

NRSPM

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DEPARTMENT OF THE ENVIRONMENT  
2 MARSHAM STREET LONDON SW1P 3EB  
01-212 3434

My ref: J/PSO/18009/83

Your ref:

18 July 1984

Dear Kenneth:

When Patrick Jenkin wrote to you on 11 January he promised to let you know the outcome of any appeal made by Mercury Communications Limited against the refusal of planning permission for the installation of microwave radio aerials and transmission equipment at Sunley Building, Manchester.

You will be glad to know that, following a public inquiry, we have accepted the Inspector's recommendation to allow the appeal. The decision has been issued today and I am enclosing a copy of the letter for your information.

/ I am copying this letter to the Prime Minister.

Neil

NEIL MACFARLANE

The Rt Hon Kenneth Baker MP



Departments of the Environment and Transport

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Your reference  
EMS/MMM/CAW/LN217 and 9  
Our reference  
APP/B4215/A/84/11021  
Date

18 July 1984

Gentlemen

TOWN AND COUNTRY PLANNING ACT 1971  
APPEAL BY MERCURY COMMUNICATIONS LTD  
LOCAL AUTHORITY APPLICATION NO F20178

1. I am directed by the Secretary of State for the Environment to say that consideration has been given to the report of his Inspector, Mr H M A Stedham ARICS, FRTPi who with his Assessor Mr M H Walters MIEEE during the period 11-13 April and 3-4 May 1984 held a local inquiry into your clients' appeal under Section 36 of the above Act against the decision of Manchester City Council to refuse planning permission for the installation of microwave radio facilities at Sunley Building, Piccadilly Plaza, Manchester. This comprises:-

- "i. Replacement of an existing Pye Radio mast on roof with 7m high stub tower;
- ii. Erection of one 1.2m diameter and five 0.6m diameter dish antennae on stub tower;
- iii. Relocation of radio antennae on Pye Radio mast on to the stub tower;
- iv. Erection of four quadrant antennae on roof;
- v. Use of part of gallery level of building as radio equipment room".

2. The Inspector in his report, a copy of which I enclose, concluded that:-

"Bearing in mind the above facts, I am of the opinion that there is insufficient evidence to support a conclusion that the proposed installation would pose a potential threat to the health and safety of the general public or persons employed in connection with it. I appreciate that experiments carried out on various small objects suggest that microwave radiation at any frequency or power density level cannot be guaranteed to be free from potential harmful effects to

human beings. Nevertheless to justify banning on health and safety grounds something which has long been in ordinary everyday use without evidence of harm, I consider that it is necessary to go further than merely establishing that there is no absolute proof of an absence of harmful effects and to show that there are significant reasons for believing that the health or safety of human beings are likely to be put at risk.

"The National Radiological Board, a body set up by Parliament to undertake research and advice on protection from radiation hazards, is apparently satisfied on the basis of measurements and worst case calculations by its own staff about possible health hazards from Mercury equipment. The Health and Safety Executive's advice to the council that the installation would not cause a health hazard to persons in close proximity or significantly affect existing low-level radiation was confirmed in evidence given at the inquiry.

"I accept the opinion of the Assessor that a planning inquiry is not the right place to revise the country's safety standards, and I note that the consultative document published by the NRPB in December 1982, which put forward proposals for amending safety standards, took account of non-thermal effects. Worst case calculations show the emissions from the proposed antennae to be far below the amended standards and below the most stringent standards applicable anywhere. I agree with the conclusion of the Assessor that there is no reason for a low power installation to the proposed standard to be refused permission on health hazard grounds, and in the next paragraph I deal with the one reservation which he makes.

"The Assessor's reservation concerns the possibility of persons being subjected to a field from the quadrant antennae which might be harmful. As several different companies have installations on the roof, he considers that there is a possibility of these antennae being approached when not switched off for maintenance by persons without full knowledge of their characteristics. His suggestion at the inquiry of a higher mounting would make these antennae more conspicuous in views of the building. During our visit to the roof of the building after the inquiry, the Assessor was satisfied that the 2 quadrant antennae on the long sides of the building could not in practice be approached inadvertently. He considers however that acceptance of the plans should be subject to some means of restricting close access to the 2 other antennae at the ends of the building. Whilst I see no objection in principle to covering this point by a condition it may be felt that, now attention has been drawn to this problem, the manner in which the interests of safety and amenity can best be reconciled is a matter which could reasonably be left for settlement, possibly at the particular location, by representatives of the Health and Safety Executive, council and appellants.

"No objection has been raised on the grounds of the effect of the proposed tower and aerials on appearance. Structures and equipment on the roof of this very tall building are generally not visible from the near vicinity, and in the long distance views they would be seen from so many different angles that it is difficult to generalise on the effect of additions and replacements on appearance. I do not disagree with the opinion expressed by the City Planning Officer in his report to the Planning Committee on 13 December that the proposals would be no worse than, and possibly an improvement on, the existing situation.

"Subject to condition 4 being amended to cover the extra height of 0.25m, which was not opposed by the council and would not significantly affect appearance, the appellants do not object to the conditions recommended in the City Planning Officer's report except for No 3. Although theoretically this condition is not necessary, since development involving a material change in the external appearance would require planning permission, it may be felt that a condition requiring permission for any further aerials could be justified to ensure that structures on the roof did not become unreasonably conspicuous as a result of a series of extra aerials each of which did not materially change the appearance.

"The Assessor agrees with my conclusions".

3. The Inspector recommended that the appeal be allowed subject to the attachment of the conditions proposed by the City Planning Officer in a report dated 13 December 1983 to the City Planning Committee. These conditions related to the dimensions of the proposed structures and the removal of non-operational aerials and the existing Pye mast; and they also proposed that consent should be required to be obtained for the erection of any additional aerials.

4. The Secretary of State agrees with his Inspector's conclusions and accepts his recommendations except for that which relates to the imposition of a condition which would require consent to be obtained for the erection of additional aerials. The Secretary of State notes that this recommendation reflects concern about the possible cumulative visual effect of additional aerials but, having regard to the evidence given about the general visibility of structures on the roof of Sunley Building, he is not persuaded that exceptional measures to control development there are justified. Accordingly he allows this appeal and hereby grants planning permission for the installation of microwave radio facilities on Sunley Building, Piccadilly Plaza, Manchester in accordance with application No F20178 of 22 August 1983, subject to the following conditions:-

- i. The development hereby permitted shall be begun not later than 31 July 1989;

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ii. The existing Pye radio mast shall be removed on completion of the new structure;

iii. All aerials on the structure shall be operational and any aerials which cease to be operational shall be removed;

iv. The maximum height of the proposed structure including all aerials attached to it, shall not exceed 12.25m as indicated on drawing No PM/BCAE/1003/A submitted with the above application;

v. The approval hereby granted relates to the submitted drawings as amended by drawing No PM/BCAE/1001/B submitted with the above application.

5. This letter does not convey any approval or consent which may be required by any enactment, byelaw, order or regulation other than Section 23 of the Town and Country Planning Act 1971.

I am Gentlemen  
Your obedient Servant

W A ASTON  
Authorised by the Secretary of State  
to sign in that behalf

MANCHESTER CITY COUNCIL

APPEAL

by

MERCURY COMMUNICATIONS LIMITED

Inspector: H M A Stedham ARICS FRTPI  
Assessor: M H Walters MIEEE  
Date of Inquiry: 11-13 April and 3-4 May 1984  
File No: APP/B4215/A/84/11021

Tollgate House  
Houlton Street  
BRISTOL  
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June 1984

To the Right Honourable Patrick Jenkin MP  
Secretary of State for the Environment

Sir

I have the honour to report that on 11-13 April and 3-4 May 1984 I held an inquiry at the Town Hall, Manchester into an appeal by Mercury Communications Limited under Section 36 of the Town and Country Planning Act 1971 against the refusal of the Manchester City Council to permit the installation of microwave radio facilities at the Sunley Building, Piccadilly Plaza, Manchester, comprising:

- i. Replacement of existing Pye radio mast on roof with 7 m high stub tower.
- ii. Erection of one 1.2 m diameter and five 0.6 m diameter dish antennae on the stub tower.
- iii. Relocation of radio antennae on Pye radio mast on to new stub tower.
- iv. Erection of 4 quadrant antennae on the roof.
- v. Use of part of gallery level of building as radio equipment room.

1.1. The reason for refusal is that the proposed development would be a threat to the health and safety of the general public in the City and particularly to those people who would be in close and frequent proximity to the installation.

1.2. I have had the benefit of the advice of Mr Walters who sat with me as Assessor on the technical aspects of microwave radio facilities.

1.3. This report includes a description of the appeal premises and surroundings, the gist of the representations made at the inquiry, and my findings of fact, conclusions and recommendation. Lists of appearances, documents and plans are attached.

1.4. Throughout this report I have used the following abbreviations:

Mercury	Mercury Communications Limited
NRPB	The National Radiological Protection Board.
HSE	The Health and Safety Executive.
BT	British Telecom.
Hz	Hertz, namely oscillations (cycles) per second.
KHz	Kilohertz, namely thousands of Hertz.
MHz	Megahertz, namely millions of Hertz.
GHz	Gigahertz, namely thousand millions of Hertz.
mcw	Microwave.
rf	Radio frequency.
emg	Electromagnetic.

I have generally referred to power density (intensity) in  $W/m^2$ , namely watts per sq m. It can also be expressed in  $mW/cm^2$ , namely milli-watts per sq cm. The level in  $mW/cm^2$  can be obtained by dividing  $W/m^2$  by 10.

#### THE SITE AND SURROUNDINGS

2.1. The Sunley Building forms part of the post-war Piccadilly Plaza development, occupying a large island site in the centre of Manchester. A 2-storey podium covering the whole site is mainly in retail and commercial uses, but the upper part comprises 3 separate units: The Sunley Building which is just over 100 m high and used for offices lies in between Bernard House and the Piccadilly Hotel. Bernard House some 8 m north-west of the Sunley Building is about 40 m high and used as offices. The Piccadilly Hotel about 25 m to the south-east is some 55 m high.

2.2. Access to the roof of the Sunley Building is obtained via the 29th floor which is the highest floor served by the lift and is used for offices. Stairs lead through locked doors up to the 30th floor occupied by building services, radio equipment rooms and open galleries enclosed within the outer cladding of the building. Access to the roof is by cat ladders within these galleries.

2.3. North of Piccadilly Plaza is a bus station, with further north the public Piccadilly Gardens. Opposite the other 3 sides of the island block are mainly shop and office buildings of heights very considerably lower than the Sunley Building. The nearest building of similar height to the Sunley Building is the Co-operative Insurance Society (CIS) offices in Miller Street about 700 m to the north. The nearest high building is St Andrews House in Portland Street about 200 m to the south, which is also offices and roughly 70 m high.

2.4. Because of the great height of the Sunley Building, the structures on its roof cannot be seen from Piccadilly Gardens or from other points at street level in the surrounding area. The roof structures are however seen from more distant points including Piccadilly Station over 500 m to the south-east and other view-points further away. Because of the distance away of such points generally the antennae are not very obtrusive.

#### CASE FOR THE APPELLANTS

The material points are:

3.1. High priority given to the creation of an alternative communications network is shown by the urgency with which the current Telecommunications Bill is being promoted to privatise BT and extend the opportunities for other operators. Mercury is the only operator authorised to set up in competition with BT and further licences will not be considered until 1990.

3.2. The major element is a 800 km fibre-optic cable to be laid alongside the railway and backed up by a system of mcw repeater links from London to Manchester (document 2), to be used whilst the cable is being laid and as a back-up system. From points along the system, signals will be passed by further cables or mcw to distribution nodes in the major towns, from where they will be transmitted by mcw to aerials on subscribers' roofs. Distribution nodes need to be on the tallest buildings to prevent signals being blocked by land or other buildings. As mcw equipment can be installed quickly, it enables the service to be provided in the shortest time and it is also the most appropriate until a large number of subscribers is available; if and when there are sufficient to make it economic, local networks of underground cables will be laid.



3.3. BT has a similar system using frequencies in the 19 GHz band. In the last 12 months Mercury has received 24 planning permissions for similar installations in towns and cities throughout the UK and a service has been provided in the City of London since April 1983 with the approval of all authorities. Some 5 refusals of permission have been on grounds of the appearance of aerials, not safety.

3.4. Existing equipment operated by Pye Telecommunications Limited would be relocated on the proposed stub tower. The proposed 1.2 m dish antenna would form the end of the back-up link from London and the 0.6 m dish antennae would provide a high capacity service to 5 separate customers within line-of-sight of the Sunley Building. The omni-directional quadrant (or slot) antennae appear as short vertical rods and would serve customers requiring low-capacity connections. Maintenance personnel would visit the equipment at the foot of the tower for periods amounting to a maximum of 2 hours per week but it is unlikely that attention would be required to the antennae; if it was, standing instructions require the transmitter to be switched off for the period of attention.

3.5. The Sunley Building is the second tallest in Manchester, and is within a predominantly commercial area where above-ground floor uses are mainly offices; there are however a few hotels. The area is dominated by the heavy volume of traffic, and a bus terminus is located in Parker Street. The 29 upper floors of the Sunley Building comprise offices and when the building was completed in 1966 its suitability as a transmitting location was recognised: there are now 3 radio and television operators with equipment on the roof.

3.6. The planning application was supported by a memorandum, setting out Mercury's aims and describing the proposals. It was deferred by the committee for further consultations with HSE following receipt of a late objection by the British Telecommunications Union Committee (document 49) and for consideration of the possibility of relocating all the existing and proposed aerials on to a single structure. Relocation of all aerials was however ruled out for structural reasons and because of interruption to broadcasts, but the HSE confirmed that it was satisfied that the proposal was not a threat to public health (document 4). Despite this, and a recommendation for approval by the City Planning Officer who expressed the view that the current proposal would be no worse than, and possibly an improvement on, existing roof structures, the application was refused, solely on health and safety grounds.

3.7. Insofar as relevant to this appeal, planning policies for the area (document 5) recognise Manchester's role as a major regional centre, attractive to all major national concerns. With the economic recession, its activities need to be strongly protected both by sustaining those existing and by attracting new ones. Existing equipment on this roof is clearly seen from many relatively distant points, but not from the major central public open space of Piccadilly Gardens. Aggregating the Mercury and Pye aerials on one structure would remove some of the existing roof clutter and no objection on the grounds of the effect on appearance has been pursued by the council and no planning evidence called.

3.8. The proper approach to safety was stated in a recent Commons debate when the Under Secretary of State considered that development control must assess the degree of risk and balance it against other reasons for and against the action in question; Mr Macfarlane also stated that it was not for the developer to prove why he ought to be granted planning permission (document 6, columns 796-7). Section 12 of Development Control Policy Note 1 states that 'other material considerations' must be genuine planning considerations and that it is generally not desirable to use planning control to secure objectives provided for in other legislation. It would therefore be a radical departure from normal practice for workers' safety to be accepted as a planning consideration. Likely harm to the public could be a material consideration but the HSE and NRPB are the proper bodies in the present case to consider whether there would be danger.

3.9. The Radiological Protection Act 1970 (document 16) provided for the NRPB to be established to undertake research and provide advice on protection from radiation hazards. The Health and Safety at Work etc Act 1974 (document 17) is concerned with the health and safety of workers and protection of other persons from risks arising from their activities, with provision for the NRPB and HSE to work together. Paragraph 5 of circular 9/84 reaffirms the Statement in the draft circular (document 23) that the planning system should not be used to pursue objectives more appropriate to the health and safety legislation, and that the HSE will advise the planning authority on potential hazards so that it can make a properly informed decision on the planning merits. Proposed amendments to the General Development Order (document 24) would put Mercury on the same footing as BT and avoid inhibiting a rapid response to customers' needs; there is no suggestion that the intensity of mcw should be regulated because this is a matter for the HSE.

3.10. The worst cases of potential exposure to mcw involved in the proposed installation involve levels well below the most stringent standards, which are those of the Soviet Union, and only a tiny fraction of the existing and proposed UK standards (document 2). Advice given to the council by the HSE (document 4) and conclusions in the report on Mercury equipment by the NRPB (document 11) are that there are no grounds for concern about hazards from mcw radiation proposed. Since however a negative cannot be proved, it is not possible to meet the requirement in paragraph 11 of the rule 6 statement to demonstrate that transmissions would be incapable of adverse effects on the health of any person in Manchester. The Government is aware of areas of uncertainty and legal powers are available to put an end to mcw installations if they caused danger. There is no reason why radiological effects should be any different in Manchester or why Mercury should be subjected to different considerations from other mcw users there, including BT operating on similar and lower frequencies with a power of 18 watts, as compared with a maximum of 0.63 watts by Mercury.

3.11. Using the figures from table 2 of the NRPB report on Mercury equipment (document 11), Mr Cott has calculated the power density from the proposed installation at the worst points (document 7). So far as maintenance personnel are concerned, visiting equipment boxes on the roof of the Sunley Building for a maximum of 2 hours per week, the highest calculated power density at the foot of the stub tower is  $0.063 \text{ W/m}^2$  which compares with the most stringent (Russian) standard of  $1 \text{ W/m}^2$  and the UK standard of  $100 \text{ W/m}^2$ . Transmitters would be switched off if aerials needed attention, and aerials are lined up on receiving mode. No reason is seen why the quadrant antennae should not be mounted, as suggested by the Assessor, at a height of about 3 m as shown in the photographs of the Moorgate installation (document 9) to prevent accidental exposure of persons unaware of the danger of approaching them very closely when they are not switched off.

3.12. So far as the general public is concerned, buildings of 20 storeys or more within 800 m of the 103 m high Sunley Building have been listed (document 10) and calculations made of the power density at the 2 most affected, which are both offices. These are the tallest building, the CIS office which is 107 m high and 720 m away, and the nearest high building, St Andrews House, which is 70 m high and 210 m away. Using the most pessimistic assumptions, the calculated highest power density which could arise is  $0.01 \text{ W/m}^2$  at the CIS building and  $0.0005 \text{ W/m}^2$  at St Andrews House. The maximum density at the roof of the adjoining Piccadilly Hotel, which is next to the Sunley Building but about 45 m lower, would be around  $0.0001 \text{ W/m}^2$ . At street level the maximum calculated power density is also  $0.0001 \text{ W/m}^2$ .

3.13. For exposure of the public, the most stringent standard is  $0.05 \text{ W/m}^2$ , and the equivalent UK standard is at present  $100 \text{ W/m}^2$ , but it is proposed to reduce this to  $50 \text{ W/m}^2$  where children are present. The radiation to which the public is likely to be exposed would be very substantially lower than the UK standard and well below

the Russian standard. Even the most cautious interpretation of scientific literature compels the conclusion that suggestions of potential hazard are unsubstantiated and speculative.

3.14. It would be a considerable disaster for the country if mcw transmissions had to be stopped. The existing telephone system is not suitable because it cannot cover the frequency range required for modern office machines. Mercury has potential customers in Manchester but because of confidentiality is unable to identify them until agreements have been signed.

3.15. Mr Burstow's job includes giving advice on electrical matters. In his capacity of advising on the non-ionising radiation hazard associated with rf and mcw, he attended at the council's request a meeting between Mercury and the Planning Department on 1 November 1983. Based on documents supplied, indicating that there would be a 0.6 m dish antenna and several quadrant antennae, the advice of the Medical Research Council (document 14) and knowledge of the NRPB consultative report (document 19), he wrote to the council on 10 November (document 4). He was unaware that other antennae would be installed until a copy of the NRPB report on Mercury equipment (document 11) was sent by the appellants on 26 March, and did not see the application plans until just before the inquiry opened.

3.16. Although unaware of the details of the power involved when he wrote to the council on 10 November, Mr Burstow was aware of the GPO system and its output, and had a good idea of the power required. Now that he is fully aware of the Mercury proposals, he does not wish to change the views expressed in his letter; it now appears that the maximum radiated power density from the Mercury antenna would be less than the  $1.12 \text{ mW/cm}^2$  ( $11.2 \text{ W/m}^2$ ) referred to in the letter. As compared with the total power of 2.33 watts to the Mercury antennae, typical existing installations in Manchester include police, fire brigade and ambulance services with up to 100 watts fixed and 5-20 watts from vehicles at a frequency of 100 MHz, television of up to 1000 kW at 470-870 MHz, Piccadilly Radio of 2 kW at 97 MHz, ship navigation radar of 25 kW peak at 3 and 9 GHz, airport radar of 600 kW peak and 1 kW average at 600 MHz and 1 GHz and BT at Macclesfield Forest of typically 6-10 watts at a frequency of 10 GHz plus. Mr Burstow's own tests showed existing emg 'noise' level in Manchester as of the order of  $0.01 \text{ W/m}^2$ .

3.17. Despite variations in scientific opinion, the NRPB in its consultative document has summarised current opinions and come up with its own conclusions. Although in paragraph 7 it is considered that all exposures of the general public should be kept as low as reasonably practicable, at the low levels proposed the exposure is not significant. The questions raised by Professor Fröhlich are matters for the Medical Research Council and are what the NRPB was set up for. The consultative document accepts that there are differing risks at different frequencies and proposed an averaging system, ensuring that the summation of the measured power density at the frequency, divided by the appropriate limit for that frequency, should not exceed unity. The document also suggests that low power devices with a total emission of less than 7 watts may be regarded as harmless provided they are unable to deliver more than  $4 \text{ w/kg}^{-1}$  for prolonged periods.

3.18. In relation to the points made in the BT Union Committee letter (document 49) electrocution risks would not be abnormal and Mr Burstow will be asking for details of proposals. He doubts if there would be any high temperature hazards because of the low power, and there would be little radiation. As part author of Guidance Note GS21 (document 22) he considers that ignition risks could not arise because the maximum power of only 0.63 watts is well below the 2 watts required to ignite hydrogen.

3.19. Mcw are one form of emg waves, which include radiowaves, infra-red waves and light waves. Radiowaves have frequencies in the KHz and MHz region and an arbitrary

boundary has been fixed between them and mcw at 300 MHz although no sharp transition in the properties of waves occurs at that frequency. The upper frequency of mcw is defined at 300 GHz. High frequency radiowaves and mcw have many everyday uses including broadcasting, air traffic control, radar, general telecommunications, cooking and physiotherapy; there is growing interest in using mcw for cancer therapy.

3.20. Application of an electric field to any material which conducts electricity causes it to heat up. As the human body consists of 65-70% water, which has a moderately high electrical conductivity, it will dissipate heat when subjected to an electrical field. The biological effect can be therapeutic but the circumstances in which it can be considered hazardous must be examined. After a brisk walk or emotional stimulus, which increase body temperature by 1-2°C, the temperature returns to normal, no permanent biological change occurs and this is termed a reversible effect. An example of irreversible damage is the formation of a cataract if the temperature of the lens of the eye increases to around 42°C; the lens is particularly vulnerable to mcw injury because of its high water content and lack of blood supply to conduct heat away. The nature of biological damage is related directly to the temperature rise in the tissue and therefore determined partly by the power density of the mcw beam to which it is exposed. Experiments carried out on New Zealand white rabbits, whose eye lenses bear anatomic similarities to those of humans, show that mcw power density of over 1000 W/m<sup>2</sup> is required to produce a cataract.

3.21. The question is sometimes raised as to whether radiowaves and mcw cause non-thermal biological effects, which could occur at power densities lower than for thermal effects. When Professor Grant prepared his evidence he was not aware of evidence of non-thermal effects from continuous wave (ie not pulsed) low intensity 10 GHz mcw used for communications purposes. After being shown the 1971 article by Carpenter and Livstone (document 33) at the inquiry, he feels certain that, if the findings of their experiments had been confirmed, there would have been full awareness of them in scientific circles. Low level or non-thermal effects have been propounded on the basis of experiments with animals, excised tissues or cell suspensions, observed either at very high frequencies (over 40 GHz), or with pulsed waves to which the biological effect is attributed. Many of these experiments however still await confirmation.

3.22. Professor Grant accepts that some experiments have shown low-level biological effects described in reports as non-thermal, but other persons have not been able to replicate them and there may be other explanations such as artefacts. Professor Fröhlich's theory (document 34) is one possible explanation. Many experiments refer to power densities of several mW/cm<sup>2</sup> as low but Professor Grant does not accept that, say 5 mW/cm<sup>2</sup> (50 W/m<sup>2</sup>), is low or that it would not produce some heat effects even if only something like 10<sup>-5</sup>°C. He does not accept the conclusions on the yeast cell experiment in Coherent Excitations in Biological Systems (document 35, page 36) as more than one possible interpretation: this was one of the most difficult experiments to set up and get accurate results from and to his knowledge other people have been unable to reproduce these effects. Many artefacts are involved and scientific evidence cannot be described as excellent until confirmed in at least 2 other laboratories. The conclusion on the Puffing of Giant Chromosomes (document 35, pages 18-19) involved exposure of very high frequency mcw at about 50 W/m<sup>2</sup> on a fairly small area. Professor Schwan on pages 222-3 (document 35) also considers that, until results have been duplicated, their significance would continue to be debated; his recent letter (document 36) confirms that he still has doubts. Although Professor Fröhlich is a FRS and very respected in his previous field as a theoretical physicist, he came into the field of biological problems much more recently.

3.23. Professor Grant accepts that evidence of non-thermal effects at frequencies of over 40 GHz is promising, but not that nothing is known about frequencies of

the order proposed by Mercury. A frequency of 96 Hz has been used in radar since the war with no adverse effects observed. Mcw exposure hazards must be taken seriously but the present proposal involves emissions too low to be considered a danger. Although the NRPB Consultative Document (document 19) advocates exposure of the general population to be kept as low as reasonably practicable, the board has expressed the opinion that there are no grounds for concern about health hazards from Mercury equipment (document 11). There is no evidence to connect behavioural effects with mcw and reference on page 22 of Professor Grant's book (document 26) is only to "reports" of such effects.

3.24. In the United Kingdom, official interest in the possible health hazards of mcw dates from 1960 with a consensus of opinion that people should not be exposed to more than  $100 \text{ W/m}^2$ , based on the additional thermal burden not exceeding the rate at which heat is produced normally. Over the past 30 years considerable research has been carried out in the area of fundamental biophysics, observing the effects on animals and carrying out surveys on human populations exposed to mcw; more than 4000 scientific papers have appeared since 1970 on the biological effects. As a result of this research the NRPB have proposed changes in standards (document 19) taking account of both frequency and whether or not children are involved.

3.25. The Russian standard, much lower than that of the UK, is based on the observation that certain workers involved with mcw equipment exhibited functional disturbances symptomised by headaches, irritability, loss of appetite and difficulty in concentration. There is however no specific evidence to show that these reported symptoms were due to mcw exposure; 2 events occurring in sequence do not justify a conclusion that the first causes the second unless there are good scientific reasons for believing so. In a survey carried out on US Navy personnel who had been exposed to levels of  $1-10 \text{ W/m}^2$  on board an aircraft carrier, no deleterious effects were observed.

3.26. Over the past 40 years millions of people have been exposed to mcw with no biological damage observed which cannot be attributed to a gross heating effect. The level to which people in the vicinity of the Mercury antennae would be exposed would be lower than the Russian standard;  $1/5$  in the case of people working in the CIS building and  $1/15$  in the case of maintenance personnel. In the light of these worst figures, Professor Grant considers that there is no health hazard from exposure to mcw from the proposed Mercury transmitter.

3.27. Professor Grant commented on the Yannon case, in an attempt to be helpful, because it had been referred to in the letter from the BT Union Committee (document 49). He has however no direct knowledge of the case, is not an expert on medical matters and has no objection to his evidence on this point being withdrawn. The council had ample opportunity to put the Yannon case to Professor Michaelson, who has more detailed knowledge about it, but did not do so, nor was Professor Grant asked questions about it until after Professor Michaelson had returned to the United States.

3.28. Radiation refers to any type of emg energy, with frequencies increasing from that of household electricity (50 Hz) through rf, mcw, infra-red, visible light, ultra-violet and X-rays to gamma radiation. There is a distinction between non-ionising radiation, which includes mcw, and ionising radiation, which includes X-rays, gamma rays and radiation associated with nuclear physics and power plants. Cumulative irreversible damage can occur in tissues exposed to ionising radiation, but Professor Michaelson considers that there is no scientific or medical evidence that continuous exposure to low-level mcw fields, namely  $100 \text{ W/m}^2$ , results in damage to biological systems. Mcw do not penetrate the body, and the effect on human bodies cannot be compared with experiments such as with yeast where material

the size of a yeast cell or chromosomes of a midge are exposed to high power densities with a very high absorption rate. The effects of experiments on isolated systems in vitro cannot be compared with effects on the human body which has a lot of controls and adaptive mechanisms; if parts of the body are affected, other parts take over. Power densities which are low for humans could be very high for animals.

3.29. A large body of data on the biological effects of exposure to mcw, accumulated over the past 75 years, indicates that prolonged whole-body exposure at intensities over  $1000 \text{ W/m}^2$ , which is 10,000,000 times greater than that of the Mercury proposals at street level, could be dangerous at frequencies where significant energy is absorbed. Lower levels at densities of  $10\text{-}100 \text{ W/m}^2$  are well tolerated by human beings and are the basis of the standards of the relevant UK and US safety bodies. Evaluation of the biological effects of mcw exposure needs to differentiate between established effects and speculative reports, and to consider when effects become a hazard; for example some are beneficial under appropriate controlled conditions such as cancer therapy. Changes must be sufficiently understood for their significance and hazard potential to be determined.

3.30. Living organisms respond to many stimuli as part of the process of life. When normal light rays contact the eyes, the biological effect of vision is innocuous and helpful, but by staring directly at the sun the same emg energy could be harmful. As man and animals can adapt to change, biological effects may well be within their capacity to maintain a normal equilibrium; only if it compromises ability to function properly or to recover can it be considered a hazard. Even if the alleged biological effects within the prevailing standards were substantiated, none could be considered hazardous or relevant to man.

3.31. Experiments with small animals must be carefully designed and performed to eliminate responses due to unrelated agents inadvertently introduced rather than the factor being studied. Much of the research on biological effects of mcw has been with small rodents, whose heat absorption, field concentration effects, body surface areas and thermal regulatory mechanisms differ significantly from man's. Results of exposure of common laboratory animals cannot therefore be readily extrapolated to human beings and effects would not necessarily occur in a large animal or man. As an example, at 11 GHz mice and rats absorb 10-12 times as much energy, and man is therefore at least 10 times less susceptible. Professor Michaelson concludes that animal studies and surveys have failed to identify any detrimental effects that could even tenuously be attributed to intensities of mcw energy experienced in the environment. Various retrospective studies carried out on human populations exposed to mcw energies (document 37) also show no cause for public concern about the levels of emg fields to which the general public is being exposed, or would be exposed after the Mercury antennae came into operation.

3.32. Proper assessment of risks and benefits is important, and failure to educate the public properly could result in suspicions and fears that impede much needed advances. As in all fields of science, there are some unknowns in biological aspects of emg energy, but the need for further research should not deter applications when levels involved are clearly safe. Not only are the calculated density levels from the proposed antennae low but measured levels have generally proved to be considerably lower than estimated. The proposed emissions can be seen in perspective when it is appreciated that an adult person emits emg energy at frequencies of between 300 MHz and 300 GHz at nearly  $0.0054 \text{ W/m}^2$  and that there is nothing new about rf, which comes from the sun. Thalidomide was a unique case, involving a drug which was put on the market after research a lot of which was questionable.

3.33. A careful review of the sizable literature shows that there is little, if any, firm evidence of any biological effect not associated with direct heat

generation which would influence physiologic integrative processes, and at the proposed levels thermal input is insufficient to elicit significant alterations in body function. Analysis of laboratory studies shows no biological effects hazardous to health or safety and there is no confirmed evidence of alteration to reproductive capacity or neonatal growth influenced by ambient levels of mcw/rf energies; reference to "little information" in paragraph 8.1.2 of the World Health Organisation report (document 31) is because people have not been exposed to levels needed to establish effects. There is no convincing evidence for direct interaction with blood cells, or theoretical basis for expecting mcw exposure to cause cancer.

3.34. Critical analysis of available literature and theoretical considerations which are irrefutable indicate to Professor Michaelson that sufficient scientific data is available on which to conclude that there are no biological effects which may be hazardous to health of safety as a result of the ambient levels of emg energy emitted by mcw/rf communication systems.

3.35. There was no reference to Professor Fröhlich in the rule 6 statement and his views were first mentioned at the inquiry. [An adjournment offered by me was not taken up because of Professor Michaelson's imminent return to the United States.] Professor Fröhlich is at the nearby Liverpool University and it is unfortunate that he did not attend the inquiry to explain his views. He knows that mcw transmissions are already carried out on a large scale and, if he is so concerned, it is surprising that he has not made representations about them long ago. Professor Grant finds his note (document 41) difficult to understand, and it is common ground that his theory is not wholly accepted as proven. Even if it is right, it does not follow that the Mercury proposals involve a significant risk.

3.36. It can be seen from the manuscript of Professor Fröhlich's note that, when he wrote that use of these frequencies appeared to him highly irresponsible, he was under the impression that 1-3 GHz was involved, and that when informed of the correct frequencies he simply amended the figures in his note. These particular frequencies cannot therefore, as implied in the note, be regarded as especially dangerous. It would have been helpful to have asked Professor Fröhlich if he thought that it was highly irresponsible for all mcw emissions not to be stopped.

3.37. It appears that Dr Smith believes that mcw emissions of the level proposed, which are far below the standards proposed in the December 1982 Consultative Document of the NRPB (document 19), would expose several thousand people in Manchester to likely harmful effects and that none of the existing emissions referred to by Mr Burstow are safe. It is surprising therefore that he did not avail himself of the invitation in the consultative document to comment on the NRPB proposals, nor has he written to the HSE. The fact that the NRPB has kept up to date is shown by many references in paragraph 8 of the document to recent documents, and by December 1982 Professor Fröhlich's theory would have been well known to the board. The NRPB report (document 11) stating that there would seem to be no concern about possible health hazards from Mercury equipment was based on measurements and worst case calculations by the board's own staff. Dr Smith agreed that the conventional theory of mcw effects on biological material is adhered to by the NRPB and the large majority of scientists.

3.38. Assessment of risk is essentially a matter for the NRPB and HSE and not for a local planning authority or any particular Inspector. It was accepted on both sides that there is nothing special about the proposed installation or Manchester itself to make this different from the many similar installations elsewhere in the country. Whether or not they pose significant health risks must be considered in the same way everywhere. Faced with compliance with standards everywhere in the world, and a consensus of opinion that there is no actual risk, the council has fallen back on the view that as long as there is any uncertainty nothing should be allowed. It is irresponsible for the council to whip up fears despite the views

of the relevant authorities, the NRPB and HSE, and then argue that development should be refused on grounds of psychogenic effects on the public; such refusal would not be on account of danger but because belief in danger could make some people feel ill.

3.39. Providing for such matters to be up for discussion at every public inquiry would be against the public interest. Parliament has set up the NRPB and HSE to advise on such questions, and on technical matters the planning authority should seek the advice of the HSE and follow it. It is recognised that advice may change as scientific knowledge grows, but a planning inquiry is a grotesquely unsuitable forum for investigating the correctness of the NRPB evaluation of the evidence it has received. On the basis of Lord Diplock's judgement on *Bushell v The Secretary of State* (document 38) it would be a rash Inspector who, in the light of the cross-examination of 3 witnesses at a 5-day planning inquiry in Manchester, came to a conclusion that the NRPB was wrong.

3.40. The Secretary of State's approach to technical matters was recently restated in paragraph 10 and Appendix 3 of circular 9/84. In the context of the present case, presumably the Secretary of State does not consider that there are significant risks because mcw emissions are not listed as hazardous in the circular, nor are they excluded from the General Development Order consent to the Post Office, airports authority etc in the draft amendments to the order (document 24). If the Secretary of State considered mcw emissions to be an unacceptable risk, no doubt he would revoke the GDO etc, but permission cannot be allowed in London but refused in Manchester, or allowed to BT but refused to Mercury.

3.41. BT is no safer than Mercury and has a Project Overlay which has similar characteristics to that of Mercury. One of the largest of the existing emissions referred to by Mr Burstow is by BT whose Kilostream and Megastream systems use mcw. The council chose to accept the views of the BT Union Committee which has produced no evidence to support its claim that BT can provide the necessary services. The council has produced no witness to support the views that Manchester citizens are afraid, no planning evidence against the proposal, and no witness to refute criticisms that refusal was based on political bias because of the effect of the Mercury proposal on BT. The proposed installation would not make the slightest difference to safety unless by some extraordinary chance: firstly, Professor Fröhlich's theory is correct, and secondly, when applied to human beings it was found to have harmful consequences, and thirdly, by some unhappy chance the particular frequencies proposed were found to be more harmful than those currently in use.

3.42. There is no objection generally to the conditions suggested in the City Planning Officer's report (document 4). As a result of a minor amendment the height of the structure referred to in condition 4 should be 12.25 m not 12 m. Condition 3 should be imposed only if some good reason was given and, since permission was refused only on safety grounds, no basis has been put forward for limiting the number of antennae.

#### CASE FOR THE COUNCIL

The material points are:

4.1. Radiowaves in the frequency range of up to 300 GHz are non-ionising emg radiation and by convention those between this frequency and 300 MHz are referred to as mcw. Except close to the antennae, the power density of emissions decreases at the square of the distance from the source. In considering how mcw radiation reacts with biological systems, Dr Smith considers it necessary to bear in mind the limits of present knowledge; it is generally agreed that more research is needed. Very little is known about the non-thermal interaction of mcw radiation



on the organisation of biological systems, and it is not yet possible to predict all the effects, let alone detailed effects, on biological materials in the living state.

4.2. Conventional theory is concerned with heat generated and field interactions which may be produced by such radiation. According to this theory, biological systems have a high propensity to absorb electrical energy and convert it into heat. Absorption of energy from emg waves leads to heat development and possible direct field interactions with membranes, biopolymers and biological fluids. Direct field interactions have not been thought to be great at power densities of under  $10 \text{ W/m}^2$  as the membrane field strengths in biological materials are greater than the fields produced by such densities. Thus according to the conventional view, the relevant effects of mcw radiation at power densities of  $1-10 \text{ W/m}^2$  is the direct production of heat.

4.3. Research has shown however that this theory cannot account for 4 kinds of phenomena: Firstly, different effects may be produced in the same biological material by the same quantity of energy deposition as between mcw radiation and other means such as heat baths; this shows that mcw radiation can produce significant effects not dependent on its heating capacity. Secondly, effects can be produced by mcw radiation at such low levels that a direct thermal effect is not a reasonable hypothesis. Thirdly, the level of effects does not increase proportionately with frequency increase, may increase or decrease in a discontinuous fashion, or may in some cases stabilise at a particular level. Fourthly, when energy is supplied, there may be a time lag before any effect occurs.

4.4. An alternative approach is to consider energy deposition as capable of creating organisation in a biological material. One of the most common features in biology is that energy supplied by food or sunlight is partly used to build up and maintain a very complex organisation. Intense sunlight may well warm a plant, but its action cannot be regarded as entirely thermal.

4.5. Professor Fröhlich who is a distinguished scientist and a FRS has advanced a theory to account for biological effects of mcw radiation which do not depend on thermal action. According to this theory, the release of stored energy in active biological systems, in the form of high energy chemical bonds and electrical fields in membranes, may be triggered by a very small increase in energy additional to that in the environment or within the body. Mcw radiation may affect by interactions with enzymes the processes of energy storage in biological systems as well as triggering energy release. Professor Fröhlich states (document 34, page 148) that the strongest evidence for the existence of such non-thermal non-linear effects arises from their dependence on frequency, intensity and time of irradiation. He draws attention to the significance of mcw radiation as a source of coherent excitation of a biological system; coherence determines properties at one space-time point when they are known at another. He puts forward 3 basic types: i. coherent excitation of a single polar node, ii. excitation of a metastable highly polar state, and iii. vibrations arising from more complex processes and giving rise to limit cycles. Their products are highly ordered states of electrical energy, shown to be physical possibilities by Professor Fröhlich but their realisation in actual biological systems has to be determined experimentally.

4.6. Two criteria may be used to determine whether a biological effect is non-thermal, namely i. expected only at certain frequencies and ii. dependent upon energy supply exceeding a critical value with little extra effect from further supply. Some recently reported experiments which provide excellent evidence of non-thermal effects concern yeast cells and the giant chromosomes of the midge fly (documents 35 and 42). They illustrate how non-thermal effects may be produced. These effects are frequency specific with a time-lag before onset. They can be induced at low power densities if the exposure period is sufficient.

4.7. Having worked at frequencies other than these examples, Dr Smith knows of no reason why the range of 10-13.5 GHz should be assumed to be incapable of producing non-thermal effects. He is aware of no theoretical ground or experimental work suggesting, let alone establishing, a threshold at or close to 42 GHz below which non-thermal effects will not occur. The expected frequencies are for example 10-100 GHz for affecting cell membranes and 1 GHz for DNA or RNA molecules; these are all in the region proposed to be used by Mercury.

4.8. Confusion in the results from many experiments so far conducted may arise from insufficient precision in the research. The implications of accepting that mcw radiation can contribute to the process of energy build-up as well as triggering release of energy from the body's own storage systems have not yet been explored in detail. Although some effects may be harmless, it cannot now be said that all will be.

4.9. Emg fields and rf radiation occur naturally over a wide range of frequencies. The ionosphere shields the earth's biosphere from radiations of this kind originating in space. The intensity of naturally occurring fields is low and mostly due to atmospheric electricity; emissions from the sun and stars, although measurable are very weak. Natural radiation is incoherent; the oscillations are not continuous and have random variations in their phases.

4.10. Since about 1880 electricity and its applications have developed rapidly but in the 100 KHz to 300 GHz range the proliferation of man-made sources of energy has occurred only over the last few decades. Exposure to man-made radiation may be much higher than from natural radiation and is mostly coherent radiation. Man has had no real opportunity to adapt to mcw levels of this kind, intensity and duration.

4.11. Mcw radar as a possible hazard was discussed in scientific literature as early as 1943 but 10 years elapsed before the first proposals for safety limits to protect people. Only in 1960 did the Medical Research Council put forward recommendations of a  $100 \text{ W/m}^2$  limit for continuous exposure (document 14), following an American lead. Both standards however were based on avoiding thermal effects. International standards still vary significantly (document 46). In 1982 the NRPB consultative document proposed reducing the  $100 \text{ W/m}^2$  limit to  $50 \text{ W/m}^2$  for the general population and recommending that all exposures of the general population should be kept as low as reasonably practicable.

4.12. Recognition of possible non-thermal effects has been slow and, apart from the Russian-based ones, standards are still based only on thermal effects. They have also been considered only in terms of power density although it is impossible to classify biological effects on intensity alone as the absorbed energy depends on the dielectric properties of the particular material, which vary with mcw frequency and depend on the composition of the particular system.

4.13. Standards have been based on surveys of human exposures, laboratory experiments on animals and general considerations. The few epidemiological studies have generally been limited in scope and in general the available data concerning health effects of mcw on man are insufficient and of inadequate scientific quality. Laboratory experiment results are not consistent, and extrapolation to man is difficult. The thalidomide experience shows that failure to produce an effect in a laboratory does not guarantee no effect on man. Until there is more and properly funded research concentrating on non-thermal effects, and the mechanisms of interaction between biological materials and mcw radiation are better understood and explored, Dr Smith considers it impossible to state that exposure to mcw radiation at any particular intensity and frequency for any particular period has been shown to be safe. In a statement given to Dr Smith (document 41), Professor Fröhlich considered that at the present state of scientific knowledge it was not possible to answer questions about the possible harmfulness of mcw in the 10-13 GHz region and

that, until appropriate experiments had been carried out in this frequency region on various biological objects in order to be sure of their response, it appeared to him highly irresponsible to use them.

4.14. The fact that risks are being taken more seriously in the United States is shown in a very recent report (document 47). Expertise available to the NRPB in 1982 is less than available to Dr Smith today, and moreover there is a time-lag between carrying out work and writing it up. Figure 10 on page 55 of Coherent Excitations published in 1983 (document 35) shows a biological effect which was significant at 0.5 and 5 W/m<sup>2</sup> was not significant at 50 W/m<sup>2</sup> so that effect does not necessarily reduce with power.

4.15. The proposed installation would use phase modulation, with the carrier wave always left on whether traffic was being carried or not. The service from the quadrant antennae would extend to a maximum distance of 10 km. From the information supplied it can be estimated that a beam over ½ km wide would come into the centre of Manchester from Werneth Low, and there would be a beam of similar width at Werneth Low (plan H). There would also be beams to and from 5 high-capacity users not yet specified. Beams directed at lower buildings would irradiate windows at higher levels in such buildings. There would be numerous returning beams from those served by the quadrant antennae which, because of the height of the Sunley Building, would have to point downwards and would irradiate windows from a high angle. The sum total of these beams should not produce an appreciable thermal effect but it is not possible to be certain whether or not there would be harmful non-thermal effects.

4.16. The frequencies involved are such as might be expected to affect cell membranes and modulation might induce lower frequency effects. It is not known how long a human being can store coherent mcw radiation or how much accumulated power density would trigger a non-thermal effect. The critical integrated energy density capable of producing a non-thermal effect in yeast was probably less than 1.8 kilojoules per sq m and, if it was assumed that a non-thermal effect might arise at 2 kJ/m<sup>2</sup>, which is close to the energy density implied by earlier Russian standards for exposures of up to 10 hours, the time taken to produce such an effect at various distances is shown on table 1 (document 43), assuming that the NRPB measurements on Mercury equipment were correct. These figures show what might conceivably occur and with present knowledge it is not possible to be sure what will happen and to whom. There is a possibility that the Mercury proposals would lead to effects on some people, some of which might be harmful. Dr Smith considers that there is not sufficient knowledge to be able to state that the proposals are safe.

4.17. The council considers that in health and safety matters it is unrealistic to seek to draw a distinction between workers and the general public; this would mean considering persons whilst going to work but not when they were working. The Health and Safety at Work etc Act 1974 (document 17) covers employees in section 2 and the public in section 3. Paragraphs 4-5 of circular 9/84 make it clear that there should be a measure of planning control over the creation of hazards. It has been suggested on behalf of Mercury that if the council objects to the present application it should take action against existing mcw users. Apart from some possibility of revocation however the council has no power, and many of the users are covered by the General Development Order.

4.18. It is no longer accepted as axiomatic that radiation is safe just because of low level and NRPB now consider that exposure should be kept as low as possible. It is always possible to argue that more replication of experiments is needed and it may be a long time before all scientists agree. If Professor Fröhlich is correct however we appear to be on the threshold of a dramatic change of view, and the

World Health Organisation has come down on the side of non-thermal effects. It also advocates keeping exposure to mcw as low as possible (document 31, page 105) and this can be achieved by not approving mcw systems when there is a safer alternative.

4.19. It is perfectly possible to avoid irradiating the population of Manchester by using communications systems relying on underground cables. It is clear from Mr Cott's evidence that Mercury's choice of mcw was based on economic rather than technical reasons and that future replacement of mcw links by fibre-optic cables was dependent upon economic rather than safety reasons; the firm's requirements could be met by cables. Planning is concerned with use not the user and if BT can provide a service by safer means there is no justification for approving the mcw proposals by Mercury. Mr Cott has little knowledge of facilities available in Manchester from BT, and was unable to produce any evidence that Mercury had any prospective customers in the city; there is no evidence to support the firm's optimism about demand for the proposed services.

4.20. At the time when Mr Burstow wrote to the council on 10 November advising on the application, he was unaware of details of the Mercury proposals. He did not know how many aerials were proposed or the power input to them. The HSE role is limited to considering whether the proposal complies with the relevant standard.

4.21. The confident statement in Professor Grant's evidence that there is no health hazard from exposure to mcw from the Mercury transmissions conflicts with statements made by him in books and papers. These include references in his book (document 26, page 22) to well established biological hazards of mcw, and to numerous reports of behavioural effects; in his 1981 paper (document 27, page 605) to effects on the growth rate of yeast as capable of being accounted for by Professor Fröhlich's theory but inexplicable in terms of a thermal effect, and to not everything being universally understood; and in his 1982 paper (document 28, pages 3-4) to effects which cannot be clearly explained in terms of a thermal mechanism, to non-thermal effects of clinical significance and biological importance, to an appropriate theory by Professor Fröhlich for a phenomenon which cannot be accounted for by classical physics, and to the need to understand more fully the mechanism of non-thermal effects.

4.22. Professor Grant accepts that the conclusion of Professor Fröhlich that there are non-thermal effects from mcw may be correct, and although he stated that there was no evidence of such effects at 10 GHz, these were demonstrated in experiments reported in 1971 (document 33). He gave evidence about the Yannon case, in which the widow of a New York radio technician was awarded compensation because it was accepted that her husband's death had been due to exposure to mcw, but admitted that he had no direct knowledge of the case. No evidence of this case was given by Professor Michaelson who knows more about it.

4.23. Professor Michaelson has not carried out the scientist's duty to present a balanced judgement, expressing both of the conflicting theories accepted by highly respected persons and then identifying his preferred opinion. On page 116 of his 1981 article (document 30) he refers to Eastern European reports of a wide variety of functional changes and considers that a careful search needs to be made for exposed groups not yet studied, on page 109 he refers to the fact that there have been few epidemiological studies, generally limited in scope, and despite his reference to no direct evidence that mcw are carcinogenic on page 116 he considers more intensive and extended monitoring necessary. His evidence that there is no cause for concern does not square with references on pages 13, 15, 79 and 82 of the World Health Organisation report (document 31). He refers to a survey of naval personnel exposed to radar but the fact that there were no effects from 9 GHz does not establish that there would be no effect at 10.5 GHz; this would not even be established by the absence of an effect at 10.3 GHz.

4.24. Even if it were to be accepted that hazards from the proposed installation were not such as to justify refusal of permission, laymen knowing of the disagreement about safety between respected experts would consider that there must be a risk. Furthermore the public is ignorant as to the distinction between ionising and non-ionising radiation. Psychogenic effects would therefore be likely because people do feel ill when they think that they may be ill.

4.25. The council is not happy about the Assessor's suggestion that possible danger to persons on the roof of the building from the quadrant antennae should be removed by mounting them on tall poles. This would make them more prominent and affect the appearance of the building.

4.26. The remarks by Lord Diplock in *Bushell v The Secretary of State* quoted by the appellants were concerned with a matter of Government policy and therefore not relevant to the present case. It is submitted as a matter of law that there is no obligation on the planning authority, or the Secretary of State, to follow blindly the advice of the HSE or NRPB.

#### FINDINGS OF FACT

I find the following facts:

5.1. The appeal relates to rearrangement of some of the existing structures and aerials on the roof of this 100 m high building in the centre of Manchester and the erection of a new stub tower and further aerials.

5.2. No objection has been raised on grounds of the effect of the proposals on the appearance of the building which can be seen from many points in the city, and the application was refused only on the grounds of a threat to the health and safety of the public.

5.3. The Health and Safety Executive was consulted on the application, and advised the council that the proposed installation would not cause a health hazard to persons in close proximity or significantly affect the low level radiation from existing radio frequency and microwave installations.

5.4. A subsequent report by the National Radiological Protection Board on safety considerations of microwave transmissions from equipment used by Mercury concludes that, on the basis of measurements and worst case calculations by NRPB staff, there would seem to be no grounds for concern about possible health hazards from any combination of communication equipment in systems used or proposed by Mercury.

5.5. Calculated power density levels involved in the non-ionising microwave radiation from the proposed aerials affecting maintenance workers, the occupiers of the (office) buildings where the effects would be greatest, an adjacent hotel and persons in the street are substantially below the standards proposed by the NRPB in its consultative document issued in December 1982 in which reference is made to non-thermal effects and well below the most restrictive standards which are those applying to the Soviet Union.

5.6. Historically, standards designed to safeguard people from potential harmful effects of electromagnetic radiation have been based mainly on preventing damage caused by heating.

5.7. Experiments carried out in recent years involving exposure of animals, insects, excised tissues and cell suspensions to microwave radiation have reported biological effects regarded as not caused by heating; such effects were found to be not necessarily restricted to particular frequency levels nor proportionate to intensity of radiation.

5.8. Pending replication of results of experiments in other laboratories, the existence of non-thermal biological effects from microwave radiation is not universally accepted by scientists.

5.9. The population of the United Kingdom has been exposed to microwave radiations at least since the war and uses of microwave equipment in Manchester include British Telecom, emergency services, television, radio, and radar in connection with the airport and ship navigation.

5.10. Retrospective studies of persons who had been exposed to microwave and radio frequency radiation have not produced substantive evidence of harmful effects.

5.11. Satisfactory evidence was not available at the inquiry regarding the circumstances in which compensation was paid to the widow of a New York radio technician or to substantiate a connection between microwave radiation and disorders suffered by workers concerned with microwave equipment in the Soviet Union.

5.12. A suggestion by the Assessor that the proposed quadrant antennae should be mounted at a height of about 3 m, to prevent accidental exposure of persons unaware of the danger of approaching them too closely when not switched off for work to be carried out on them, was accepted on behalf of Mercury but considered inappropriate by the council because of the effect on appearance.

#### CONCLUSIONS

6.1. Bearing in mind the above facts, I am of the opinion that there is insufficient evidence to support a conclusion that the proposed installation would pose a potential threat to the health and safety of the general public or persons employed in connection with it. I appreciate that experiments carried out on various small objects suggest that microwave radiation at any frequency or power density level cannot be guaranteed to be free from potential harmful effects to human beings. Nevertheless to justify banning on health and safety grounds something which has long been in ordinary everyday use without evidence of harm, I consider that it is necessary to go further than merely establishing that there is no absolute proof of an absence of harmful effects and to show that there are significant reasons for believing that the health or safety of human beings are likely to be put at risk.

6.2. The National Radiological Board, a body set up by Parliament to undertake research and advice on protection from radiation hazards, is apparently satisfied on the basis of measurements and worst case calculations by its own staff about possible health hazards from Mercury equipment. The Health and Safety Executive's advice to the council that the installation would not cause a health hazard to persons in close proximity or significantly affect existing low-level radiation was confirmed in evidence given at the inquiry.

6.3. I accept the opinion of the Assessor that a planning inquiry is not the right place to revise the country's safety standards, and I note that the consultative document published by the NRPB in December 1982, which put forward proposals for amending safety standards, took account of non-thermal effects. Worst case calculations show the emissions from the proposed antennae to be far below the amended standards and below the most stringent standards applicable anywhere. I agree with the conclusion of the Assessor that there is no reason for a low power installation to the proposed standard to be refused permission on health hazard grounds, and in the next paragraph I deal with the one reservation which he makes.

6.4. The Assessor's reservation concerns the possibility of persons being subjected to a field from the quadrant antennae which might be harmful. As several different

companies have installations on the roof, he considers that there is a possibility of these antennae being approached when not switched off for maintenance by persons without full knowledge of their characteristics. His suggestion at the inquiry of a higher mounting would make these antennae more conspicuous in views of the building. During our visit to the roof of the building after the inquiry, the Assessor was satisfied that the 2 quadrant antennae on the long sides of the building could not in practice be approached inadvertently. He considers however that acceptance of the plans should be subject to some means of restricting close access to the 2 other antennae at the ends of the building. Whilst I see no objection in principle to covering this point by a condition it may be felt that, now attention has been drawn to this problem, the manner in which the interests of safety and amenity can best be reconciled is a matter which could reasonably be left for settlement, possibly at the particular location, by representatives of the Health and Safety Executive, council and appellants.

6.5. No objection has been raised on the grounds of the effect of the proposed tower and aerials on appearance. Structures and equipment on the roof of this very tall building are generally not visible from the near vicinity, and in the long distance views they would be seen from so many different angles that it is difficult to generalise on the effect of additions and replacements on appearance. I do not disagree with the opinion expressed by the City Planning Officer in his report to the Planning Committee on 13 December that the proposals would be no worse than, and possibly an improvement on, the existing situation.

6.6. Subject to condition 4 being amended to cover the extra height of 0.25 m, which was not opposed by the council and would not significantly affect appearance, the appellants do not object to the conditions recommended in the City Planning Officer's report except for No 3. Although theoretically this condition is not necessary, since development involving a material change in the external appearance would require planning permission, it may be felt that a condition requiring permission for any further aerials could be justified to ensure that structures on the roof did not become unreasonably conspicuous as a result of a series of extra aerials each of which did not materially change the appearance.

6.7. The Assessor agrees with my conclusions.

#### RECOMMENDATION

7.1. I recommend that the appeal be allowed subject to conditions generally on the lines of the City Planning Officer's report dated 13 December 1983 and paragraph 6.6 above.

I have the honour to be  
Sir  
Your obedient Servant

H M A STEDHAM

APPEARANCES

FOR THE APPELLANT

Mr K Schiemann QC and Mr R Cornwath - Instructed by Messrs Bird & Bird, London WC1.

They called:

Mr E M Sheard MA FRICS - Partner, Messrs J R Eve, London SW1.

Mr P Cott MSc FIEE CEng - Technical Director, Mercury Telecommunications Limited.

Mr D J Burstow BSc CEng MIEE - H M Senior Electrical Inspector of Factories, Health and Safety Executive, Manchester.

Professor E H Grant BSc PHD FInstP - Professor of Experimental Physics, University of London.

Professor Sol M Michaelson BSc DVM SMIEEE - Professor of Radiation Biology, and Biophysics, and Associate Professor of Medicine and of Laboratory Animal Medicine at the School of Medicine and Dentistry in the University of Rochester, New York.

FOR THE COUNCIL

Mr R A Henderson QC and Mr J Howell

They called:

Dr C W Smith BSc(Hons) PhD FIEE CEng - Senior Lecturer, Department of Electronic and Electrical Engineering, University of Salford.

DOCUMENTS

- Document 1 - Lists of persons present at the inquiry.
- " 2 - Comparison of microwave radiation exposure levels from proposed facilities with safety standards of different countries.
- " 3 - Sketch showing Mercury's proposed national trunk fibre-optic cable network and microwave link.
- " 4 - City Planning Officer's report to the Planning Committee on application, including copy of observations from Health and Safety Executive.
- " 5 - Resume of planning policy documents by Mr Sheard.
- " 6 - Extract from Hansard for 21 February 1984.



DOCUMENTS CONTINUED

- Document 7 - Calculations by Mr Cott.
- " 8 - Graph showing power density at street level due to side lobes from 1.2 m antenna at power level of 0.63 W.
- " 9 - Leaflet describing Mercury telecommunications system.
- " 10 - High rise buildings within 0.8 km of Sunley Building.
- " 11 - Report by National Radiological Protection Board on Safety Considerations of Microwave Transmissions from Equipment used by Mercury.
- " 12 - Estimated power density at Piccadilly Hotel.
- " 13 - Article by Mr Cott on Mercury telecommunications system.
- " 14 - Home Office publication on Safety Precautions Relating to Intense Radio-Frequency Radiation, 1960.
- " 15 - Press notice of revised recommendations of Medical Research Council, January 1971.
- " 16 - Extract from The Radiological Protection Act 1970.
- " 17 - Extract from Health and Safety at Work etc Act 1974.
- " 18 - Agreement between Health and Safety Commission and National Radiological Protection Board, April 1975.
- " 19 - NRPB consultative document on Proposals for the Health Protection of Workers and Members of the Public against the Dangers of Extra Low Frequency, Radiofrequency and Microwave Radiations, December 1982.
- " 20 - Correspondence between the Health and Safety Executive and the council, April 1984.
- " 21 - Letter from HSE to the appellants' solicitors, 4 April 1984.
- " 22 - HSE guidance note GS21 on Assessment of Radio Frequency Ignition Hazard.
- " 23 - Extracts from draft circulars on Conditions and Planning Controls over hazardous development.
- " 24 - Extract from proposed amendments to the General Development Order.
- " 25 - Summary of qualifications and experience of Professor Grant.
- " 26 - Extracts from Dielectric Behaviour of Biological Molecules in Solution by Professor Grant (1977).
- " 27 - Article by Professor Grant on Biological Effects of Microwaves and Radio Waves, December 1981.
- " 28 - Article by Professor Grant on Interaction of Radiowaves and Microwaves with Biological Material 1982.

DOCUMENTS CONTINUED

- Document 29 - Summary of qualifications and experience of Professor Michaelson.
- " 30 - Article by Professor Michaelson on Health Implications of Exposure to Radiofrequency/Microwave Energies 1981.
- " 31 - Environmental Health Criteria 16: Radiofrequency and Microwaves, World Health Organisation 1981.
- " 32 - Review of Environmental Health Criteria 16 by Professor Michaelson.
- " 33 - Article by Carpenter and Livstone on Evidence for Nonthermal Effects of Microwave Radiation: Abnormal Development of Irradiated Insect Pupae 1971.
- " 34 - Article by Professor H Fröhlich on The Biological Effects of Microwaves and Related Questions 1980.
- " 35 - Coherent Excitations in Biological Systems, edited by Fröhlich and Kremer, 1983.
- " 36 - Correspondence between appellants and Professor H P Schwan regarding his paper concluding the Symposium on Coherent Excitations.
- " 37 - Summary by Professor Michaelson of studies carried out on human populations exposed to microwave and radiofrequency energies.
- " 38 - Extracts from report of Bushell and Another v Secretary of State for the Environment (1981).
- " 39 - Appeal decision relating to premises at Heywood, Bury.
- " 40 - Summary of qualifications, experience and qualifications of Dr Smith.
- " 41 - Statement given to Dr Smith by Professor H Fröhlich FRS.
- " 42 - Description by Dr Smith of experiments on yeast cells and giant chromosomes of a midge fly.
- " 43 - Table and figures produced by Dr Smith.
- " 44 - Glossary of electronic/electromagnetic terms, and international system of units and orders of magnitude.
- " 45 - Electromagnetic radiation and biological systems.
- " 46 - Microwave and radio frequency exposure limits in various countries.
- " 47 - Report on The Drive to Regulate Electromagnetic Fields in the United States, March 1984.
- " 48 - Correspondence between the council and the appellants' solicitors, March-April 1984.
- " 49 - Letter from the British Telecommunications Union Committee opposing the planning application.
- " 50 - Folder of literature on British Telecom National Networks services.

PLANS

Put in by the appellants

Plan A - Roof plan showing existing and proposed aerials. Scale: 8 ft to 1 in.

" B - Sections through gallery of building at level 30 showing existing and proposed aerials and equipment rooms. Scale: 8 ft to 1 in.

" C - South-west elevation of building showing existing and proposed aerials and towers. Scale: 16 ft to 1 in.

" D - North-west elevation of building showing aerials and towers. Scale: 16 ft to 1 in.

" E - Site of Sunley Building and its surroundings. Scale: 1/1,250.

" F - Microwave links of British Telecom, the Gas Board and the Policy. Scale: 1/50,000.

Put in by the council

" G - Location and surroundings of Sunley Building. Scale: 1/1,250.

" H - Approximate width of signal beams between Sunley Building and Werneth Low. Scale: 1/50,000.