ATTACHMENT 5

LICENSE AUTHORITY FILE COPY

DO NOT REMOVE

SAFETY EVALUATION REPORT

OF THE

NINE MILE POINT UNIT 1 NUCLEAR POWER STATION

DOCKET NO. 50-220

ISSUED: December 27, 1974

TABLE OF CONTENTS

1.0 INTRODUCTION

On January 4, 1974, the Commission published its acceptance criteria for emergency core cooling systems for light water power reactors (39 FR 1003). This rule included Appendix K to 10 CFR Part 50 which specifies analytical techniques to be employed for the evaluation of the ECCS effectiveness. On August 5, 1974, General Electric officially submitted a draft topical report[1] constituting their proposed ECCS evaluation model.* The Regulatory staff reviewed the General Electric documents and published a Status Report on October 15, 1974,[2] which addressed each item required by Appendix K and identified areas which had been acceptable to the staff and areas of staff concern which were to be resolved.

On November 13, 1974, the Regulatory staff published a Supplement to the Status Report[3] which addressed each of these areas of concern. As reflected in the Supplement to the Status Report, for some items, additional information was provided to enable the staff to accept the General Electric approach. For some other items, General Electric has agreed to modify its model in accordance with the staff's comments. For still other items, the staff concluded that adequate justification had not been provided and that further modification was required. With

*The information contained in these reports had been the subject of a number of informal conferences and discussions between the staff and General Electric starting just after the publication of the Acceptance Criteria in January 1974.

these required modifications, the General Electric evaluation model would be acceptable to the staff. General Electric is making the required modifications. In addition, in the period since the Supplement to the Status Report was issued (on November 13, 1974) General Electric has made the modifications discussed in Section 2.0 and performed the sensitivity studies described below. As discussed in Section 2.0 the modifications made in connection with these studies are acceptable. This Safety Evaluation Report for the Nine Mile Point Plant and the Supplement to the Status Report resolve all items concerning the non-jet pump model relating to the Nine Mile Point facility. Accordingly, the General Electric model with the modifications described in Section 2.0 of this Safety Evaluation are acceptable and conform to Appendix K.

A report of the Advisory Committee on Reactor Safeguards, attached as Appendix B, was issued on November 20, 1974 regarding the generic review and the acceptability of the General Electric ECCS Evaluation Model.

On August 2, 1974, Niagara Mohawk Power Corporation (the licensee) submitted an analysis of ECCS performance for the Nine Mile Point, Unit 1 Nuclear Power Station along with proposed Technical Specification changes to reflect the impact of the new ECCS evaluation model calculations.[4] These evaluations were based upon the General Electric August 5, 1974 evaluation model.

Section 3.0 of this Safety Evaluation discusses the applicability of the generic General Electric evaluation model to the specific Nine Mile Point Unit 1 analyses.

As stated in the Status Report and Supplement, the August 5th General Electric evaluation model was deficient and specific model changes noted in the Status Report and its Supplement were required. These changes are now being made to the generic General Electric evaluation model. Since the Nine Mile Point evaluations were based upon a deficient model, they are similarly deficient. A revised set of computations for Nine Mile Point (and for other facilities in a like position) based upon the newly revised and now acceptable evaluation model cannot be performed for a number of months.

To determine the effect of the model changes made to the August 5, 1974 General Electric evaluation model, the staff requested, and General Electric submitted a series of sensitivity studies, which quantified the effect of the model changes on the results of calculations performed using the August 5, 1974 models.(5) The staff followed the performance of these sensitivity studies while they were in progress and has reviewed the results upon completion. These results are discussed in Section 4.0 along with a discussion of the effects of these results on the evaluation submitted for Nine Mile Point on August 2, 1974.

From these studies it appears that additional operating restrictions are required to assure that in the event of a

postulated loss-of-coolant accident, ECCS cooling performance will not exceed the limiting values for calculated peak cladding temperature, local oxidation and hydrogen generation set forth in 10 CFR 50.46 (b). Appendix A of this document describes the manner in which these restrictions on reactor operation are derived and presents the acceptable operating limitations. Although these restrictions were established on the basis of applicable sensitivity studies of the effect of model changes, the staff believes that in conformity with the requirements of 10 CFR 50.46, these restrictions should be verified by a reanalysis based upon the General Electric Evaluation Model, as corrected. An evaluation of ECCS performance, wholly in conformity with 10 CFR 50.46 and Appendix K, and based on an approved evaluation model should be submitted for the Nine Mile Point plant, as promptly as it can reasonably be performed, along with proposed Technical Specifications based upon such an evaluation.

During the interim, before an evaluation wholly in conformity with the requirements of 10 CFR 50.46 can be submitted and evaluated, continued conformance to the requirements of the Commission's Interim Acceptance Criteria and the restrictions contained in the licensee's August 2, 1974 submittal combined with the additional limitations set forth in Appendix A hereto will provide reasonable assurance that the public health and safety will not be endangered.

2.0 ECCS EVALUATION MODEL

The staff Status Report[2] provides a complete evaluation of the General Electric ECCS Evaluation Model.* Each part of 10 CFR 50, Appendix K was addressed and appropriate comments regarding compliance to each part of the model were included. All phases of the General Electric analytical methods were concluded to meet Appendix K requirements with the exceptions noted in the Status Report and its Supplement 1. General Electric had agreed to all of the modifications noted in the Status Report, except those discussed in the Supplement. The Supplement discussed these items and concluded that General Electric's approach was acceptable. The Supplement to the Status Report indicates the need for demonstrating compliance with the single failure criteria for BWR plants other than BWR-3 Type plants. The Nine Mile Point facility is an earlier GE design and has consequently required specific review of single failure considerations. The systems as described in the SAR for the Nine Mile Point Facility satisfy the single failure criteria.

Since the Supplement was issued on November 13, 1974 General Electric has made modifications of its model to reflect staff requirements in order to perform the generic studies requested by the staff to determine the effect of all required model changes on the previously submitted calculations which had employed the General Electric's August 5th model. Described below are the other considerations described in the

*A complete listing of each computer program in the same form as used in the Evaluation Model, was furnished to the Regulatory staff for review at San Jose, and locked in a file cabinet at San Jose with the staff retaining the keys.

Status Report, (which were not resolved by the Supplement), which require model modifications, i.e., assembly power, fission energy and Post-CHF heat transfer.

2.1 ASSEMBLY POWER

For analysis of fission heat, decay of actinides, and fission product decay, the evaluation model must use the 102% factor for assembly power, rather than the 100% factor used in the GE August 5th model. This change has been properly made by General Electric.

2.2 FISSION ENERGY RELEASE

The licensee submittal was based on the General Electric August 5th model which used the value of 207.5 Mev/fission. The fission product decay must be based on 200 Mev/fission as recommended in the October, 1971 version of the proposed ANS-5.1 guide, and required by Appendix K. GE has now properly made this change.

2.3 POST-CHF HEAT TRANSFER

For non-jet pump plants a heat transfer correlation for conditions immediately after dryout was derived from experiments. The data were obtained for times as long as three to five seconds after dryout for a test section having a uniform heat flux. The staff noted in the Status Report that further justification for using the correlation beyond three to five seconds was required. This justification has not been provided. Therefore, the staff required that the correlation only be applied over approximately 1-1/2 seconds which corresponds to the heat fluxes of interest. The staff also required that the fuel assembly peak planar heat flux be used in the correlation rather than the average heat flux. Following this period,

the heat transfer coefficient should be calculated using the Ellion pool film boiling correlation until the node uncovers, and then it should be assumed to be zero. This change has been properly made for the model. Additional allowances have been made to the MAPLHGR curves to account for variations in initial bundle power and void fraction based on sensitivity studies performed by General Electric.

We believe that these changes (2.1, 2.2 and 2.3 above) adequately rectify the deficiencies identified in the Supplement to the Status Report. We now conclude that the evaluation model described in reference 1 with the modifications described in Sections 2.1 through 2.3, which have been included in the General Electric model, [5,6] will conform to Appendix K to 10 CFR Part 50.

To respond to the staff requirements within the limited time available, certain considerations were not included which would tend to provide a more realistic treatment of post-CHF heat transfer. General Electric has indicated that it is considering revisions to the post-CHF portion of its model to include factors it believes would be improvements. Staff review and approval will be required before these changes can be incorporated into the model.

3.0 APPLICABILITY OF GENERIC EVALUATION MODEL

The General Electric ECCS Evaluation Model for non-jet pump reactors is composed of two computer codes. The model consists of a blowdown code (SAFE), a heat transfer correlation, and a fuel assembly heat-up code (CHASTE). The heat transfer correlation and the results from the blowdown analysis are applied to the heatup code. Each of these codes also requires plant specific and fuel input parameters together with thermal-hydraulic correlations in accordance with Appendix K to 10 CFR Part 50. The sensitivity studies, fuel and system parameters, and thermal-hydraulic correlations in the model used by the licensee constitute an acceptable ECCS evaluation of the Nine Mile Point Unit 1.

4.0 RESULTS OF LOCA CALCULATIONS

The licensee performed a break spectrum analysis from a small break to the design basis loss-of-coolant accident (LOCA). The design basis LOCA coincident with the worst single failure (failure of one of the core spray diesels) yielded a peak clad temperature of 2200°F in the ECCS limited exposure range, a maximum core-wide hydrogen generation of 0.5% and a maximum local cladding oxidation of 17%. The highest temperature intermediate break yielded a peak clad temperature of 2150°F at a break area of o.5 ft ^{2}.

The analysis submitted in reference 4 showed that the reactor is ECCS limited with respect to linear heat generation rate (LHGR) at all exposures. A maximum (bundle) average planar linear heat generation rate (MAPLHGR) is used in the analysis. The MAPLHGR curves versus planar exposure are limits of operation to ensure conformance with 10 CFR 50.46 and Appendix K to 10 CFR Part 50.

All of the model deficiencies noted in Section 2.0 of this document were examined by General Electric with regard to impact assessment on current operating reactors. This was done by a series of sensitivity studies conducted by General Electric and reviewed by the staff. (5,6) These studies show that the required modifications described in Section 2.0 result in the need for adjustment of certain operating limitations proposed by licensee, in his submittal. (4) The model corrections would cause an increase in calculated peak clad temperature. However, a new LOCA limited MAPLHGR curve, which is an incremental

decrease in the MAPLHGR curve as originally submitted by the licensee, would restrict peak clad temperature to 2200°F and the local cladding oxidation to 17%. Thus, the new MAPLHGR curves set forth in Appendix A assure that the criteria of 10 CFR 50.46(b) are not exceeded.

5.0 CONCLUSIONS

Based on the analysis set forth in this Safety Evaluation, certain limitations, in addition to those contained in licensee's submittal, [4] are required to assure conformance with the calculated peak clad temperature, and maximum oxidation and hydrogen generation criteria of 10 CFR 50.46(b). The restrictions should limit operations to conform to the MAPLHGR curves, set forth in Appendix A. These restrictions should be verified by a re-analysis based on the General Electric evaluation model, modified as described in this Safety Evaluation Report. As discussed in the Status Report [2], the plant also conforms to the two remaining criteria, i.e., maintenance of a coolable geometry and long-term cooling. The heat removal system for long-term cooling for the plant described in the SAR is satisfactory for these requirements.

An evaluation of the ECCS performance wholly in conformance with 10 CFR 50.46 and Appendix K, based on an approved evaluation model, should be submitted for the Nine Mile Point Unit 1 facility as soon as practicable, but within six months.

In the interim, operation should conform to the requirements of the Interim Acceptance Criteria and the previously approved Technical Specifications, as well as the requirements of the licensee's submittal (4) and the requirements of Appendix A.

6.0 REFERENCES

1. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR, Appendix K NEDE-20566, (Proprietary) and NEDO-20566 (Non-Proprietary) Draft, August 1974.

2. Status Report by the Directorate of Licensing in the Matter of General Electric ECCS Evaluation Model Conformance to 10 CFR 50, Appendix K, October 1974.

3. Supplement 1 to the Status Report by the Directorate of Licensing in the Matter of General Electric ECCS Evaluation Model Conformance to 10 CFR 50, Appendix K, November 13, 1974.

4. Nine Mile Point Unit 1 Nuclear Power Station Loss-of-Coolant Accident Analysis Conformance with 10 CFR 50, Appendix K, August 1974.

5. Letter from G. Gyorey, GE to V. Stello, AEC, dated December 13, 1974.

6. Telecopy from D. J. Liffengren, GE to S. Israel, AEC, dated December 17, 1974.

APPENDIX A
NINE MILE POINT UNIT 1
OPERATING RESTRICTIONS

The proposed Technical Specification limiting conditions of operation present two limiting areas on power distribution related to LOCA analysis. These are the limiting assembly maximum average planar linear heat generation rate, MAPLHGR, and the minimum critical power ratio limit related to boiling crisis, MCPR. The MPCR value used in the sensitivity studies was 1.19

The limiting value of MAPLHGR included with the proposed Technical Specifications submitted on August 2, 1974 has been revised to account for the General Electric ECCS Evaluation Model deficiencies which have been discussed in this report. The revised values are given in Figures A-1 through A-5. Operation should conform to these values.

Operation should also conform to a limiting MCPR value of 1.19.

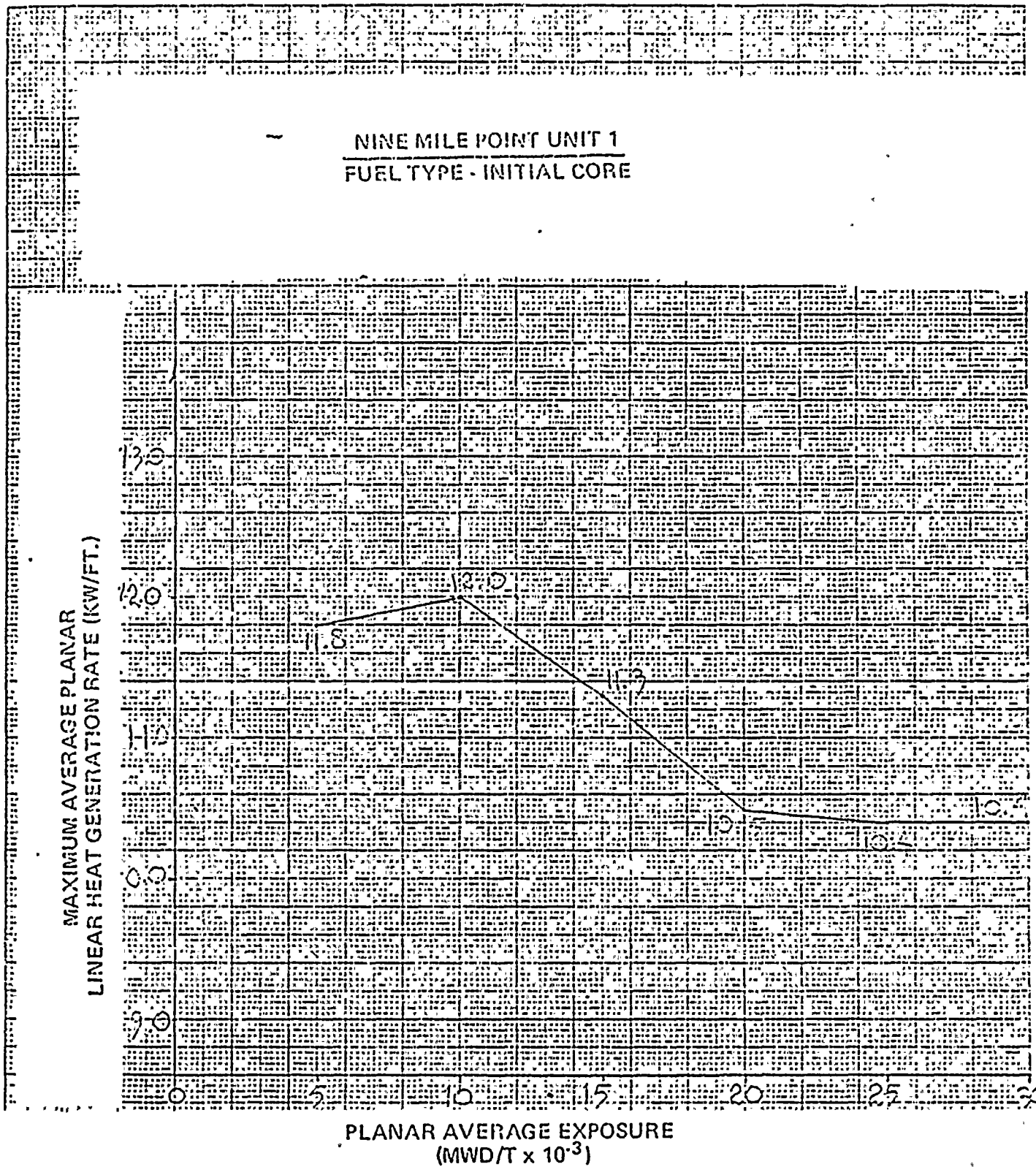

FIGURE A-1 MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE VERSUS PLANAR AVERAGE EXPOSURE

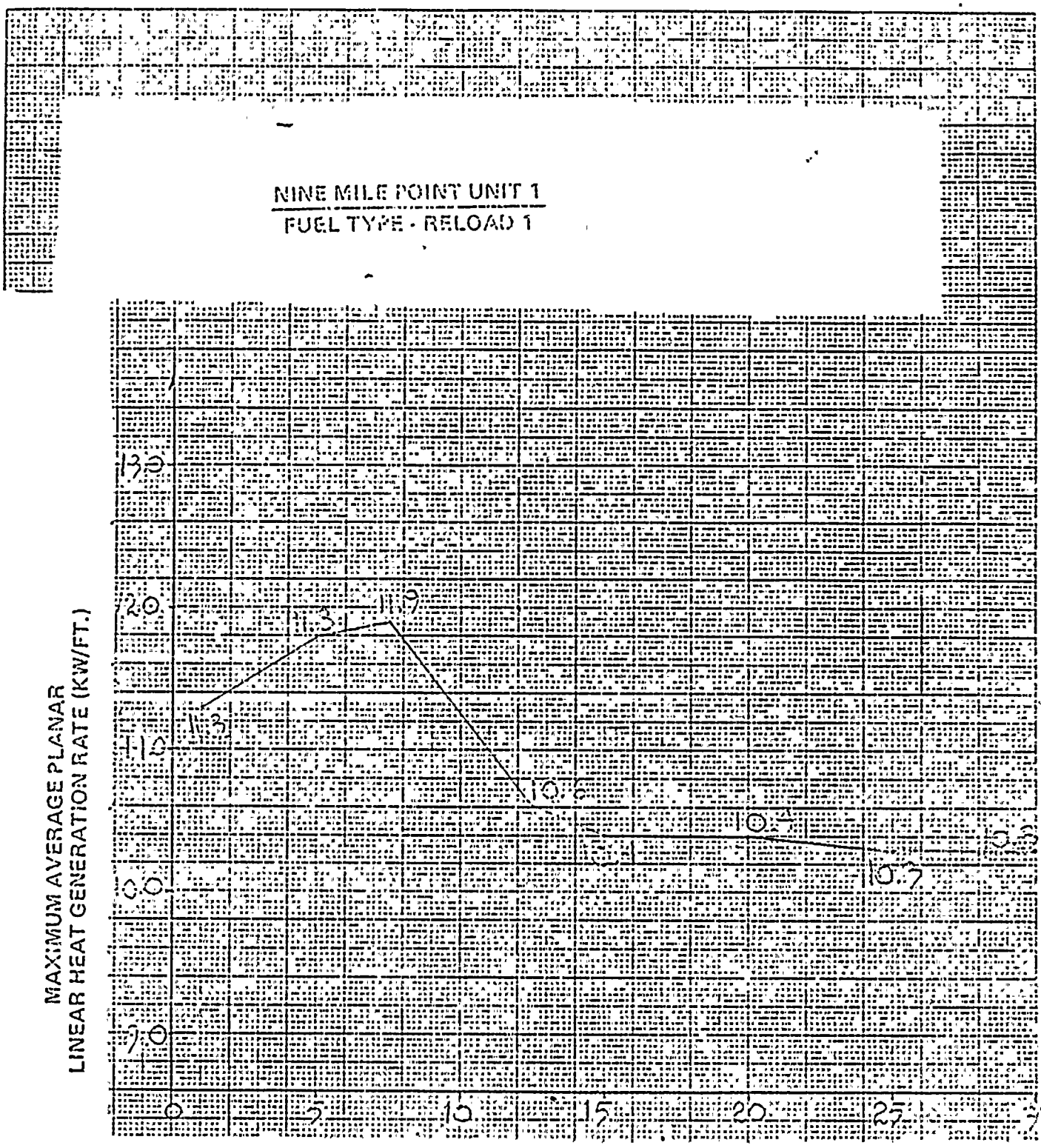

FIGURE A-2 MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE VERSUS PLANAR AVERAGE EXPOSURE

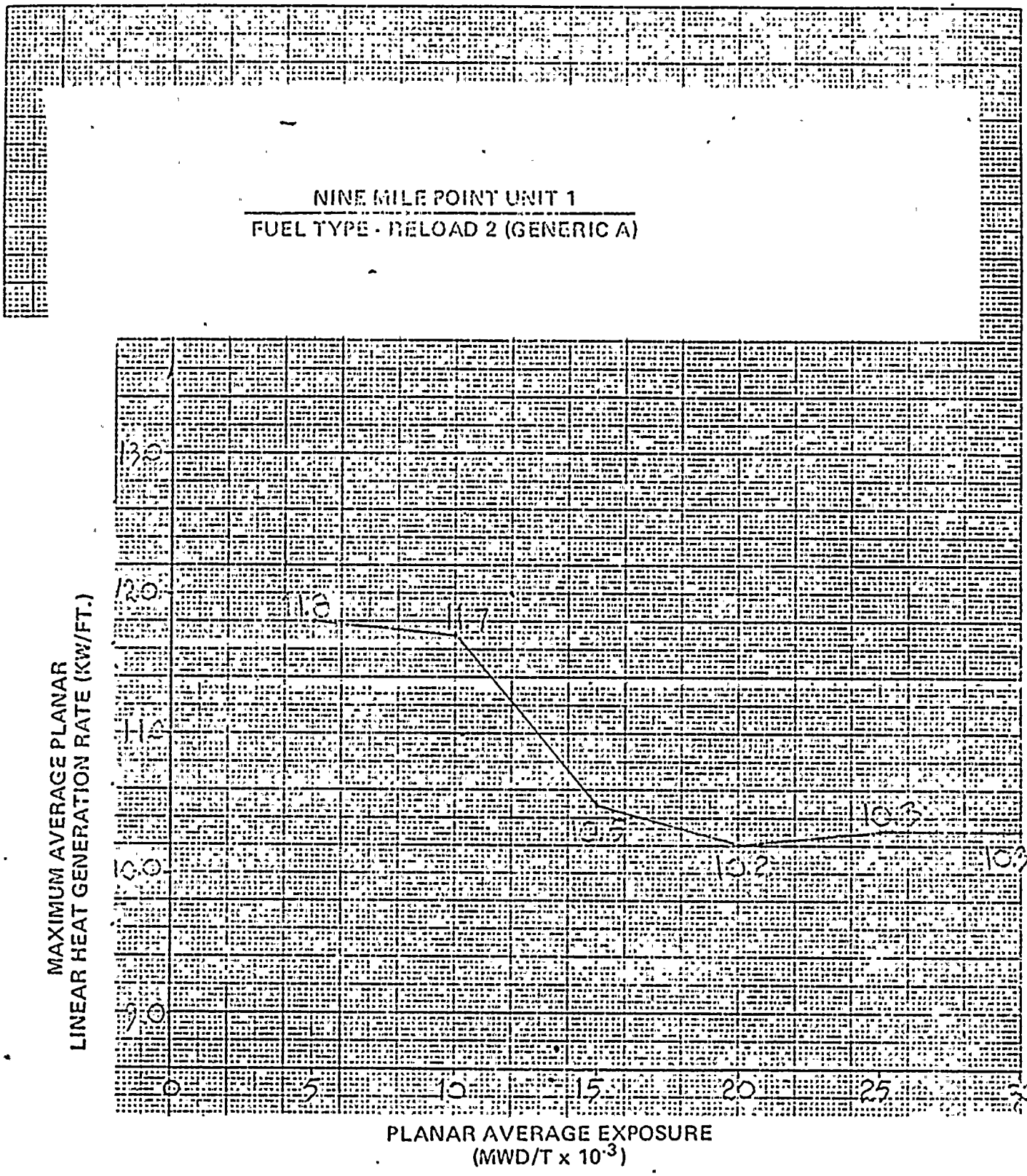

FIGURE A-3 MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE VERSUS PLANAR AVERAGE EXPOSURE

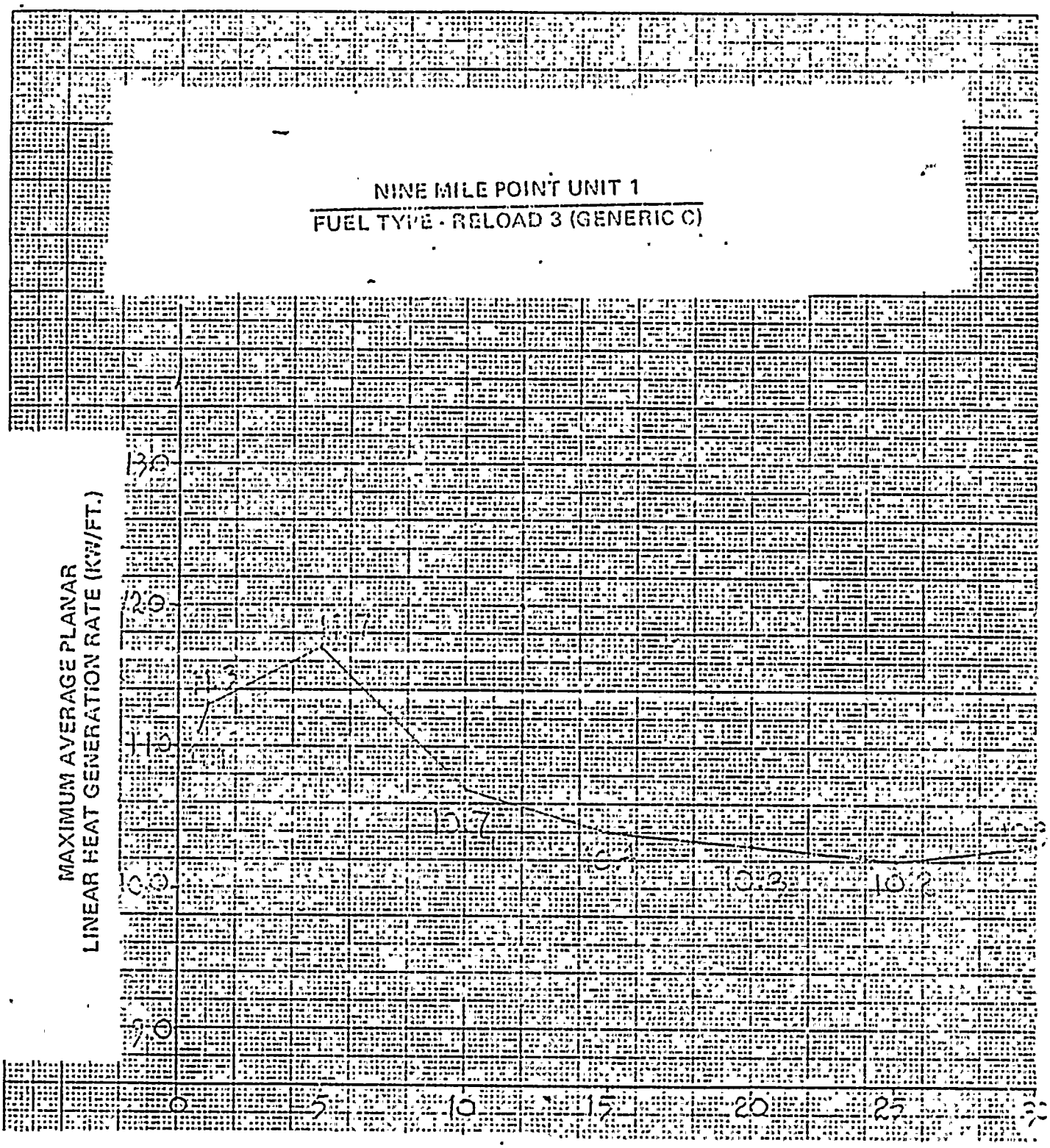

FIGURE A-4 MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE VERSUS PLANAR AVERAGE EXPOSURE

NINE MILE POINT UNIT 1

FUEL TYPE - RELOAD 4 (8 x 8)

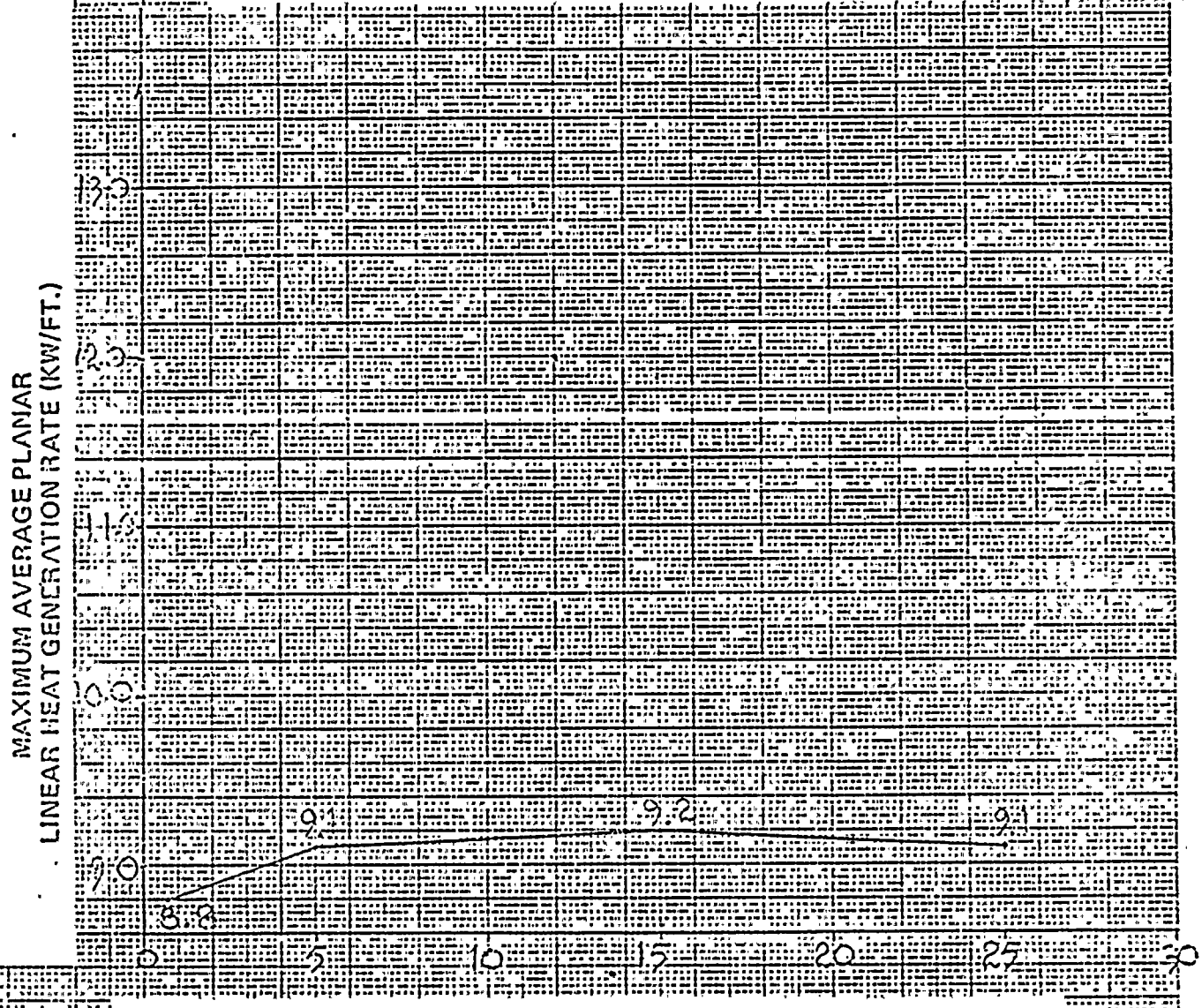

FIGURE A-5 MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE VERSUS PLANAR AVERAGE EXPOSURE