DEC 4 1989

MEMORANDUM FOR: Record

FROM: John J. Surmeier

SUBJECT: SUMMARY OF MEETING BETWEEN LLWM AND EPRI, NUMARK AND DUKE POWER

On November 28, 1989 management and staff from the Division of Low-Level Waste Management and Decommissioning (LLWM) with EPRI, NUMARC and Duke Power representatives to discuss source term scaling issues relating to low-level waste disposal and EPRI-sponsored research in this area. EPRI has developed a methodology to estimate the amount of I-129 generated by reactors that indicates that the reported activity of I-129 on waste disposal manifest records may be at least two orders of magnitude higher than is actually generated and disposed of as low-level radioactive waste. EPRI is in the process of validating this methodology. A list of the attendees at the meeting are presented below. A copy of the vugraphs used by EPRI are attached.

NRC	EPRI	NUMRAC
Richard Bangart	Patricia Robinson	Lynne Fairobent
Michael Bell	Jene Vance	
Paul Lohaus		
John Surmeier	DUKE POWER	
Garry Roles		
Robert Fonner	Mary Birch	
Michael Weber		

John Surmeier

John J. Surmeier

Attachment:
Copy of vugraphs

cc: NRC PDR
Central Files
SECY
J. Taylor
H. Thompson
R. Bernero
T. Murley
R. Bangart
M. Bell
P. Lohaus
R. Fonner
L. Fairobent, NUMARC
P. Robinson, EPRI
M. Birch, Duke Power

1/1

WM-3
425
NL14

Delete: ACNW

LLW Issues

- SOURCE TERM & PERFORMANCE ASSESSMENT FOR DISPOSAL SITES

- CLEAN WASTE VERIFICATION (FREE RELEASE)

- WASTE CLASSIFICATION
  - -Scaling Factor Predictor Code, RADSOURCE
  - -Generic Scaling Factors for DAW

- WASTE VOLUME
  - -Compact Sites
  - -Storage On-Site

- "0" Solid LLW ALWR

10CFR61

EPRI Research Work

#1 Waste Classification / Scaling Factors

- Industry Wide Database 1985-Present
- Waste Characterization- Chemistry/Radiochemistry
  - -Low Activity Waste Streams (DAW, Soil,Oil)
  - -RCS Column Testing
- Development & Validation of Scaling Factor Predictor Code RADSOURCE

#2 Waste Disposal Source Term

- Data that Demonstrates Analytical & Sampling Conservatism in Scaling Factor Methodology
- Data to Validate I-129/Tc-99 Disposal Site Source Term From Fuel Release Mechanisms Developed by J. Vance

LLW Disposal Facility
I-129 Tc-99
Source Term Development

Problem

- Tc-99 & I-129 are mobile isotopes in the environment
- Recall from 10CFR61, doses are inventory controlled not concentration controlled
- Inventories of Tc-99 & I-129 are potentially limiting the siting of new compact LLW facilities
- Source terms derived from 10CFR61 sampling programs & shipping records over predicts the inventory by a significant margin

Need

Development of I-129 & Tc-99 Source Term

√ Correct

√ Credible

√ Defensible

and

√ Can Be Developed Cost-Effectively

Solution

Development of a Predictive I-129 & Tc-99 Source Term Model Based On:

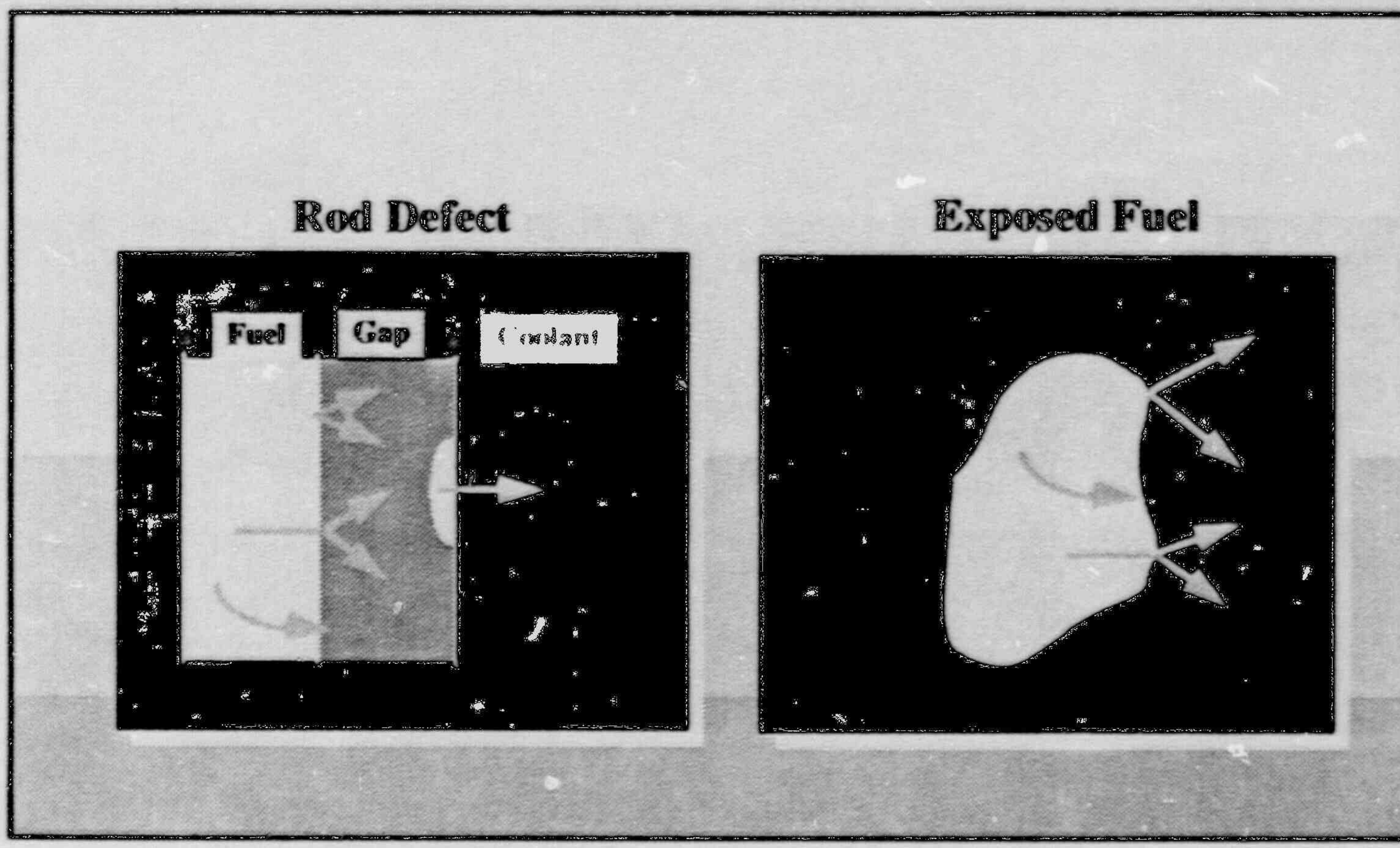
- **Utilization of Fundamental Fuel Release Mechanisms**
- **Derivation of Fuel Release Rates**

Background

- Reactor Fuel is Ultimate Source of I-129
- Reactor Fuel May Be Exposed or In Fuel Pins
- Fuel Contained in Fuel Pins Will Release Fission Products from Defect in Cladding
- I-129 is Released from Fuel by 3 Fundamental Mechanisms:

Recoil
Diffusion
Knockout

Fuel Sources for Release of I-129



6 Steps to Source Term

Step 1: Develop I-129/I-131 fuel release ratios for

Recoil, Diffusion, Knockout

Step 2: Determine I-131 release rate profile for each compact reactor over 3 fuel cycles

Step 3: Develop I-131 fuel release mechanisms profiles over the same time period

x% Tramp   y% Cladding

q1/y Recoil
q2/y Diffusion
q3/y Knockout

6 Steps to Source Term

Step 4: Develop time-integrated I-129 release rate profile

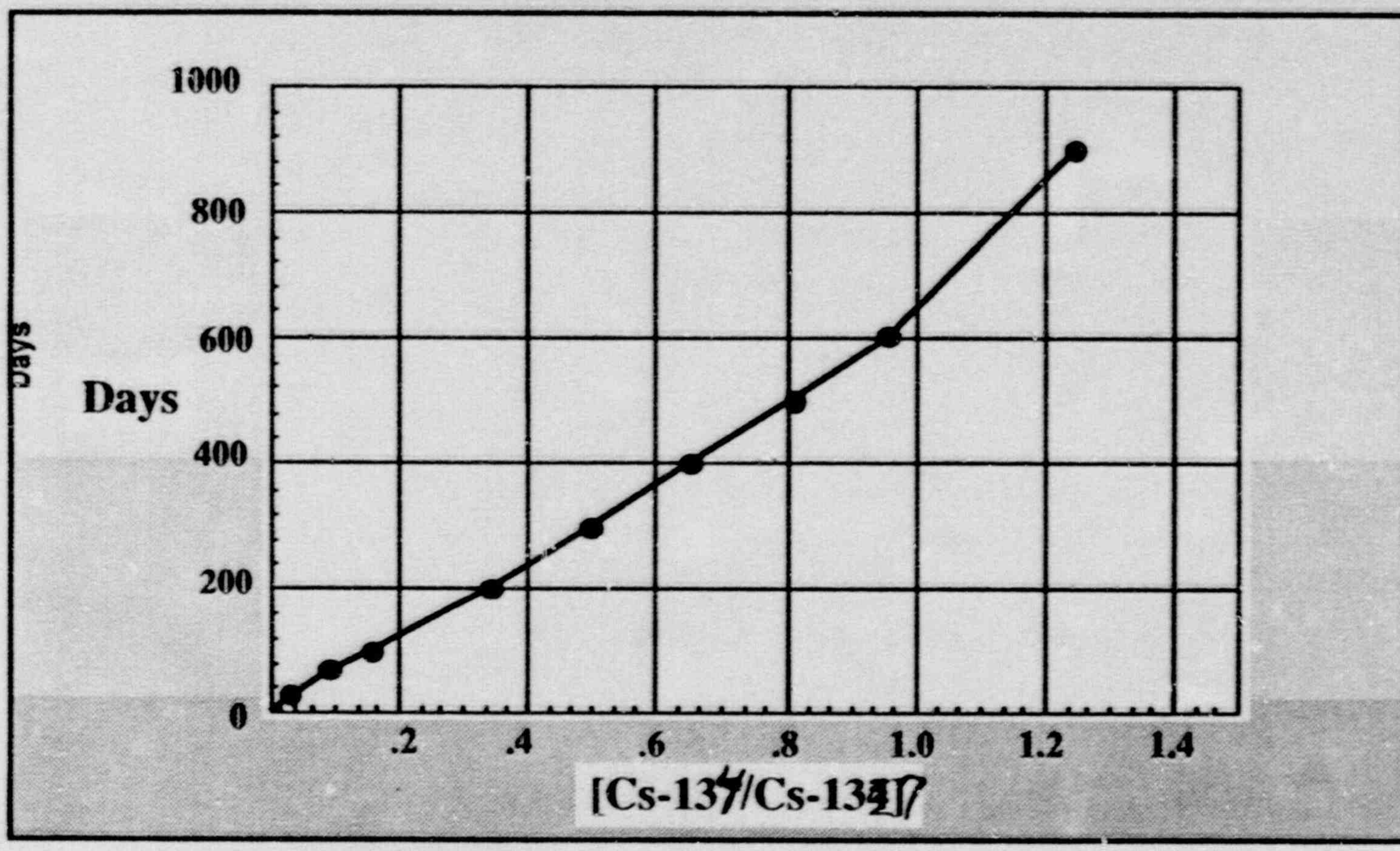
Step 5: Analyze all plants in compact region

Step 6: Derive Annual release quantity for compact reactors

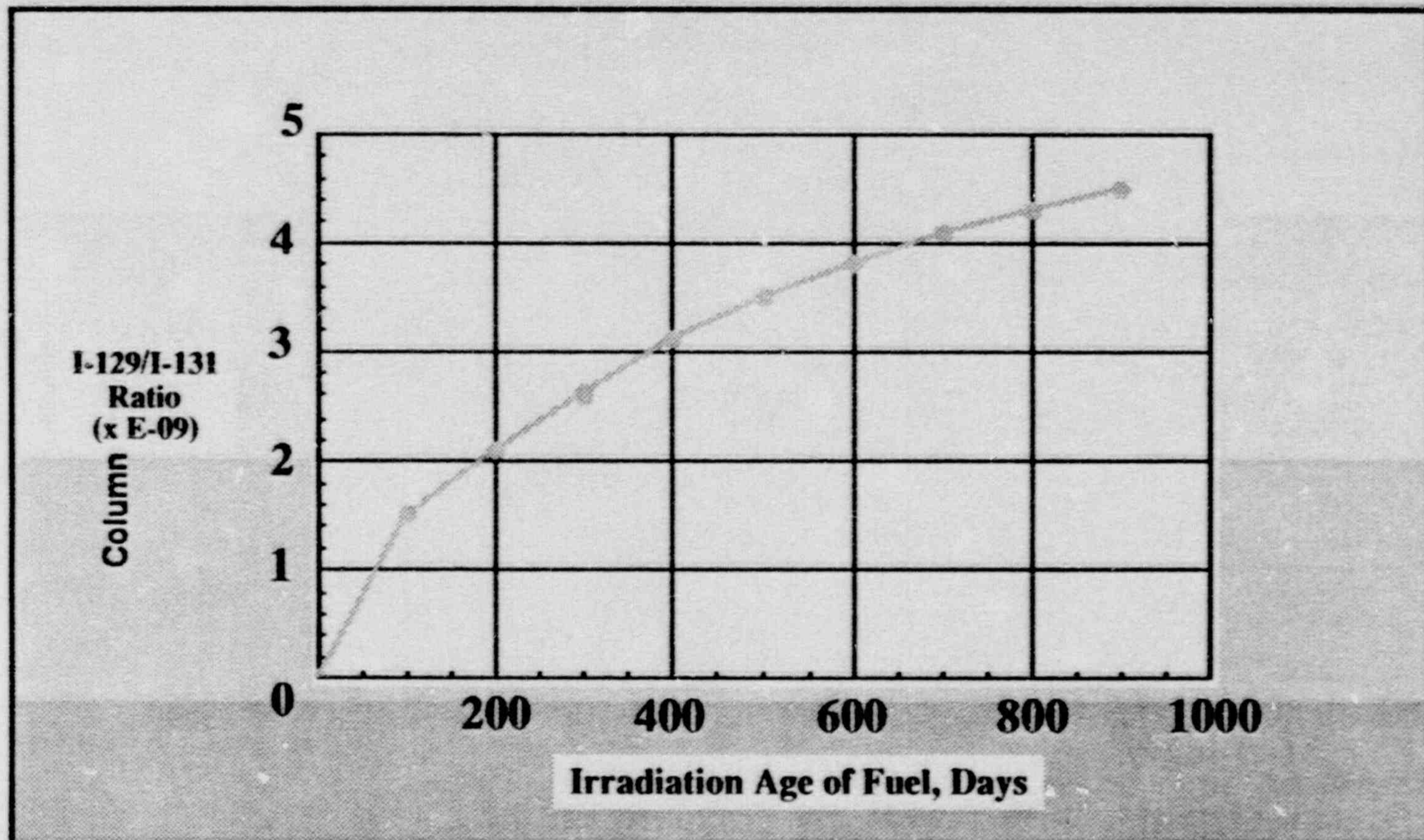
I-129 / I-131 Release Ratios

- **RECOIL:** Constant = 4.55 E -10
- **DIFFUSION:** Irradiation Age Dependent
- **KNOCKOUT:** Irradiation Age Dependent

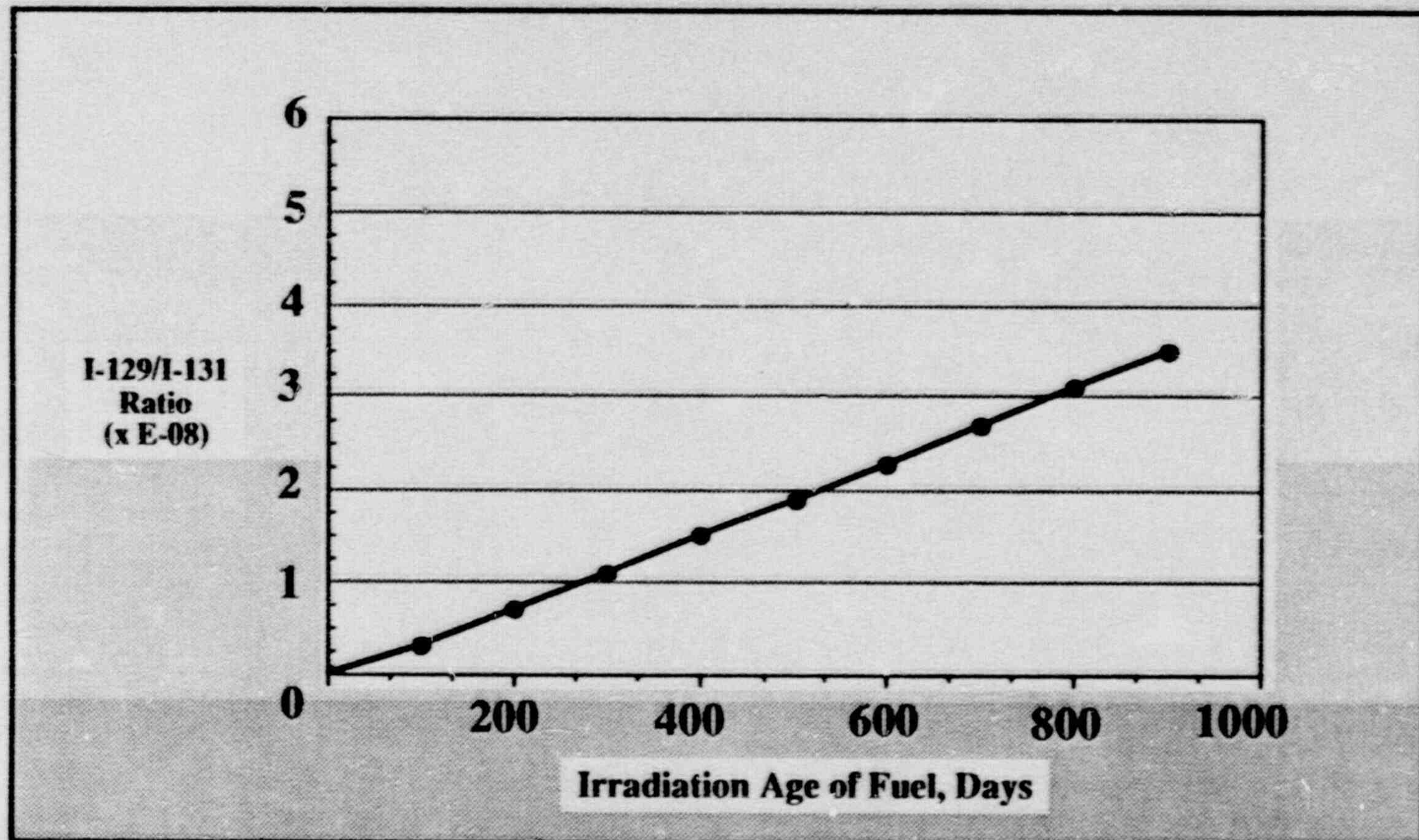
[Cs-134/Cs-137] vs Irradiation Time



I-129/I-131 Ratio From Diffusion



I-129 / I-131 Ratio from Knockout



Fuel Release Conditions

- Determined by Ratios of 5 Short-Lived Iodines

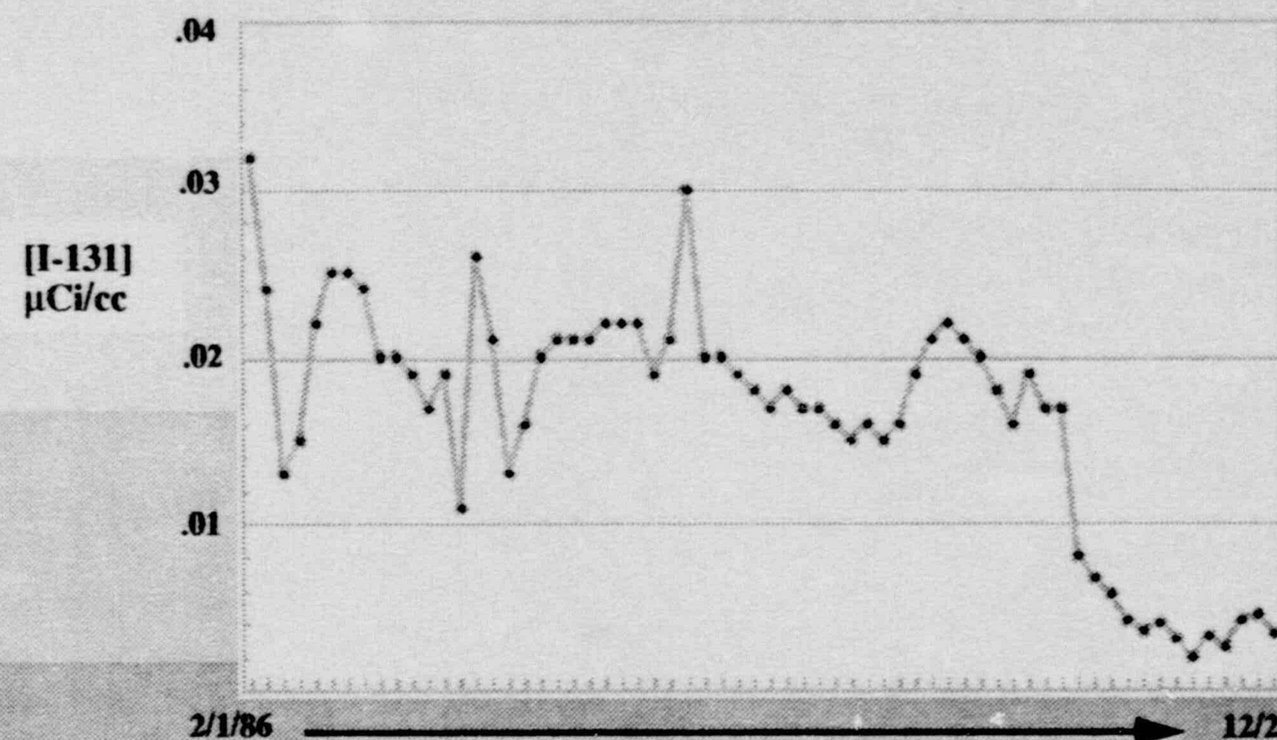
I-131
I-132
I-133
I-134
I-135

- Solve for Fractional Releases

A = fraction exposed fuel
B = fraction pin defects
Q1= fraction recoil release
Q2= fraction diffusion release
Q3= fraction knockout release

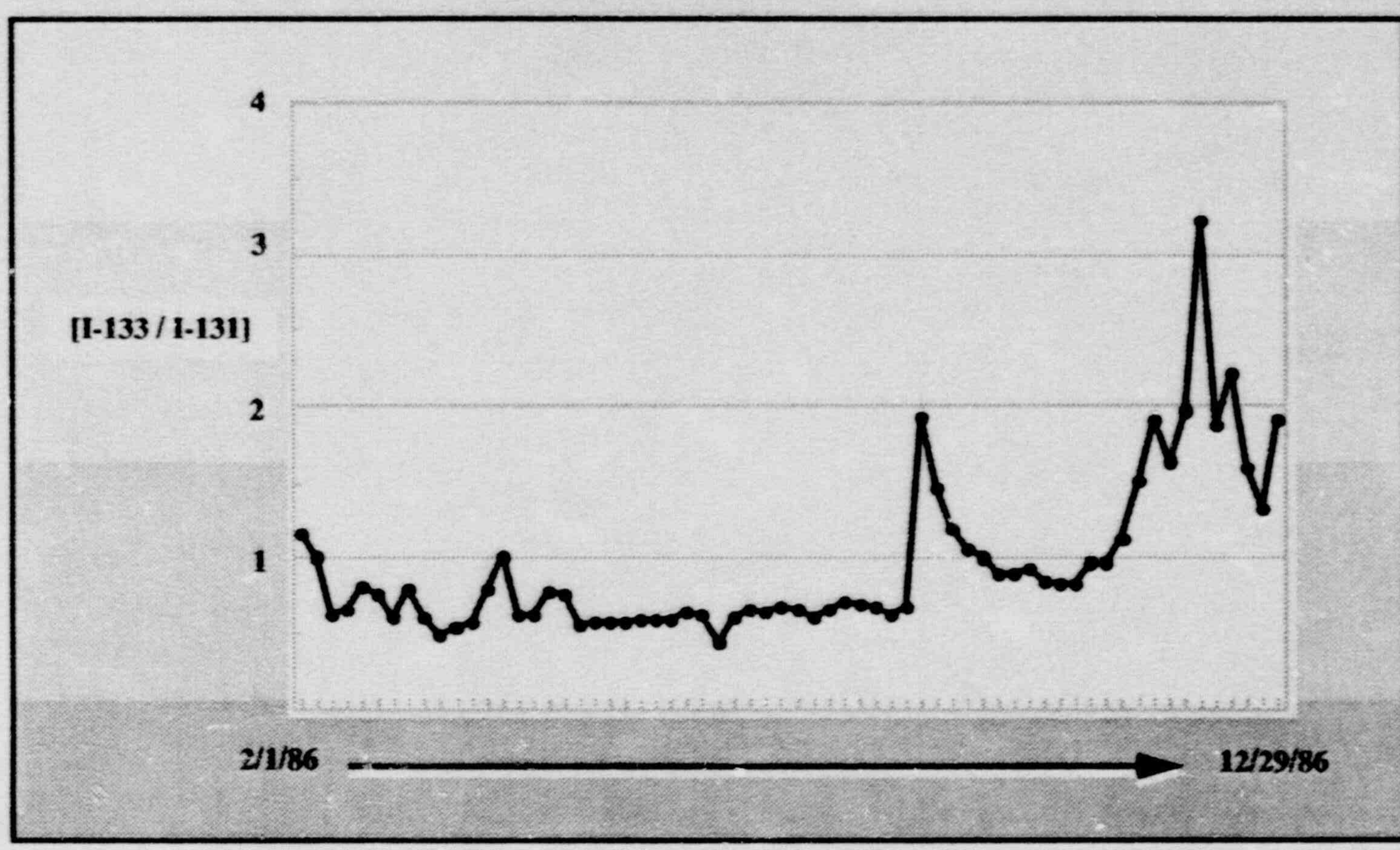
- Determine Age

I-131 RCS Concentration vs. Time



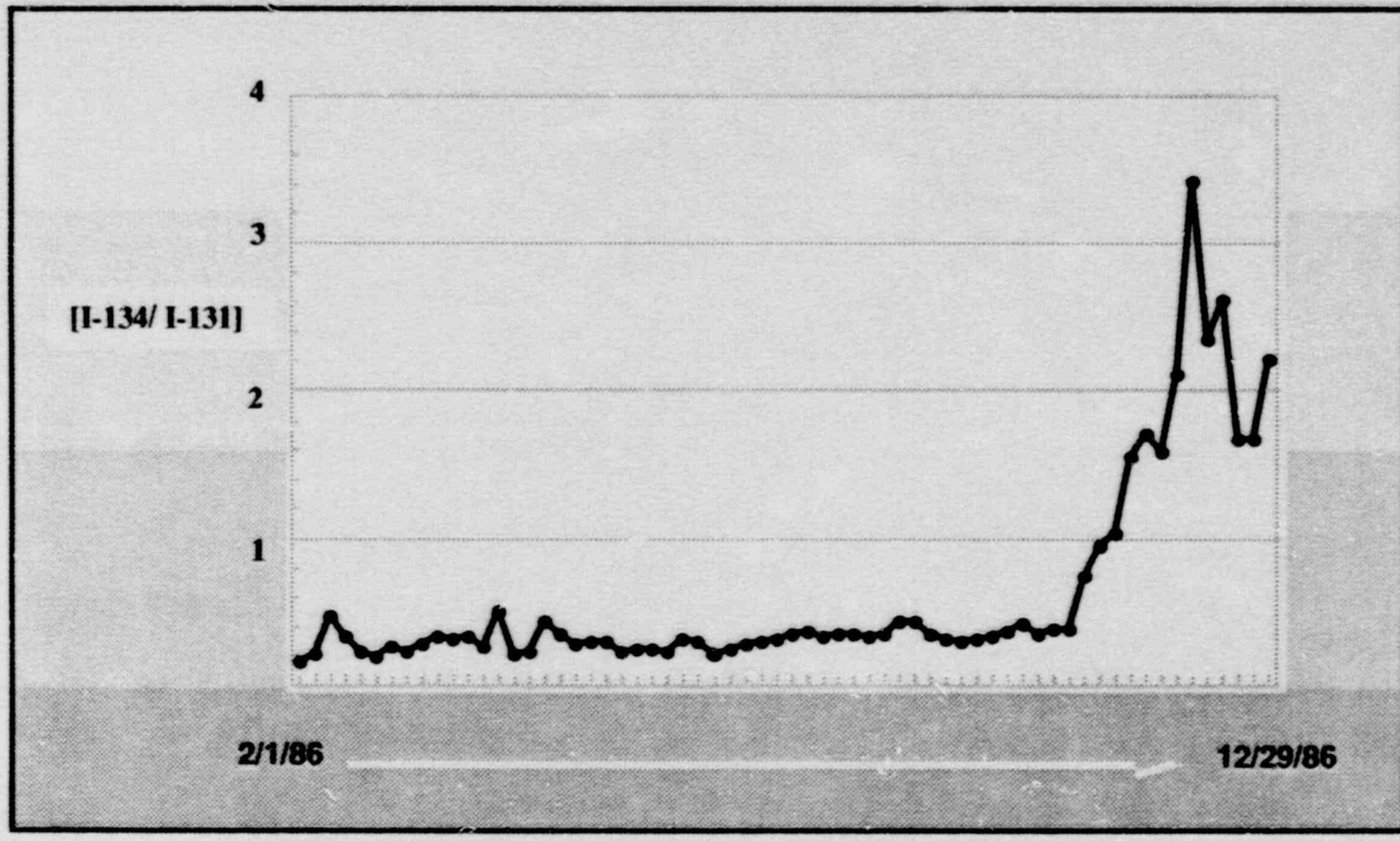
IP-3

I-133 / I-131 Ratio vs. Time



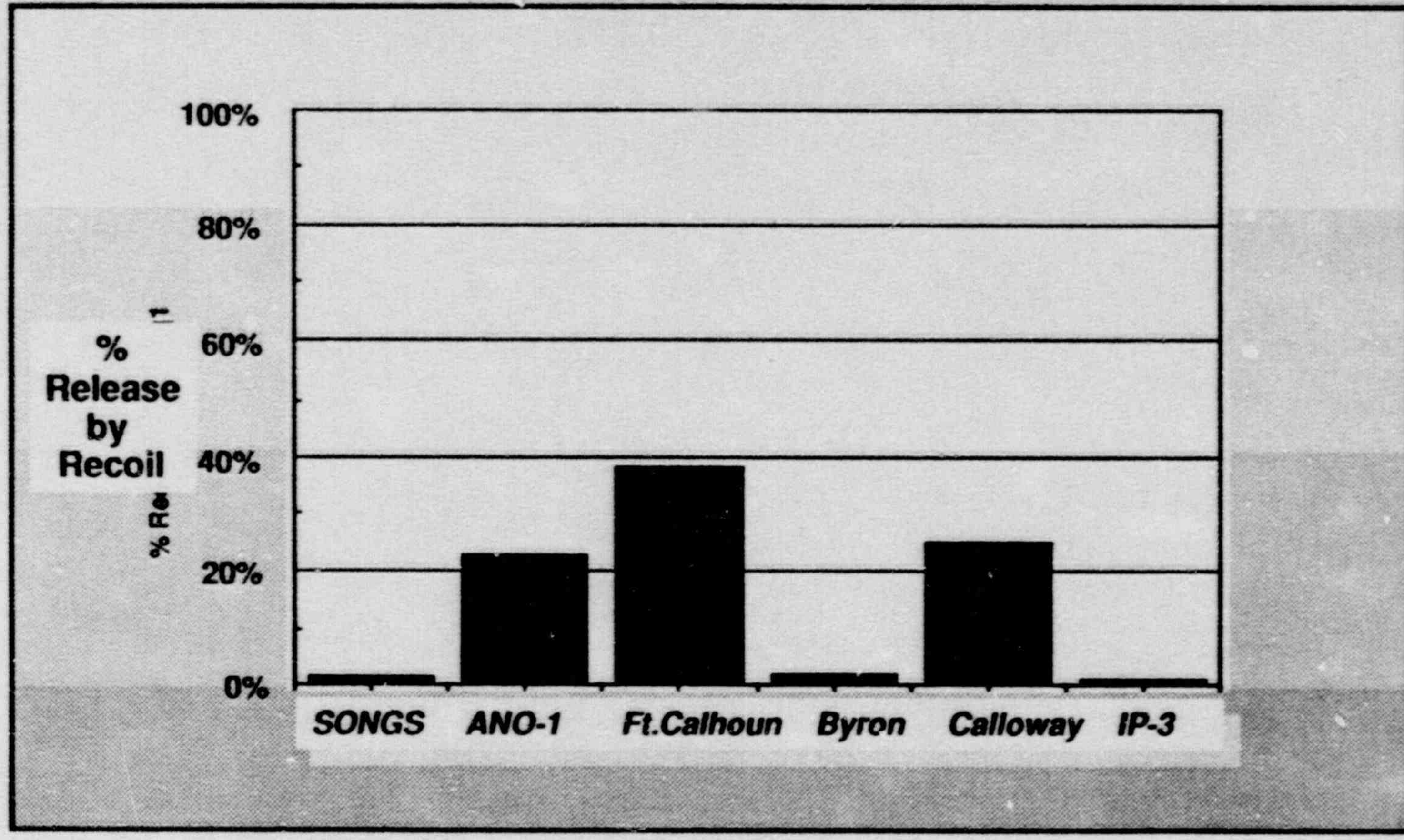
IP-3

I-134 / I-131 Ratio vs. Time

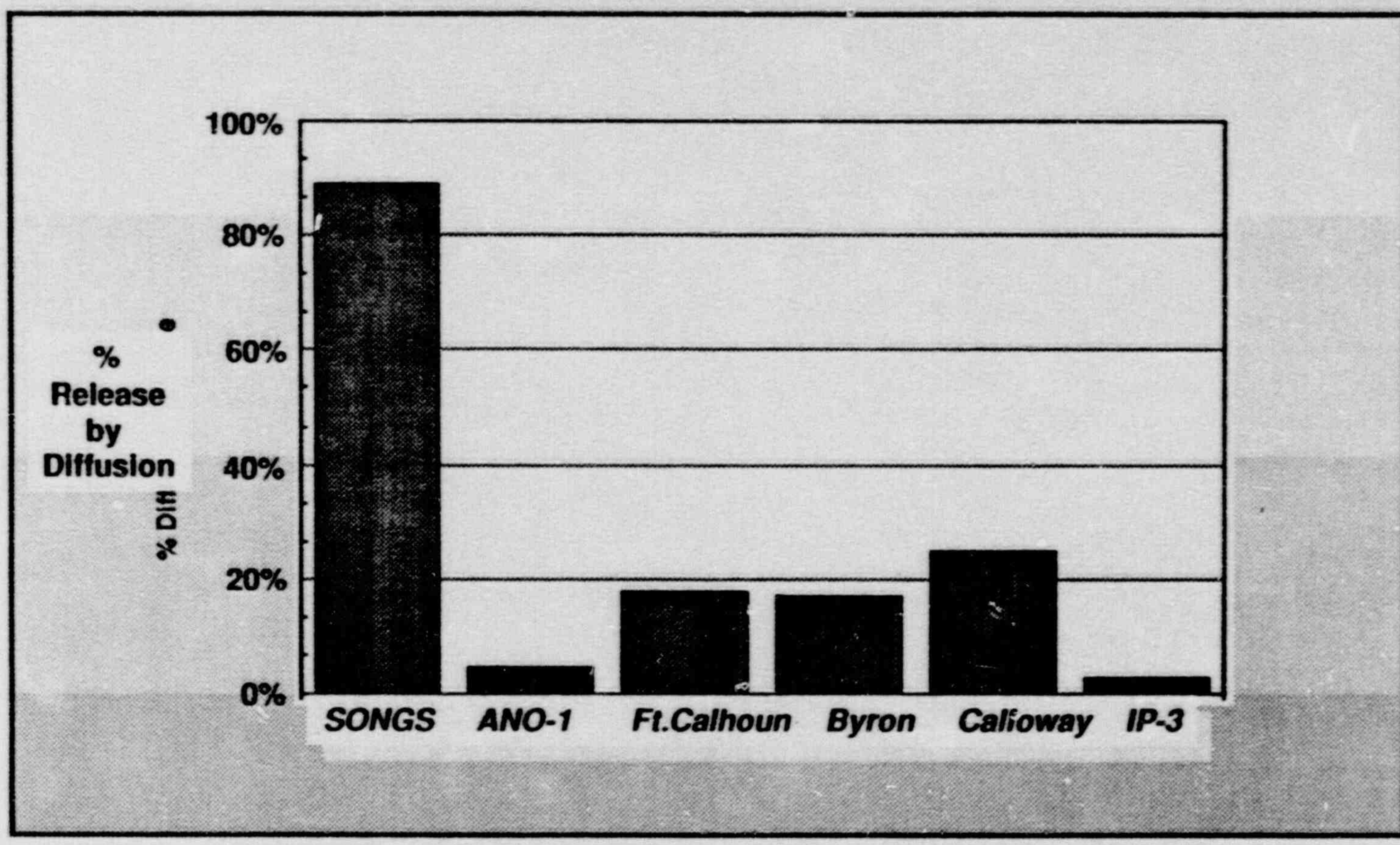


IP-3

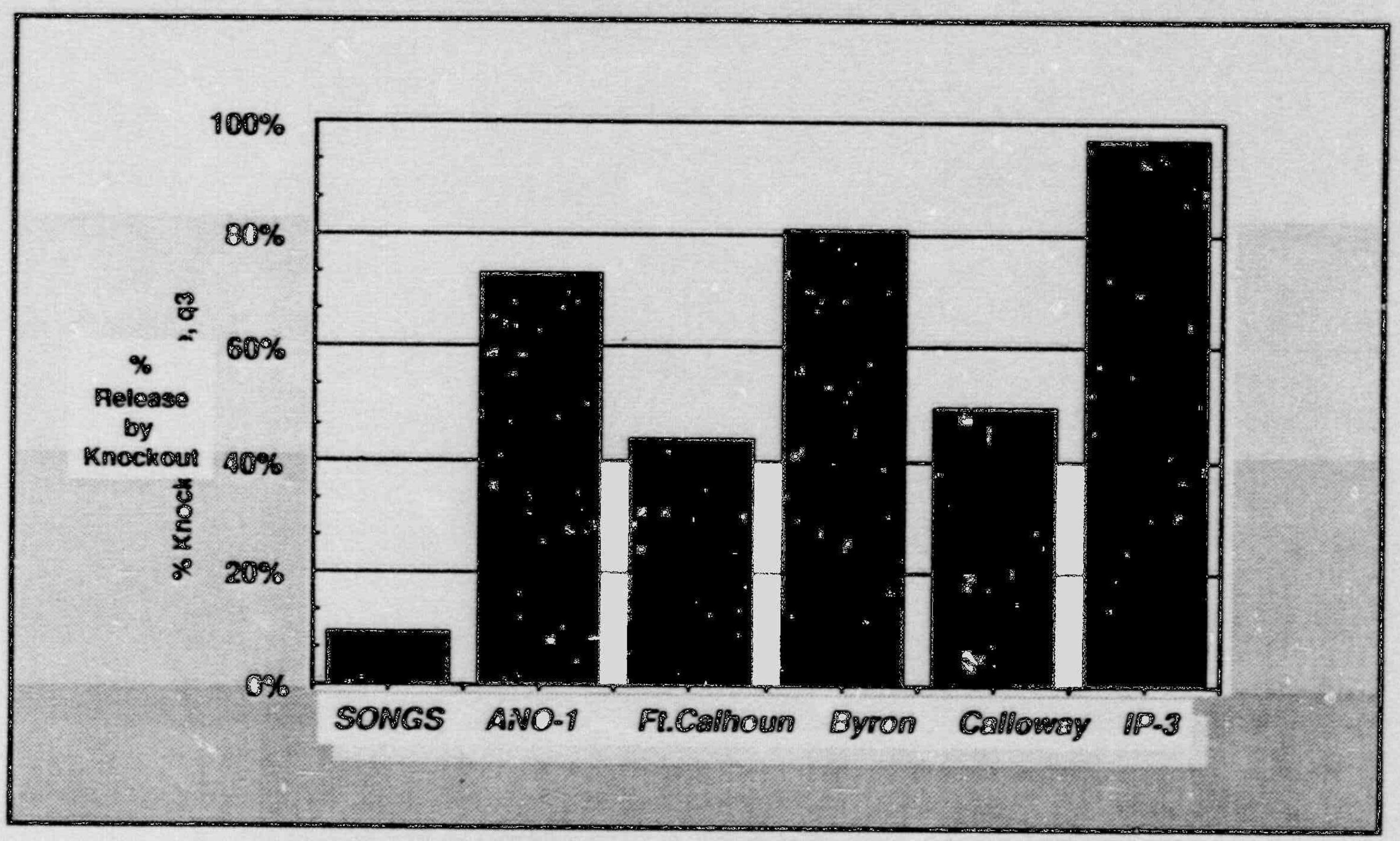
Recoil Release Mechanism



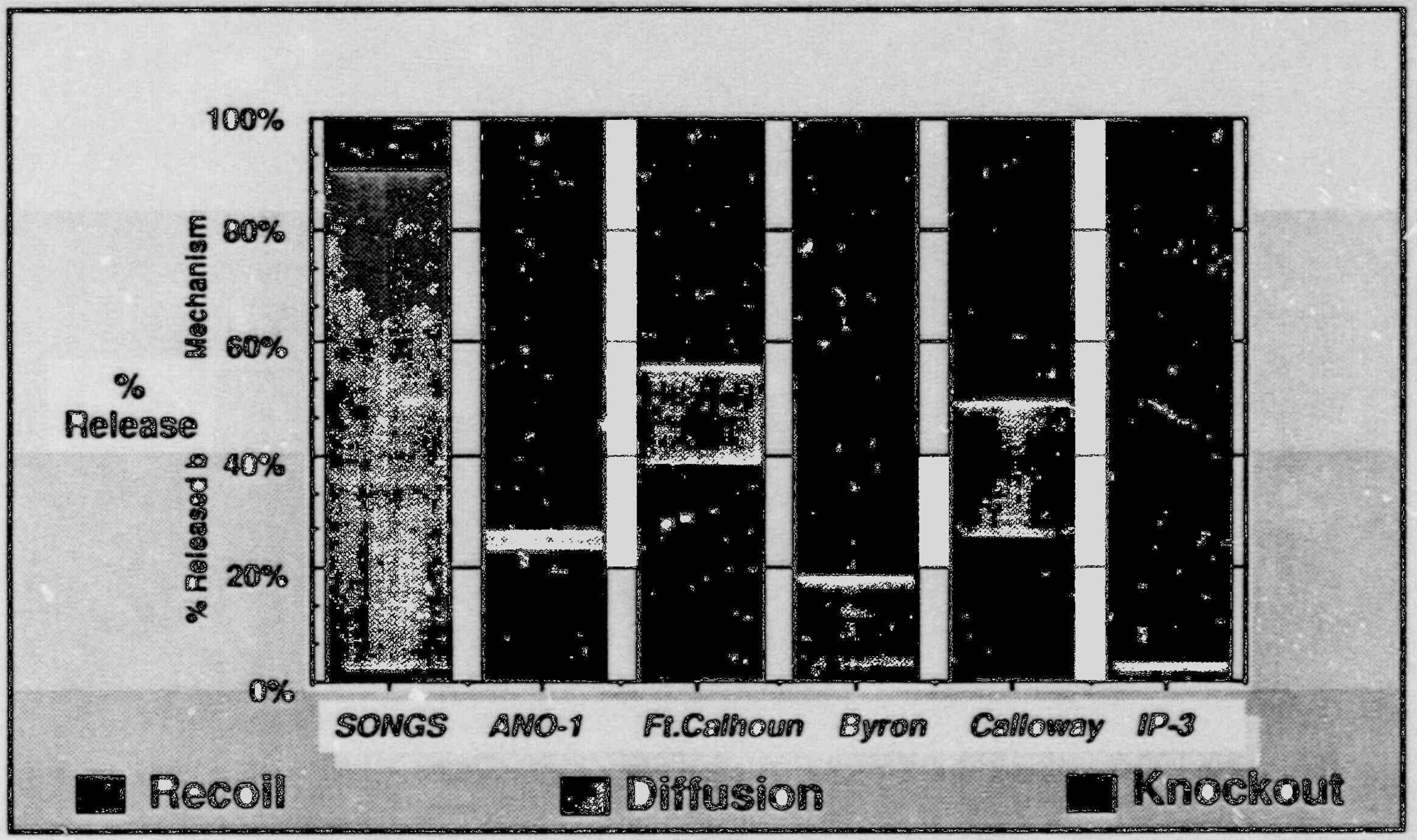
Diffusion Release Mechanism



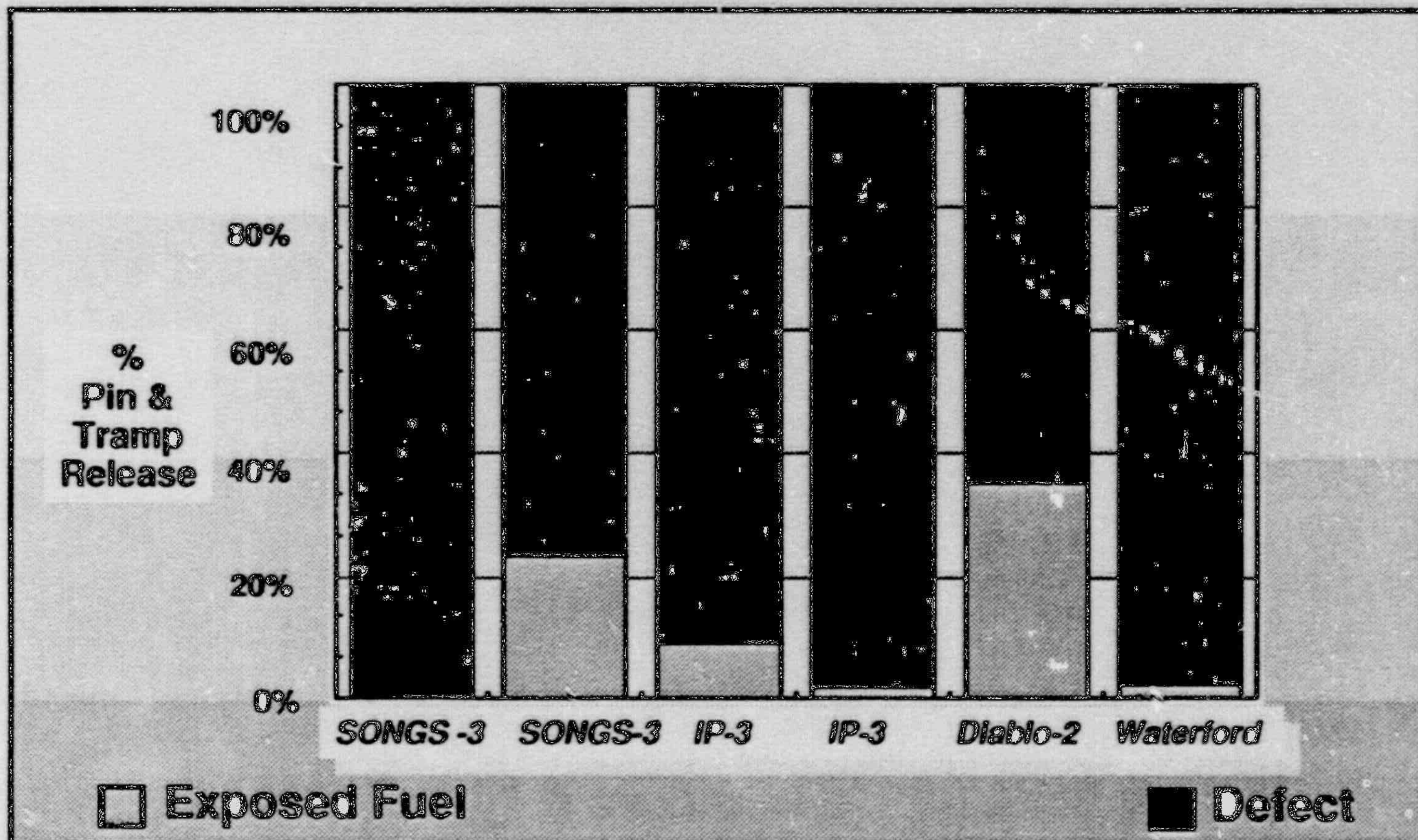
Knockout Release Mechanism



All Fuel Release Mechanisms



Exposed Fuel vs. Pin Defect



Ex: I-129 / I-131 Release Ratios

Release Mechanism	I-129 / I-131 Ratio
Recoil	4.55 E-10
Diffusion @ 500 days	3.43 E-09
Knockout @ 500 days	1.70 E-08

Plant Examples:	I-129 / I-131 Ratio	I-129 RCS Concentration
SONGS	4.64 E-09	1.16 E-09 μCi/cc
Indian Point-3	1.82 E-08	2.22 E-10 μCi/cc