November 29, 1976 F121

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Dockets Nos. 50-247
and 50-286

Consolidated Edison Company
of New York, Inc.
ATTN: Mr. William J. Cahill, Jr.
Vice President
4 Irving Place
New York, New York 10003

Gentlemen:

RE: INDIAN POINT UNITS NOS. 2 AND 3

The NRC staff has recently obtained information which indicates that fission gas releases from fuel pellets with high burnup may be under-predicted by the current industry models for fission gas release. As a result, actual end-of-life fuel rod pressure may be higher than that which was considered in the safety analysis for your facility. Although this situation does not lead us to suspect that fuel design limits have been or are currently being exceeded at your facility, the potential may exist for such an occurrence in the future as higher fuel burnups are reached. Consequently, you are requested to evaluate the effects of increased fission gas releases on the safety analysis for your facility in accordance with the schedule specified below.

If the estimated date on which any fuel rod in your facility will reach a local exposure (burnup) of 20,000 Megawatt-days per metric ton of Uranium (MWD/tU) is sooner than June 1, 1977, provide the following information within 30 days of receipt of this letter. (If this estimated date is later than June 1, 1977, your response may be submitted within 90 days of receipt of this letter).

a. The estimated date on which any fuel rod in your facility will reach a local exposure (burnup) of 20,000 Megawatt-days per metric ton of Uranium (MWD/tU).

b. Using the correction technique described in the attached enclosure, modify the fission gas release model in the thermal performance code for the fuel in your facility and calculate the fission gas release, fuel rod pressure, fuel temperature, etc. for burnups up to and including the

MHY

target peak-rod burnup. Provide a comparison of the results of your calculations with those obtained using the uncorrected fission gas release model.

c. Describe the impact (if any) of larger fission gas releases on the LOCA analysis and other safety analyses for your facility.

d. If internal fuel rod pressures, as calculated using the above-mentioned fission gas release correction, are predicted to exceed the nominal system pressure for your facility, provide the date that this is anticipated to occur and discuss the implications of operating under both normal and accident conditions with fuel cladding tensile stresses.

We have advised all U. S. fuel manufacturers by separate correspondence that this information request is being sent to licensees of operating power reactors. In our letter to the fuel manufacturers, we have indicated that bounding calculations for appropriate plant groupings would be acceptable.

This request for generic information was approved by GAO under a blanket clearance number B-180225 (R0072); this clearance expires July 31, 1977. Three signed originals and 40 copies of your response will be required.

Sincerely,

Robert W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors

Enclosure:
Burnup-Dependent Correction
for Fission Gas Release
Models

cc w/enclosure:
See next page

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DATE ➤	11/2?/76	11/2?/76	11/29/76			

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Enclosure 1

Recent ANS standards activities (1-3) lead us to believe that high burnup gas releases are underpredicted by current LWR industry models. We have previously (4) looked for a burnup dependence and found none for LWRs in the burnup range from 400 to 18,300 MWd/tU. Thus, we incorrectly presumed that the strong burnup dependence exhibited by LMFBR data (5) was not representative of LWR fuels during their shorter burnup lifetimes.

New high burnup UO_2 data mentioned by Westinghouse to the ANS group (2) and discussed with the NRC (6) show, however, that the sharp release increase seen in LMFBR data occurs also in LWR fuels. Therefore, in the absence of a complete analysis of high burnup LWR UO_2 data, we will assume that the burnup dependence is the same in LWR and LMFBR oxide fuels. This assumption, however, will be applied only in the high burnup region above 20,000 MWd/tU since the current industry models have been checked with the data base (4) ranging to 18,300 MWd/tU.

The following correction has been derived to give an increased release fraction $F'(Bu,T)$ as a function of burnup and the uncorrected release prediction $F(T)$. Burnup Bu is the local burnup in megawatt-days per metric ton of uranium (MWd/tU), and T, which is not an explicit variable in the correction, is temperature.

$$F'(Bu,T) = F(T) + [1-F(T)]\frac{(1 - \exp[-0.436 \times 10^{-4}(Bu-20000)])}{(1 + [0.665/F(T)]\exp[-1.107 \times 10^{-4}(Bu-20000)])} \quad (1)$$

Figure 1 shows schematically how this correction would be applied to the GAPCON gas release model, which is independent of burnup. In the event an existing model contains a burnup dependence, F(T) would be the predicted release fraction under the temperature conditions of interest, but with the burnup variable set equal to 20,000 MWd/tU.

Equation 1 is a replication of the Dutt and Baker (7) LMFBR correlation, which is an updated version of the correlation in Ref. 5. Equation 1 was derived by assuming a convenient functional form depending on F(T) and Bu and fitting it to the Dutt and Baker curves using a non-linear regression procedure. No conservatism has been intentionally added. Figure 2 shows how closely Eq. 1 reproduces the Dutt and Baker curves.

References

1. R. O. Meyer (NRC), memorandum to P. S. Check, "Summary of Meeting of ANS-5.4 Working Group on Fuel Plenum Gas Activity," February 25, 1976.

2. R. O. Meyer (NRC), memorandum to P. S. Check, "Summary of ANS-5.1 (Decay Heat) and ANS-5.4 (Fission Gas Release) Activities," June 22, 1976.

3. R. O. Meyer (NRC), memorandum to P. S. Check, "Summary of ANS-5.4 Meeting on Fission Gas Release," October 6, 1976.

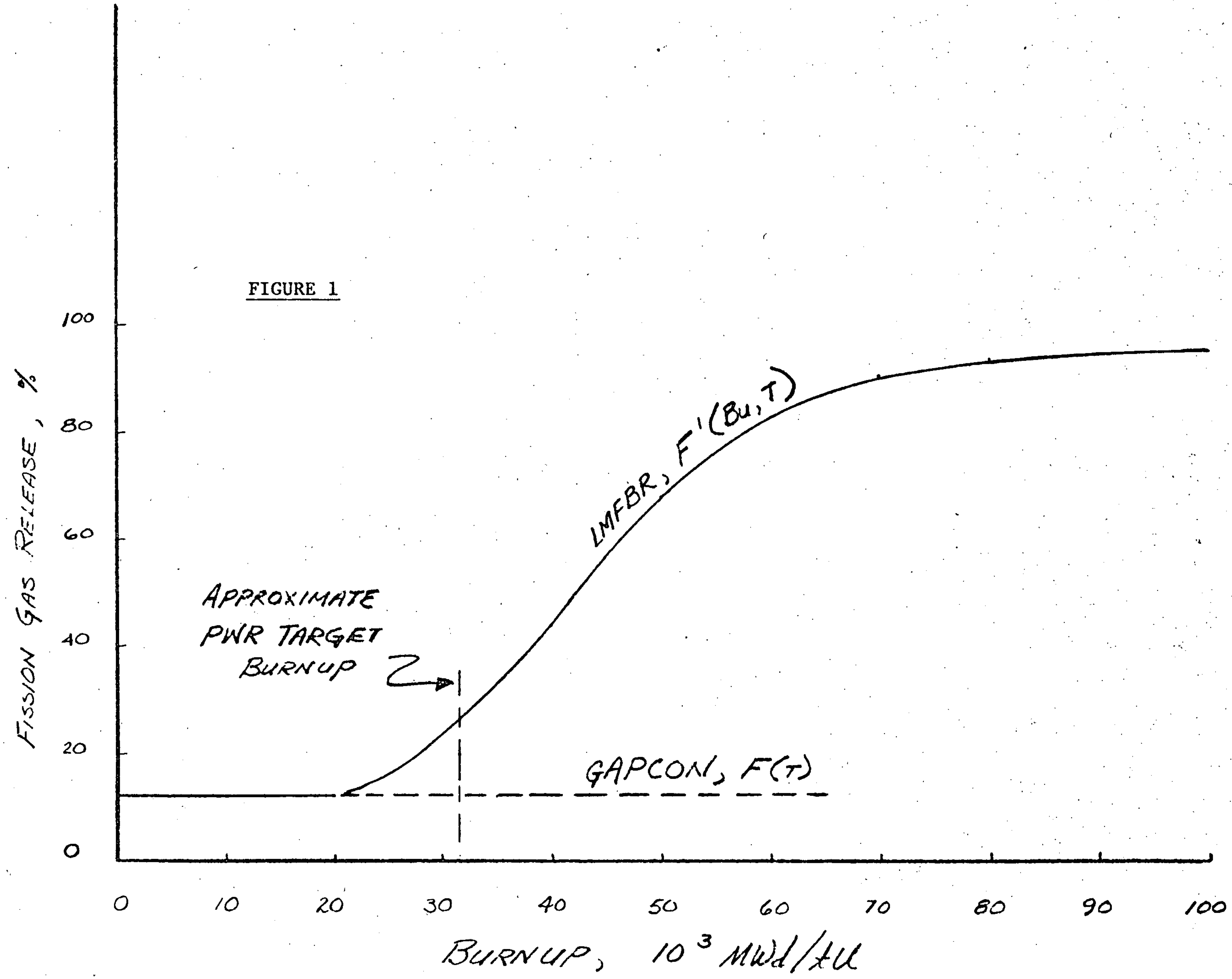
4. C. E. Beyer and C. R. Hann, "Prediction of Fission Gas Release from UO Fuel," Battelle report, BNWL-1875, November 1974.

5. D. S. Dutt, D. C. Bullington, R. B. Baker, and L. A. Pember, "A Correlated Fission Gas Release Model for Fast Reactor Fuels," Trans. Am. Nucl. Soc. 15, 198 (1972).

6. R. O. Meyer (NRC), memorandum to P. S. Check, "Summary of Meeting with Westinghouse on Fuel Rod Pressures," September 22, 1976.

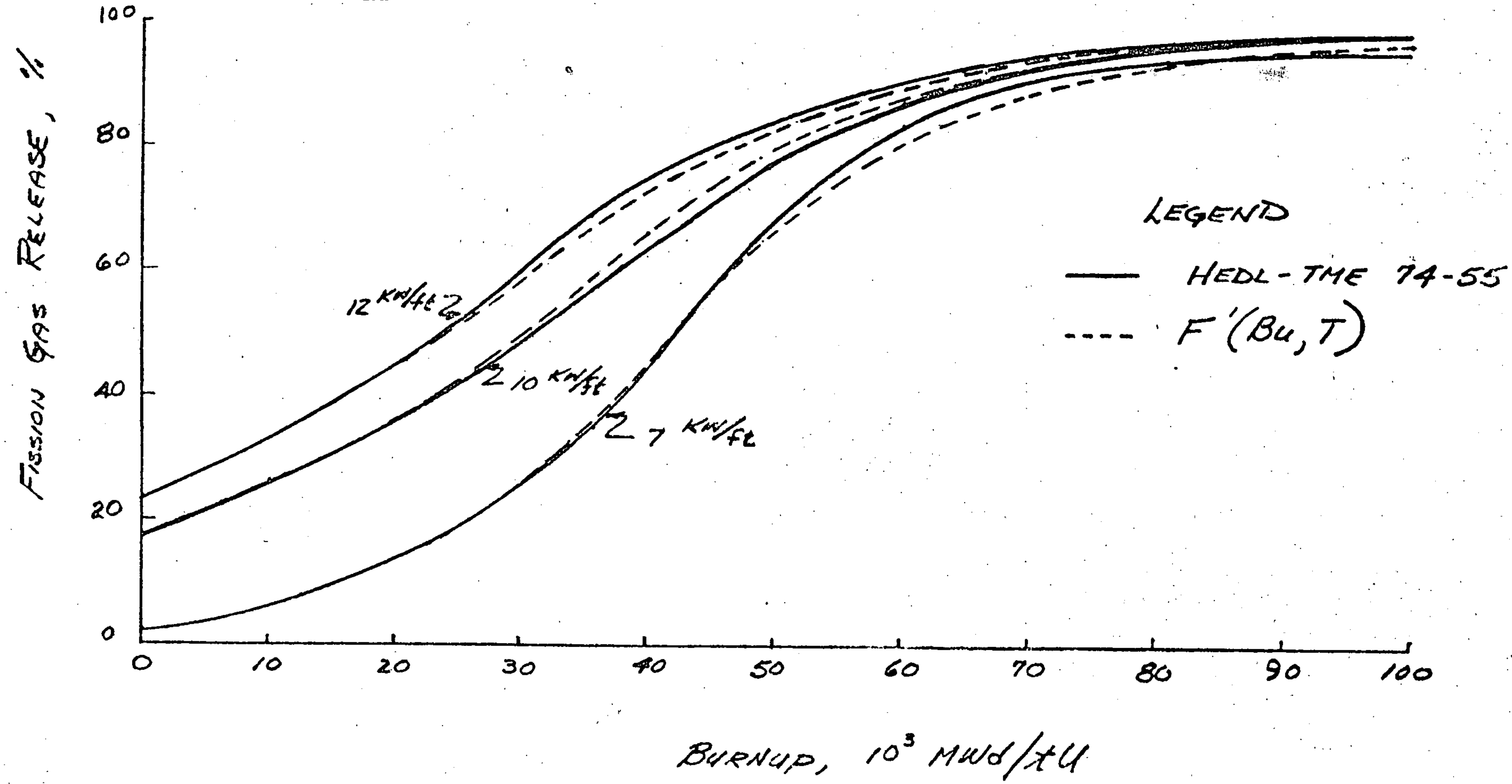
7. D. S. Dutt and R. B. Baker, "Siex: A Correlated Code for the Prediction of Liquid Metal Fast Breeder Reactor (LMFBR) Fuel Thermal Performance," Westinghouse Hanford report, HEDL-TME 74-55, June 1975.

FIGURE 1



100
80
60
40
20
0
Fission Gas Release, %
LMFBR, F'(Bu,T)
Approximate
PWR Target
Burnup
GAPCON, F(T)
0
10
20
30
40
50
60
70
80
90
100
Burnup, 10³ MWd/tU

FIGURE 2



Fission Gas Release, %
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
Burnup, 10^3 MWd/tU
12 kW/ft
10 kW/ft
7 kW/ft
Legend
HEDL-TME 74-55
F'(Bu, T)