



## **Safety Toaster with Built-in Smoke Detector** (Ionization Particle Sensor)

### **Justification request**

For: DEFRA  
By: Paul Brown  
Date: 16<sup>th</sup> February 2005

Justification Application Centre (JAC)  
Zone 4/E6  
Ashdown House  
123 Victoria Street  
London SW1E 6DE

**Mr. Paul Brown**  
**Director**  
**Magnetic Design**  
10 Bishops Road  
Trumpington  
Cambridge  
CB2 2NH, England  
Tel: 07786 352 458  
Fax + tel. line 2: 01223 840236

## Toaster using an ionizing smoke detector as a safety device

**Magnetic Design requests DEFRA to confirm and approve that their new product, a toaster using an ionizing smoke detector as a safety device, is a justified use of a radioactive source.**

This presentation outlines the product design and describes the health, safety and social benefits of the practice.

### **Classification:**

According to the The Justification of Practices Involving Radiation Regulations 2004 (SI 2004/1769) it is anticipated and requested the toaster be classified as:

Purpose	Class or type of practice
15. Safety devices	Use of ionizing radiation in smoke and fire detectors and other safety instruments

**The product requiring justification is a standard toaster combined with an ionizing smoke detector (as typically mounted on the ceiling of most properties as a smoke alarm)**

The product uses the smoke detector as a sensing device to monitor the state of the toasting process, instead of using a timer as normally found on most toasters.

It stops the toast burning or smoking and acts as a safety device by detecting smoke and pre-emitted particles at source and then safely switching off the heating elements before smoking occurs.

The sensor gives automatic cooking time adjustment for any bread and offers several key benefits:

- *Will stop toast burning*
- *Will prevent ceiling smoke alarms being accidentally activated*
- *Will encourage healthier eating (no more burnt carcinogenic toast)*
- *Will eliminate fires, damage, inconvenience, injury or deaths due to kitchen fires caused by normal toasters*



**The ionizing sensor offers completely automated timing adjustment for any bread, guaranteeing perfect toast everytime and thus eliminates burnt toast or the potential for fire**

It adjusts the toasting time to compensate for the state of the food, i.e. if the bread is already toasted and is inserted for reheating a *second time* it will reduce the time automatically so as not to burn the food.

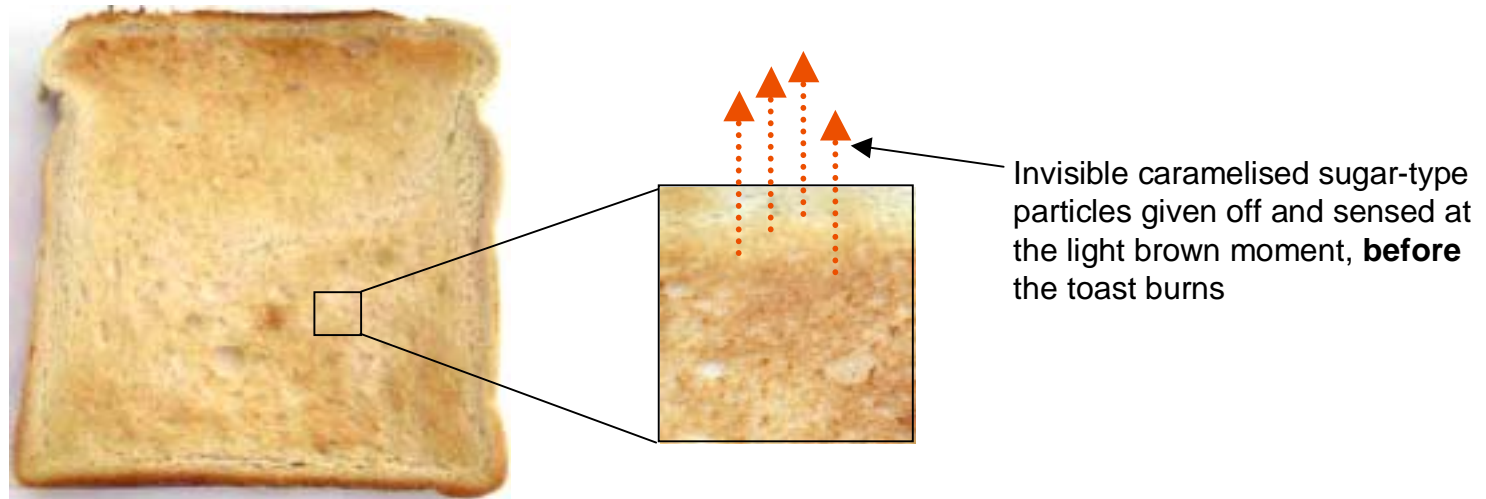
It monitors smoke (carbon) particles but will also measure caramelisation effects. This means the sensor can detect when toast is perfectly light golden brown. Therefore it offers:

- *Perfect toast everytime*
- *Adjusts the cooking time up or down to any bread type and condition (frozen, dry, thick, thin, fruit bun, brown, white, bagel, etc.)*
- *Better cooked food*
- *Less stress at breakfast time*
- *No more smoky kitchens*



### The system is measuring the Maillard caramelisation process (browning effects)

As bread/toast starts to turn light brown complex sugar molecules caramelize within the bread, the colour changes and the bread emits small invisible particles of sugar and toast along with the well known sweet aroma. (Eventually carbon particles would also be given off if the toast was allowed to carry on cooking to a burnt state).

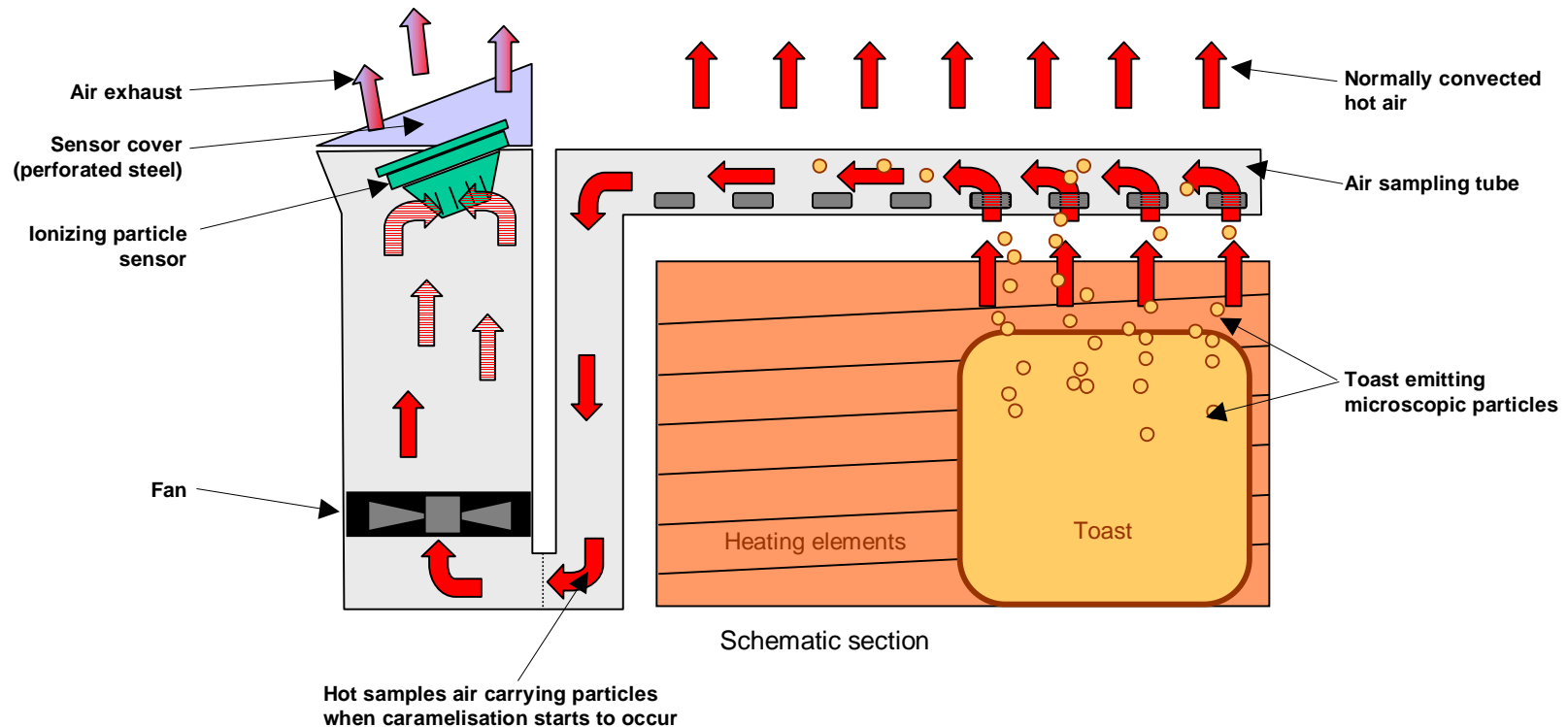


Several complex chemical changes occur during toasting process but the ionizing sensor value changes **ONLY** at the 'Maillard' pigment change moment, so can detect the moment **BEFORE** toast smokes, blackens or burns.

## Ionizing particle sensing toaster- how it works

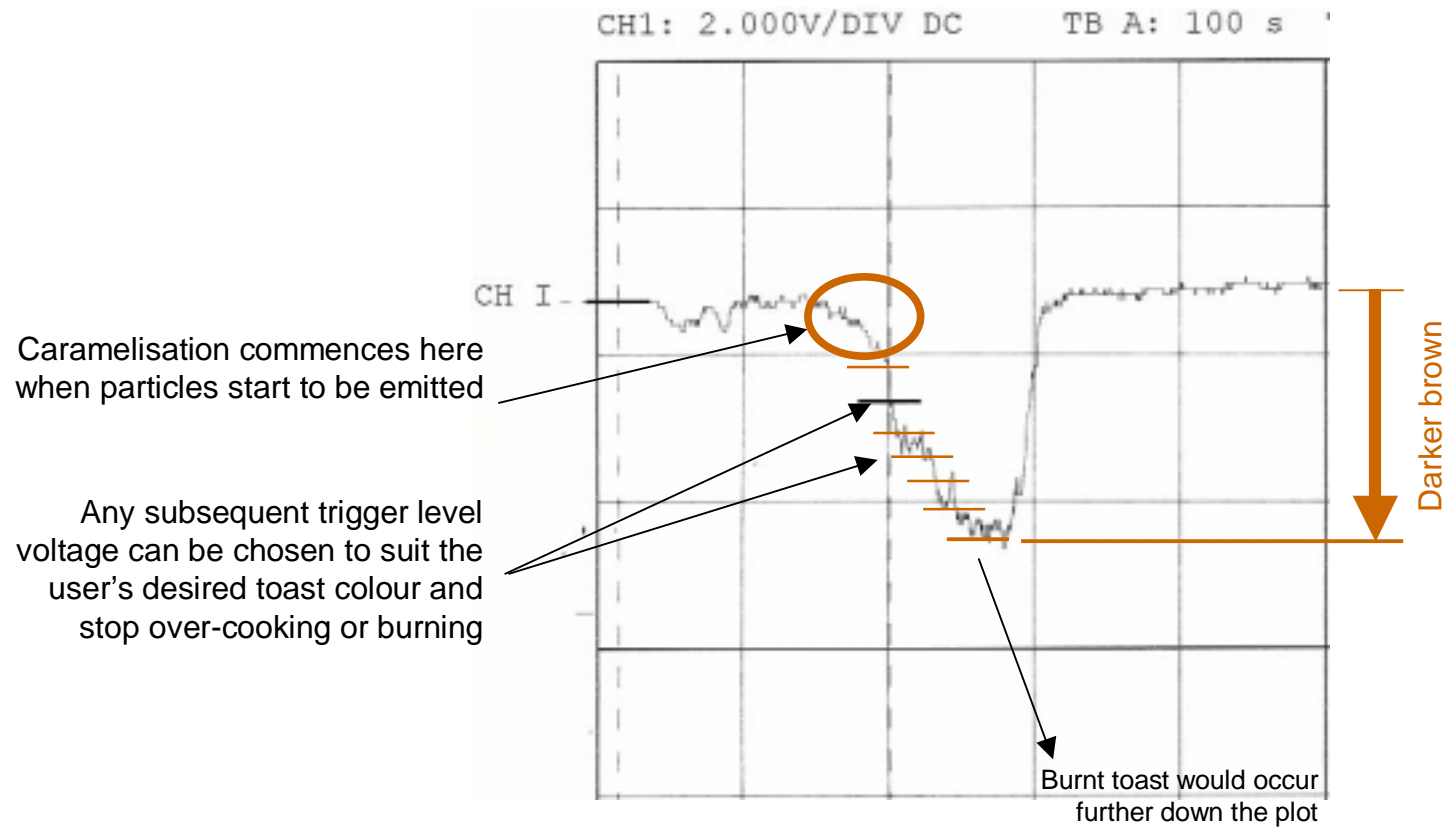
The ionization particle sensing toaster adjusts the toasting time automatically based on real-time readings of particle emissions from the toast monitored throughout the cooking process.

Air-borne particles are sucked off the toast by a fan, down a sampling tube and blown over a particle sensor which measures the state of the toast, popping it up when correctly cooked. It is *impossible* to burn the toast with this system.



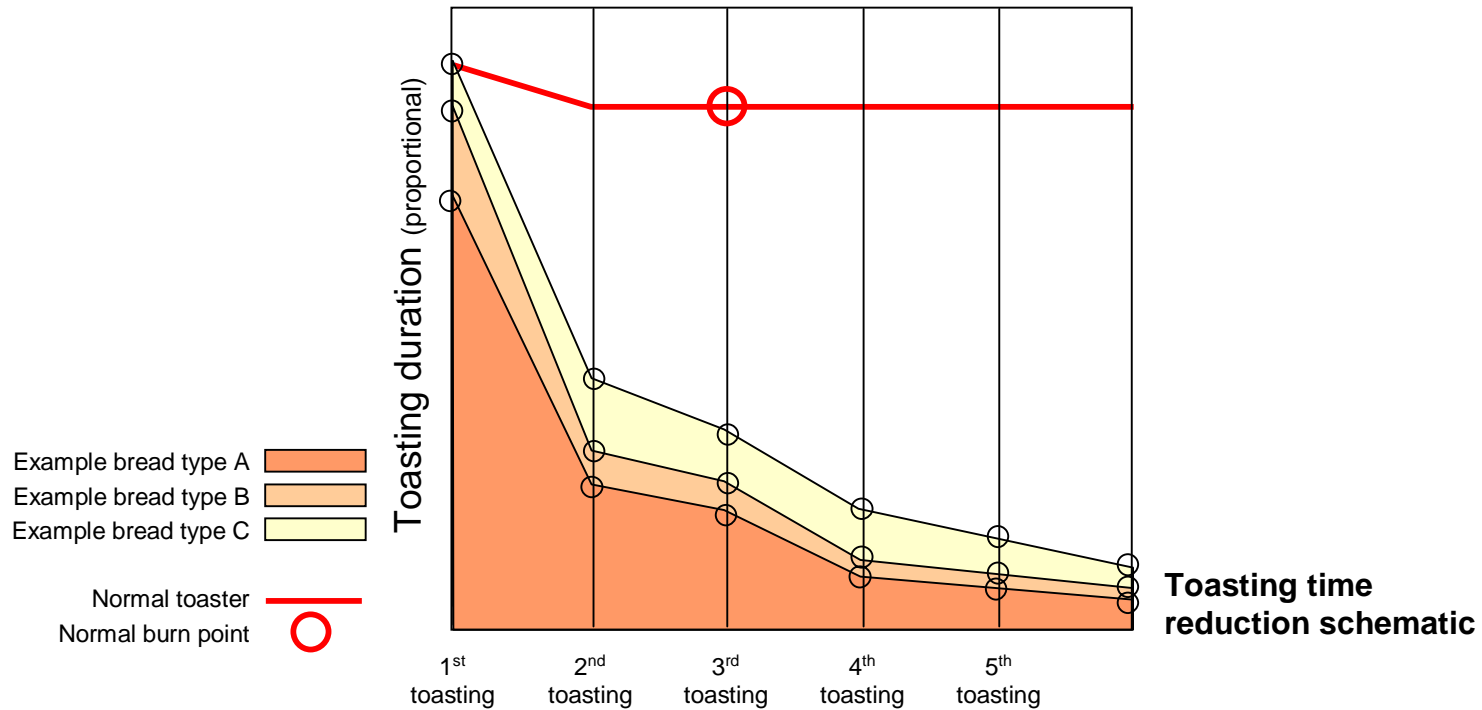
**As the bread starts to brown a distinctive voltage drop occurs within the sensor which can be measured and a trigger point selected to pop up the toast**

Any voltage trigger point can be selected along the declining plot-line, that relates to a certain particle emission and hence brownness level, to pop up the toast at the right colour every time for every bread type.



**The technology is proven to work so well that it is impossible to burn the toast, offering great convenience and safety benefits**

The cooking time is automatically reduced each time the same piece of toast is reheated





## Safety Toaster with Built-in Smoke Detector- Justification request

### The sensor we will use is a standard smoke detector chamber

The sensor is a stock component we will buy from:

#### HTSL (High Technology Sources Ltd.)

Address: High Tech Sources Limited, Unit 6, Moorbrook, Southmead Industrial Estate, Didcot, Oxfordshire, OX11 7HP Tel: 01235 514200

Part ref. **DSCB1C**

Source activity: <37kBq. [1µCi] 241Am

#### Volumes:

Expected annual sales of the safety toaster are 50-120,000 units per annum in the UK.

#### Manufacturer's recycling responsibilities:

Future legislation depicts that manufacturers will be obliged to accept end of life products, such as this safety toaster, for responsible disassembly and recycling where possible. The ionizing sensor is fully removable to comply with this requirement for responsible disposal (see page 11).

The easily removable sensor also enables the user to easily upgrade, service or recycle this component to lengthen the life of the toaster.



**Sources** PRE-RELEASE DRAFT  
**Smoke detector ionisation chamber type DSCB1C**

**General Description**  
The DSCB1C (fig 1) is a small, compact and robust dual ionisation chamber of advanced design containing a single radioisotope source producing ionisation in both chambers. The chamber has a unique internal geometry, which allows the detector chip to be positioned beneath the chamber within a recess in the moulded plastic base. Pins of the chip can be connected directly to the collector electrode inside the protective RF shield of the cover. This isolates the highly sensitive connection between the collector electrode and pin 15 from other parts of the detection circuitry and it provides a high degree of immunity from external electrical interference.

The external design features and dimensions of the DSCB1C can be seen in figures 2 and 3. The electrodes and source holder are made of AISI 304 stainless steel. The plastic insulator material is specially chosen for its exceptional mechanical stability and resistance to moisture and oxidising chemicals in the air. The units are supplied assembled and ready to mount on a suitable printed circuit board using the pre-trained tags provided.

Details of the sealed source design can be found in the data sheets 'Americium-241 alpha foil and sources' (6) and 'Safety and Packaging' (5). Both of these are available on request. In accordance with OECD requirements (7) the source activity is less than 47kBq (1µCi) 241Am. The Recommended Working Life of the source is 10 years. The BS/ISO/ANSI rating of the ionisation chamber is C15000.

The design, manufacture and testing of the DSCB1C is managed within the scope of AEA Technology's Quality System which is certified by Lloyd's Register Quality Assurance for compliance with BS EN ISO9001:1994 (8).

AEA Technology expertise in the design and construction of ion chambers is well established and wide-ranging. A consultancy service is available to assist in the design of systems using ion chambers and in the provision of testing and computational modelling services to measure and model the performance of customers' own designs.

The internal design of the DSCB1C is shown schematically in figure 4. This figure highlights the compact internal design features and the location of the ion cloud within the chamber.

United Kingdom: 100 Harwell, Didcot, OX11 0QD, Tel: +44 (0)1235 440191  
United States: 60 North Avenue, Burlington, MA 01803, Tel: +1 781 379 8000  
Germany: Gabel, Glasberg 1, D-69114 Sinsheim, Tel: +49 (0)6207 991111  
Hong Kong: Suite 1808 14/F, Central Plaza, 18 Harbour Road, Wanchai, Tel: 00 852 8118 1998

AEA Technology is a business unit of AEA Technology plc

Fig 1. DSCB1C



Fig 2. Side view



Fig 3. Bottom view



AEA TECHNOLOGY

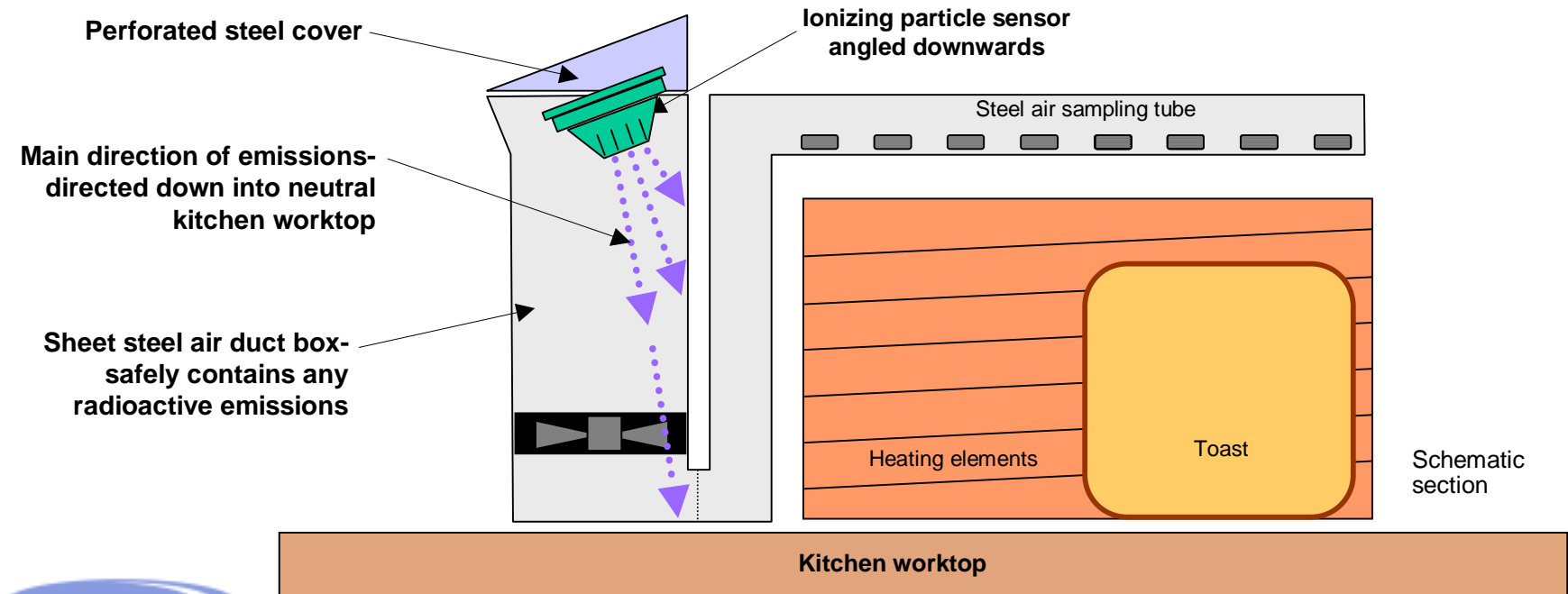
10 of 11 Q24421-01-08 (en) 1

**The system is designed for maximum safety as the sensor is mounted within a steel casing, thus reducing any emissions to the user to virtually zero**

The sensor is mounted upside-down inside a sheet steel air duct box capped with a perforated steel cover. This thoughtful design reduces any emissions, and therefore exposure levels, to virtually zero for safe use by consumers, in even in daily close proximity to the toaster (NRPB to confirm tests).

**Design safety benefits:**

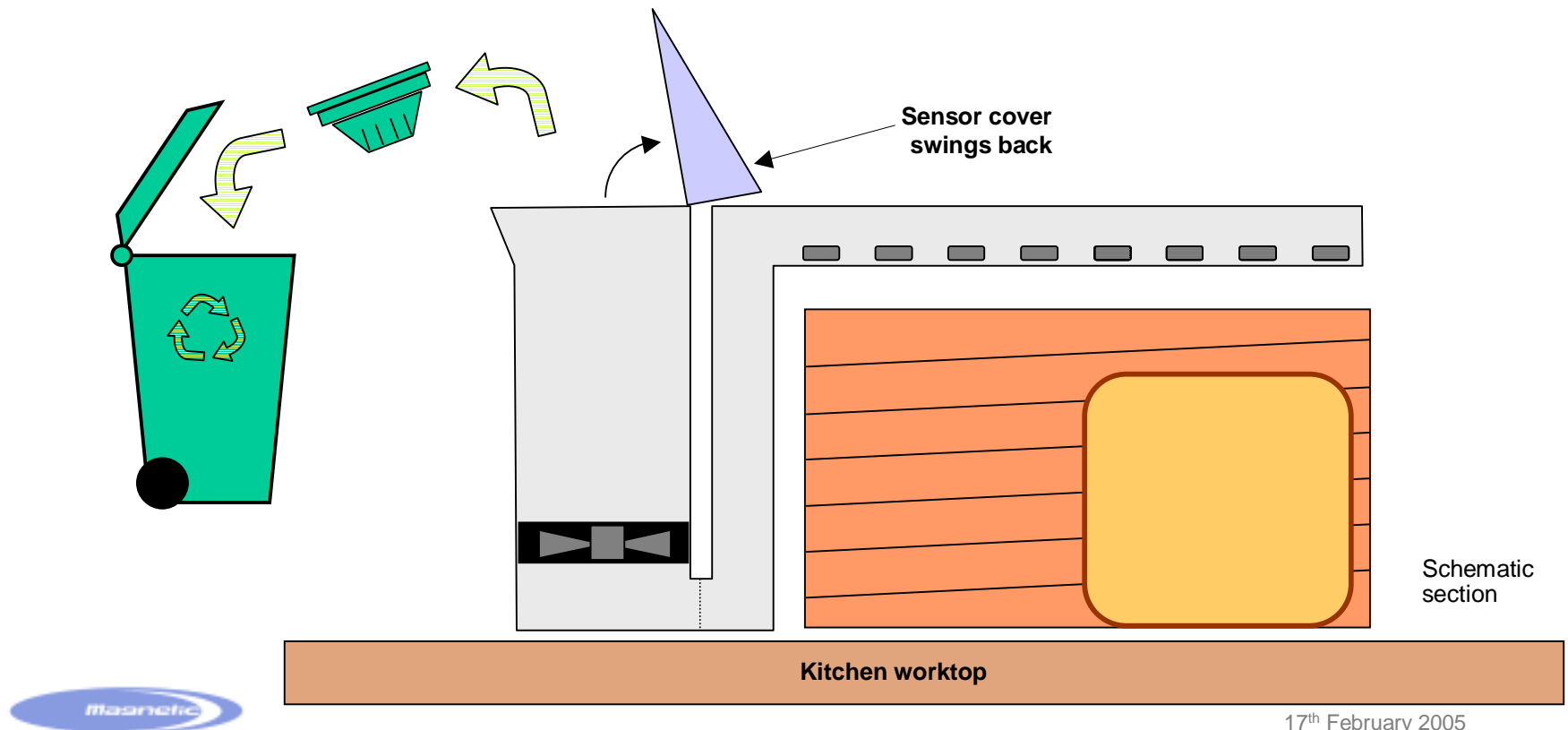
- Any extraneous emissions from the sensor are directed safely downwards into the kitchen worktop
- In addition to this any extraneous emissions from the sensor are safely contained within the steel air duct box



## For responsible disposal and future recycling the sensor is easily removable

The sensor can easily be removed for:

- Responsible environmental disposal in dedicated bins for ionizing smoke detectors etc. (possibly introduced in the future)
- Recycling (possibly introduced in the future)
- Servicing or replacing the sensor



**The benefits of the safety toaster include:**

- Will never burn or blacken the toast
- Safety feature- will prevent accidental fires, injury or deaths caused by poorly controlled toasters
- Health benefits (no more carcinogenic burnt toast)
- Will reduce accidental triggering of smoke alarms (a major problem in hospitals)\*
- Will eliminate the common annoyance of smoky kitchens
- Automatic time adjustment to cook or reheat any type of bread/bun/roll/bagel perfectly
- Gives a more convenient and relaxing user experience

**\* Poorly controlled toasters not only cause inconvenience in homes but are a major problem in UK hospitals, hotels, student flats etc. whereby fire crews are called out automatically and residents/patients are evacuated with the associated down-time, expense, inconvenience and trauma caused. The safety toaster will resolve this issue.**

see next pages for details>



## Safety Toaster with Built-in Smoke Detector- Justification request

---

### **The safety toaster will help resolve a national common problem of smoking toasters causing patient and staff evacuations in UK hospitals:**

Hello Paul

I am enquiring about your developments on the non burn toaster.

I work for a NHS Trust and we have a problem with false callouts to the fire brigade, mostly due to burnt toast. The fire brigade is having a national program to try to reduce unnecessary callouts and I think that a non burn toaster would be welcomed, not only by my Trust but hospitals around the country.

Can you please advise if you have developed your product and if so when it will be available to purchase?

Thanks

John Roberts

EBME Department

Countess of Chester Hospital      Please respond to [EBME@COCH.NHS.UK](mailto:EBME@COCH.NHS.UK)

---

Dear sir

I represent the National Association of Hospital Fire Officers and as you are probably aware the healthcare sector suffers more than it should from false alarms caused by burning toast.

We were therefore delighted to hear of your 'Intelligent Toaster' and congratulate you on the Design award which will allow you to develop your idea.

As the editor of the Association Newsletter, which goes to about 380 members, I wonder if it is possible to run an article on your product and if so could you send me a picture of the toaster. I have the copy from the Daily Mirror but it is not a good copy and I did not want to just scan that without your permission.

Yours sincerely

Phil Cane

Fire Safety Manager    Tel: 01603 421930



17<sup>th</sup> February 2005



## The safety toaster will help resolve a national common problem of evacuations in UK hospitals (cont.):

Paul

Your query relating to fire alarms in NHS premises caused by toasters has been passed to me for a response. The idea of your invention does have some appeal as toaster related incidents in the NHS are a significant problem, and Trusts are constantly looking to reduce the burden of unwanted fire signals.

With regard to your specific queries: No. of false alarms caused by toasters- we don't collate the information centrally down to this level, it is more likely to be held at each individual Trust. We do however know that overall in an acute healthcare setting, 43% of incidents are related to cooking which includes toaster incidents. In patient access areas alone, the figure is 32% related to cooking, many of which are likely to be related to toasters. In non-patient access areas, the figure is 56%, most of which are more likely to be cooking rather than toasters. Cost to the NHS for calling out fire service - no direct financial cost. There is an indirect cost associated with taking staff away from their normal working for the duration of the alarm, the disruption to patient care etc. An estimate of cost to the fire service for a call out would be in the region of £250 - £300 per appliance. How many toasters does the NHS have - how long is a piece of string? You could estimate one toaster in each ward/department as an average. Some may have more than one, others may not have any. They would also be in the staff residences, and this could be in the kitchen areas of even individual rooms. Wild guess - 1000's.

I don't know if this information has been of any use to you. If you are planning a demonstration, I would be interested in viewing as, I'm sure, would my colleague Colin Newman of Inventures (currently the consultancy arm of NHS Estates). Colin is involved in drafting guidance on behalf of the Agency specifically on reducing unwanted fire signals.

If I can be of any further help, or you want to contact me, my details are below.

Paul Roberts  
Fire Safety Adviser  
NHS Estates (An Executive Agency of the Department of Health)



## Safety Toaster with Built-in Smoke Detector- Justification request

---

### **The safety toaster will help resolve a national common problem of evacuations in UK hospitals (cont.):**

grahamcs@chsheff-tr.trent.nhs.uk  
cc:"Stephen Price(Email)"stephenp@chshefftr.trent.nhs.uk  
To:paul.brown@camcon.co.uk  
09/26/02 04:17 PM

Subject: burning toast.....

Dear Paul,  
Watched 'Tomorrow's World' last night, the awards, and was extremely interested in your toaster. I work in the 'estates' department at one of the country's largest Community Health NHS Trusts. Our Mental Health wards are continually 'burning toast' and activating alarms and causing on average 2 to 3 unnecessary Fire service attendances per week. This is costing the country a lot of money.....

We would be very pleased to hear from you, and to discover how far you have got with the development of your ideas. We are based in Sheffield.

Yours sincerely  
Graham C. Scott



17<sup>th</sup> February 2005



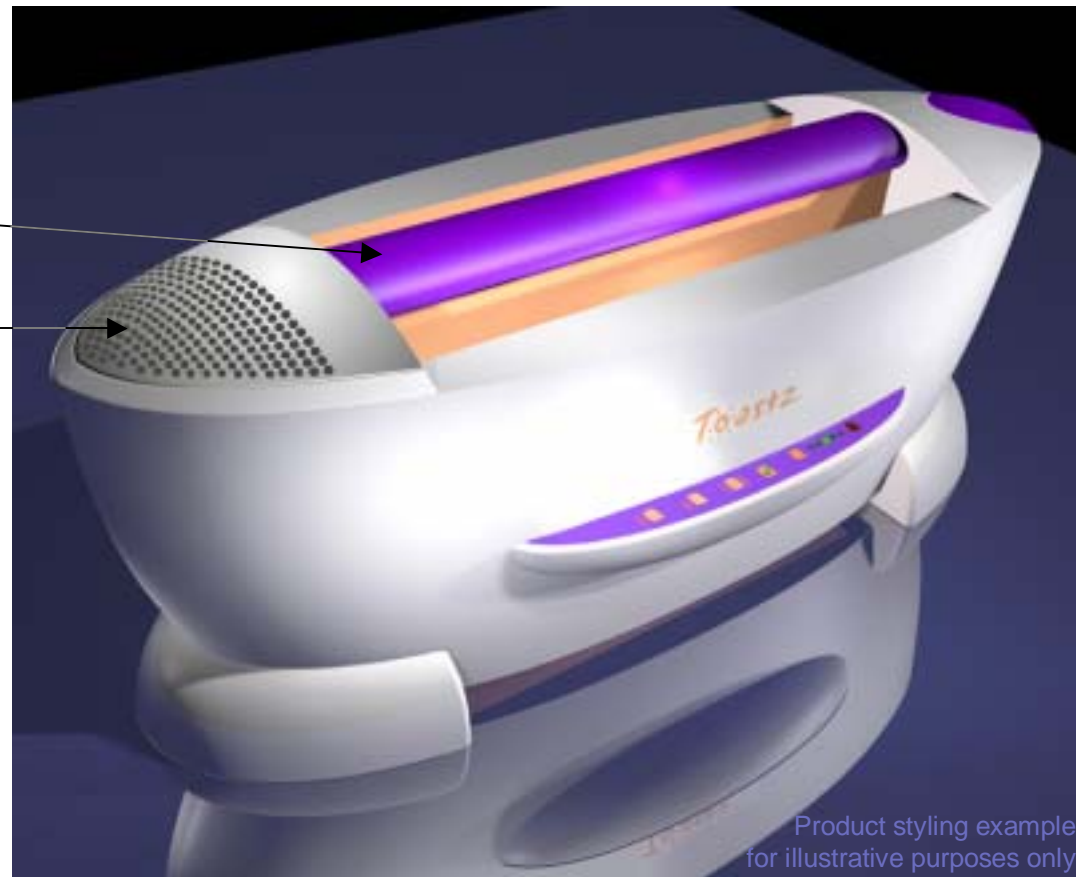
Safety Toaster with Built-in Smoke Detector- Justification request

---

The safety toaster could appear like this with the sensing tube visible across the top and the sensor cover to the side

Particle sampling tube

Perforated steel cover  
over the sensor



## Justification- summary

We believe the safety toaster is a justified practice involving ionizing radiation.

It has significant social, health and safety benefits and all with negligible exposure to users.

## Timing

We wish for approval of justification to be passed *as soon as possible*.

We cannot continue with development without DEFRA's approval and this important project is currently suspended as we wait.

*Your prompt attention would be much appreciated. Please call me if you need any further information:*

## General note:

The safety toaster is a DTI SMART funded project (now completed) with the obligation to commercialise the technology as soon as possible. We have two well known UK brands wishing to go-ahead with production but neither of which will proceed unless DEFRA agrees the practice is justified. I look forward to hearing from you soon.

**Mr. Paul Brown**  
**Director**

**Magnetic Design**

10 Bishops Road

Trumpington

Cambridge

CB2 2NH, England

Tel: 07786 352 458

Fax + tel. line 2: 01223 840236

