.4151	1.4062	1.3951	1.3732	1.3551
350	1.4762	1.4701	1.4669	1.4645	-	1.4617	1.4604	1.4517	1.4422	1.4223	1.4079
500	1.4744	1.4698	1.4666	1.4646	-	1.4620	1.4603	1.4535	1.4453	1.4280	1.4160
750	1.4355	1.4320	1.4303	1.4287	-	1.4268	1.4254	1.4216	1.4148	1.4015	1.3921
1000	1.3809	1.3786	1.3779	1.3765	-	1.3760	1.3752	1.3733	1.3682	1.3586	1.3517
1500	1.2667	1.2666	1.2674	1.2671	-	1.2678	1.2667	1.2702	1.2669	1.2615	1.2584
2000	1.1616	1.1634	1.1648	1.1655	-	1.1670	1.1667	1.1728	1.1710	1.1685	1.1683
Case 13											
0	0.5582	0.5564	0.5555	0.5554	-	0.5488	0.5482	0.5484	0.5519	0.5499	0.5491
0.5	0.5577	0.5558	0.5546	0.5537	-	0.5471	0.5468	0.5469	0.5489	0.5466	0.5444
1	0.5606	0.5580	0.5572	0.5560	-	0.5492	0.5491	0.5481	0.5497	0.5457	0.5434
3	0.5852	0.5812	0.5793	0.5782	-	0.5710	0.5707	0.5680	0.5675	0.5595	0.5548
5	0.6120	0.6075	0.6062	0.6034	-	0.5976	0.5964	0.5930	0.5907	0.5805	0.5739
7.5	0.6431	0.6376	0.6360	0.6341	-	0.6279	0.6265	0.6227	0.6188	0.6068	0.5994
10	0.6705	0.6655	0.6634	0.6614	-	0.6555	0.6543	0.6505	0.6453	0.6324	0.6234
15	0.7187	0.7137	0.7119	0.7095	-	0.7043	0.7025	0.6981	0.6923	0.6781	0.6683
20	0.7605	0.7553	0.7533	0.7510	-	0.7466	0.7450	0.7400	0.7339	0.7180	0.7076
35	0.8582	0.8537	0.8514	0.8490	-	0.8452	0.8436	0.8388	0.8313	0.8144	0.8017
50	0.9275	0.9228	0.9205	0.9182	-	0.9150	0.9129	0.9087	0.9007	0.8824	0.8694
75	1.0055	1.0008	0.9988	0.9970	-	0.9942	0.9922	0.9878	0.9788	0.9602	0.9460
100	1.0567	1.0526	1.0506	1.0482	-	1.0454	1.0440	1.0392	1.0300	1.0108	0.9958
150	1.1181	1.1136	1.1106	1.1091	-	1.1062	1.1049	1.0992	1.0898	1.0704	1.0550
200	1.1497	1.1449	1.1424	1.1404	-	1.1376	1.1365	1.1300	1.1214	1.1010	1.0860
350	1.1742	1.1696	1.1672	1.1646	-	1.1621	1.1607	1.1542	1.1453	1.1264	1.1118
500	1.1608	1.1555	1.1523	1.1503	-	1.1477	1.1464	1.1396	1.1308	1.1131	1.0991
750	1.1121	1.1069	1.1037	1.1015	-	1.0987	1.0970	1.0906	1.0831	1.0665	1.0542
1000	1.0562	1.0508	1.0474	1.0454	-	1.0428	1.0414	1.0341	1.0274	1.0131	1.0023
1500	0.9496	0.9441	0.9406	0.9388	-	0.9362	0.9348	0.9282	0.9227	0.9107	0.9022
2000	0.8579	0.8526	0.8494	0.8474	-	0.8446	0.8435	0.8373	0.8328	0.8231	0.8162

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 14											
0	0.8361	0.8311	0.8292	0.8268	-	0.8185	0.8173	0.8145	0.8141	0.8051	0.8003
0.5	0.8619	0.8566	0.8543	0.8521	-	0.8438	0.8426	0.8385	0.8363	0.8245	0.8176
1	0.8818	0.8762	0.8736	0.8714	-	0.8636	0.8615	0.8576	0.8540	0.8403	0.8320
3	0.9325	0.9270	0.9241	0.9217	-	0.9151	0.9134	0.9082	0.9015	0.8855	0.8744
5	0.9663	0.9612	0.9580	0.9561	-	0.9505	0.9484	0.9434	0.9352	0.9179	0.9057
7.5	1.0029	0.9972	0.9945	0.9924	-	0.9880	0.9858	0.9805	0.9718	0.9533	0.9401
10	1.0355	1.0299	1.0277	1.0255	-	1.0214	1.0192	1.0142	1.0050	0.9857	0.9720
15	1.0940	1.0883	1.0861	1.0839	-	1.0803	1.0785	1.0727	1.0633	1.0432	1.0283
20	1.1426	1.1375	1.1354	1.1334	-	1.1296	1.1279	1.1222	1.1118	1.0910	1.0758
35	1.2491	1.2440	1.2414	1.2393	-	1.2365	1.2345	1.2291	1.2184	1.1963	1.1792
50	1.3165	1.3122	1.3091	1.3071	-	1.3049	1.3027	1.2970	1.2861	1.2637	1.2461
75	1.3857	1.3812	1.3791	1.3766	-	1.3740	1.3725	1.3663	1.3554	1.3327	1.3150
100	1.4265	1.4215	1.4193	1.4171	-	1.4145	1.4128	1.4064	1.3962	1.3735	1.3558
150	1.4655	1.4610	1.4586	1.4564	-	1.4540	1.4518	1.4460	1.4353	1.4135	1.3965
200	1.4779	1.4733	1.4707	1.4683	-	1.4663	1.4644	1.4578	1.4481	1.4270	1.4110
350	1.4572	1.4525	1.4499	1.4477	-	1.4457	1.4435	1.4376	1.4281	1.4102	1.3966
500	1.4085	1.4042	1.4012	1.3989	-	1.3962	1.3952	1.3885	1.3811	1.3647	1.3530
750	1.3179	1.3129	1.3099	1.3080	-	1.3057	1.3040	1.2976	1.2912	1.2782	1.2689
1000	1.2307	1.2255	1.2228	1.2208	-	1.2182	1.2169	1.2109	1.2056	1.1948	1.1867
1500	1.0818	1.0763	1.0729	1.0708	-	1.0685	1.0671	1.0617	1.0575	1.0498	1.0447
2000	0.9614	0.9564	0.9533	0.9511	-	0.9492	0.9482	0.9428	0.9397	0.9336	0.9296
Case 15											
0	1.5152	1.5128	1.5118	1.5107	-	1.5030	1.5027	1.5017	1.5040	1.5005	1.4980
0.5	1.4976	1.4938	1.4920	1.4908	-	1.4852	1.4848	1.4823	1.4806	1.4730	1.4680
1	1.4846	1.4806	1.4792	1.4780	-	1.4732	1.4719	1.4689	1.4658	1.4561	1.4501
3	1.4536	1.4502	1.4480	1.4465	-	1.4433	1.4420	1.4380	1.4321	1.4190	1.4098
5	1.4470	1.4424	1.4408	1.4389	-	1.4368	1.4348	1.4306	1.4230	1.4085	1.3976
7.5	1.4542	1.4501	1.4482	1.4466	-	1.4442	1.4426	1.4377	1.4293	1.4131	1.4007
10	1.4691	1.4647	1.4624	1.4608	-	1.4586	1.4567	1.4521	1.4432	1.4257	1.4124
15	1.5027	1.4984	1.4964	1.4943	-	1.4920	1.4906	1.4851	1.4760	1.4569	1.4425
20	1.5347	1.5299	1.5276	1.5259	-	1.5238	1.5220	1.5164	1.5069	1.4869	1.4720
35	1.6039	1.5997	1.5977	1.5961	-	1.5936	1.5920	1.5863	1.5761	1.5557	1.5403
50	1.6464	1.6424	1.6404	1.6383	-	1.6362	1.6347	1.6291	1.6193	1.5987	1.5832
75	1.6853	1.6811	1.6795	1.6773	-	1.6751	1.6738	1.6684	1.6587	1.6397	1.6259
100	1.7031	1.6994	1.6970	1.6960	-	1.6935	1.6915	1.6865	1.6775	1.6599	1.6468
150	1.7099	1.7064	1.7041	1.7030	-	1.7008	1.6993	1.6945	1.6866	1.6711	1.6597
200	1.6991	1.6958	1.6943	1.6922	-	1.6907	1.6893	1.6848	1.6776	1.6646	1.6545
350	1.6341	1.6315	1.6297	1.6287	-	1.6269	1.6257	1.6217	1.6162	1.6065	1.6004

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	1.5593	1.5563	1.5541	1.5531	-	1.5513	1.5504	1.5462	1.5423	1.5353	1.5300
750	1.4389	1.4354	1.4330	1.4318	-	1.4301	1.4291	1.4247	1.4222	1.4173	1.4137
1000	1.3318	1.3278	1.3254	1.3239	-	1.3222	1.3216	1.3171	1.3149	1.3111	1.3086
1500	1.1556	1.1513	1.1487	1.1476	-	1.1453	1.1449	1.1402	1.1390	1.1364	1.1345
2000	1.0191	1.0151	1.0122	1.0107	-	1.0083	1.0079	1.0041	1.0024	1.0006	0.9987

Table C-12: k-infinity for DBRC cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 4											
0	0.5578	0.5564	0.5555	0.5550	0.5551	0.5485	0.5481	0.5481	0.5511	0.5500	0.5485
0.5	0.5573	0.5555	0.5545	0.5539	0.5541	0.5473	0.5470	0.5464	0.5490	0.5462	0.5449
1	0.5605	0.5581	0.5565	0.5560	0.5559	0.5494	0.5489	0.5480	0.5497	0.5457	0.5436
3	0.5830	0.5795	0.5780	0.5766	0.5768	0.5697	0.5690	0.5668	0.5653	0.5583	0.5536
5	0.6071	0.6025	0.6009	0.5994	0.5997	0.5931	0.5917	0.5888	0.5864	0.5766	0.5707
7.5	0.6302	0.6263	0.6240	0.6221	0.6234	0.6170	0.6161	0.6129	0.6086	0.5975	0.5904
10	0.6475	0.6431	0.6407	0.6395	0.6408	0.6356	0.6343	0.6306	0.6262	0.6141	0.6062
15	0.6672	0.6636	0.6616	0.6601	0.6630	0.6585	0.6569	0.6535	0.6489	0.6364	0.6277
20	0.6748	0.6711	0.6694	0.6679	0.6731	0.6690	0.6680	0.6643	0.6589	0.6462	0.6382
35	0.6609	0.6582	0.6566	0.6553	0.6649	0.6623	0.6609	0.6583	0.6530	0.6416	0.6332
50	0.6261	0.6238	0.6226	0.6219	0.6348	0.6328	0.6318	0.6288	0.6242	0.6132	0.6063
75	0.5627	0.5608	0.5597	0.5596	0.5742	0.5730	0.5719	0.5697	0.5652	0.5563	0.5496
100	0.5055	0.5038	0.5029	0.5028	0.5187	0.5178	0.5166	0.5148	0.5111	0.5028	0.4973
150	0.4167	0.4151	0.4149	0.4148	0.4297	0.4289	0.4285	0.4272	0.4236	0.4174	0.4127
200	0.3532	0.3524	0.3520	0.3513	0.3660	0.3652	0.3645	0.3634	0.3605	0.3554	0.3510
350	0.2417	0.2411	0.2411	0.2408	0.2520	0.2516	0.2511	0.2505	0.2479	0.2450	0.2418
500	0.1839	0.1833	0.1831	0.1831	0.1924	0.1919	0.1913	0.1906	0.1892	0.1867	0.1849
750	0.1315	0.1311	0.1309	0.1311	0.1377	0.1376	0.1372	0.1370	0.1359	0.1341	0.1327
1000	0.1025	0.1021	0.1023	0.1021	0.1076	0.1074	0.1072	0.1069	0.1061	0.1047	0.1039
1500	0.0711	0.0709	0.0711	0.0708	0.0748	0.0747	0.0745	0.0745	0.0739	0.0730	0.0723
2000	0.0547	0.0545	0.0545	0.0544	0.0574	0.0573	0.0574	0.0571	0.0566	0.0561	0.0555
Case 5											
1	0.4947	0.4942	0.4941	0.4937	0.4889	0.4882	0.4880	0.4881	0.4886	0.4896	0.4897
1.25	0.4472	0.4468	0.4468	0.4468	0.4405	0.4403	0.4402	0.4409	0.4417	0.4434	0.4438
2	0.3464	0.3461	0.3465	0.3461	0.3389	0.3391	0.3392	0.3396	0.3416	0.3442	0.3454
2.25	0.3224	0.3223	0.3225	0.3222	0.3152	0.3159	0.3155	0.3160	0.3181	0.3207	0.3215
2.75	0.2842	0.2844	0.2847	0.2846	0.2779	0.2777	0.2782	0.2783	0.2803	0.2827	0.2835
3	0.2688	0.2690	0.2697	0.2691	0.2624	0.2623	0.2620	0.2630	0.2649	0.2667	0.2686

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 6											
30	0.1210	0.1210	0.1203	0.1207	-	0.1207	0.1208	0.1198	0.1207	0.1202	0.1199
35	0.1136	0.1127	0.1130	0.1134	-	0.1132	0.1134	0.1132	0.1132	0.1133	0.1126
40	0.1073	0.1072	0.1080	0.1076	-	0.1072	0.1076	0.1071	0.1072	0.1071	0.1071
45	0.1032	0.1027	0.1032	0.1030	-	0.1026	0.1027	0.1028	0.1026	0.1026	0.1030
50	0.0999	0.0989	0.0990	0.0996	-	0.0994	0.0994	0.0994	0.0996	0.0992	0.0989
55	0.0963	0.0964	0.0967	0.0967	-	0.0960	0.0966	0.0965	0.0962	0.0964	0.0961
60	0.0938	0.0942	0.0937	0.0942	-	0.0940	0.0942	0.0936	0.0940	0.0939	0.0938
65	0.0921	0.0921	0.0914	0.0920	-	0.0919	0.0920	0.0918	0.0916	0.0915	0.0917
70	0.0901	0.0906	0.0903	0.0897	-	0.0901	0.0898	0.0903	0.0899	0.0899	0.0900
Case 7											
1E-20	0.4113	0.4096	0.4091	0.4083	0.4086	0.4075	0.4076	0.4053	0.4033	0.3989	0.3955
0.05	0.3643	0.3638	0.3638	0.3634	0.3630	0.3627	0.3622	0.3620	0.3604	0.3573	0.3556
0.1	0.3329	0.3327	0.3325	0.3320	0.3321	0.3316	0.3315	0.3312	0.3297	0.3284	0.3270
0.2	0.2953	0.2946	0.2951	0.2951	0.2948	0.2942	0.2945	0.2938	0.2937	0.2924	0.2915
0.3	0.2729	0.2725	0.2730	0.2728	0.2727	0.2725	0.2724	0.2723	0.2728	0.2708	0.2705
0.4	0.2583	0.2586	0.2584	0.2582	0.2580	0.2582	0.2578	0.2577	0.2575	0.2574	0.2563
0.5	0.2474	0.2478	0.2475	0.2476	0.2473	0.2471	0.2473	0.2470	0.2472	0.2468	0.2463
0.6	0.2395	0.2390	0.2393	0.2395	0.2389	0.2388	0.2389	0.2387	0.2393	0.2395	0.2392
0.7	0.2328	0.2328	0.2326	0.2330	0.2321	0.2325	0.2326	0.2325	0.2330	0.2334	0.2334
0.8	0.2275	0.2274	0.2274	0.2269	0.2272	0.2270	0.2267	0.2274	0.2279	0.2290	0.2290
0.9	0.2230	0.2227	0.2230	0.2230	0.2226	0.2227	0.2226	0.2227	0.2237	0.2250	0.2254
0.95	0.2210	0.2207	0.2213	0.2210	0.2203	0.2206	0.2207	0.2211	0.2219	0.2233	0.2238
1	0.2190	0.2192	0.2191	0.2189	0.2187	0.2185	0.2189	0.2191	0.2202	0.2218	0.2220
Case 8											
1	0.7397	0.7383	0.7382	0.7375	0.7356	0.7349	0.7343	0.7331	0.7308	0.7259	0.7215
1.5	0.6170	0.6161	0.6157	0.6153	0.6115	0.6108	0.6110	0.6102	0.6092	0.6072	0.6044
2	0.5254	0.5249	0.5249	0.5248	0.5195	0.5192	0.5192	0.5190	0.5190	0.5183	0.5172
2.5	0.4566	0.4559	0.4561	0.4560	0.4505	0.4504	0.4504	0.4502	0.4506	0.4505	0.4501
3	0.4028	0.4028	0.4029	0.4029	0.3970	0.3968	0.3970	0.3972	0.3983	0.3988	0.3985
4	0.3259	0.3264	0.3261	0.3259	0.3206	0.3204	0.3208	0.3212	0.3221	0.3233	0.3232
5	0.2744	0.2740	0.2747	0.2741	0.2689	0.2690	0.2695	0.2695	0.2708	0.2719	0.2721
6	0.2364	0.2363	0.2367	0.2366	0.2319	0.2321	0.2323	0.2323	0.2332	0.2350	0.2352
7	0.2087	0.2083	0.2086	0.2082	0.2035	0.2038	0.2042	0.2040	0.2052	0.2068	0.2075
8	0.1855	0.1862	0.1860	0.1861	0.1819	0.1822	0.1821	0.1827	0.1834	0.1852	0.1858
9	0.1681	0.1683	0.1687	0.1689	0.1645	0.1650	0.1655	0.1649	0.1661	0.1672	0.1680

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 9											
0	0.8365	0.8314	0.8294	0.8275	0.8269	0.8181	0.8171	0.8142	0.8137	0.8055	0.8005
0.5	0.8613	0.8560	0.8536	0.8515	0.8514	0.8431	0.8416	0.8381	0.8354	0.8242	0.8174
1	0.8805	0.8746	0.8722	0.8697	0.8698	0.8621	0.8602	0.8562	0.8523	0.8388	0.8305
3	0.9223	0.9166	0.9142	0.9117	0.9124	0.9071	0.9045	0.8997	0.8934	0.8775	0.8668
5	0.9413	0.9360	0.9335	0.9314	0.9333	0.9282	0.9264	0.9218	0.9143	0.8982	0.8869
7.5	0.9511	0.9465	0.9443	0.9421	0.9458	0.9418	0.9400	0.9351	0.9276	0.9117	0.8997
10	0.9528	0.9481	0.9462	0.9441	0.9497	0.9457	0.9445	0.9398	0.9322	0.9166	0.9045
15	0.9403	0.9362	0.9344	0.9331	0.9426	0.9392	0.9375	0.9337	0.9261	0.9105	0.8991
20	0.9170	0.9133	0.9116	0.9109	0.9231	0.9205	0.9188	0.9154	0.9083	0.8938	0.8822
35	0.8280	0.8251	0.8240	0.8232	0.8422	0.8406	0.8394	0.8359	0.8301	0.8168	0.8068
50	0.7418	0.7394	0.7387	0.7379	0.7599	0.7587	0.7575	0.7548	0.7491	0.7374	0.7282
75	0.6256	0.6236	0.6225	0.6223	0.6458	0.6445	0.6438	0.6415	0.6366	0.6272	0.6195
100	0.5382	0.5362	0.5358	0.5353	0.5583	0.5580	0.5570	0.5548	0.5505	0.5422	0.5358
150	0.4185	0.4180	0.4173	0.4174	0.4384	0.4370	0.4368	0.4355	0.4316	0.4252	0.4198
200	0.3432	0.3422	0.3413	0.3414	0.3598	0.3591	0.3587	0.3575	0.3545	0.3496	0.3455
350	0.2220	0.2215	0.2212	0.2209	0.2344	0.2339	0.2337	0.2327	0.2309	0.2277	0.2251
500	0.1642	0.1640	0.1635	0.1634	0.1740	0.1736	0.1734	0.1726	0.1714	0.1690	0.1675
750	0.1147	0.1146	0.1143	0.1143	0.1218	0.1216	0.1215	0.1210	0.1201	0.1186	0.1176
1000	0.0882	0.0882	0.0879	0.0878	0.0938	0.0938	0.0936	0.0933	0.0926	0.0915	0.0908
1500	0.0605	0.0604	0.0603	0.0603	0.0643	0.0643	0.0643	0.0640	0.0636	0.0629	0.0625
2000	0.0461	0.0460	0.0459	0.0458	0.0490	0.0490	0.0489	0.0488	0.0485	0.0480	0.0477
Case 10											
0	1.5156	1.5125	1.5116	1.5105	1.5107	1.5034	1.5029	1.5015	1.5042	1.5004	1.4979
0.5	1.4950	1.4915	1.4903	1.4890	1.4888	1.4835	1.4829	1.4800	1.4786	1.4712	1.4666
1	1.4793	1.4757	1.4739	1.4724	1.4732	1.4687	1.4673	1.4642	1.4607	1.4515	1.4454
3	1.4255	1.4216	1.4204	1.4188	1.4207	1.4177	1.4167	1.4130	1.4075	1.3953	1.3869
5	1.3828	1.3798	1.3777	1.3765	1.3807	1.3789	1.3772	1.3736	1.3673	1.3551	1.3455
7.5	1.3372	1.3343	1.3325	1.3316	1.3392	1.3371	1.3359	1.3322	1.3257	1.3126	1.3030
10	1.2955	1.2924	1.2913	1.2902	1.3011	1.2992	1.2979	1.2946	1.2879	1.2744	1.2647
15	1.2185	1.2158	1.2145	1.2137	1.2301	1.2283	1.2272	1.2243	1.2177	1.2049	1.1942
20	1.1474	1.1448	1.1436	1.1430	1.1631	1.1621	1.1612	1.1579	1.1518	1.1397	1.1293
35	0.9694	0.9674	0.9665	0.9657	0.9934	0.9925	0.9916	0.9892	0.9835	0.9726	0.9635
50	0.8352	0.8337	0.8327	0.8320	0.8626	0.8617	0.8607	0.8584	0.8533	0.8437	0.8362
75	0.6767	0.6751	0.6744	0.6741	0.7043	0.7033	0.7026	0.7011	0.6961	0.6886	0.6824
100	0.5680	0.5668	0.5660	0.5659	0.5944	0.5936	0.5930	0.5911	0.5876	0.5807	0.5758
150	0.4293	0.4288	0.4282	0.4279	0.4525	0.4520	0.4517	0.4502	0.4470	0.4425	0.4385
200	0.3453	0.3448	0.3444	0.3442	0.3652	0.3647	0.3645	0.3633	0.3611	0.3571	0.3541
350	0.2178	0.2173	0.2172	0.2169	0.2317	0.2315	0.2312	0.2305	0.2290	0.2268	0.2253

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	0.1592	0.1588	0.1587	0.1586	0.1698	0.1696	0.1693	0.1689	0.1679	0.1663	0.1654
750	0.1099	0.1098	0.1098	0.1097	0.1176	0.1175	0.1174	0.1171	0.1163	0.1154	0.1148
1000	0.0841	0.0840	0.0839	0.0838	0.0900	0.0900	0.0899	0.0897	0.0891	0.0884	0.0880
1500	0.0572	0.0571	0.0570	0.0571	0.0614	0.0613	0.0612	0.0611	0.0608	0.0603	0.0600
2000	0.0433	0.0433	0.0433	0.0433	0.0466	0.0465	0.0464	0.0464	0.0461	0.0458	0.0455
Case 12											
0	0.9330	0.9285	0.9266	0.9253	-	0.9169	0.9157	0.9132	0.9128	0.9043	0.9005
0.5	0.9511	0.9452	0.9437	0.9411	-	0.9335	0.9323	0.9285	0.9258	0.9144	0.9076
1	0.9655	0.9595	0.9569	0.9553	-	0.9477	0.9461	0.9416	0.9372	0.9242	0.9161
3	0.9972	0.9913	0.9887	0.9867	-	0.9810	0.9788	0.9734	0.9672	0.9507	0.9405
5	1.0103	1.0048	1.0025	0.9997	-	0.9953	0.9935	0.9879	0.9807	0.9643	0.9526
7.5	1.0167	1.0121	1.0094	1.0073	-	1.0029	1.0014	0.9960	0.9884	0.9718	0.9599
10	1.0188	1.0137	1.0116	1.0095	-	1.0063	1.0047	0.9995	0.9918	0.9746	0.9628
15	1.0176	1.0131	1.0111	1.0088	-	1.0063	1.0050	1.0005	0.9919	0.9758	0.9630
20	1.0129	1.0088	1.0071	1.0053	-	1.0027	1.0012	0.9967	0.9888	0.9725	0.9602
35	0.9904	0.9869	0.9856	0.9835	-	0.9821	0.9806	0.9762	0.9690	0.9531	0.9411
50	0.9617	0.9581	0.9566	0.9555	-	0.9541	0.9524	0.9493	0.9418	0.9268	0.9154
75	0.9075	0.9051	0.9040	0.9024	-	0.9019	0.9008	0.8982	0.8915	0.8781	0.8679
100	0.8536	0.8526	0.8512	0.8505	-	0.8498	0.8487	0.8465	0.8413	0.8296	0.8210
150	0.7581	0.7567	0.7567	0.7558	-	0.7559	0.7549	0.7541	0.7499	0.7407	0.7339
200	0.6783	0.6774	0.6779	0.6772	-	0.6775	0.6767	0.6771	0.6734	0.6661	0.6610
350	0.5121	0.5124	0.5132	0.5125	-	0.5132	0.5124	0.5139	0.5121	0.5083	0.5056
500	0.4105	0.4110	0.4117	0.4113	-	0.4125	0.4115	0.4138	0.4124	0.4099	0.4083
750	0.3084	0.3089	0.3099	0.3093	-	0.3102	0.3096	0.3121	0.3111	0.3106	0.3096
1000	0.2467	0.2476	0.2488	0.2481	-	0.2488	0.2484	0.2511	0.2503	0.2494	0.2495
1500	0.1768	0.1774	0.1780	0.1780	-	0.1785	0.1782	0.1803	0.1801	0.1798	0.1802
2000	0.1380	0.1384	0.1386	0.1389	-	0.1392	0.1391	0.1405	0.1405	0.1405	0.1410
Case 13											
0	0.5580	0.5564	0.5557	0.5546	-	0.5482	0.5487	0.5482	0.5509	0.5497	0.5491
0.5	0.5574	0.5558	0.5546	0.5536	-	0.5476	0.5469	0.5465	0.5491	0.5463	0.5441
1	0.5604	0.5580	0.5568	0.5559	-	0.5496	0.5486	0.5480	0.5495	0.5458	0.5436
3	0.5839	0.5796	0.5782	0.5769	-	0.5704	0.5699	0.5669	0.5661	0.5583	0.5536
5	0.6084	0.6041	0.6021	0.6003	-	0.5938	0.5930	0.5900	0.5873	0.5772	0.5711
7.5	0.6332	0.6289	0.6266	0.6250	-	0.6194	0.6177	0.6143	0.6104	0.5993	0.5917
10	0.6525	0.6478	0.6462	0.6445	-	0.6390	0.6374	0.6335	0.6294	0.6172	0.6092
15	0.6778	0.6736	0.6717	0.6699	-	0.6652	0.6637	0.6601	0.6548	0.6427	0.6342
20	0.6909	0.6873	0.6855	0.6834	-	0.6798	0.6786	0.6745	0.6696	0.6574	0.6479
35	0.6926	0.6894	0.6878	0.6868	-	0.6836	0.6824	0.6792	0.6739	0.6628	0.6543
50	0.6687	0.6657	0.6646	0.6636	-	0.6615	0.6602	0.6576	0.6530	0.6426	0.6348

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	0.6143	0.6122	0.6112	0.6100	-	0.6091	0.6082	0.6057	0.6019	0.5924	0.5863
100	0.5609	0.5588	0.5577	0.5572	-	0.5560	0.5553	0.5533	0.5498	0.5417	0.5360
150	0.4714	0.4699	0.4693	0.4687	-	0.4679	0.4675	0.4653	0.4628	0.4568	0.4520
200	0.4044	0.4037	0.4027	0.4020	-	0.4017	0.4012	0.3998	0.3973	0.3925	0.3885
350	0.2823	0.2812	0.2813	0.2806	-	0.2804	0.2805	0.2793	0.2779	0.2747	0.2718
500	0.2166	0.2162	0.2157	0.2153	-	0.2152	0.2151	0.2141	0.2132	0.2107	0.2092
750	0.1562	0.1559	0.1556	0.1554	-	0.1551	0.1551	0.1544	0.1537	0.1523	0.1513
1000	0.1222	0.1219	0.1216	0.1217	-	0.1216	0.1214	0.1210	0.1205	0.1193	0.1184
1500	0.0853	0.0852	0.0850	0.0850	-	0.0850	0.0848	0.0844	0.0840	0.0834	0.0831
2000	0.0654	0.0654	0.0655	0.0654	-	0.0651	0.0652	0.0651	0.0647	0.0643	0.0640
Case 14											
0	0.8361	0.8309	0.8292	0.8268	-	0.8181	0.8172	0.8146	0.8141	0.8054	0.8006
0.5	0.8623	0.8562	0.8536	0.8518	-	0.8429	0.8419	0.8383	0.8353	0.8239	0.8170
1	0.8809	0.8752	0.8725	0.8703	-	0.8624	0.8608	0.8565	0.8525	0.8394	0.8308
3	0.9251	0.9189	0.9166	0.9142	-	0.9081	0.9058	0.9013	0.8947	0.8789	0.8681
5	0.9473	0.9416	0.9392	0.9369	-	0.9317	0.9299	0.9250	0.9174	0.9012	0.8896
7.5	0.9627	0.9573	0.9551	0.9528	-	0.9492	0.9470	0.9420	0.9346	0.9173	0.9059
10	0.9704	0.9655	0.9631	0.9613	-	0.9575	0.9560	0.9510	0.9434	0.9267	0.9151
15	0.9704	0.9660	0.9638	0.9621	-	0.9594	0.9577	0.9529	0.9457	0.9302	0.9185
20	0.9579	0.9542	0.9524	0.9510	-	0.9486	0.9469	0.9430	0.9360	0.9205	0.9088
35	0.8921	0.8893	0.8878	0.8865	-	0.8848	0.8840	0.8806	0.8742	0.8613	0.8510
50	0.8181	0.8155	0.8143	0.8132	-	0.8116	0.8113	0.8078	0.8024	0.7910	0.7823
75	0.7081	0.7061	0.7045	0.7041	-	0.7029	0.7022	0.6997	0.6952	0.6860	0.6785
100	0.6201	0.6184	0.6178	0.6170	-	0.6161	0.6152	0.6130	0.6089	0.6016	0.5953
150	0.4942	0.4931	0.4925	0.4916	-	0.4909	0.4908	0.4882	0.4858	0.4800	0.4753
200	0.4102	0.4094	0.4087	0.4082	-	0.4075	0.4069	0.4060	0.4034	0.3985	0.3955
350	0.2714	0.2705	0.2700	0.2696	-	0.2695	0.2694	0.2680	0.2669	0.2641	0.2621
500	0.2028	0.2021	0.2018	0.2018	-	0.2014	0.2014	0.2007	0.1997	0.1979	0.1963
750	0.1428	0.1425	0.1423	0.1420	-	0.1419	0.1418	0.1413	0.1408	0.1396	0.1390
1000	0.1104	0.1101	0.1099	0.1098	-	0.1097	0.1097	0.1093	0.1089	0.1080	0.1077
1500	0.0759	0.0758	0.0757	0.0756	-	0.0755	0.0755	0.0752	0.0751	0.0746	0.0744
2000	0.0580	0.0579	0.0578	0.0577	-	0.0577	0.0576	0.0575	0.0574	0.0571	0.0569
Case 15											
0	1.5149	1.5122	1.5117	1.5106	-	1.5031	1.5028	1.5022	1.5038	1.5001	1.4985
0.5	1.4955	1.4919	1.4903	1.4892	-	1.4836	1.4828	1.4804	1.4791	1.4714	1.4663
1	1.4806	1.4769	1.4750	1.4736	-	1.4693	1.4679	1.4652	1.4618	1.4521	1.4457
3	1.4319	1.4282	1.4265	1.4249	-	1.4222	1.4206	1.4172	1.4112	1.3989	1.3906
5	1.3973	1.3934	1.3914	1.3902	-	1.3880	1.3868	1.3830	1.3763	1.3627	1.3539
7.5	1.3628	1.3592	1.3578	1.3559	-	1.3541	1.3527	1.3489	1.3420	1.3287	1.3189

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	1.3319	1.3283	1.3270	1.3254	-	1.3235	1.3228	1.3189	1.3120	1.2985	1.2881
15	1.2734	1.2710	1.2691	1.2674	-	1.2667	1.2651	1.2612	1.2552	1.2418	1.2313
20	1.2174	1.2146	1.2132	1.2120	-	1.2105	1.2100	1.2064	1.2002	1.1874	1.1774
35	1.0655	1.0632	1.0622	1.0611	-	1.0602	1.0595	1.0565	1.0510	1.0402	1.0318
50	0.9414	0.9391	0.9379	0.9376	-	0.9365	0.9356	0.9331	0.9286	0.9193	0.9123
75	0.7846	0.7823	0.7815	0.7809	-	0.7802	0.7794	0.7772	0.7739	0.7666	0.7614
100	0.6709	0.6690	0.6684	0.6677	-	0.6672	0.6666	0.6645	0.6618	0.6563	0.6520
150	0.5190	0.5181	0.5173	0.5171	-	0.5165	0.5160	0.5144	0.5124	0.5090	0.5058
200	0.4234	0.4224	0.4217	0.4216	-	0.4208	0.4209	0.4196	0.4181	0.4155	0.4134
350	0.2726	0.2720	0.2717	0.2713	-	0.2712	0.2712	0.2702	0.2695	0.2683	0.2673
500	0.2013	0.2007	0.2005	0.2004	-	0.2002	0.2002	0.1996	0.1991	0.1984	0.1979
750	0.1401	0.1398	0.1397	0.1396	-	0.1396	0.1396	0.1391	0.1389	0.1385	0.1382
1000	0.1076	0.1074	0.1073	0.1072	-	0.1071	0.1071	0.1068	0.1068	0.1064	0.1063
1500	0.0735	0.0734	0.0733	0.0733	-	0.0733	0.0732	0.0731	0.0730	0.0729	0.0728
2000	0.0559	0.0558	0.0557	0.0557	-	0.0557	0.0557	0.0555	0.0555	0.0554	0.0554

Table C-13: (k_{DBRC}-k_{ref}) for DBRC cases without absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 4											
0	-40	-10	90	30	10	30	60	0	30	-10	-50
0.5	0	-20	20	-10	20	-30	20	-30	-10	0	30
1	50	30	-40	40	30	-50	10	-50	40	0	-20
3	-10	0	-20	0	-20	30	-10	0	0	-10	-20
5	-20	0	20	-10	50	-60	30	-20	40	10	30
7.5	30	-10	30	20	10	30	-10	-20	20	0	-40
10	20	-10	-10	10	-70	10	0	20	-20	-20	-70
15	10	-10	10	30	0	-40	30	10	-20	0	-90
20	10	20	-10	-20	40	-30	-50	-50	-30	-110	-140
35	-20	-10	0	-80	-100	10	-90	-50	-100	-210	-340
50	-60	-40	-60	-50	-30	0	-70	-60	-160	-220	-460
75	0	-40	-60	-90	-20	-130	-70	-130	-170	-290	-490
100	-40	-50	-60	-50	-100	-120	-70	-100	-170	-350	-450
150	0	-50	-30	-70	-50	-40	-20	-80	-180	-350	-510
200	-30	-10	-20	-80	20	-20	10	-110	-150	-380	-500
350	-20	-10	-60	-40	10	-50	0	-40	-120	-300	-440
500	0	-30	-30	20	-20	-50	-40	-110	-140	-260	-430
750	0	20	-40	-30	-40	-20	-10	-10	-110	-220	-290
1000	-20	40	0	0	-10	0	-20	-60	-60	-190	-260
1500	-20	-20	-50	0	-20	10	-30	10	-40	-130	-160

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
2000	-20	50	0	0	-20	-40	10	-60	-40	-60	-120
Case 5											
1	-10	30	60	10	20	40	0	-30	0	-70	-120
1.25	20	40	50	-10	-40	-10	10	10	10	-40	-50
2	10	10	0	40	10	10	-10	-30	30	-60	-110
2.25	40	40	40	-20	20	60	10	20	-20	-40	-120
2.75	-40	30	0	10	10	-50	-20	-100	0	-30	-110
3	-30	0	20	30	-20	10	0	0	-30	-30	-10
Case 6											
30	-20	30	-30	0	-	20	-70	10	-80	-70	-110
35	0	-30	-20	-50	-	-10	-20	-60	-10	-50	-130
40	-50	10	0	-40	-	10	0	30	0	-30	-20
45	-10	80	-40	20	-	20	-10	-10	-40	-30	-60
50	-60	-20	-50	-70	-	30	0	-10	0	-70	-80
55	10	30	40	-20	-	30	-10	-20	0	20	-10
60	-50	20	0	40	-	-20	-30	-100	-40	-60	-60
65	-20	-30	0	0	-	-30	-30	-20	-10	-60	-40
70	-20	0	0	-40	-	-60	-30	10	-20	-50	-70
Case 7											
1E-20	0	-10	50	-50	30	-10	-80	-40	-120	-160	-280
0.05	-60	-20	-30	-30	-30	-50	-60	-20	-70	-180	-330
0.1	-20	-10	-10	0	-30	-30	-70	-10	-70	-180	-320
0.2	10	-20	-70	-40	20	-30	-50	-70	-50	-170	-260
0.3	30	10	-20	70	-20	10	-10	-40	-70	-90	-220
0.4	30	30	10	20	-50	10	-60	-70	-40	-150	-150
0.5	30	-50	0	-10	-10	10	-10	20	-20	-130	-120
0.6	-40	-40	-10	30	10	-10	-60	10	-10	-70	-150
0.7	-20	-30	-50	30	30	-20	-50	-10	0	-90	-150
0.8	10	10	-20	-30	20	-40	10	-20	40	-40	-120
0.9	0	30	-10	0	20	0	0	-20	0	-40	-110
0.95	-70	20	-20	20	-20	-40	10	10	10	-40	-70
1	0	30	-20	20	-30	-40	-20	-10	-30	-40	-40
Case 8											
1	10	-20	10	20	-50	-50	20	0	-70	-270	-320
1.5	-30	-50	10	-30	40	-60	-50	-20	-40	-190	-270
2	20	-30	10	-20	-20	0	-90	-40	-60	-120	-220
2.5	40	-10	-40	0	50	10	-30	-40	-50	-130	-240
3	-40	0	-20	-20	40	10	-10	10	-50	-80	-200
4	10	0	40	0	-50	-30	10	-30	-50	-50	-170

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
5	-40	0	-10	10	-50	20	-10	-80	20	-40	-210
6	50	10	-10	-30	-40	-20	40	-30	-30	-90	-80
7	10	-40	50	20	50	-20	-30	0	20	-50	-90
8	40	40	10	60	-10	-10	20	-10	-30	-90	-60
9	30	-10	50	-40	10	0	-40	50	-40	-50	-10
Case 9											
0	20	20	-10	10	20	20	-20	30	-60	-10	10
0.5	-10	-40	-20	20	-40	-30	50	-20	10	30	-10
1	-30	20	10	-20	-30	-80	50	50	-10	10	-60
3	10	0	0	20	-20	40	0	50	-80	-40	-70
5	30	20	30	0	0	20	-20	10	-50	-100	-180
7.5	10	20	20	30	40	20	-20	0	-40	-170	-200
10	-40	-10	40	-10	-20	60	50	-40	-20	-180	-350
15	0	-30	10	-50	-30	-30	0	-60	-120	-260	-450
20	-20	10	-70	-20	-40	-50	-60	-50	-150	-310	-480
35	-30	-10	-20	-70	-10	-50	-20	-50	-140	-370	-570
50	-20	-20	20	-40	-30	-30	-40	-80	-160	-390	-550
75	-20	40	0	-30	-90	-60	-60	-40	-200	-430	-580
100	-40	20	-30	-20	20	-60	-90	-70	-180	-380	-530
150	-20	-30	-40	-50	-60	-60	-40	-120	-200	-300	-450
200	0	-50	-40	-50	-20	-30	-60	-80	-170	-320	-480
350	10	-20	40	10	-20	-20	-50	-40	-90	-190	-300
500	0	10	30	0	-20	-40	-30	-20	-80	-160	-240
750	20	-30	-10	-10	-10	0	10	-60	-20	-100	-170
1000	10	0	10	50	-30	40	20	10	-50	-60	-120
1500	-50	-50	0	20	10	-10	-30	-10	-40	-110	-70
2000	20	-40	0	-10	30	-30	-50	0	40	-20	-20
Case 10											
0	30	-20	50	40	20	-20	20	0	40	-40	0
0.5	30	30	10	20	-40	0	-40	40	0	10	0
1	-10	-10	20	-20	60	-30	50	-10	-10	10	-90
3	20	-40	80	-20	-20	-40	0	-30	-30	-90	-160
5	0	40	-20	-50	-30	-10	-40	-30	-70	-160	-190
7.5	20	-10	-40	-10	20	-20	-60	-110	-150	-190	-220
10	0	-20	10	-30	40	-20	-60	-100	-90	-220	-310
15	0	20	30	10	-50	-10	-60	-100	-130	-270	-360
20	-50	-10	-30	-40	-50	-10	-50	-90	-130	-270	-430
35	0	10	-10	40	10	-60	-40	-120	-90	-290	-440
50	40	-10	-90	0	-40	-20	-50	-50	-90	-270	-370

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
75	30	80	10	0	-30	-30	30	-50	-110	-250	-320
100	20	-40	-30	-10	-20	-10	-10	-60	-80	-140	-290
150	0	10	0	-10	-30	20	30	-50	-50	-120	-180
200	20	-40	0	20	10	0	-10	30	-40	-30	-160
350	-40	20	-40	0	-40	-20	90	0	10	30	-90
500	30	0	10	30	-10	30	0	10	-10	-30	-10
750	20	70	40	30	20	40	20	-50	20	-40	-70
1000	30	10	60	-30	0	-20	30	-10	30	-30	-50
1500	10	10	-40	-20	0	0	30	20	-20	-40	-20
2000	10	-10	20	20	-20	20	-30	-10	-30	-10	10
Case 12											
0	30	0	-30	-10	-	-30	50	0	20	-10	-70
0.5	0	20	60	0	-	-20	10	10	20	20	0
1	-20	-40	30	-10	-	-30	60	-20	10	-10	-70
3	-30	-30	-30	0	-	0	10	-30	-50	-80	-90
5	-10	-10	-10	-30	-	-60	-60	-30	-70	-170	-170
7.5	-30	-10	-40	0	-	-70	-30	-100	-10	-220	-200
10	-30	-50	-50	-30	-	-50	-70	-80	-110	-110	-330
15	30	-20	-50	-10	-	-60	-90	-110	-110	-220	-340
20	10	-30	-40	-40	-	-110	-20	-80	-70	-220	-380
35	30	10	-10	-90	-	-50	-70	-70	-170	-290	-450
50	-90	-40	-20	-20	-	-70	-80	-90	-130	-290	-450
75	10	-50	-60	-10	-	-60	-80	-110	-120	-290	-470
100	-10	-70	-50	-30	-	-80	-60	-70	-150	-280	-460
150	-10	10	20	-30	-	-70	-20	-90	-160	-240	-480
200	20	20	-40	-20	-	-70	-40	-100	-160	-220	-410
350	30	-30	-40	10	-	-40	0	-50	-90	-200	-260
500	-20	30	-20	0	-	-30	-70	-20	-30	-210	-220
750	-30	20	50	30	-	-10	-30	-20	0	-110	-230
1000	-50	-60	30	-30	-	-20	10	-80	20	-30	-120
1500	20	-20	50	10	-	40	-20	0	0	-20	-110
2000	20	40	-20	0	-	10	10	-40	-20	-30	-20
Case 13											
0	-10	-10	-20	50	-	40	0	50	50	10	10
0.5	10	10	-20	-10	-	-10	-50	50	-10	20	-70
1	-10	-10	40	10	-	20	10	-40	-30	-40	-40
3	70	10	-10	10	-	10	30	0	30	80	-20
5	0	20	70	-90	-	0	20	-10	0	50	-70
7.5	0	-60	0	-10	-	0	0	10	-20	-40	-60

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
10	20	50	30	30	-	10	30	60	-20	-30	-90
15	10	-10	60	0	-	-10	20	0	-30	-60	-120
20	20	-20	-10	-30	-	30	-20	-40	-10	-110	-230
35	-40	10	20	-40	-	0	-60	-90	-80	-180	-360
50	-60	-30	-60	-90	-	-70	-110	-120	-110	-290	-410
75	-90	-100	-70	-40	-	-50	-60	-80	-180	-300	-440
100	-120	-70	-20	-110	-	-110	-70	-130	-170	-360	-530
150	-70	0	-80	-20	-	-60	-60	-140	-190	-360	-540
200	0	-20	-30	-10	-	-60	-30	-120	-90	-390	-550
350	-120	-50	-10	-100	-	-90	-30	-90	-180	-330	-460
500	-30	-80	-20	0	-	-50	-30	-30	-130	-300	-420
750	-40	-20	0	-40	-	-30	-80	-20	-50	-270	-350
1000	-10	-30	-30	0	-	10	20	-50	-90	-200	-270
1500	-20	10	0	0	-	20	10	-20	10	-110	-190
2000	-10	-20	-30	0	-	-20	-10	-10	-10	-80	-90
Case 14											
0	-10	20	-20	-50	-	30	20	0	10	-50	-10
0.5	-10	20	30	10	-	10	40	-40	10	-40	20
1	0	-50	-30	-10	-	-20	-30	-10	30	-40	-60
3	-40	30	0	40	-	-30	10	-30	-10	-40	-120
5	-20	30	10	-20	-	-20	-20	20	-50	-90	-210
7.5	-10	-20	-30	-20	-	20	-50	-10	-60	-140	-280
10	-20	-50	0	-20	-	-40	-70	-30	-70	-230	-350
15	-40	-70	-50	-40	-	-60	-50	-110	-110	-230	-430
20	-70	-70	-50	-40	-	-100	-40	-70	-200	-360	-490
35	-40	-40	-120	-60	-	-100	-100	-100	-200	-370	-560
50	-90	-10	-60	-40	-	-30	-80	-180	-200	-380	-590
75	-70	-70	30	-70	-	-100	-40	-140	-200	-410	-600
100	-10	-60	-10	-60	-	-60	-20	-130	-130	-350	-560
150	20	20	10	-10	-	-50	-50	-110	-140	-320	-440
200	-10	-30	-30	-80	-	-100	-40	-110	-130	-280	-390
350	10	0	10	-40	-	40	-50	10	-80	-240	-280
500	20	-30	30	-60	-	-80	-10	-70	-50	-160	-250
750	10	10	20	20	-	40	-20	-40	-20	-130	-110
1000	-10	-60	20	10	-	0	-30	0	20	-80	-160
1500	90	20	50	-10	-	0	-30	20	0	-70	-50
2000	20	-10	0	-40	-	-10	10	-20	-20	-70	-20

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 15											
0	0	30	20	60	-	20	-10	-10	-20	-30	10
0.5	60	40	0	-30	-	-10	20	60	-30	30	-10
1	10	-50	0	10	-	10	-20	-20	0	-10	-10
3	-20	30	-40	0	-	-40	-10	-10	10	-80	-130
5	10	-60	-30	-50	-	-60	-20	-40	-130	-150	-230
7.5	-50	-10	-10	-20	-	-10	-30	-70	-120	-240	-360
10	-30	0	-70	-50	-	-90	-70	-50	-100	-230	-380
15	-40	-60	-40	-70	-	-80	-70	-100	-160	-280	-410
20	-50	-40	-90	-30	-	-60	-80	-120	-160	-310	-430
35	-80	-20	-20	-20	-	0	-20	-90	-160	-290	-470
50	-60	-10	-10	-20	-	-70	-40	-50	-140	-290	-430
75	-20	-30	0	-10	-	-70	-60	-30	-60	-240	-280
100	20	-20	-50	30	-	-20	-70	-70	-90	-170	-260
150	-10	10	-30	30	-	-20	-20	10	-40	-140	-190
200	-30	-30	30	-60	-	10	-10	-10	-60	-80	-180
350	-40	-20	-20	0	-	-20	-30	10	-70	-90	-50
500	0	30	0	0	-	20	0	10	10	10	-70
750	0	20	-30	-10	-	10	-20	-40	-20	10	-50
1000	30	-20	-30	-40	-	-20	-10	-10	-10	-50	-40
1500	10	-40	10	30	-	0	30	20	0	0	20
2000	-10	10	0	-10	-	-40	-10	50	-50	0	-20

Table C-14: (k_{DBRC}-k_{ref}) for DBRC cases with absorber

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 4											
0	-10	-20	0	-30	10	20	0	-10	-60	30	-20
0.5	-20	-10	-10	10	10	30	-20	10	60	-20	30
1	20	10	-10	-10	-30	0	0	10	40	10	-20
3	-30	0	30	30	40	-40	30	60	-60	40	-20
5	10	-30	10	50	20	40	-40	0	-10	0	-20
7.5	-20	20	10	0	10	-10	-50	20	-70	-30	0
10	0	-30	-30	0	-10	10	20	-10	0	-60	-80
15	-40	20	0	30	-10	10	10	-10	40	-10	-140
20	-30	20	-40	-10	50	-30	30	20	-20	-110	-140
35	-30	20	-10	-40	-40	10	-70	40	-40	-120	-260
50	10	-30	10	-30	50	10	30	-10	-20	-140	-220
75	0	-10	-20	0	-50	0	-70	-10	-80	-110	-270
100	-30	-50	0	-20	10	10	-80	-10	-20	-110	-190

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
150	30	-50	-20	10	-20	-40	-60	0	-60	-90	-150
200	-10	0	40	-40	20	30	-30	-30	-40	-60	-200
350	-10	-20	50	30	10	0	40	20	-100	-30	-140
500	10	10	-30	20	50	-10	-40	-10	-50	-30	-50
750	0	-30	-10	0	-10	10	-10	0	0	-30	-40
1000	0	-30	10	0	20	-10	-20	20	0	-20	-10
1500	-10	-10	0	-20	-10	0	-10	-10	0	-10	-20
2000	0	0	0	0	-10	-10	10	0	-20	-10	-30
Case 5											
1	20	60	70	20	-10	-10	-30	-10	-100	-20	-20
1.25	60	-20	20	40	0	0	10	80	-60	-40	-40
2	40	-10	-20	-10	0	0	-10	20	-10	-10	-20
2.25	0	-60	-20	-90	-10	60	-20	10	10	-20	-60
2.75	-30	20	20	10	20	-20	50	20	20	40	-40
3	10	-30	60	-20	40	-10	-80	-40	10	-30	-40
Case 6											
30	20	-40	-80	0	-	20	-10	-80	-20	20	-30
35	50	-60	-60	0	-	0	50	-30	-10	30	0
40	-30	-10	40	-20	-	-20	0	-10	-40	10	-30
45	40	-30	100	40	-	-40	10	30	-20	30	20
50	40	30	-30	0	-	-40	20	40	40	-20	-20
55	-10	10	30	20	-	-90	60	30	-10	30	-20
60	-30	0	-50	10	-	50	60	-40	20	-20	20
65	30	0	-80	-10	-	60	30	30	-20	0	0
70	10	20	30	-90	-	-30	-30	10	-30	-10	-10
Case 7											
1E-20	50	-30	-30	-20	40	-10	80	-10	0	-10	-40
0.05	-30	-10	40	60	-20	40	0	30	10	-90	-90
0.1	-20	30	0	0	-30	-20	-20	-20	-60	-20	-40
0.2	0	-70	50	30	10	-40	20	-60	-20	-10	-50
0.3	-20	-60	30	-30	10	-20	-30	10	80	-40	-40
0.4	0	40	10	10	0	40	-10	10	-40	20	-110
0.5	-20	40	10	-50	20	-10	-20	30	10	-40	-70
0.6	30	-70	20	60	-40	10	20	20	-10	-30	-50
0.7	-10	10	-30	30	-30	50	40	30	40	-10	-50
0.8	10	20	-10	-60	10	-40	-40	10	30	20	-40
0.9	10	10	0	-10	40	30	0	0	-40	-10	-10
0.95	30	30	10	-20	20	0	10	20	-20	-20	-20
1	50	-30	10	-50	0	-10	-20	10	0	-20	-40

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 8											
1	-20	-40	40	-10	-20	-30	-30	-20	-40	-110	-160
1.5	80	0	0	10	10	-60	0	-30	-10	-50	-160
2	0	-30	0	-10	50	20	0	-10	0	-80	-50
2.5	30	-20	30	10	20	-40	0	-30	-40	-100	-110
3	-10	-30	0	-10	-40	-10	-30	10	20	-10	-70
4	-30	0	-10	-20	10	-50	-30	-20	-10	-50	-100
5	60	-40	60	0	20	0	50	-40	40	-20	-100
6	0	-20	-10	10	0	20	10	0	10	10	-80
7	60	40	0	-30	0	10	20	-40	-30	-20	-10
8	-30	50	-30	-20	0	20	-50	20	-30	0	-30
9	-20	30	10	60	10	40	70	-10	-10	-30	-10
Case 9											
0	40	10	10	0	-60	-30	-20	-20	-30	20	10
0.5	10	10	10	10	10	-40	-40	10	-20	-10	20
1	50	30	40	20	40	10	0	20	-30	10	-60
3	10	10	10	-10	-30	90	-20	20	-20	-30	-110
5	-10	-30	-20	20	10	20	40	30	-20	-70	-180
7.5	-40	40	60	-20	20	20	20	-20	-20	-70	-240
10	20	-30	0	-50	-10	-30	-10	-30	-60	-120	-290
15	10	-30	0	-10	40	-70	-60	-20	-70	-230	-390
20	10	-10	-10	-10	-20	-20	-50	-30	-50	-190	-380
35	50	0	-30	-50	-60	-40	-60	-30	-30	-180	-340
50	0	-40	10	-40	-70	-30	-60	-50	-100	-220	-360
75	-10	-10	-20	-40	0	-60	-40	-20	-70	-120	-220
100	20	-40	-30	-30	-40	-10	-40	-40	-50	-150	-220
150	-70	-40	-10	-10	30	-60	0	20	-30	-120	-180
200	10	-10	-70	10	-10	-40	-20	10	-40	-30	-120
350	-10	10	0	0	0	-10	0	10	-10	-10	-70
500	-10	10	-40	-20	0	-10	0	-30	-10	-30	-30
750	-10	0	0	10	0	-10	0	-10	-10	0	-10
1000	-10	10	-10	0	0	10	10	0	0	0	-10
1500	0	0	0	10	0	-10	0	0	10	0	0
2000	10	10	0	-10	-10	0	0	0	0	0	0
Case 10											
0	0	-20	10	10	30	70	30	-10	-30	40	-40
0.5	10	-20	40	20	-20	-10	40	-70	10	0	0
1	0	20	-20	-20	50	60	10	-20	-30	-20	-20
3	10	-10	40	30	-30	-40	-10	-20	-40	-100	-160

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
5	20	10	-40	20	-20	-40	-60	-50	-50	-110	-240
7.5	-10	30	0	20	0	-80	-60	-30	-120	-170	-250
10	0	-20	20	30	10	-60	-80	-20	-110	-260	-300
15	40	30	20	20	-40	-60	-20	40	-50	-180	-370
20	0	-20	0	0	-60	-60	-40	-40	-100	-190	-360
35	40	-20	10	-40	-50	-30	-30	-30	-60	-150	-300
50	30	0	10	-30	0	10	-30	-20	-70	-110	-210
75	40	-10	20	10	-40	-50	0	20	-40	-80	-180
100	10	-10	-20	20	10	10	-20	-30	20	-70	-130
150	10	10	0	0	20	20	50	10	-20	-20	-100
200	-20	0	20	0	0	-10	10	20	10	-10	-90
350	10	-10	10	-10	10	10	10	0	-10	0	-20
500	10	-10	-10	-10	10	0	-10	0	0	-10	-10
750	-10	0	10	10	-10	0	0	0	-10	0	-10
1000	10	10	10	-10	0	10	0	10	0	-10	-10
1500	0	0	-10	10	0	0	0	0	0	0	0
2000	-10	0	0	10	10	0	-10	0	0	0	-10
Case 12											
0	-50	-10	-10	40	-	20	-30	20	40	-60	60
0.5	-10	-80	0	-10	-	-10	10	40	10	-20	-30
1	-10	0	20	50	-	10	0	10	-20	-10	-50
3	-70	-30	-20	-30	-	20	-20	-50	-20	-60	-120
5	-20	-60	-10	-40	-	-20	30	-20	-50	-80	-170
7.5	-20	40	-20	20	-	-110	-100	-30	-70	-120	-300
10	10	-50	-40	-60	-	-40	-30	-50	-60	-220	-310
15	-10	-20	20	-50	-	-30	-40	-20	-80	-140	-360
20	-20	10	-30	-30	-	-90	-20	-50	-50	-190	-380
35	10	-60	20	-30	-	-40	-50	-70	-30	-220	-450
50	60	-60	-30	-30	-	-10	-70	-50	-50	-210	-500
75	0	-20	-30	-60	-	-10	-40	0	0	-190	-510
100	-40	30	-50	-10	-	10	-20	-60	0	-130	-470
150	30	0	20	-30	-	0	0	-40	50	-70	-480
200	0	-20	-20	10	-	30	30	40	50	-20	-410
350	-50	-10	40	10	-	-10	20	10	90	30	-310
500	30	40	-20	-30	-	30	-20	50	100	50	-240
750	10	-30	20	-20	-	-20	-20	60	40	100	-160
1000	-20	-50	70	-20	-	-10	0	120	50	20	-150
1500	-10	0	30	-10	-	0	-10	50	50	80	-90
2000	10	20	-10	20	-	-10	0	20	40	30	-60

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
Case 13											
0	10	10	-10	10	-	-30	30	-10	-50	-20	-30
0.5	10	50	10	-10	-	10	-40	30	-10	-20	-80
1	-40	30	40	-30	-	10	-20	20	-20	-20	-10
3	40	-20	-10	20	-	40	50	20	20	-20	-50
5	50	30	-20	-20	-	-10	10	10	40	-30	0
7.5	-20	10	-30	0	-	20	0	20	-30	-20	-60
10	30	0	20	20	-	10	20	-20	0	10	-30
15	0	20	-20	10	-	10	-30	0	-40	-40	-120
20	-50	20	20	-30	-	30	40	-20	-60	-60	-160
35	10	0	0	30	-	-50	-10	-110	-70	-130	-280
50	-30	-60	0	10	-	20	-50	-90	-70	-160	-280
75	-60	0	0	-40	-	30	-20	-20	-40	-150	-230
100	30	-40	-60	-40	-	-20	-70	-50	-40	-150	-230
150	0	-10	0	10	-	30	0	-30	-50	-100	-190
200	0	40	10	-60	-	10	-20	30	-40	-50	-140
350	-40	-30	30	0	-	-10	0	40	50	-30	-60
500	0	0	-10	-30	-	-20	-20	-30	10	-40	-40
750	0	0	-20	10	-	-40	0	0	-10	-20	-40
1000	20	10	-30	10	-	20	-20	0	0	-10	-40
1500	-10	0	-20	0	-	10	0	-10	-20	-20	10
2000	-20	-20	20	20	-	-20	-10	20	0	0	0
Case 14											
0	-20	-10	-10	-80	-	-10	10	-10	30	0	20
0.5	70	-20	0	30	-	-30	-20	20	-10	-60	-50
1	40	30	0	10	-	20	-10	20	-10	-10	-50
3	10	-30	0	-20	-	-40	-50	0	-20	-30	-70
5	0	10	-10	-60	-	-10	-40	-20	-80	-80	-160
7.5	10	-50	-30	-30	-	30	-10	-20	-30	-150	-230
10	50	10	-10	-10	-	-10	10	-40	20	-150	-270
15	30	10	-50	-30	-	-40	-60	-100	-80	-190	-290
20	-20	-40	-40	0	-	-10	-60	-30	-80	-260	-460
35	-50	-90	-10	-40	-	-50	-20	-60	-100	-210	-380
50	0	10	-30	0	-	-40	0	-90	-110	-230	-310
75	-30	-10	-80	-30	-	-30	-30	-70	-70	-120	-270
100	-10	-30	30	0	-	-10	-30	-70	-90	-130	-220
150	-20	10	0	-10	-	10	40	-60	-20	-70	-190
200	-30	0	0	40	-	-10	-40	70	0	-80	-60
350	0	20	-20	-40	-	-10	10	-30	-10	-40	-60

	193K	233K	263K	273K	273Kw	293.6K	313K	373K	500K	800K	1073K
500	0	-20	-20	0	-	0	0	30	10	-10	-70
750	-10	-10	0	-10	-	-10	-10	0	0	-20	-20
1000	0	-10	0	10	-	-10	0	0	0	-20	-10
1500	0	0	0	0	-	0	0	-10	10	-10	0
2000	0	0	0	0	-	10	-10	0	10	0	-10
Case 15											
0	-40	-10	20	50	-	-10	10	20	-30	-40	0
0.5	20	-20	-20	-20	-	0	-10	-10	20	10	-20
1	20	40	-20	0	-	-20	0	30	0	-10	-40
3	-50	-30	-30	-40	-	10	-30	20	-20	-90	-130
5	-10	-50	-80	-50	-	-40	-30	0	-80	-200	-180
7.5	-10	20	0	-50	-	-50	-20	-60	-120	-170	-280
10	10	-50	-10	-10	-	-40	0	-60	-70	-170	-330
15	-20	30	-10	-70	-	10	-50	-100	-40	-180	-330
20	10	-50	-40	0	-	-110	30	-50	-100	-160	-370
35	-10	0	-50	-10	-	-40	20	-20	-60	-170	-280
50	40	-30	-30	10	-	-30	-30	-30	-60	-130	-290
75	30	-10	0	-30	-	-10	-40	-20	-20	-120	-160
100	40	-30	40	-10	-	10	-10	-30	-20	-60	-150
150	-10	20	0	30	-	10	10	-20	-10	-20	-90
200	20	10	-20	10	-	-10	-20	10	-10	-10	-80
350	10	10	0	-20	-	10	10	-20	0	-10	-30
500	20	0	0	10	-	-10	20	0	-10	10	-20
750	0	-10	0	0	-	10	10	0	0	0	-20
1000	10	0	10	0	-	0	0	0	20	0	-10
1500	0	0	0	0	-	10	0	10	0	10	0
2000	0	0	0	0	-	0	10	0	0	0	0

Table C-15: Comparison of ice and water for 273.15 K homogeneous cases without absorber

	Case 3 Δk_{f-i}	Case 3 Δk_{f-w}	Case 3 Δk_{i-w}	Case 4 Δk_{f-i}	Case 4 Δk_{f-w}	Case 4 Δk_{i-w}	Case 9 Δk_{f-i}	Case 9 Δk_{f-w}	Case 9 Δk_{i-w}	Case 10 Δk_{f-i}	Case 10 Δk_{f-w}	Case 10 Δk_{i-w}
0	-20	30	50	10	30	20	10	-40	-50	20	60	40
0.5	0	30	30	-10	-20	-10	-20	-30	-10	-10	-30	-20
1	-20	50	70	30	-10	-40	-30	-80	-50	-20	30	50
3	10	0	-10	0	-40	-40	50	30	-20	10	40	30
5	-50	-40	10	0	50	50	10	-10	-20	30	20	-10
7.5	0	-10	-10	30	10	-20	70	70	0	90	80	-10
10	140	130	-10	20	-10	-30	90	80	-10	30	130	100
15	360	360	0	120	120	0	140	80	-60	120	110	-10
20	540	500	-40	120	150	30	150	140	-10	90	150	60
35	960	950	-10	180	130	-50	200	190	-10	210	160	-50
50	1210	1230	20	260	230	-30	230	190	-40	190	130	-60
75	1530	1430	-100	350	290	-60	200	180	-20	100	110	10
100	1710	1580	-130	370	270	-100	280	210	-70	100	150	50
150	1690	1530	-160	320	270	-50	240	180	-60	120	100	-20
200	1560	1380	-180	400	280	-120	210	160	-50	120	100	-20
350	1110	920	-190	330	260	-70	220	140	-80	190	150	-40
500	660	590	-70	330	220	-110	220	160	-60	220	150	-70
750	200	160	-40	250	210	-40	230	160	-70	230	190	-40
1000	-100	-80	20	260	180	-80	200	160	-40	170	130	-40
1500	-420	-320	100	230	150	-80	170	110	-60	180	130	-50
2000	-550	-430	120	200	80	-120	160	110	-50	190	110	-80

Table C-16: Comparison of ice and water for 273.15 K heterogeneous cases without absorber

	Case 5 Δk_{f-i}	Case 5 Δk_{f-w}	Case 5 Δk_{i-w}
1	740	780	40
1.25	930	1110	180
2	1980	2400	420
2.25	2340	2820	480
2.75	3220	3830	610
3	3660	4280	620

	Case 7 Δk_{f-i}	Case 7 Δk_{f-w}	Case 7 Δk_{i-w}
0	180	250	70
0.05	270	270	0
0.1	260	260	0
0.2	320	390	70
0.3	610	610	0
0.4	1010	1040	30
0.5	1470	1550	80
0.6	2040	2130	90
0.7	2580	2690	110
0.8	3160	3290	130
0.9	3710	3820	110
0.95	3970	4090	120
1	4230	4350	120

	Case 8 Δk_{f-i}	Case 8 Δk_{f-w}	Case 8 Δk_{i-w}
1	180	170	-10
1.5	190	250	60
2	220	270	50
2.5	290	440	150
3	390	560	170
4	730	950	220
5	1080	1380	300
6	1440	1800	360
7	1860	2320	460
8	2290	2790	500
9	2620	3100	480

Table C-17: Comparison of ice and water for 273.15 K homogeneous cases with absorber

	Case 3 Δkf-i	Case 3 Δkf-w	Case 3 Δki-w	Case 4 Δkf-i	Case 4 Δkf-w	Case 4 Δki-w	Case 9 Δkf-i	Case 9 Δkf-w	Case 9 Δki-w	Case 10 Δkf-i	Case 10 Δkf-w	Case 10 Δki-w
0	-10	0	10	-20	10	30	0	-10	-10	20	10	-10
0.5	20	10	-10	10	-10	-20	-20	30	50	10	-20	-30
1	20	10	-10	-10	-20	-10	-20	-10	10	-20	50	70
3	10	20	10	30	50	20	0	-10	-10	50	50	0
5	90	120	30	30	30	0	80	80	0	100	90	-10
7.5	210	180	-30	60	30	-30	50	70	20	160	140	-20
10	280	250	-30	10	30	20	80	110	30	230	240	10
15	380	310	-70	90	70	-20	180	210	30	280	250	-30
20	360	300	-60	110	160	50	210	210	0	400	380	-20
35	60	50	-10	210	200	-10	320	330	10	510	470	-40
50	-300	-280	20	200	320	120	410	360	-50	560	520	-40
75	-850	-830	20	320	290	-30	410	470	60	550	500	-50
100	-1220	-1220	0	280	370	90	420	430	10	520	510	-10
150	-1790	-1710	80	300	300	0	390	360	-30	450	450	0
200	-1920	-1860	60	260	330	70	350	340	-10	400	380	-20
350	-1980	-1950	30	260	190	-70	250	260	10	280	270	-10
500	-1770	-1690	80	210	170	-40	170	180	10	200	210	10
750	-1500	-1430	70	100	120	20	150	130	-20	150	130	-20
1000	-1280	-1210	70	100	120	20	110	110	0	110	120	10
1500	-930	-910	20	70	50	-20	80	80	0	80	70	-10
2000	-760	-730	30	50	50	0	60	50	-10	70	60	-10

Table C-18: Comparison of ice and water for 273.15 K heterogeneous cases with absorber

	Case 5 Δkf-i	Case 5 Δkf-w	Case 5 Δki-w
1	50	120	70
1.25	100	190	90
2	120	230	110
2.25	40	260	220
2.75	140	240	100
3	120	240	120

	Case 7 Δkf-i	Case 7 Δkf-w	Case 7 Δki-w
0	20	50	30
0.05	40	0	-40
0.1	50	-20	-70
0.2	0	10	10
0.3	-10	30	40
0.4	10	-10	-20
0.5	-70	40	110
0.6	30	-30	-60
0.7	30	70	40
0.8	0	80	80
0.9	40	170	130
0.95	70	150	80
1	80	140	60

	Case 8 Δkf-i	Case 8 Δkf-w	Case 8 Δki-w
1	-60	30	90
1.5	10	60	50
2	-40	140	180
2.5	10	110	100
3	20	70	50
4	100	170	70
5	70	160	90
6	80	130	50
7	50	180	130
8	50	140	90
9	90	140	50