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USNRC

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BEFORE THE COMMISSIONERS:
Nunzio J. Palladino, Chairman
Victor Gilinsky
James Asselstine
Thomas Roberts
Frederick Bernthal

In the Matter of

METROPOLITAN EDISON COMPANY

Docket 50-289

Three Mile Island Nuclear
Generating Station, Unit 1

AAMODT MOTIONS FOR INVESTIGATION
OF LICENSEE'S REPORTS OF RADIOACTIVE RELEASES
DURING THE INITIAL DAYS OF THE TMI-2 ACCIDENT
AND POSTPONEMENT OF RESTART DECISION
PENDING RESOLUTION OF THIS INVESTIGATION

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151 ABSTRACT

Interviews with residents in two areas which were in the path of radioactive releases from TMI-2 March 28, 29 and 30, 1979 demonstrate cancer deaths seven times greater than the Pennsylvania average.

Interviews with residents in these areas reveal that radiation-related health effects were experienced on March 28, 29, 30

1979 which could have resulted from exposures of 5 to 100 rems or more.

Analysis of flora growth abnormalities observed in the same geographic area are demonstrably the result of severe radiation exposure.

These three sets of observations are compelling evidence of release of airborne radioactive materials during the accident at TMI-2 orders of magnitude greater than have been acknowledged by the Licensee, the NRC Staff or the Commonwealth of Pennsylvania.

The significance of this conclusion, in the context of the Restart Proceeding, is that:

1. the records of airborne releases of radioactive materials during the early hours of the accident, which the Licensee asserts were "lost", were more likely intentionally destroyed to prevent disclosure of the hazard the accident posed to the health of the residents of the region.

2. the estimates of core damage and resultant source terms were intentionally minimized on March 31, 1979 to similarly deceive the public, and

3. although residents have attempted to raise the issue of serious health effects which occurred during the early days of the accident as well as illnesses which have subsequently developed, the Licensee has maintained its posture of deception to this day, asserting as recently as April 1984 in a newsletter to stockholders that no human injury has been caused by the TMI-2 accident.

Therefore, we herein motion the Commission to stay its decision in rendering a judgement as to this licensee's fitness to operate the TMI-Unit 1 until these allegations are fully examined.

2.0 INTRODUCTION

Restart of TMI-1 is pendant upon a judgement that the Licensee's management possesses the integrity needed to safeguard the public from the potential dangers of plant operation. We herein present evidence that, in the early days of the accident, people who lived at high elevations in a generally northwesterly direction from the plant were subjected to radiation exposures of 100 rems or more. The significance of this evidence lies in the fact that the Licensee, as well as the NRC and the Commonwealth of Pennsylvania, holds a publicly stated position that radiation releases at the time of the accident were negligible and that this position is supported by the willful withholding of data by Licensee which would prove this position false.

Licensee asserts that missing radiation records from the first day of the accident and the missing vent filters were "lost". We believe that they were intentionally destroyed.

Beyond this, we believe that the subsequent venting - with helicopter measurements of 1200 mr directly over the plant on March 30, 1979 - demonstrate the presence of hazardous doses to the population. These measurements were grossly optimistic for two reasons: First, the helicopter blades forced the plume away from the measuring instrument and, secondly, the measuring device did not measure beta and alpha emissions from particulates, which, we believe, comprised a significant portion of the releases.

Finally, no dosimetry was on the ground in the areas we have surveyed where we found severe health effects. Yet, despite repeated assertions by residents of the areas over which plumes passed that significant radiation effects were experienced by them, not a single evaluation of these claims has appeared on the record of the Restart Proceeding.

Following is a summary of the results of only a few weeks of surveying the population in areas where several plumes passed in the early days.

3.0 THE HEALTH SURVEY

3.1 METHOD

A group of women*, several of whom had expertise in conducting survey, went from door-to-door. A form, organized on the basis of information provided by Dr. Carl Johnson of Denver, Colorado was used. (See Attachment 1.)

*The primary interviewers were Francine Taylor, Norma Ritterspach, Jane Lee and Marjorie Aamodt. Assisting were Joyce Corradi, Linda Barash, Sally Stephenson, Drenda Witmer, Marie Inslee, Paula Kinney, Susan Folta, Helen Hocker, Mary Osborn, and Erma Weaver. Also interviewing were Austin Ritterspach and Cory Folta.

The areas selected were ones where residents had experienced erythema and metallic taste during the early days of the accident. One of these areas was six miles northwest of the plant (Area 1) and the other, three and one-half miles southwest (Area 2). A third area, seven miles northwest of the plants, was chosen because of its high elevation (Area 3) and clear view of the TMI plants. Figure 1 summarizes these area characteristics as well as age distribution of the residents.

Almost every household was willing to provide the information solicited. There were no refusals in Area 1, four in Area 2 and 2 in Area 3. The interviewers represented themselves as a group of citizens interested in health issues.

Several other residents of the TMI area, not in the precise areas surveyed, but residing or working in the area northwest of the plants were also interviewed because we learned of their unique experiences.

While the questionnaire did 'suggest' symptoms, the interviewers found, without exception that this did not more than remind the participant. All interviewers were of the opinion that the residents were conservative in their provision of information and that what was obtained was less than actually existed. For instance, a woman with an obvious lump in her arm did not mention it until the interviewer questioned her about it.

Figure 1 - DESCRIPTION OF AREA STUDIES

	LOCATION	MEDIAN 5 YEAR AGE RANGE	POPULATION AGE RANGE
Area 1	Elevated area 6 miles Northwest of TNI	35-39	1-80+
Area 2	Elevated area 3½ miles <u>Southwest</u> of TNI	35-39	1-80+
Area 3	Short road high elevation 7 miles Northwest of TNI	35-39	1-80+

3.2 RESULTS OF SURVEY

The survey produced the following significant information:

- a. a cancer death rate for each area from six to over eight times greater than expected,
- b. a large number of cancers and other tumors diagnosed after 1979,
- c. a number of other serious health effects, and
- d. first-hand accounts by residents of exposure to plumes in each of the areas surveyed.

3.21 CANCER DEATH RATE

Figure 2 presents the cancer death rate analysis. Based on data obtained concerning only those 313 persons about which information was obtained, the overall cancer mortality rate for the five year period since the accident was 6.5 times higher than expected. Even if it were assumed that there were no cancer deaths among the 144 persons about whom no information was obtained, the mortality rate is 5.2 times higher than expected. The highest rates were in Areas 1 and 3. These areas also provide the most reliable data since essentially the entire populations were surveyed.

FIGURE 2 - CANCER DEATH RATE ANALYSIS

AREA	1	2	3	ALL
Number of houses in Area	35	93	15	143
Total Number of households 1979 - 1984	42	-	17	
Number of Household about which Information was obtained	40	56	14	110
Number of Persons about which Information was obtained	112	156	45	313
Estimated Number of Persons in all Households 1979 - 1984	118*	288*	51*	457*
Expected Cancer Deaths ^{1,2} based on All Persons in All Households	1.27	3.10	0.55	4.93
Persons about which Information was obtained	1.21	1.68	0.48	3.37
Actual Cancer Deaths	7	9	4	20
Ratio of Actual to Expected Based on All Persons	5.51	2.90	7.26	4.00
Based on Persons Surveyed	5.79	5.36	8.33	5.95

* Estimated on basis of 3.1 persons/family not surveyed

¹ 215.6/100,000/yr. - Monthly Vital Statistics Report, Table 21,
Vol. 31, No. 6, Supplement 9/30/82

² For five year period 1979 - 1984

3.22 OTHER HEALTH EFFECTS - DIAGNOSED CANCERS AND TUMORS

Shown below are the number of diagnosed cancers and other tumors among living persons in each of the three areas. These data would suggest a continuing cancer mortality rate far in excess of that expected.

FIGURE 3 - CANCERS AND TUMORS DIAGNOSED - PERSONS LIVING

AREA	NUMBER
1	6
2	10
3	3
ALL	19

3.23 OTHER HEALTH EFFECTS

Other health effects picked up by the survey were most notably five cases of anemia, four cases of spontaneously ruptured or collapsed organs, seven persistent rashes and eleven birthing abnormalities in nineteen pregnancies.

Three of the four cases of ruptured or collapsed organs occurred in Area 3; the fourth case was in Area 1. A fifth case (subject of Affidavit 6) occurred out of the areas surveyed but in a northwesterly direction from TMI and to an individual who was subjected to fallout from a plume on Friday, March 30, 1979.

FIGURE 4-COLLAPSED AND RUPTURED ORGANS

Effect	Year	Age
Lung Collapsed	1980	19
Aortic Valve Ruptured	1981	43
Spleen Ruptured	1983	53
Kidney Collapsed	1983	55 (Approx.)
Artery to Heart 90% Blocked	1984	29

The eleven birthing abnormalities were as follows: one birth defect, miscarriage (fetus outside of uterus), four other miscarriages, one stillbirth, three Caesarean Sections and one premature. The dates of these occurrences were not identified in all cases, however all occurred since March 1979. The birth defect and the pregnancy outside the uterus occurred in 1979.

3.24 STATEMENTS OF RESIDENTS WHO EXPERIENCED A RADIOACTIVE PLUME DURING THE INITIAL DAYS OF THE ACCIDENT

Affidavits 1 through 7 present first-hand accounts of the touchdown of plumes. The individuals supporting Affidavits 1 through 4 reside in the three areas surveyed. Affidavit 5 presents additional evidence of plume touchdown near Area 3. Affidavit 6 presents the account of a resident's insight from a plume several miles beyond Area 1 on a northwesterly line from TMI. Affidavit 7 presents an individual's experience with a plume six and one-half miles north northwest of TMI before 8 a.m. March 28, 1979.

Figure 5 summarizes the date, location and extent of each individual's experience.

FIGURE 5 INDIVIDUALS' RADIATION EXPOSURE

AFFIDAVIT	AREA	DATE	SYMPTOMS
1	1	3/29/79	Erythemia Metallic Taste Burning Throat Hair Loss Rashes
2	2	4/2/79	Erythemia Metallic Taste Nausea
4	3	3/28/79 (evening)	Tearing Eyes
5	Near 3	3/28, 29/79	Nausea Metallic Taste Exposed Film
6	Beyond 1	3/30/79	Erythemia Tingling Skin Hair Greying and Loss Discoloration of Skin Skin Cysts

4.0 RADIATION EFFECTS ON PLANTS

Affidavit 8 was provided by Dr. James E. Gunckel, the world authority on radiation effects on plants. Dr. Gunckel's affidavit provides an explanation for the numerous abnormalities observed in a variety of plants by local residents.

Dr. Gunckel examined plants and leaves provided by Mary Osborn of Swatara. The flora were gathered in the area of her home, approximately six and one-half miles north northwest of TMI. Other specimens were provided by Helen Hocker from her yard which is approximately three miles northwest of TMI. Also considered was Affidavit 9 of a farmer located two miles west of the plant.

5.0 DISCUSSION

The suggestion that the cancers present in the areas surveyed were initiated by radioactive releases from the TMI accident defies the generally accepted theory of a period of considerable latency following exposure. We suggest that this theory is not viable in the present case. We believe that the critical exposure was to beta and alpha particulates and that the general biological effects of this irradiation were similar to that described by Dr. Gunckel as effective in plants. (See Affidavit 8.)

The hypothesis of particulate exposure is supported by Affidavits 1, 2, and 6. The reddening of skin occurred on exposed areas. According to Dr. Edward Branigan of the NRC, the dose would be in excess of 100 rems. (Verbal communication with Mary Osborn)

Although we present no baseline for cancer deaths for the selected areas for the five years prior to the accident, we believe that the residents reached back to recall 'recent' cancer deaths. In Area 2 two cancer deaths prior to 1979 were reported. We conclude that there were few cancer deaths (as would be expected in a population of this size), possibly only the two reported in these areas in the five year pre-accident period. This conclusion is supported by the frequently-expressed opinion of the residents as well as a medical doctor, a paramedic and two nurses we met in the area that, since the TMI accident, the occurrence of cancer has increased enormously on the west shore and that life is terminated in a more rapid fashion than would be expected.

Although no data is available for expectations of cancer and other tumor diagnoses, as well as the other health effects, the numbers of occurrences of serious health problems in a population of this size is alarming. Particularly so, when according to the residents, all of these effects occurred after March 1979.

We attempted to have soil samples from the areas analyzed. A spectral analysis has not been completed. EPA soil sampling since the accident was recently published, however we have not had an opportunity to view the data. This information has not been provided in the Restart Proceeding. The only information concerning soil sampling that we have found in the studies of the accident is an assertion in the Rogovin Report (Vol. II, Part 2, p. 389) that although several radionuclides were detected in some samples, they could not be attributed to the accident. Alpha particulate contamination was not determined since it was assumed that uranium

and plutonium isotopes had not escaped in view of the Licensee's representation of only one to two percent core damage. These positions are no longer tenable in view of the more recent recognition of extensive core damage. Alpha emitters, if ingested or inhaled, can produce severe health effects. (See Attachment 2.)

Aside from the failure of NRC or the Licensee to survey for alpha particulate contamination, we have little confidence in any official data so far provided. An independent dose assessment study commissioned by the Burger Fund about two years ago and conducted by Jan Beyea may soon provide some more reliable information. This study has been completed and has received peer review, however it is, unfortunately, languishing in the court in Harrisburg.

Although the Beyea study may provide conclusive evidence to support our position that the the serious health effects on the west shore are related to radioactive releases during the initial days of the accident, consideration of our motion need not await its publication. The personal affidavits provide clear evidence of high radiation dose to residents of the west shore. The health data shows severe effects on the health of the residents in the areas studied. According to an authority (See Attachment 2, p. 151) "Whereas the effects of radiation are nonspecific, i.e., other agents or diseases can cause the same damage...where the effects of radiation are being studied, conclusions can (only) be drawn on the basis of incidence of a particular type of damage above that normally occurring in a comparable population." Clearly the incidence of cancer deaths in the areas studied far exceeds the expected, and this high incidence is clearly tied to the TMI-2 accident by the personal experiences of the residents with high radiation exposure.

It is a fact that the Licensee, the NRC and the Commonwealth of Pennsylvania have no data in their possession which can define the quantity of radioactive materials emitted over the areas of this study during the early days of the accident. On the other hand, the record is replete with evidence of radiation release records being "lost", filters being "lost" and calculations and measurements of high dose rates being explained away or denegated. (See NUREG-0600, II-397; II-3-18; II-3-77; NUREG-0760 at 31-33.)

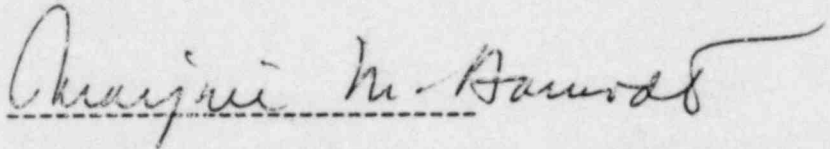
6.0 CONCLUSIONS

The evidence is here. A grossly high cancer mortality rate is present exactly where plumes traveled in the early days of the accident. The fact that radiation monitoring data and TMI plant records have been "lost" or misconstrued only emphasizes the point that the Licensee conspired to hide the seriousness of the accident. The Licensee alone monitored radiation releases during the initial days of the accident.

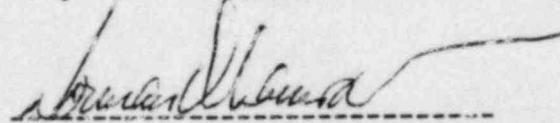
7.0 MOTIONS

1. We move that the Commission act immediately to investigate the circumstances surrounding the falsification of radiation emission information in the early days of the accident and during subsequent investigations of the accident. We move that the Commission take a prime role in this investigation.
2. We move that the Commission postpone any decision relative to restart of Unit 1 until the matter of Motion 1 has been fully resolved.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Marjorie M. Aamodt", written over a horizontal dashed line.

Marjorie M. Aamodt

A handwritten signature in cursive script, appearing to read "Norman O. Aamodt", written over a horizontal dashed line.

Norman O. Aamodt

June 21, 1984

AFFIDAVIT 1

On April 24, 1984, I, [REDACTED], provided the following information in response to a questionnaire presented by Francine Taylor of Lancaster, Pa. and to Marjorie Aamodt in a subsequent interview that same day. I also provided Ms. Aamodt with a letter which was addressed to Governor Thornburgh and is dated November 19, 1981. I never received an answer to this letter. The letter is attached to this affidavit and is to be considered a part of it.

At the time of the TMI accident, I was living at [REDACTED], not far from my present home. This area is approximately four miles northwest of TMI. Concerning my experiences following the accident at TMI: On Thursday, March 29, 1979, I was working all day with my son in our garage. The garage doors were open. That night when I took a shower, my face, neck and hands looked like I was at the seashore and got burned real bad. I felt nauseous. My eyes were red and burning. I felt like I was looking through water. Friday morning when I got out of bed, my lips and nose were blistered, and my throat and inside my chest felt like fire. It tasted like burning galvanized steel. My son had similar experiences. He was 22 years old at the time. On Friday we decided to evacuate. While packing our truck, a township police officer, in a closed car, shouted over his loudspeaker system, "Bill, don't breath this air. Get inside!" We spent the first night in Mechanicsburg with relatives. We convinced other family members to go with us and traveled to Front Royal, Va. on Saturday. We stayed at a camp ground in Front Royal for about one week. During this time I experienced severe diarrhea which caused rectal bleeding. We took one of our dogs with us, a German Shepherd, female. Following our arrival in Virginia, the dog passed only blood from the rectum and bleed from the nose and mouth. Since I felt that these conditions may have been caused by nervousness due to our flight, I gave her a sedative. When we returned home, we went in the garage first and found our male German Shepherd had died. His eyes were milky white. We had provided about 100 lb. of food and 50 gallons of water, however, he had only drunk water, about five gallons. It appeared that he had thrown up some of this water before he died. We had five cats that lived in a box on the back porch. All but one was dead. All cats had milky white eyes. The one living cat had one eye that was milky white: skin grew over this eye during the following weeks. This cat lived for about six months after the accident. She had kittens prior to her death. The kittens were born dead and hairless. I should also note that we noted a metallic taste when we entered our home after the evacuation.

My son and I have both experienced hair loss; mine was on my head, arms, legs and torso. This hair has regrown. My son lost hair on his arms and torso, which has also regrown. In 1981 a sore developed on my leg. The sore remained for two years, healing after we moved to Florida. The effected area is still detectable as a faint discoloring. The skin was inflamed, open, and raised; the doctor's diagnosis was uncertain. Also in 1981 my wife, [REDACTED], was diagnosed as having paroxysmal tachycardia and in 1982 as having an underactive thyroid. I have also experienced problems with my heart. Although I had had a slight mummer prior to the accident, I had passed a physical required for racing cars. However, in December 1980 I needed to undergo an aortic valve replacement. I was 43 years old at the time.

The spring following the accident, our walnut trees did not produce any leaves, and there were no walnuts. There were no flies or other flying insects until July 1979. There were no birds, squirrels or pheasants

The spring following the accident, our walnut trees did not produce any leaves, and there were no walnuts. There were no flies or other flying insects until July 1979. There were no birds, squirrels or pheasants for about a year and one-half following the accident. I found a number of dead birds. A number of neighbors died of cancer.

In 1983, I felt that I could not continue to live in this neighborhood, so close to the TMI plants. I sold my home and business at considerably less than its appraised value and moved to Florida. However, we returned this year and are living in a new home at [REDACTED], near our previous home. We got homesick. My daughter and grandchildren live in this area, as well as other relatives, and telephone communication with them was not sufficient contact. My son left with us for Florida and has stayed there.

I had been in business in Fairview Township, York County, for twenty-two years. I operated an automobile sales and service shop. I was involved in community affairs as a justice of the peace and in politics as a committeeman.

All of the above information was provided voluntarily, and I attest to its truthfulness.

[REDACTED]
[REDACTED]
[REDACTED]

AFFIDAVIT 2

On May 5, 1984, I, [REDACTED], provided the following information to Marjorie Aamodt at my place of residence on [REDACTED]. My residence is approximately 2-3 miles south west of TMI and is at a high elevation,

On Monday evening, April 2, 1979, after returning from West Virginia where I had evacuated with my family, I worked outside on my camper from approximately 6 until 7 p. m. My family stayed inside. When my wife called me in for supper, my skin was burning. My face, arms and hands were reddened and remained that way for *about 12 hours*. I had a metallic taste. I felt nauseous. I felt "funny in the head". I took a shower that evening before going to bed. Since I had a head cold, I went to the doctor's the next day. I told my doctor about my experiences the following evening. He read from a book what symptoms are related to radiation exposure. We noted that these symptoms matched what I had experienced, however the doctor reassured me that nothing had come out of the plant. Concerning the weather conditions on the Monday evening, April 2, 1979, I remember that there was a light mist over the area.

[REDACTED]

Date Sworn _____

AFFIDAVIT 3

I, [REDACTED] provided the following information to Marjorie Aamodt in a telephone conversation on June 18, 1984. I was ill with the flu at the time of the TMI accident. I was in bed most of the time. However, one day, which I believe was Friday, March 30, 1979, I was out of bed and decided to shake out a throw rug. I went out on the porch. It sounded as if it was raining. The sound appeared to be in the trees. I could not see any rain so I reached out beyond the porch roof to try to feel it. I did not feel any rain on my hands or arms. I was extremely puzzled, I was impressed by the stillness except for the sound of rain. There were no sounds of birds or other sounds to which we are accustomed. This all seemed very strange, however I was too sick at the time to pursue the matter further, so I returned to bed. My certainty in dating this event on March 30, 1979 is tied to a telephone call I received later that same day. A neighbor called to tell me that my son had been taken from his school to Dillsburg because of the TMI accident, and she volunteered to pick him up.

I could never get the experience of the silence and the rain-like sound out of my mind. Subsequently, several of my friends told me about similar experiences at the same time. One of these friends is [REDACTED]

I and my sons remained during the accident. We would have chosen to leave, however I am a widow, and I did not have sufficient financial resources to leave.

[REDACTED]

Date-----1

AFFIDAVIT 4

On April 28, 1984, at my home, [REDACTED], I related the following experiences that I had at the time of the accident at TMI. On Wednesday evening, March 28, 1979, unaware of any problems at the TMI plants, my wife and I were outside in the evening to take a walk on our street. The walk lasted approximately ten minutes. That evening, my eyes began to water and burn. My eyes watered throughout the entire night.

In the fall of 1982, I began to have problems with my eyes. My eyes felt like they were burning. About three months after this occurred, I decided to see a doctor. At this time the skin around my eyes was irritated and red, and there was a distinct red mark on the innerside of my nose. Although the redness around my eyes has disappeared, the mark on my nose has remained.

The first doctor appeared unable to help, and since I was troubled about my eye condition, unique to me during my lifetime, I saw a second doctor. I also had a rash on my forearms which had come and gone since shortly after March 1979. This rash is particularly noticeable after showering and in warm weather. The dermatologist prescribed Prednizone.

In 1981, my wife [REDACTED] was diagnosed as having fibroid tumors in her uterus. These tumors were large, but were successfully removed in September of 1982.

I believe that my skin conditions and possibly my wife's tumors are related to some exposure we may have gotten from the accident at TMI. We were unaware of the problems there or any dangers to ourselves until several days after the accident. Actually, it was a TMI worker who is a neighbor and who evacuated early on the first day of the accident who returned on the weekend to warn his neighbors to evacuate.

[REDACTED]
Dated-----

AFFIDAVIT 5

On Friday, April 27, 1984, I provided the following information to Marjorie Aamodt in my dental office in [REDACTED] Pa., located at [REDACTED]. This information concerned my experiences on Wednesday and Thursday, March 28 and 29, 1979. On those days, I discovered that the X-ray films in my dental office in [REDACTED] were fogged. This office is located on the corner of [REDACTED] and [REDACTED] in a stone building 5 miles north west of TMI. The film fogging can be described as alternately light and dark banding across the entire film. Approximately 75 films were "fogged". These films had been placed in a little container for easy access in the X-ray room. The X-ray room has an outwall of cinderblock and gypsum board. The film is #2 oral film, fast D film, 0.2 mr exposure. The machine is marked as 70 KV, 7.5 m.amps, 3/10 sec., for jaw exposure. On Friday following, March 30, 1979, I posted new film outside the building each day for an entire week, however these films were not exposed. On Wednesday and Thursday, March 28 and 29, 1979, I experienced a metalish taste and a queasy stomach. I felt "funny" and expressed this feeling to my receptionist. At that time I had no knowledge of the accident at TMI.

[REDACTED] 5/7/84

Date Sworn _____

AFFIDAVIT 6

I, [REDACTED] provided the following information to Jane Lee and Marjorie Aamodt on May 11, 1984.

On Friday evening, March 30, 1979, I was standing on the front porch of my home. My home faces south. It was raining, and the wind was blowing. All of a sudden the cat that had been let out began to howl in a most unusual way. I had never heard a sound like that from this or any other cat. I called the cat by name, however it did not come home. From the direction of the howling, I could tell that the cat was under the porch. I went over to the bannister and leaned over to call the cat again. While standing in this position at the east side of the porch, I experienced a most unusual sequence of events. Suddenly, the wind stopped; there was a movement in the limbs of the trees next to the porch, and a wave of heat engulfed me. The gust of heat brought the rain over me. Then the wind started again. This all happened in about one minute. I was so startled that I went in, taking the cat, who had by now come up on the porch. I wiped the cat's wet coat and then washed my hands and face. My face felt tingly. About an hour later, I washed my face again and wiped my arms and legs with the towel. I noticed that my arms and face were pink. I applied a lotion because my skin felt tingly.

On Saturday morning, my skin was a darker pink, and there was an itch at the front of my scalp. This was the only part of my scalp that was not covered by a scarf. When I went to church on Sunday, my friends commented that I looked healthy and sunburned. On this day, hard little lumps, a little bigger than a pinhead appeared on my forehead and into the hairline.

On Tuesday, my scalp felt prickly and tingly, so I washed my hair again, shampooing it three times which is more than I customarily do. (I generally wash my hair once a week.) About three weeks later, I noticed that a lot of gray hairs had appeared across the front of my hair. When I washed my hair that week, my comb was full of hair. The next week, the loss of hair increased. I called my hairdresser, [REDACTED] who subsequently applied treatments which he believed would arrest the loss of hair. The hair loss did appear to stop. The gray hairs have also disappeared, and my hair is now uniformly brown as it was before the events described.

In the subsequent weeks, the skin on my forearms and neck turned darker and was scaly. This condition lasted for several years. There is however some permanent discoloration however it not prominent. My forearms were, and continue to be, very sensitive to the sun, becoming itchy with exposure. I try to avoid sunlight. I have also noticed that if my arms are injured, the bruise will last longer than was normal for me prior to the events described above.

A number of spots have appeared on my face and chest. These appeared after the tiny hard bumps went away. Six of these spots, or pimples, remain. Some of the pimples have yellow centers. The size of these pimples appears to have diminished somewhat, and they are not sensitive, however I am uncomfortable with this condition of my skin, unlike its condition prior to the events described above.

Of greatest concern to me presently is the loss of the function of a kidney. Toward the end of November 1981, I was in renal failure. My doctor described my condition as an unusual case. He stated that one of my kidneys had died. I was in Holy Spirit Hospital under the care of Drs. Bean and Eaton. I have not fully recovered, and I have not been able to resume my customary social and household activities.

I live on a farm with my husband. We were not able to evacuate during the accident, although I wanted to leave, because my husband would not ask anyone else to stay to do his job of caring for the animals. Despite our continual attention to the cattle, we experienced the first deformed calves ever born on our farm the following spring. The calves' heads hung to one side until they were six months old. Their necks appeared twisted. I also noted that the Norway maple by our home had deformed leaves which were curled at the edges.



Date-----

AFFIVADIT 7

I, [REDACTED] reside at [REDACTED] six and one-half miles north northwest of TMI. This was also my residence at the time of the TMI accident as well as that of my husband, son and daughter.

On the morning of March 28, 1979, my husband was putting his tools into his truck. It was six o'clock in the morning when he came in to ask me to go out and smell the air. I wondered to myself whether it would be the Hershey chocolate smell or the aroma of Capitol Bakers' bread. This time the air was different. The air smelled like metal. It was overwhelming. I could taste metal in my mouth. It seemed as though as every taste bud in my mouth could sense this metal. We were very puzzled.

Later that morning, at 8 o'clock, my son and I walked my daughter to the bus stop. There was no metallic smell in the air.

[REDACTED]

Date-----

AFFIDAVIT 8

I, [REDACTED] of [REDACTED] provided the following information to Jane Lee, a neighbor, and Marjorie Aamodt at my home on [REDACTED] on Monday, May 7, 1984. I provided this information voluntarily and attest to its truthfulness.

My home is approximately 2 miles from the TMI plants. My house faces in that direction and is north west of TMI. I have several trees in my frontyard. One of these, a maple at the south corner of the yard next to a wooden fence appeared to be affected by the accident at TMI. This tree is about 30 years old and is still living, however it has undergone considerable changes. About a week after the accident, I noticed that the leaves in the center of the tree were turning brown. The leaves then dropped off leaving a circle of defoliation about twelve feet in diameter. The next year the barked dropped off many branches. This caused these branches to die. About one-fourth of the limbs are now gone. The top of the tree, which was the area that was affected after the accident, now has few leaves. Two pear trees, one a Keifer and the other a Harvest, both planted in the late 1920's, have died. Six trees had been good bearing trees prior to the accident, however they all produced dwarfed pears after the accident. The number of pears decreased also. Since the accident, I can no longer grow clover seed, because the clover yields so few seeds. In 1981, the last year I grew clover, there were only 0-10 seeds per stem, whereas I got about 75-125 seeds per stem before the accident. This problem has affected other farmers in my area, but is not a problem on a farm in this area but at a greater distance from the TMI plants, approximately 12-15 miles. I attribute the decrease in seed production to the disappearance of bumble bees that pollinate clover. Last year we had no apples from our 3 trees. One apple tree, in the yard, started 'going back' after the accident. Last year, it only had a couple of leaves, three blossoms and no apples. The only crop that 'does good' is potatoes. We have had a number of problems with livestock including sows that did not come into heat. These sows were not born on my farm, but were purchased from a farm near here.

I was inside my house on the day of the accident and stayed in most of the time. I have a rash 'back of my ear' and down on the side of my face' ever since the Krypton venting began.

I have lived in this area all of my life and have farmed since 1912.

[REDACTED]

Attendum - The leaves on my garlic plants curled tightly, and the plants died. This happened in 1979 after the accident.

The Bulletin
of the Torrey Botanical Club

Editor-in-Chief: James E. Gunckel

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Bridgewater, N.J. 08807
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May 11, 1984

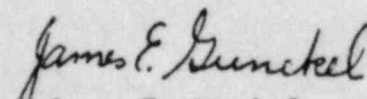
AFFIDAVIT 9

I have carefully examined a few specimens of common plants collected shortly after the accident at TMI and compared them with specimens collected more recently. The current abnormalities are probably carried forward by induced chromosomal aberrations. There were a number of anomalies entirely comparable to those induced by ionizing radiation -- stem fasciations, growth stimulation, induction of extra vegetative buds and stem tumors.

Most of the stem abnormalities described in the literature, and in my own experience, are induced by relatively high doses of X or gamma rays extending over a period of usually 2-3 months. Notable exceptions, however, are similar responses to beta ray exposure from radioisotopes (P^{32} , Zn^{65} , Ca^{45}) and for only 24 hours. In other words, it would have been possible for the types of plant abnormalities observed to have been induced by radioactive fallout on March 29, 1979.

In discussing the general biological effects of irradiation, some clarification may be helpful. In plants, the dose rate (e.g., mr/hr) is much more important than total dose (e.g., mr/yr) in inducing abnormalities. Further, the "quality factor" for gamma and beta radiation is not the same as generally assumed. In fact, I have incontrovertible experimental results to show that beta rays are at least a quality factor of two in plants.

I am the world authority on modifications of plant growth and development induced by ionizing radiations, having researched this area for 34 years at the Brookhaven National Laboratory and at Rutgers University. The three review papers appended attest to my expertise.


James E. Gunckel

ATTACHMENT #1
A VOLUNTARY COMMUNITY HEALTH SURVEY

Case number 190

Date: _____

Location: _____

1. Have you been contacted by the Pa. Dept. of Health survey on TMI? _____ When? _____

2. Family name _____ Willing to participate? yes _____ no _____

3. Family members:

name	status	sex	birth-date	3/28/79	Location 3/29/79	3/30/79
(doctor)						

If deceased, when? _____ Onset of illness _____ Diagnosis _____ Dr. _____

4. Current address and phone no.: _____
Address on 3/28/1979: _____

5. Persons outdoors?

name	3/28-hours	3/29-hours	3/30-hours

6. If vacated the area:

who	to where	when left--when returned

7. Did anyone notice (indicate date, time, who)

- a. unusual atmospheric conditions _____
- b. metallic taste, smell _____
- c. eye irritation, burning _____
- d. skin irritation, " ", reddening _____
- e. irritation of nose, throat, chest _____
- f. experience nausea _____
- g. experience vomiting _____
- h. experience diarrhea _____
- i. experience headaches _____
- j. develop hypothyroidism _____ hyperthyroidism _____
- k. within 2-4 wks unusual hair loss or color change _____
- l. red spots under skin _____ bleeding gums _____
- m. unusual bleeding _____
- n. cancer _____ form _____ treatment _____ doctor _____
- o. later was there confirmed (doctor) anemia _____ blood or thyroid disorder _____

8. women: If pregnant, date of last menstrual period before 3/28/79 _____
Complications with pregnancy? _____ stillbirth _____ miscarriage _____
premature birth _____ Date of birth _____ Wt. at birth _____
health of child since birth _____
caesarean section _____ Date of birth _____ wt. at birth _____
health of child since birth _____ crib death _____

9. History of disorders in family tree (leukemia, cancers, thyroid, etc.) _____

10. Animals.

name	age in 3/79	inside/outside	alive/dead	health problems

11. Additional comments _____

Dangerous Properties of Industrial Materials

Fifth Edition

N. IRVING SAX

Assisted by:

Marilyn C. Bracken/Robert D. Bruce/William F. Durham/Benjamin Feiner/
Edward G. Fitzgerald/Joseph J. Fitzgerald/Barbara J. Goldsmith/John H. Harley/
Robert Herrick/Richard J. Lewis/James R. Mahoney/John F. Schmutz/
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TABLE 5A.3. Summary of Effects Resulting from Acute Whole Body External Exposure to Radiation

0-25 rems	25-100 rems	100-200 rems	200-300 rems	300-600 rems	600 or more
No detectable clinical effects. Delayed effects may occur	Slight transient reductions in lymphocytes and neutrophils.	Nausea and fatigue, with possible vomiting about 125 rems	Nausea and vomiting on first day.	Nausea, vomiting and diarrhea in first few hours.	Nausea, vomiting and diarrhea in first few hours.
	Disabling sickness not common; exposed individuals should be able to proceed with usual duties.	Reduction in lymphocytes and neutrophils with delayed recovery.	Latent period up to 2 weeks or perhaps longer.	Latent period with no definite symptoms, perhaps as long as 1 week.	Short latent period with no definite symptoms in some cases during first week.
	Delayed effects possible, but serious effects on average individual very improbable	Delayed effects may shorten life expectancy in the order of 1 percent.	Following latent period symptoms appear but are not severe; loss of appetite, and pallor, petechiae, diarrhea, moderate emaciation.	Epilation, loss of appetite, general malaise, and fever during second week, followed by hemorrhage, purpura, petechiae, inflammation of mouth and throat, diarrhea, and emaciation in the third week.	Diarrhea, hemorrhage, purpura, inflammation of mouth and throat, fever toward end of first week.
			Recovery likely in about 3 months unless complicated by poor previous health, superimposed injuries or infections.	Some deaths in 2 to 6 weeks. Possible eventual death to 20 percent of the exposed individuals for about 450 rems.	Rapid emaciation and death as early as the second week with possible eventual death of up to 100 percent of exposed individuals.

would be completely absorbed by 1.1 g. cm² of aluminum it would also be absorbed by 1.1 g. cm² of air. However, the absorber thickness would be only about 0.25 inch for the aluminum and over 30 feet for air.

The result of ionization is merely a conversion of the radiation energy into another form of energy within the absorber, and it is these secondary effects which are of the greatest importance in radiation protection work.

The primary effects of ionization and the distribution of this ionization over various path lengths in different absorbers have been mentioned previously. The different types of radiation also show different degrees of absorption and these differences also are biologically significant. Alpha particles are heavy, slow moving, and expend their energy in a relatively short path. They are, therefore, spoken of as showing high specific ionization, i.e., a large number of ions are formed per unit length of path in the absorber. Gamma and x-radiations, on the other hand, require a great thickness of absorber for complete absorption. Gamma rays and x-rays have a low specific ionization, i.e., the ionization is spread out over the relatively long path required for complete absorption. Beta particles are intermediate in their specific ionization.

Biological Effects

The biological effects of radiation are considered here only in sufficient detail to be of assistance in problems of radiation protection. Some of the information is also required for an understanding of the concepts that have gone into the formulation of permissible levels.

X-rays or γ rays, because of their penetrating nature, may dissipate only a fraction of their energy in passing through the body. This is particularly true of high-energy rays. The energy dissipated is, of course, the absorbed dose delivered to the body or portion of the body.

Radioisotopes, in contrast, may present a further hazard when the material is taken into the body where it irradiates the tissues or organs internally. The most serious effects from this standpoint are produced by the α emitters such as Ra, U and Pu. They are particularly marked because α emitters outside the body expend their energy either in penetrating the clothing or the dead cells of the epidermis; usually the radiation cannot penetrate to living cells. Once they are taken into the body via ingestion or inhalation, this same property of short-range and high specific ionization increases their relative effect considerably. Emitters located in a small section of tissue will irradiate that small section very heavily.

Beta emitters can be both an internal and an external hazard. The range of most external β radiation is great enough that the outer tissues, at least, will be penetrated. The most common external effects have been radiation burns and malignancies of the skin. Internally, they may

produce a considerable effect. Their specific ionization is high although not as great as that for α radiation.

The preceding paragraphs have emphasized the ionization effects, particularly specific ionization. Many secondary effects can be caused by the ionization process. It may disrupt molecules, it may destroy body cells, or the energy may merely appear in final form as heat released within the absorber. Depending on the location of the absorbing atom within the molecule, the ionization may or may not disrupt the molecule. If this molecule is in a critical place within the cell, the cell, its function, or its ability to reproduce itself may be destroyed. Many of these processes are reversible; that is, damage caused by molecule disruption or cell destruction can be reversed by the usual reparative mechanism of the body. This is confirmed by experimental data which show that a fixed total dose spread out over a period of weeks produces a smaller effect than the same dose delivered in a few minutes. However, in the case of a large acute dose or continued chronic overexposure, there is the possibility that non-reversible damage will occur.

Another type of cell change which is possible is that the regulative functions of a tissue may be destroyed. In this case a carcinoma (cancer) may be produced. Although the mechanism is not fully understood, there is direct evidence that continued insult to a tissue may produce this result. The high rates of leukemia among radiologists, bone cancer among Ra dial painters, and lung cancer among miners of the Czechoslovakian, German, and U.S. uranium mines all point to radiation as the causative agent. This irreversible damage in chronic radiation exposure was apparently cumulative and the cumulative effects led to the illnesses.

Internal Emitters. The biological effects of radiation from radioisotopes in the body are complicated by several factors. In any determination of radiation effects, whether in working populations or in animal experiments, the following factors must be considered: (1) the location of specific isotopes in the body, and (2) the relative sensitivity of different tissues to radiation.

The general effects of external radiation have been previously described but there are certain modifications in the consideration of radiation from internal sources. The first is that different elements tend to localize in different organs of the body, e.g., calcium or strontium in bone, iron in the red blood cells, and iodine in the thyroid. This is true for any material which is metabolized following either inhalation or ingestion. Of course, many not readily soluble substances will remain in the lungs for long periods after inhalation. This means that the total amount of such a radioactive material is not distributing its dose uniformly but rather is concentrating its effect on a relatively small fraction of the body.

Most of the heavy metals tend to be deposited in the

bone structure. After deposition, there is usually a continuous excretion of the isotope which gradually reduces the amount present. The excretion rate of such materials has been considered to follow much the same pattern as the radioactive decay of an isotope. The time required by the body to eliminate one-half the total quantity it contains is thus referred to as "biological half-life." Most of the experimental data on excretion seem to fit a power function which is the resultant of a number of exponentials rather than a simple exponential function, but the concept of biological half-life is still used in deriving permissible levels.

Such body deposits may depend on many physiological factors both in the process of deposition and of excretion. For many years a high calcium diet was recommended for radium workers, as it was supposed that a large excess of calcium entering the body would reduce the amount of Ra deposition. Actually, the relative radium deposition is a function of the ratio of radium to calcium in the blood stream. Unless the calcium level of the blood is maintained at a very high value there will still be deposition of radium. The increase in the blood calcium required to cut the radium deposition by even a factor of three would be impossible to attain.

Besides the bone structure, common sites of deposition are the lungs and lymph nodes for inhaled particles, and specific organs for certain isotopes, such as the thyroid for iodine and spleen for iron.

A second consideration is that certain organs or tissues are more radiosensitive than others. The membranes lining the bronchi are supposedly quite sensitive to radiation and this is the primary site of many lung cancers attributed to inhaled radioactive material. The spleen is also sensitive to radiation and relatively small doses have produced more irreversible damage in that organ than in other parts of the body.

The organ most likely to be damaged because of the combined effects of concentration and radiosensitivity is known as the critical organ for a particular isotope. In general, any cell in the process of division (mitosis) is radiosensitive and for that reason a person is more sensitive to radiation during his growing period than as an adult.

Radiation Injury. The effects of radiation are nonspecific; i.e., other agents or diseases can cause the same damage. For example, it is impossible to distinguish between radiation-induced anemia and normally incident anemia. Other possible effects such as lung cancer, leukemia, and bone cancer present similar difficulties.

In any case, where the effects of radiation are being studied, conclusions can only be drawn on the basis of incidence of a particular type of damage above that normally occurring in a comparable population. If tabulations are made of incidence in a particular group, such as chemical operators exposed to radiation in a process

State Representative Stephen Reed's Letter to the NRC

August 8, 1979

Honorable Joseph M. Hendrie, Chairman
U.S. Nuclear Regulatory Commission
Washington, District of Columbia

Dear Chairman Hendrie,

I am entirely baffled by the apparent refusal of the U.S. Nuclear Regulatory Commission to have extensively reviewed the reports by hundreds of Three Mile Island area residents who, during March 28-31, 1979 primarily, and at times subsequent, experienced:

- (a) metallic taste in their mouth
- (b) metallic or Iodine-like odor in the air
- (c) irritated and watery eyes
- (d) moderate or severe respiratory inflammation
- (e) gastro-intestinal dysfunction and diarrhea
- (f) disruption of the menstrual cycle in females
- (g) skin rashes (some appearing as radiation burns)
- (h) sharp, abnormal pains in joints.

The U.S. Public Health Service and Pennsylvania State Dept. of Health are jointly conducting a survey of TMI area residents to record medical histories so that the full health consequences of TMI radiation releases in the next 25 years will be documented. That is all fine and should be done. But why is there a complete dismissal by the NRC of any immediate indications of exposure to levels of radiation higher than what were immediately thought the first dates of the accident? Psychosomatically induced ailments are possible with some, but not with hundreds or even more persons and I suggest this matter has been conveniently laid aside.

The NRC is charged with ascertaining full details about the TMI accident. You are further charged with knowing the full effects of even low level radiation on populations near to nuclear reactors. Failure to pursue the aforementioned reports from TMI area residents is a dismal failure of your most important safety responsibilities to the tens of millions of people living near reactors, not to mention the people around TMI.

I therefore recommend that all available expertise be applied to ascertaining the cause of these physical ailments associated with the TMI accident and a completely accurate public disclosure made of its cause and the level of radiation or contamination that people may have been exposed to. The inability of both Metropolitan Edison and the NRC to know even to this day (or at least to have disclosed if you actually do know) the levels of exposure is in itself a major, most serious failing of pre-TMI accident obligations by both parties. And if it is determined that the exact cause of these physical ailments cannot be determined due to the lack of adequate research on the subject pre-TMI, then the public should know the extent to which we indeed are unprepared to deal with nuclear plant emissions.

Yours sincerely,

STEPHEN R. REED
State Representative

Publications of James E. Gunckel

IV. The Effects of Ionizing Radiation on Plants: Morphological Effects, The Quarterly Review of Biology, Vol 32, No. 1, March 1957

Modifications of Plant Growth and Development Induced by Ionizing Radiations, Encyclopedia of Plant Physiology, Vol XV/2, 1965

Aberrant Growth in Plants Induced by Ionizing Radiation, with Arnold H. Sparrow, Abnormal and Pathological Plant Growth, Brookhaven Symposia in Biology No. 6 (1954)

Ionizing Radiations: Biochemical, Physiological and Morphological Aspects of their Effects on Plants, with A. H. Sparrow, Encyclopedia of Plant Physiology, Vol XVI, 1961

This is to certify that the document AAMODT MOTION OR
INVESTIGATION OF LICENSEE'S REPORTS OF RADIOACTIVE RELEASES DURING
THE INITIAL DAYS OF THE TMI-2 ACCIDENT AND POSTPONEMENT OF RESTART
DECISION PENDING RESOLUTION OF THIS INVESTIGATION was served by

~~United Parcel Service~~ on June 21, 1984 on the following Service List

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