EPA noted above, is limited to only moving in the right direction by making more stringent limits, and does not state that these limits will protect from all mechanisms.

4.5 The 1988 RF standard of the International Radiation Protection Association (IRPA) acknowledged that its criteria, *"protects against thermal hazards,"* and, *"In view of our limited knowledge on thresholds for all biological effects, unnecessary exposure should be minimized."* [Ad-Hoc Petition at pg. 18, IRPA 1988]

4.6 Lack of any protection from induced or contact currents in the Commission's rules further justifies that the Commission's claims in #3.0 above [from FCC 96-326, #1,#168, #169] that its limits *"will protect the public and workers*[69]*"*, that *"they are sufficient to protect the public health*[70]*"* and that they *"provide assurance that recent scientific knowledge is taken into account*[71]*"* are unwarranted. To see this consider that the federal health agencies, university researchers, and other national and international standards all provide for some protection from induced or contact currents. Thus, it is very unclear to the Ad-Hoc Association of how the Commission can decide not to provide for induced and contact current protection and yet at the same time continue to claim its limits are sufficient to protect workers and the public health, and that the recent scientific knowledge has been taken into account in establishing its limits. Consider the following:

4.6.1 EPA told the Commission in 1993 that it should consider the NCRP RF criteria with the addition of,

> *"the 1992 ANSI/IEEE limits for induced and contact RF currents, for the frequency range of 300 kHz to 100 MHz, to protect against shock and burn."*[37]

4.6.2 NIOSH, after finding the induced and contact current protections were removed from the Commission's proposed rules, told the Commission,

> *"NIOSH urges the FCC to develop an additional component to the rules in the near future to address these important aspects of rulemaking* (referring to induced and contact current rules)[66]."

4.6.3 OSHA reported on the Commission's adopted rules and told the Commission,

> *"Absent from your proposed approach is the adoption of limits for RF induced foot and contact currents, such as those presented in the ANSI/IEEE and ACGIH standards....In order to complete your criteria for maximum RF exposures, we strongly recommend that FCC adopt the food and contact current limits published by ANSI/IEEE and ACGIH."*[65]

4.6.4 Dr. E. Adair, then of John B. Pierce Laboratory, noted that a disadvantage of 1986 NCRP compared to the 1992 ANSI/IEEE RF standard was *"no protective limits on induced and contact currents at low frequencies are provided.*[72]"

4.6.5 Dr. A.W. Guy, Emeritus Professor, Center for Bioengineering at the University of Washington also urged the Commission to adopt a standard that would *"provide guidelines to include contact and induced current hazard not covered in the older NCRP standard.*[73]"

4.6.7 National and international standard setting bodies provide some protection from induced and contact currents

(i) 1992 ANSI/IEEE and ACGIH RF standards provide this protection, as noted by OSHA[65] and others.

(ii) The 1988 RF standard of the IRPA that its electric and magnetic field strength limits for occupational exposure apply *"provided that the body-to-ground current does not exceed 200 mA, and that any hazards of radiofrequency burns are eliminated according to the recommendations* (in its RF shocks and burns section). Indeed, the Commission refers to this standard in its NPRM at para. 24.

(iii) A review published under the joint sponsorship of the United Nations Environment Programme, the IRPA, and the World Health Organization (WHO) gave the findings of a WHO/IRPA Task Group on Electromagnetic Fields in the range of 300 Why to 300 GHz which include, "Field exposure guidelines should also contain RF limits to eliminate hazards from shocks and burns." [WHO, 1993 at pg. 178].

Also, the WHO/IRPA 1993 RF standard requires that the electric and magnetic field strengths for occupational exposures only apply *"provided that the body-to-ground current does not exceed 200 mA, and the hazard of RF burns is eliminated. In general, RF burns will not occur if the current at the point of contact does not exceed 50 mA"*...and that general population limits apply, *"provided that any hazard from RF burns is eliminated."* [WHO/IRPA, 1993, at pg. 185][76]

(iv) NCRP 1986: In its rules the Commission states its limits are generally based on those in 1986 NCRP sections and including 17.4.1[77]. Yet in this section it states,

"The recommended limits of exposure below 30 MHz, and perhaps at frequencies somewhat higher, apply to free-space exposure conditions....For other conditions, such as standing on the ground with insulation (e.g. shoes or wooden floor) and being grounded by contact of the hand with a grounded object (e.g. metal fence or pipe) or being grounded and touching an insulated metallic object (e.g. truck or crane) these limits should be lowered ....(and exposure limits are not to allow) RF burns at point of contact (200 mA). [NCRP 1986 at pg. 281 in 17.4.1]

Thus, by deleting from its standard any protections from RF burns the Commission has overlooked one of the requirements of NCRP 1986 for applying its limits. Hence, the Commission has misunderstood that it has adopted the NCRP 1986 limits, since these limits are conditional on the RF burns criteria being met - but which the Commission has deleted.

4.6.8 Therefore, if the Commission nevertheless decides that its rules will not provide protection from induced and contact currents, in spite of the consensus that such protections should be in an RF standard, then the Commission should acknowledge this lack of protection, and should not claim its limits *"will protect the public and workers*[69]*"*, that *"they are sufficient to protect the public health*[70]*"* and that they *"provide assurance that recent scientific knowledge is taken into account*[71]*"*. For as shown above, these claims are unwarranted.

4.6.9 If the Commission continues to believe that there are not reliable means to measure induced or contact currents (in spite of the evidence from NAB and NIOSH), that to assure sufficient protection the Commission must reduce its limits so that for most anticipated situations and body sizes, the limits for induced or contact currents recommended by EPA will not be exceeded. These limits for reasonable 'worst case' body sizes have been determined. The 1992 ANSI/IEEE RF committee which the Commission regards as having expert knowledge reports, "An anatomically realistic model of a human being has been used ... " and refers to certain dosimetric studies of O.P.Gandhi[78] using the FDTD method found valid by the Commission[80]. In these studies Gandhi considers how stringent the electric field strengths must be to assure induced and contact current limits do not exceed safe levels. Accordingly, since the Commission has decided to follow a policy of "an abundance of caution"[79] the Commission's rules must protect from induced and contact current hazards and thus should adopt the limits recommended by Gandhi for this purpose[78], or even the lower limits requested elsewhere in the Ad-Hoc Association FCC 96-326 Petition.

4.6.10 Given the above, the Commission also should recognize it may have overlooked or misunderstood the need and issues concerning induced and contact currents, and it should at least change its rules and adopt the EPA recommendations concerning induced and contact currents. The Commission notes that NIOSH finds such measurements feasible, and reports, "NIOSH states that with a properly calibrated, frequency-tunable, field intensity meter, induced current measurements cold be measured for stations operating up to 108 MHz."[81] While the Commission noted that a study found certain measurement equipment unreliable, it is noted that this study was released in September 1995, indicating the actual data collection was done almost two years ago, and that in its FCC 96-326 rule the Commission noted a 'clamp-on' device that "may show improved results."[82] No doubt over the past year the Commission has, *"out of an abundance of caution"*[79] studied this device and can now find measurement feasible. If not, then the Commission should indicate the efforts it has made to seek from NIOSH and OSHA recommended measurement equipment, and the Commission's evaluation of that equipment. In any case, since in at least residential and other public areas there is not a framework for monitoring induced or contact currents, the recommended limits of Gandhi[78] should not be exceeded, as noted in 4.6.9 above.

4.7 The Commission's limits for workers are not adequately protective because the Commission has disregarded NIOSH's and OSHA's directive to require in the Commission's rules the elements of an RF program.

4.7.1 NIOSH has told the Commission, "In general, the standard provides minimal guidance on control measures, appropriate medical surveillance, training, or hazard communication."[29] Since the Commission's adopted rules are practically identical to that which NIOSH commented upon, its comments are still valid. Especially important is "medical surveillance" since because there are grounds for doubt of the protection provided by the Commission's rules, by assuring there is medical surveillance, the Commission is acting with prudence to help assure unsuspected problems or RF hazards are detected. Thus medical surveillance is a critical element if the higher tier of exposure for workers is to be allowed - otherwise, the Commission's rules lack this important protection.

4.7.2 OSHA has told the Commission concerning its RF limits

"The resulting limits for maximum RF field strength, power density and localized SAR would be appropriate elements in a comprehensive RF protection program, and part of an employer's overall safety and health program."[65]

Since the Commission determined it did not have the authority to put into its rules the few sentences requested by OSHA that would name the elements required in such a program, therefore the Commission has no assurance that the comprehensive RF program elements indicated by OSHA will be established. Accordingly, since the Commission has said it will defer to the advice of the federal health agencies, and since by not requiring the needed RF safety program elements OSHA says are needed, it follows that the Commission cannot approve of the higher tier of exposure for workers. For OSHA states this should only be allowed when the Commission's rules provide for an RF safety program that will *"mitigate any potential increase in risk."*[61] While the Ad-Hoc Association does believe the Commission has jurisdiction to state the necessary elements of an RF safety program, if the Commission does not believe this, then also it cannot permit the higher tier exposure to be allowed until there are assurances need RF protections will be in place - a requirement OSHA says is necessary.

While the Commission states OSHA should step in and provide the specific rules, it is not clear this is likely to occur. First, Congress has mandated that the Commission set the RF rules, and if the Commission's rules include the workplace, then a court may find OSHA does not have jurisdiction to make more stringent requirements than the Commission. In addition, OSHA may not have the personnel or other resources to undertake a rulemaking proceeding establishing such procedural requirements for the telecommunications and other industries, for as the Commission has seen from its experience, such an OSHA proceeding could require substantial resources. Therefore, since the Commission was given the mandate and responsibility to set safe RF safety rules in the workplace it must do so. For the above reasons for the Commission to approve of the higher tier of exposure but not provide for the needed RF safety program would not show prudence or due diligence. Since the Commission has done otherwise, and has allowed the higher exposure without assuring the needed medical surveillance and other program elements are in place, in this regard the Commission's rules also lack adequate protection of worker safety.

4.8 Summary of federal health agencies comments

The above leads to the understanding that the federal health agencies have concurred that the Commission's approach is an improvement and one which provides an improved standard to protect from the adverse effects from body over-heating, but not protection from nonthermal effects or from induced current or from RF shocks and burns from contact currents.. The July 1996 comments of each federal health agency to the Commission, and the reaffirmation of M. Nichols in January 1997, all lead to the conclusion that Mr. Hankin has *correctly construed* the EPA Administrator as well as those of the other federal health agencies, and these comments all are consistent with concurring .that, *"The statement referring to 'adequate protection' pertains to thermally related effects."* [page 2 of N. Hankin letter noted above].

Therefore, the above is yet one more reason the Commission should not presume its limits are sufficiently protective and therefore it should seek the evaluations of the federal health agencies of the Ad-Hoc Association claims and RF health effects claims of other parties to this proceeding. As requested and described in 4.6.9 and 4.6.10 the Commission should at least change its rules to prevent induced and contact current limits from being exceeded.

5. Studies found suitable for RF standard setting by the 1991 IEEE RF committee include many studies showing adverse health effects below the Commission's 4 W/kg hazard threshold, demonstrating the limited protection of the Commission's criteria

Besides considering the assessments already in the record of the federal health agencies, one way to demonstrate to the Commission that its limits have limited protection is to consider studies finding evidence of adverse effects below the Commission's 4 W/kg hazard threshold. In order to help identify well designed and properly analyzed, science-based studies, the Ad-Hoc Association considered the studies selected by the Literature Surveillance, Engineering Validation, and Biological Validation 1991 IEEE RF committees. These 1991 IEEE studies are called, the Final List of Papers Reviewed For IEEE C95.1-1991 (the 1991 IEEE RF standard).

The Ad-Hoc Association reported in its FCC 96-326 Petition the following results from these 'final list' papers, with exposure levels in percent of the FCC hazard threshold, and page

cited in the Ad-Hoc Association FCC 96-326 Petition at pg. 10-12, author reference is in ( ) and may be found in the Ad-Hoc Association Petition.

5.1 Studies of 'operant behavior disruption' among the papers found suitable for standard setting by 1991 IEEE RF committees. Note, this behavior is the disruption of learned behavior or learning of new behavior and which was claimed by both 1986 NCRP and 1991 IEEE to be the basis for their RF standard. Hence, studies identified as well done and reviewed for developing the 1992 ANSI/IEEE should nevertheless report disruption of learned behavior or learning of new behavior ***below*** the 4 W/kg hazard threshold of these standards; this raises considerable uncertainty as to the protection of the Commission's limits which are also based upon these two standards. The evidence for this is as follows:

5.1.1. At 58% of the Commission hazard threshold, "decrement in discriminative performance" [at 10, e.g. at page 10 of the Ad-Hoc Association 96-326 Petition] (Mitchell et al. 1977)[16]

5.1.2 At 50% of the Commission hazard threshold, "marked decrements in responding occurred," [at 10] (Gage et al. 1979)[17]

5.1.3 At 50% of the Commission hazard threshold, "the monkeys tended to take longer to make a detection response." (de Lorge 1984)[18]

5.1.4 At 40% of the Commission hazard threshold, "increased decrements in rates of behavioral responding..." [at 10] (Gage et al 1982)[19]

5.1.5 At 30% of the Commission hazard threshold, "rats ability to discriminate the appropriate (time interval to get food) was disrupted." [at 10] (Thomas et al 1982)[20]

5.1.6 At 18% of the Commission hazard threshold, "Error responding was increased during most of the session." [at 10] (Schrot et al. 1980)[21]

5.1.7 At 5% of the Commission hazard threshold, rats given dextroamphetamine, used to treat children and adults with Attention Deficit Disorder, *"the response rates were notably higher* (too many responses, indicating more errors)." [at 11] Thomas et al. 1979)[22]

5.2 Other 'final list' studies found suitable for standard setting by 1991 IEEE committees

At 50%-75% of the Commission hazard threshold there was observed

5.2.1 Increased cancer acceleration for breast cancer[23],

5.2.2 Increased lung sarcoma cancer nodules[23],

5.2.3 Accelerated skin cancer with prior RF exposure prior to applying a skin carcinogen[23],

5.2.4 Skin cancer with simultaneous RF exposure and application of a skin carcinogen[23] [details for 5.2.1-5.2.4 given in #7.4-7.8 below and also see at Ad-Hoc Association FCC 96-326 Petition at 11 and at footnote 89 of this petition] (Szmigielski, 1982)[23]

5.2.5 At 58% of the Commission hazard threshold, *"frequency of structural anomalies* (in nerve cells) *was approximately 3 times greater"* [Ad-Hoc FCC 96-326 Petition at11] (Switzer, 1979)[24]

5.2.6 At 50% of the Commission hazard threshold, "high rate of cranioschisis" (incomplete cranial development), [Ad-Hoc FCC 96-326 Petition at 11] (Berman, 1979)[25]

5.2.7 At 0.25% (1/400th) of the Commission hazard threshold, increased evidence of brain damage [Ad-Hoc 96-326 Petition at 11] {NCRP 1986, Oscar 1977)[26].

5.2.8 At 0.15% (about 1/600th) of the Commission hazard threshold, changes in ultrastructure changes in part of brain, which "most probably effect their function and constitutes one of the elements of pathogenesis of early disturbances in people exposed to this environmental hazard." [Ad-Hoc 96-326 Petition at 12] {Belokrinitskiy 1982)[27].

Therefore, adverse health effects have been reported among studies found to be well-done, scientifically sound, and suitable for standard setting by 1991 RF standard committees. Some scientist may require more replicated experiments and refinements before allowing adverse effects at these levels to be conclusively established as a scientific fact. Yet, the existence of the above scientifically well-done studies necessarily prevents claims that the Commission's hazard threshold provides protection from such effects. Since uncertainty will likely continue, prudence requires that due diligence, and not scientific certainty, should direct public policy. Hence, the Commission should acknowledge the Commission's limits do not provide protection for the adverse effects noted above and observed at exposure levels below the Commission's 4 W/kg hazard threshold. Those effects occurring below the hazard threshold of the Commission, reported here and elsewhere in this proceeding should be acknowledged by the Commission when it indicates the limited nature of its standard's protection.

5.3 NCRP 1986 RF review overlooks papers IEEE 1991 committees find suitable for standard setting and which report disruption of behavior below the hazard threshold of NCRP 1986, further raising doubts as to the thoroughness of the NCRP 1986 review, and the protection provided by NCRP 1986 limits.

The 1986 NCRP review upon which its standard is based did not include many of the 1991 IEEE final list paper studies above even though they were published by the end of 1982 cut-off date [see NCRP 1986, pg 4], and where published in well-known peer-reviewed journals, e.g. paper 5.1.2 (1979) in Journal of Microwave Power, paper 5.1.4 in 1982 in Radio Science, and papers 5.1.6 in 1980 and 5.1.5 in 1982 both in Bioelectromagnetics. Thus, the absence from NCRP consideration of these significant papers raises doubts as to the thoroughness of the NCRP review and increases uncertainty regarding the protection 1986 NCRP limits provide.

5.4 Three additional studies at 15% to 18% of the Commission's hazard threshold find disruption of operant behavior and these further support evidence that the Commission's hazard threshold needs to be more stringent and that RF exposure limits derived from the present threshold should not be expected to protect from all mechanisms of interaction.

[see Ad-Hoc Association FCC 96-326 at page 16, footnotes 131, 133 and see Lai, Guy et al 1989[35], and D'Andrea 1986[32] D'Andrea and de Lorge 1990[33]]. These studies include a 1989 study reporting "deficits" in spatial memory at 15% of the Commission's hazard threshold[Lai, Guy et al 1989[35]] and the study was also replicated in 1994 [Lai, Guy et al. 1994][34]. Please note the co-authors of these papers include Dr. A. Guy, the Chairman of the 1986 NCRP and Chairman of the dosimetry committee that reviewed papers for the 1992 ANSI/IEEE RF standard, and Dr. Lai is also a member of the committee which determined this standard - hence these papers can reasonably be assumed to be of a quality suitable for standard setting. In addition, the two authors (D'Andrea and de Lorge) whose 4 studies on disruption of behavior were those selected by 1992 ANSI/IEEE to determine its hazard threshold[36] subsequently prepared a review in 1990 of papers of disruption of operant behavior. They concluded significant disruption of operant behavior occurs at below 0.7 W/kg which is 8% of the Commission's hazard threshold, and stated,

"Based on results of these studies, it is possible to specify that a threshold for significant behavioral effects at 2450 MHz is between 0.7 and 0.4 W/kg."[33]

Thus 7 studies show disruption of operant behavior at exposures below 4 W/kg, with some occurring at 0.7 W/kg. In addition, 3 more papers report similar disruptions at exposures in the range of 0.6 to 0.7 W/kg, with a 1994 paper replicating the results of a 1989 paper. Thus, 4 papers report disruption of operant behavior at 0.6 to 0.7 W/kg and whose co-authors include those with leadership roles in RF standard setting, and includes 1 'final list' 1991 IEEE paper. Since such disruption is the one criteria for setting RF safety standards for which there is a consensus, the above is sufficient evidence to place the RF hazard threshold at no more than 0.6 W/kg, or 15% of the Commission's present hazard threshold.

6. Correctly stating the extent of protection provided by the Commission standard was a central concern of the federal health agencies (and not just one of many details to address).

6.1 EPA, as one of its four summary points in its 1993 letter[37] to the Commission, raised its concern that the limited protection of an RF standard be recognized, and noted the 1992 ANSI/IEEE claim of complete protection was *"unwarranted."*

6.2. FDA, as one of its two main concerns in its 1993 letter to the Commission[30], focused on the uncertainty of protection provided by a standard based upon the 4 W/kg hazard threshold that it was evaluating (1992 ANSI/IEEE), and FDA noted findings of associations of cancer development with RF at exposure levels below the 4 W/kg hazard threshold of the Commission.

6.3 NIOSH in its 1/2 page of "General Comments" in its 1994 letter, while mentioning 3 key concerns, for <u>only one</u> did it explicitly instruct what the Commission *"should"* do, and stated,

"The exposure levels that would be set by the standard are based only on one dominant mechanism - - adverse health effects caused by body heating. Nonthermal biological health effect have been reported in some studies and research continues in this area. The standard <u>should</u> note that other health effects (below 4 W/kg) may be associated with RF exposure and that exposure <u>should</u> be minimized to the extent possible."[38]

6.4 In addition, to see how important this issue is, note there was considerable attention given to the clarification of N. Hankin of EPA that the "adequate protection" of the Commission's limits to which the EPA Administrator referred was considering only protection from thermal effects. For example, in the industry journal Radio Communications Report (RCR), it was noted,

"The wireless industry and the Electromagnetic Energy Association had pressed EPA for months to publicly restate its backing for the new hybrid RF exposure guideline as expressed by EPA head Carol Browner....Much confusion and anger were created when Norbert Hankin, an associate under Nichols, told David Fichtenberg of Washington state in an Oct. 8 letter that the new RF standard does not protect against potential nonthermal health risks,...".

Ironically, the article was titled, *"EPA gives commission's new RF guideline a clean bill of health,"* which is surprising, since the EPA administrator M. Nichols stated Mr. Hankin's remarks were *"incorrectly construed as a departure from the Administrator's position in July* (1996)." As noted above, EPA thus reaffirmed that Mr. Hankin's comments give the proper interpretation of the EPA Administrator's use of "adequate protection." Hence, not only should Ms. Nichols remarks convince the Commission that its standard has limited protection, but also, it should highlight for the Commission that for many parties, the nature of the protection provided by the Commission's rules is a major concern. Thus, above it has been noted the importance given in public discussion on this matter, and the important focus given by the federal health agencies that the 4 W/kg provides limited protection from thermal effects (at best). Accordingly, the Commission is urged to correct its statements about the protection provided by its standard as noted herein (and in the Ad-Hoc Association FCC 96-326 Petition at pg 16,18, and comments throughout the Reply Comments of the Ad-Hoc Association, dated Oct. 28, 1996, to the Comments of Arch Communications and the Cellular Telephone Industry Association.)

7. That cancer acceleration has a positive association with RF exposure below the Commission's hazard threshold should further motivate the Commission to revise its statements of the protection provided by its rules, and to adopt the requests of the Ad-Hoc Association FCC 96-326 Petition, and other requests made herein and in this proceeding.

A preponderance (8 of 9) of reported cancer studies in which animals were exposed for at least 3 months to RF at levels below the Commission's hazard threshold shows a positive assoication between RF exposure and cancer acceleration, and all 9 of 9 show results consistent with there being a biological effect of RF on cancer development. In addition, 2 studies where RF exposure was less than 3 months still show results, although not reported to be statistically significant, yet suggest a positive association of cancer and RF.

To obtain an "unbiased" list of reported studies of cancer outcomes and RF exposures for at least 3 months at levels below the Commission's hazard threshold, the Ad-Hoc Association used the

references in a recent, May 1997, Radiation Research peer-reviewed study on this topic. Insofar as the paper was received for publication in July 1996, animal cancer studies reported since then in Microwave News were also included in the Ad-Hoc Association review. Since the Ad-Hoc Association is concerned about the adequacy of the Commission's 4 W/kg hazard threshold, only studies of exposure at or below this threshold were reviewed. Results show a preponderance of studies showing a positive association between RF exposure and cancer acceleration. Please consider:

- Recently reported results:

7.1. Lymphoma cancer: At no more than 35% of the Commission's hazard threshold, compared to controls there was a two-fold increase of lymphoma incidence for lymphoma prone mice exposed 18 months to 900 MHz pulsed at 217 Hz, as reported in May 1997[2]. Of control mice 22 of 100 developed lymphoma cancer compared to 43 of 101 mice exposed to RF for 18 months.

7.2. Mammary cancer: A study begun in 1989 found that at 8% of the Commissions hazard threshold, 30% more of mice exposed 19 months to RF developed palpable abnormalities (likely mammary tumors) than controls - the likelihood of occurring by chance was less than 1%[3]. After 19 months 115 of 200 mice exposed to RF at 0.32 W/kg (8% of 4 W/kg) developed palpable abnormalities compared to 88 of 200 control mice.

- Other results of a positive, statistically significant association of cancer and RF exposure:

7.3. Primary malignant tumors in the aggregate: At no more that 10% of the Commission's hazard threshold, there was a more than 3 fold increase in primary malignant tumors aggregated from all sites after 25 months for RF continuously exposed rats compared to controls, at 2450 MHz (Chou et al 1992) [Ad-Hoc Association FCC 96-326 Petition at 16 and footnote 111][40] 18 of 100 rats exposed to 0.4 W/kg developed primary malignant tumors compared to 5 of 100 controls.

7.4. Skin cancer while exposure to RF: At 50% of the Commission's hazard threshold, mice were exposed or sham exposed 2 hours a day for 6 months to RF at 2450 MHz and also treated with every 2nd day with a skin carcinogen, 3,4, benzopyrene, for 6 months. Half the RF exposed

animals died by the 268th day compared to half the control mice living to the 331st day. There were 100 mice in each group. (Szudzinski, 1982) [referenced in Exhibit 87 in the Ad-Hoc Association FCC 96-326 Petition][41]

7.5. Skin cancer while exposure to RF: At no more than 50% to 75% of the Commission's hazard threshold, mice were exposed or sham exposed to RF at 2450 MHz for 5 months and also treated with a skin carcinogen application of 3,4 benzopyrene every 2nd day for 5 months. After 8 months from the start of the carcinogen application, there was a 4.6 fold increase in mice with skin cancer for RF exposed compared to control mice; 23 of 40 mice so exposed to radio signals and a skin carcinogen developed skin cancer compared to 5 of 40 control mice only exposed to the skin carcinogen. (Szmigelski, 1982)[23]

7.6. Skin cancer after first 1 or 3 months prior exposure to RF: At no more than 50% to 75% of the Commission's hazard threshold, mice were exposed to RF at 2450 MHz for 1 or 3 months, and then after the end of the RF exposure period the mice were treated with a skin carcinogen 3,4 benzopyrene every 2nd day for 5 months. After 8 months from the start of the application of the skin carcinogen there was a 4.5 fold increase in mice with skin cancer for those exposed to RF for 1 month. 18 of 40 mice that had 1 month of prior exposure to radio signals and then exposed to a skin carcinogen 3,4 benzopyrene developed skin tumors compared to 4 of 40 control mice only treated with skin carcinogen.

Moreover, 29 of 40 mice exposed to RF as above, but for 3 months instead of 1 month prior to application of skin carcinogen, developed skin tumors resulting in a 7.25 fold higher incidence than controls (4 of 40 mice).

Note that a cumulative effect of the RF exposure is suggested, since more mice developed tumors after 3 months of RF exposure prior to skin carcinogen treatment than those exposed to RF for only month. (Szmigelski, 1982) [Ad-Hoc Association FCC 96-326 Petition at page 11- a 1991 IEEE final list paper, and footnote 89][23]

7.7. Mammary cancer: At no more than 50% to 75% of the Commission's hazard threshold, mammary cancer prone mice were exposed or sham exposed to RF at 2450 MHz. After 8 months, there was a 6 fold increase in mice with skin cancer for RF exposed compared to control

mice. 18 of 40 breast tumor prone mice developed palpable breast tumors compared to just 3 of 40 control mice. (Szmigelski, 1982)[23]

7.8. Sarcoma cancer nodules in lung: At 50% to 75% of the Commission's hazard threshold, for mice injected with sarcoma cancer cells, mice exposed 3 months to RF at 2450 MHz had 69% more sarcoma cancer colonies on the average than control mice (Szmigelski, 1982).[23]

Study showing a suppressive effect of RF on brain tumor development

7.9. Brain tumor growth in carcinogen and non-carcinogen treated rats: (Adey et al, 1996) At about 837 MHz rats were exposed in the far field from the fetal period, when they were exposed to the carcinogen ENU (ethylnitrosourea) through 23 days after birth. Then they were also exposed in the near field from day 35 for 22 months. Time averaged near-field exposures were from 14% to 19% of the Commission's SAR hazard threshold, pre-natal exposures were less. Treated rats and rats not treated with a brain carcinogen were divided between controls (sham exposed) and those exposed to RF, with about 56 to 60 per group. Of the those exposed to carcinogen 4 of the RF exposed and 13 of the controls developed brain tumors. Of those not exposed to carcinogen 2 of the RF exposed and 7 of the controls developed brain tumors. Microwave News (July/August 1996, pg. 11) reports these results were statistically significant and indicate a suppressive effect of the irradiation. Thus, even though the sample design was not prepared to test for a suppressive effect, the strength of the results yet indicate a biological effect of the irradiation.

Other results where exposure was less than 3 months and results were consistent with a RF - cancer association, but where authors did not report statistically significant differences:

7.10. Melanoma skin cancer: At 30% of the Commission's hazard threshold, mice injected with melanoma cells and exposed to pulsed 2450 MHz RF had melanoma tumor sizes on the average 30% greater than controls by the last day measurements were made (at 27 days after inoculation 5 RF exposed mice and 6 controls remained alive) (Santini, 1988) [referenced in Ad-Hoc Association FCC 96-326 Petition Appendix 7][42]

7.11. Transplanted brain tumor growth: Part of a small sample size exploratory experiment included exposing at 915 MHz 12 pairs of rats to 3 modulation patterns of 4, 8.33 and 16 Hz, 4

pairs per pattern, with the maximum average whole body specific absorption rate (SAR) of exposure being no more than 1% of the Commission's hazard threshold ("Low SAR" group). 25 additional pairs were exposed to 3 other modulation patterns of 50 and 217 Hz and continuous wave, with the average SARs being 25%, 10%, and 42% respectively of the Commission's hazard threshold ("High SAR" group). The area of the tumor of each member of the pair was measured when either member showed neurological signs of a brain tumor.

The average of the ratios of the tumor size of each exposed animal to that of its matched control have been aggregated by the Ad-Hoc Association and found to be for the pairs exposed to less than 1% of the Commission's hazard threshold: 4.0, and for pairs exposed to 10% to 42% of that threshold the average ratio was 1.7, with no change observed at around 10% of the Commission's hazard threshold. It is unclear whether these ratios may be due to chance since the raw data was not available to the Ad-Hoc Association and the number of sample pairs was small. Still, this suggests a stronger promotional effect at a lower SAR; note that this suggestive pattern is consistent with a finding (Cleary,1990)[44] that SARs about 6 times greater than the Commission's hazard threshold suppressed brain tumor cell growth in a cell culture medium, but that at 1/5th of this SAR that brain tumor growth was stimulated.

Also, Salford et al. report,

"It is noteworthy that for some modulation frequencies the average tumour size in the exposed animals largely exceeds the average tumour size in the controls, despite the fact that the number of matched pairs where the exposed animal shows a larger tumor than the controls only insignificantly exceeds the number of pairs showing the reverse. This might indicate that in the few animals, that for some reason, are sensitive to the (RF) exposure, tumor growth is stimulated strongly." (Salford, 1993) [Ad-Hoc Assoc. FCC 96-326 Petition at footnote 128][43]

Some comments on study #7.9 compared to study #7.11 are:

- #7.11 used transplanted tumors cells vs. #7.9 which used a chemical carcinogen to promote cancer
- the SAR exposure levels in #7.9 were near the "High SAR" in #7.11 at which no effect was seen, and so both #7.9 and #7.11 saw no promotional effect at an SAR of about 10%-42% of the Commission's hazard threshold.

- one may speculate that there is some threshold mechanism of interaction in the brain suppressing tumor promotion such that at the higher SAR of #7.9 this threshold is exceeded while at the Low SARs of #7.11 it is not activated and thus permits brain tumor promotion. A parallel for this may be found by considering X-rays. It has been noted, *"Low dosage with X-rays of rats at the time of ENU dosage has been reported to sharply reduce subsequent incidence of induced brain glial tumors..."* (reviewed in Adey, 1997). Yet, it is known that while high doses of X-rays can be used to treat and reduce tumors, that some low doses of X-rays can also serve as a carcinogen.

8. FDA and EPA comments on animal RF cancer studies

8.1 A FDA review of the laboratory evidence "strongly suggests" RF can accelerate cancer

A 1993 review of laboratory studies of RF and cancer was made by the FDA Center for Device and Radiological Health [given in Ad-Hoc Association FCC 96-326 Petition in Exhibit 7]. There review included within it all of the animal studies above published through 1992, i.e. studies #7.3 through #7.9, and also included Cleary (1990) noted above. The review concluded that while there is limited data,

> *"The fact remains, however, that the data which exists strongly suggests that microwaves can, under at least some conditions, accelerate the development of malignant tumors. This in-vivo (live animal) data is also supported by in-vitro data which has demonstrated not only malignant transformation but other effects on the cell's growth control mechanisms."*

Since this review, studies #7.1, 7.2, and 7.10, and #7.11 have been published. All provide data consistent with RF having a biological effect, with #7.1 and #7.2 providing data showing the cancer acceleration effect was statistically significant, and #7.10 provide data consistent with an acceleration effect.

8.2 EPA makes science policy assuming no threshold for a carcinogen and states,

> *"Based on extensive scientific evidence, EPA believes it prudent to assume that carcinogens, including radionuclides, pose a risk of health effects even at low levels of exposure. Based on this science policy judgment, EPA calculates health risk estimates assuming that risk of incurring either cancer or hereditary effects is linearly proportional to the dose received in the relevant tissue."* [Federal Register Vol. 54, No. 240, pg. 51659, Dec. 15, 1989]

9. Cancer epidemiological studies further support Ad-Hoc Association FCC-96-326 and FCC-96-487 Petition for Reconsideration requests

The Commission is urged to review the epidemiological studies noted in this proceeding, including those of the Petitions for Reconsideration of FCC 96-326 and FCC 96-487 submitted by the Ad-Hoc Association and of the Cellular Phone Taskforce.

Some studies showing cancer effects associated with chronic low level RF exposure

9.1 Residential study finding a 2.74 increase in childhood lymphatic leukemia mortality near TV transmitters[45]

9.2 Residential study finding a 1.83 increase in adult leukemia incidence associated with living close to TV, FM radio transmitters[6]

9.3 For a study of 20 transmitters it was reported, "*there is evidence of a decline in leukemia risk with distance from transmitters...*"[7]

9.4 A 3.7 to 13.9 fold increase for various types of leukemia, 3 fold for Hodgkin's disease, lymphoma and lymphosarcoma, and 2 fold of any cancer in military personnel exposed to RF at levels below 'safe' FCC limits[46].

9.5 Increased Hodgkin's disease was reported in MIT laboratory staff when compared to a cohort of similar professionals (a physician cohort was used).[83]

9.6 Increased testicular cancer in persons self reporting exposure to microwaves. For a case control study, "A statistically significant association was found for reported exposure to microwave and the other radio waves. The finding held for seminomas and the other tumor types."[85]

9.7 Hawaii study of census tracts with TV or FM transmitters reports, "Observed incidence rate of all cancers for males and females was found to be significantly higher in census tracts with broadcasting towers than the expected rate (likelihood due to chance is less than 1/100th) after adjusting for age and race."[90,84]

Two controversial studies showing results consistent with a RF - cancer promotion association

9.8 NCRP 1986 overlooks or misunderstand important findings on a study of the Moscow American Embassy Study where exposure continued for a 23 year period [51] Since this was one of two general mortality epidemiological studies reviewed by NCRP 1986, and because important

considerations were overlooked, this will be discussed in detail. Consider the following reported information:

9.8.1 98.8% of the urban U.S. population was exposed to a power density of less than 0.5 microwatts/sq. cm for frequencies from 54 MHz to 900 MHz. Contributions to power density from frequencies over 900 MHz were negligible, and excludes AM frequencies whose absorption by humans is negligible.[52,53]

9.8.2 Biological effects associated with RF at 1 to 10 microwatt/sq. cm.

9.8.2.1 At 1 microwatt per sq. cm. millimeter length radio waves suppressed the ability of chromosomes stressed from their normal shape by X-rays to return to their original positions.[54]

9.8.2.2 At between 0.2 and 8 microwatts per sq. cm an epidemiological study of one transmitter group found for those living near TV transmitters a 2.74 fold increased risk for childhood leukemia mortality[45].

9.8.2.3 At less than 10 microwatts per sq. cm. a 6 fold increase in microneuclei occurred in cattle living near sources of RF exposure. Microneuclei occur may occur when chromosomes break.[50]

9.8.2.4 At 10 to 50 microwatts per sq. cm. for RF exposed workers at a radar station, *"Abnormal micronuclei (detached portions of nuclear DNA) were more numerous in workers with microwave than with vinyl chloride* (and than with controls)." [reported by W.R. Adey[55] on studies of Garaj-Vrhovac et al (1990[56],1992[57])]

9.8.3 Exposure levels at Russian and Eastern European U.S. embassies were near 1 microwatt per sq. cm.

(a) Tests at all Eastern European comparison posts were made periodically.... *"levels (~1 microwatt per sq. cm were detected at these Eastern European embassies,"* and it is also reported that for the U.S. embassy that there were *"background levels near 1 microwatt per sq. cm."* [1986 NCRP, pg. 211-214]

(b) Maximum exposure by the Moscow embassy was 5 microwatts per sq. cm. (except for a 8 month period from June 1975 to Feb. 7, 1976). It is also reported that,

"An independent analysis of the RFEM field that had been incident on the Moscow Embassy was performed later by engineers and physicists of the Johns Hopkins University Applied Physics Loboratory[58]. They estimated uniformly lower power densities than those

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June 10, 1997

Ms. J. Hoce
Kinko's

RE: Installation of 3M Scotchtint ™ Washington, DC Store

We propose to furnish all labor, material and equipment to install 3M Scotchtint ™ Window Film to windows for the location of . The price of this proposal is listed below for the 3M Films RE50NEARL or RE35NEARL. Please, do not hesitate to contact me if you have any questions.

Store Front (5) panels $ 480.00

Our prices would include the following:

1. A complete turn key operation.

2. A 3M 10 Year Warranty for both labor and material should cracking, peeling, optic distortion or demetalization occur.

3. A 3M one year glass breakage warranty should failure result due to film application (limit $500 per window).

4. All work to be performed by in-house, 3M trained employees experienced in applying films such that tenant disruptions are minimized.

We thank you for this opportunity to present this proposal.
Sincerely,

Tanya M. Davis
Sales Executive

provided by the State Department except for one recording of 24 microwatts per sq. cm. in one room during a 2 hour period on 24 January 1976." [1986 NCRP, pg. 211-214]

Thus, it is likely that the average exposure by the U.S. Moscow embassy was similar or only slightly greater than that at the Eastern European embassies. Note that exposures at both U.S Moscow and U.S. Eastern European embassies exceeded levels to which 98.8% of the U.S. urban population were exposed.[see 8.1] Given this relatively much greater 'background' exposure at the Moscow and Eastern European posts than for the U.S. population, it is unclear why NCRP 1986 did not mention this point.

9.8.4 Cancer and other disease mortality at the Moscow and Eastern European embassies [from Table 5.6, page 91 from Lilienfeld et al., 1978]

	Moscow			Eastern European		
	Observed	Expected	Ratio	Observed	Expected	Ratio
All causes of death	49	105.3	0.47	132	223.7	0.59
Cancer (malignant neoplasms)	17	19.0	0.89	47	41.1	1.1
Non Cancer deaths	32	86.3	0.37	85	182.6	0.47

[non cancer death computations in each column above were made by the Ad-Hoc Association by subtracting from the total deaths the cancer deaths]

The authors explain that for just the Moscow State Department male employees the mortality ratio was 0.47. They explain that this means,

"that their mortality experience was 43% of that of that of the male population of the United States. This lower mortality ratio is not totally unexpected since it represents what has been described as the 'healthy worker effect' which results from the selection of healthy individuals for employment in the different government agencies. In addition, the degree of selection is probably even greater for assignment to these study posts." [pg 84 of Lilienfeld et al]

Thus, a 'healthy worker effect' seems to occur for both the Moscow and Eastern European embassy employees for the non-cancer deaths, with the non-cancer deaths being about 42% (37% to 47%) of what would be expected for a similar group of the U.S. population.

Given the above, one might expect that the 'healthy worker effect' would also apply to cancer deaths, and would expect that the number of cancer deaths would be about 42% of that expected for a similar U.S. population. However, this does not happen. Rather, the number of

cancer deaths is 2 fold greater than what would be expected from the 'healthy worker effect' estimate based on non-cancer deaths.

Similarly, a review of this study in an IEEE publication concurred with the above Ad-Hoc Association analysis and reported that mortality from cancer *"was proportionately more frequent than the other causes of death in both groups*[96]*."* Given that this is one of the most important findings of this study, it is unclear why NCRP 1986 did not mention it in its review - presumably these findings were overlooked or misunderstood during the NCRP 1986 review process.

9.8.5 Reasons for controversy:

9.8.5.1 Those claiming no RF effects were found chose to use the Eastern European group as 'controls'. Then they correctly find no difference between the 'controls' and the 'exposed'.]

9.8.5.2 Those claiming RF effects appear consistent with a cancer association use the U.S. population as 'controls' and both the Moscow and Eastern European embassy employees as 'exposed' since the RF exposure levels of both groups are similar (based on the NCRP 1986 RF review). Ironically, the NCRP 1986 review takes the approach of 9.8.5.1 even though in the exposure data provided in this review it is seen the exposure levels of the two groups are close.

9.8.6 Summary: The data suggests that both the Moscow and Eastern European embassy employees were exposed to around an average of 1 to 2 microwatts per sq. cm, which is a level greater than that to which 98.8% of the population is exposed. Laboratory and epidemiological studies indicate that chromosomal damage or suppression of repair, as well as increased cancer rates have been associated with RF exposure levels of around 1 microwatt per sq. cm. Both embassy groups were likely exposed near or just above this RF exposure level.

Conclusion: The U.S. Embassy study results are consistent with and are in the direction of an association of cancer with chronic low levels of RF irradiation.

9.9 Heart disease RF link at within 1992 ANSI/IEEE limits raises doubts about protection provided by the Commission's limits: An epidemiology study found suitable for standard setting by the committees preparing 1992 ANSI/IEEE reported an association between heart disease and RF exposure[93]. There were two RF wave lengths, short wave at 27 MHz and UHF at 2450 MHz. The distribution of study respondents using one or both of these wavelengths was: Only UHF:

116, Only Sort Wave: 941, UHF and Sort Wave: 1487. While Ultra sound and infra-red diathermy were also studied, the only heart disease effects found were associated with RF exposure. When the 35+ respondents were studied association with heart disease and using either UHF or Short Wave was found when considering number of treatments per week, length of employment and the both of these factors together.

The maximum partial body exposure with a 1 meter applicator - operator distance was reported to be 16.58 mW/sq. cm at the waist. The 1992 ANSI/IEEE standard allows for partial body exposure 24.7 mW/ sq. cm at 27 MHz and 20 at 2450 MHz[94]. Since a finding of an association between RF and heart disease when the maximum local body exposure was reported as 16.58 mW/sq. cm, this indicates that exposure levels allowed by 1992 ANSI/IEEE as 'safe' are associated with increased risk of heart disease. Assuming the relationship is correct between the maximum power density allowed by 1992 ANSI/IEEE and an local SAR of 8 W/kg, the findings of this study raise doubts about the protection provided by the Commission's local body exposure limit of 8 W/kg.

In addition, this maximums are for the average of 6 minutes of exposure. The authors report that for the under 35 age group the mean number of minutes within 3 feet of the UHF or Short Wave equipment is less than 2.8 minutes. Thus, actual exposure for less than 3 minutes could be double the limits allowed for 6 minutes, and yet 1992 ANSI/IEEE would still consider this 'safe'.

9.10. NCRP reviewed U.S. Naval study reports for statistically significant increased RF associated mortality risk and also increases in cancer risk consistent with a RF cancer link[88]. This study of Navy personnel during the Korean War defined a Low exposure (including radio men and radar operators whose duties keep them far from pulse generators and antennae) and High exposure group (including Technicians in Electronics, Fire Control, and Aviation Electronics). Exposure group was based upon their potential for maximum exposure and not average exposure. For example, referring to the 'high exposure' group, the authors report,

"Their mean exposure must be very low, perhaps below 1 mW/sq. cm for duty hours, but their exposure pattern is of particular interest because it infrequently includes exposures larger than 100 mW/sq. cm."

It is also reported that the 'Low' exposure group was exposed to levels *"well below 1 mW/sq. cm."* Thus, the average long term dose of the 'low exposure' group may be lower, the same, or higher, than the 'high' exposure group. Since there is evidence that there are cumulative effects from RF exposure (see section xx below), it is unclear which of these two groups are at higher risk. Therefore, that the study found little mortality or morbidity difference between these groups does not resolve any questions concerning RF effects.

Presumably recognizing this problem, the authors determined a 'hazard number' which estimated the potential for exposure based upon each individual's service history. Only those in the 'High' exposure groups were given a hazard number. The fact that 27.8% of the Electronic Technicians had a 0 hazard number further raises doubts as to the relationship between actual exposure and being in the 'High' exposure group.

The NCRP report states, *"on overall analysis, no adverse effects were detected that could be attributed to RFEM radiation."* [NCRP, 1986, 14.1.1]

It is unclear how NCRP 1986 could come to the above conclusion, given findings of statistically significant association of 'overall' mortality with potential increased exposure to RF, a statistically significant association of respiratory cancer and potential increased exposure to RF, and a consistent pattern (although not statistically significant) of 50% greater mortality than expected in the group with the potential for highest exposure compared to other exposure groups. Please see below. Given this, it appears NCRP 1986 overlooked or misunderstood the significance of the findings in this papers. Accordingly, the Commission should not rely upon the NCRP 1986 findings, but rather note the study provides evidence of adverse RF effects.

Given the above, it is more meaningful to compare groups with different Hazard Numbers. Findings include:

9.10.1 The authors report an increased overall risk of mortality was linked to increasing RF Hazard Number. The likelihood of the association occurring by chance was less than 3%. The ratio of observed to expected deaths was for Hazard Numbers 0, 1-5000, and over 5000: 0.82,

0.91 and 1.23 respectively. The highest Hazard Number group had a mortality ratio that was 50% more (1.23/0.82 = 1.5) than the group with the lowest highest Hazard Number group.

9.10.2 The authors report a statistically significant increase in respiratory cancer was linked to increasing Hazard Number (likelihood due to chance was just under 5%). The ratio of observed to expected deaths was for Hazard Numbers 0, 1-5000, and over 5000: 0.82, 0.86 and 2.20 respectively, indicating a significant increase in risk for the highest Hazard Number group.

9.10.3 Lymphatic and hematopoeitic mortality ratios are consistent with RF link:

Concerning the other cancer groups (digestive organs, lymphatic and hematopoeitic system, and other) if the cancer diagnosis category with only 3 cases in the highest Hazard Number group is excluded (digestive organ cancers) then the mortality ratio is consistently highest for the highest Hazard Number group for each caner diagnosis category. For example, consistent with the findings of 9.1-9.5 of relatively higher cancer incidence of the blood and lymphatic systems, for this diagnoses category, the mortality ratios of the 0, 1-5000, and 5000+ Hazard Number groups were respectively, 1.09, 1.04, and 1.64 (with the actual case counts being 6, 12, 8 respectively). Thus the mortality ratio for the highest Hazard Number group was 50% greater than for either of the other two groups. Thus, while the authors did not report statistical significance, perhaps due to small numbers

9.10.4 Likewise: Other malignant neoplasms showed an RF link as Hazard Number increased, where for the 0, 1-5000 and 5000+ Hazard Number groups, the mortality ratio was highest for the highest Hazard Number group, being 0.78, 0.72, and 1.17 respectively (case counts were 6, 12, 8 respectively) - note that 1.17 is 50% higher than the next highest mortality ratio.

Thus for the four cancer diagnosis categories with more than 3 cases in the highest Hazard Number group, the mortality ratio in the highest Hazard Number group was 50% greater than any other Hazard Number.

9.10.5 Diseases of the Circulatory system showed results consistent with 9.7 above suggesting an association of heart disease and RF exposure. The mortality ratios for the 0, 1-5000 and 5000+ hazard group were: 0.94, 0.83, and 1.17 (actual case counts were 36, 73, 41). Thus, the

mortality ratio for the highest Hazard Number group was 24% (1.17/0.94) the next highest hazard number.

9.10.6 Thus, the finding of increased mortality for all causes of death being associated with increased potential RF exposure was a result of a general tendency for the highest Hazard Number group for each diagnosis category to have the highest mortality ratio. Why NCRP 1986 failed to note this finding is unclear, and presumably is due to its being overlooked or misunderstood. This raises further doubts as to the thoroughness of the NCRP 1986 report and the protection its limits provide.

9.11 Increased brain, lymphatic, hematopoietic cancer and leukemia among amateur radio operators. A study of California and Washington amateur radio operators found a statistically significant increase in the proportion of deaths among amateur radio operators the cancers listed above[84,89].

9.12 Brain tumor mortality risk increases among men with electrical and electronics jobs also exposed to RF[91]. Brain tumors are more prevalent in workers in electrical and electronics jobs who tend to be both exposed to RF and to fumes from solder (which is typically lead and tin) and from solvents. Authors state, *"Risk of astrocytic tumors among those electronics manufacture and repair workers increased with duration of exposure to tenfold among those employed for 20 years or more."*

There is little data to suggest that lead alone could cause brain tumors. Authors report, *"numerous studies have been conducted of workers exposed to lead in battery plants and smelters, and none of these have indicated an excess risk of brain cancer."* Also, for the current study authors report, *"There was no increased brain tumor mortality risk among men who presumably had occupational exposure to lead."*

While authors report numerous solvents *"used throughout the electrical and electronics industry are known neurotoxins,* "only one study suggested an possible brain cancer link and reported, *"evidence of astrogliosis in gerbils exposed to methylchoroform by inhilation*[92].

There is evidence that the effect of known carcinogens can be accelerated by exposure to RF. For example, consider a study when the known skin carcinogen 3,4 benzopyrene was applied to