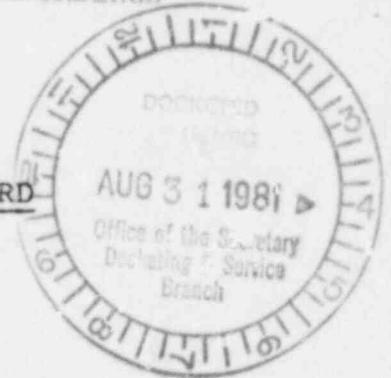


UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD



In the Matter of

PENNSYLVANIA POWER & LIGHT COMPANY

and

ALLEGHENY ELECTRIC COOPERATIVE, INC.

(Susquehanna Steam Electric Station,
Units 1 and 2)

8/28/81

Docket Nos. 50-387
50-388

AFFIDAVIT OF MORTON I. GOLDMAN IN SUPPORT
OF PARTIAL SUMMARY DISPOSITION OF
CONTENTION 1 (FUEL CYCLE DOSES)



County of Montgomery)
: SS.
State of Maryland)

Morton I. Goldman, being duly sworn, deposes and says
as follows:

1. I am Senior Vice President, Environmental Systems Group, NUS Corporation, Rockville, Maryland. I have been involved in research and consulting on environmental and radiological matters since 1950. A summary of my qualifications and experience was attached as Exhibit "A" to my Affidavit dated August 7, 1981 in support of summary disposition of the radon-222 portion of Contention 1 in this

DS03
1/1

proceeding. I give this Affidavit in support of Applicants' Motion for Partial Summary Disposition of Contention 1 (Fuel Cycle Doses). I have personal knowledge of the matters set forth herein and believe them to be true and correct.

2. Contention 1 alleges, in relevant part, that the radiological health effects of all isotopes other than radon-222 and technetium-99 which will be released during the fuel cycle required for the Susquehanna Steam Electric Station ("Susquehanna") "have been misrepresented and underestimated." The purpose of this Affidavit is to establish the radioactive doses that will be imparted on the public by the release of all isotopes other than radon-222 and technetium-99 during the fuel cycle for Susquehanna. Another witness will discuss the health effect of these doses.

3. The operation of a nuclear power plant requires that certain activities be conducted to provide the fuel for electricity generation and to manage the spent fuel after its removal from the reactor core. Each of these fuel cycle activities entails some potential for release of radioactive materials to the environment and, hence, for exposure of the public. The doses resulting from the fuel supply ("front-end") activities are those from radon-222 released as a consequence of mining and milling uranium, and have been addressed in my Affidavit in Support of Summary Disposition of Contention 1 (Radon) and in the Appeal Boards' decision in ALAB-640 in the consolidated radon proceeding and are not included here.

Similarly, the source term, doses and health effects of technetium-99 will be addressed by other witnesses.

4. The doses resulting from the post-irradiation ("back-end") management of spent fuel may vary depending upon whether or not the spent fuel is reprocessed (i.e., whether one assumes a "reprocessing mode" (with reprocessing) or a "once-through" mode (with no reprocessing).

5. As a basis for this Affidavit, I have analyzed the dose assessment performed by the NRC Staff in 1976/1977¹ on the back end of the fuel cycle [1, 2].² The NRC Staff reported its results in man-rem (and fatal cancers), per reference reactor year ("RRY"), where an RRY is defined as a 1,000 MW(e) power plant operated for one year at 80% capacity. Table 1 gives the results of the Staff's dose assessment for those long-lived nuclides potentially released during the back-end of the fuel cycle which yield total body doses, and for I-129 which is potentially most significant as a source of thyroid doses. The estimates are applicable to the reprocessing mode.

6. A very recent dose commitment estimate is presented by the NRC in its proposed "10 C.F.R. Part 51 Appendix A, Narrative Explanation of Table S-3, Uranium Fuel Cycle Environmental Data", 46 Fed. Reg. 15154 (March 4, 1981)

1 References are listed at the end of the Affidavit.

2 The dose computations by the NRC Staff are based on the source terms for the various radionuclides set forth in Table S-3 of 10 C.F.R. Part 51.

TABLE 1

LONG-LIVED RADIONUCLIDE DOSE COMMITMENTS^[1,2]
(Reprocessing)

<u>ISOTOPE</u>	<u>DOSE, Man-Rem/RRY</u>
C-14 ($T_{1/2}^* = 5700 \text{ y}$)	110 (U.S. - Total Body)
H-3 ($T_{1/2} = 12.3 \text{ y}$)	200 (U.S. - Total Body)
Kr-85 ($T_{1/2} = 10.7 \text{ y}$)	20 (U.S. - Total Body)
Non-U.S. World Population	210 (Total Body)
Total	540 Total Body
I-129 ($T_{1/2} = 1.6 \times 10^7 \text{ y}$)	0.11 (Thyroid)

* $T_{1/2}$ = radioactive half-life

("Narrative"). The Narrative uses 100 year environmental dose commitments to obtain a world population "risk equivalent" dose commitment of 650 man-rem, of which 550 man-rem are total body and the other 100 represent the higher dose commitments to certain organs (lung, bone and thyroid).

7. In my opinion, the 650 risk equivalent total body man-rem/RRY estimates in the Narrative represent a conservative upper bound to the population doses due to reprocessing activities, particularly since these estimates do not take into account the effects of any regulatory agency limits on discharges. To these amounts one must add 10 man-rem/RRY as the NRC's estimate [1, 2] of the doses resulting from solidification and disposal of reprocessing plant high level waste.³ The risk equivalent total body upper-bound dose to the world population attributable to the reprocessing mode is, therefore, 660 man-rem/RRY.

8. With respect to the once-through mode, the NRC has made an assessment of the collective dose commitment (which comes from high level waste disposal activities) [1, 2] and has projected a world population dose of 260 man-rem (total body)/RRY

3 The U.S. Department of Energy ("DOE") has presented an estimate for regional population dose from high level waste solidification amounting to some 860 man-rem over a 30 year period from a facility processing 2000 metric tons of heavy metal ("MTHM") per year [3]. At 35 MTHM/RRY, this amounts to 0.5 man-rem/RRY for this fuel cycle activity.

for the disposal of spent fuel. It should be noted that in the spent fuel disposal dose estimate, NRC has conservatively assumed the release from the repository of all fission product gases contained in the fuel.⁴

9. In summary, the conservative upper limit risk-equivalent dose commitment values for long-lived radionuclides potentially released from the back-end of the nuclear fuel cycle are:

Reprocessing Mode	660 total body man-rem/RRY
Once-through Mode	260 total body man-rem/RRY

10. Since the Susquehanna facility will require 64 RRY during the term of its operating licenses,⁵ the upper limit risk-equivalent total body doses to the world population from the fuel cycle for Susquehanna will be $660 \times 64 = 42,240$ man-rem

4 The same conservative assumption was utilized by the NRC to obtain its estimate of the doses attributable to reprocessing.

DOE has also presented an estimate of the doses to the regional population attributable to the interim storage and disposal of un-reprocessed spent fuel. This estimate, which does not assume the release of all gases contained in the fuel, is 1.2 man-rem/RRY [4].

5 Each of the Susquehanna units is rated at 1085 MWe (gross). Unit 1 is expected to operate for 30 years (1983-2013) and Unit 2 for 29 years (1984-2013) before their operating licenses expire. Together, they account for $59 \times 1.085 = 64$ RRYs.

for the reprocessing mode, and $260 \times 64 = 15,640$ man-rem for the once-through mode.

Morton I. Goldman
Morton I. Goldman

Sworn to and subscribed before me this 28th day of
August, 1981.

Joyce Conway
Notary Public
My Commission Expires
July 1, 1982

REFERENCES

1. U.S. NRC, "Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0116 (Supplement to WASH-1248), October 1976.
2. U.S. NRC, "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle (NUREG-0116)," NUREG-0216 (Supplement 2 to WASH-1248), March 1977.
3. U.S. DOE, "Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste," DOE/EIS-0046F, October 1980, Vol. 1, Table 4.7.7.
4. Ibid, Table 4.7.3.