

LAWRENCE LIVERMORE LABORATORY

June 7, 1973

Dr. Nathaniel F. Barr
Asst. Director for Measurement
and Evaluation
Division of Biomedical and
Environmental Research
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Nat:

Enclosed are xerox copies of viewgraphs used at the RARG meeting in Livermore last month. They are for your own use or for distribution to anyone whom you, as chairman of the RARG, consider appropriate. All users, however, should understand the following points:

1. These are viewgraphs used during an oral presentation and, as such, present only an outline of procedures or a compression of data without amplifying or clarifying discussion. They are therefore an incomplete representation of the work that is being done.
2. Experimental data are preliminary and subject to change as analytical results become final.
3. These are all working documents that are being used in the evolution of the Survey Final Report and will, I expect, be used to generate the AEC recommendations. They are forwarded to you for information only, and are not for quotation in any public document or forum.

Sincerely yours,



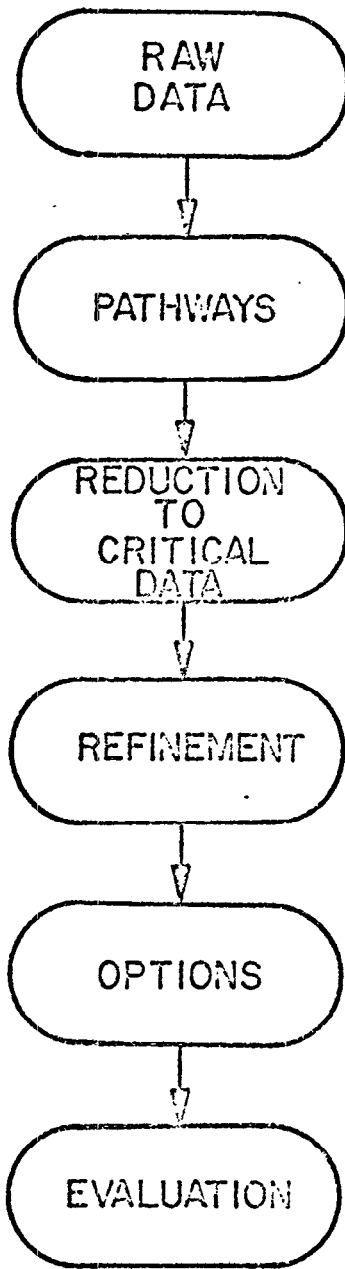
Dr. W. E. Nervik
Radiochemistry Division Leader

WEN:sa

cc: T. McCraw
D. Wilson
W. Nervik/File

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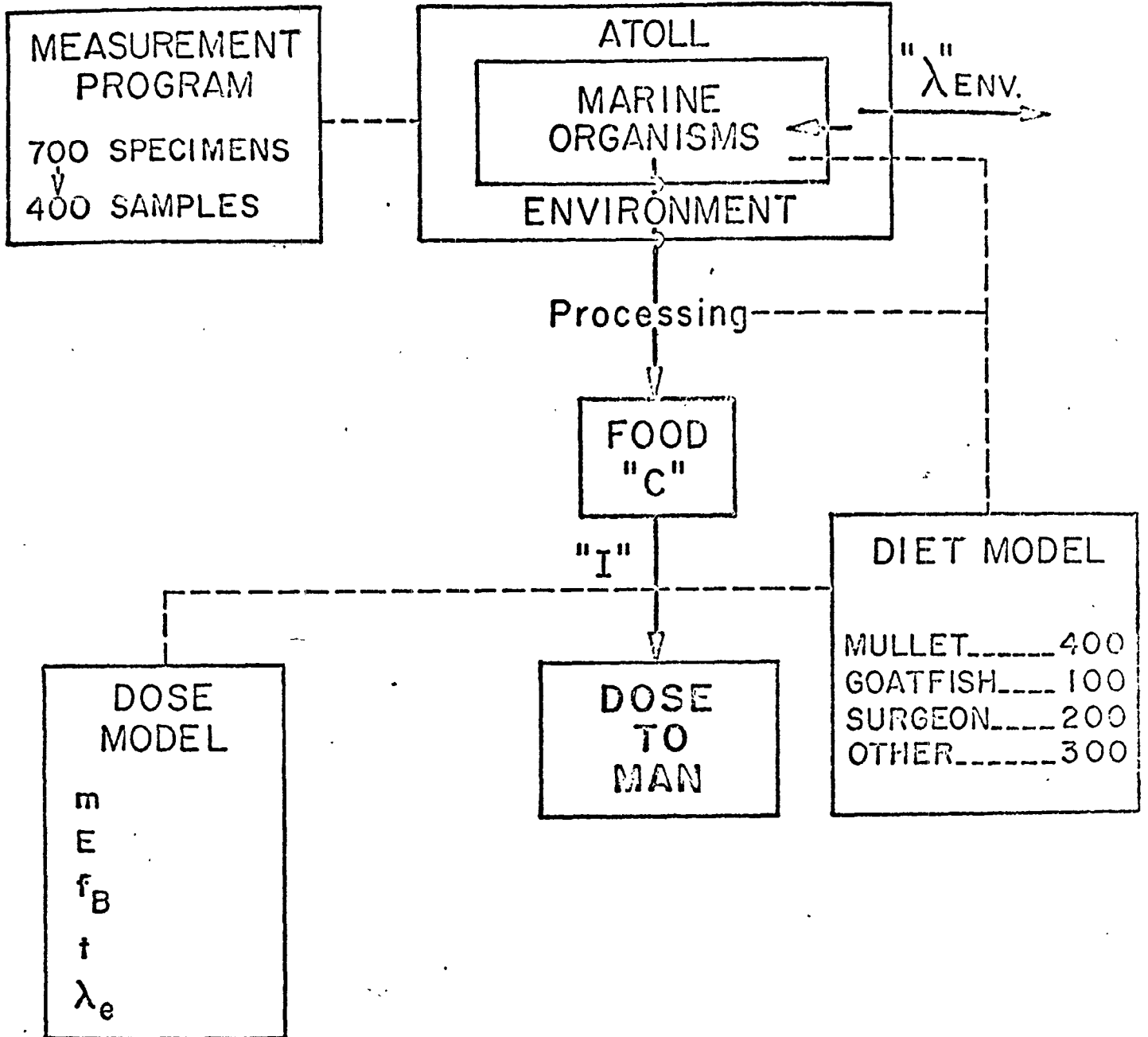
2951



EVALUATION STEPS

2952

MARINE FOOD CHAIN



2953

(USING DIET MODEL)

TOTAL ATOLL

- REM IN 30 YEARS -

	g/day	Co-60	Cs-137	Am-241	TOTAL
GOATFISH	100	0.036	0.009	0.002	0.047
SURGEON	200	0.027	0.088	0.004	0.119
OTHERS	300	0.081	0.072	0.008	0.161
MULLET	400	0.224	0.125	0.010	0.359
TOTAL	1,000	0.368	0.294	0.024	.686

EXCLUDING ALICE THRU IRENE

GOATFISH	100	0.014	0.005	0.003	0.022
SURGEON	200	0.013	0.016	0.004	0.033
OTHERS	300	0.041	0.035	0.008	0.084
MULLET	400	0.050	0.017	0.010	0.077
TOTAL	1,000	0.118	0.073	.025	0.216

2954

MREM IN 30 YRS FROM 1 GM/DAY INTAKE

<u>TOTAL ATOLL</u>	Cs-137	Co-60	Am-241	Total
MULLET (plankton feeder)	0.313	0.559	0.024	0.896
SURGEON (grazer)	0.441	0.135	0.021	0.597
GOATFISH (bottom feeder)	0.089	0.356	0.022	0.467
OTHERS (higher carnivores)	0.239	0.269	0.025	0.533

EXCLUDING ALICE THRU IRENE

MULLET	0.042	0.124	0.024	0.190
SURGEON	0.082	0.064	0.019	0.165
GOATFISH	0.046	0.143	0.025	0.214
OTHERS	0.115	0.136	0.026	0.277

2955

DOSE CONVERSION FACTORS

One gm/day intake, initial conc. of 1 pCi/g*, continued for
30 yrs, gives a whole body dose,
during the 30 years, of:

nuclide	mrem
Co-60	0.148
Cs-137	0.473
Am-241	0.215

* concentration is time dependent due to radioactive decay only

2956

DOSE-TO-MAN COMPUTATION

$$D/I \left(\frac{\text{mrem}}{\text{g/day}} \right) = \frac{k E f_M C'}{m(\lambda_e - \lambda_r)} \int_0^t \left(e^{-\lambda_r t} - e^{-\lambda_e t} \right) dt$$

<u>parameter</u>	<u>definition</u>	<u>source</u>
C', C	concentration, pCi/g, in organism and food, respectively	measurement program
$\lambda_{ENV.}$	effective environmental elimination constant, day ⁻¹	radiological half-life
I	food intake rate, g/day	diet model
f_B	fraction of activity ingested which reaches organ of reference	ICRP publications, other literature
m	mass, g, of organ of reference	ICRP (standard man)
λ_e	effective elimination constant in the reference organ, day ⁻¹	ICRP, other literature
E	effective absorbed energy per disintegration	ICRP

2957

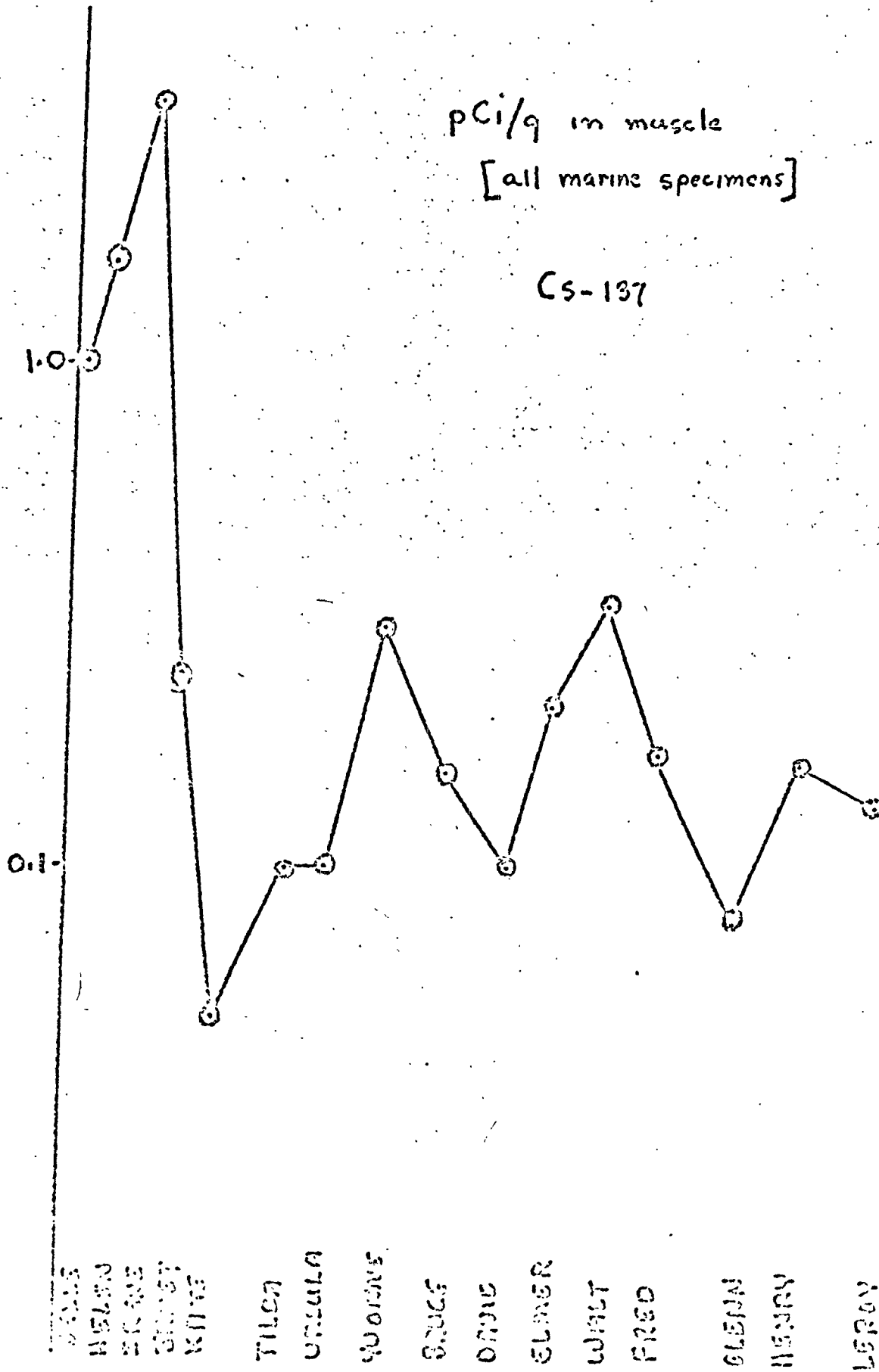
REDUCTION TO EVALUATION LIST FOR MARINE FOOD-CHAIN

ACTIVITIES DETECTED IN FISH MUSCLE	DOSE SCAN	IN VIEW OF SOILS/SEDIMENTS	DOSE EVALUATION LIST
Co-60	X	X	Co-60
Ru-102			
Ru-106	X		
Sb-125			
Ba-133			
Cs-137	X	X	Cs-137
Ce-144			
Eu-152			
Eu-155			
Bi-207			
U-235			
Am-241	X	X	Am-241

2958

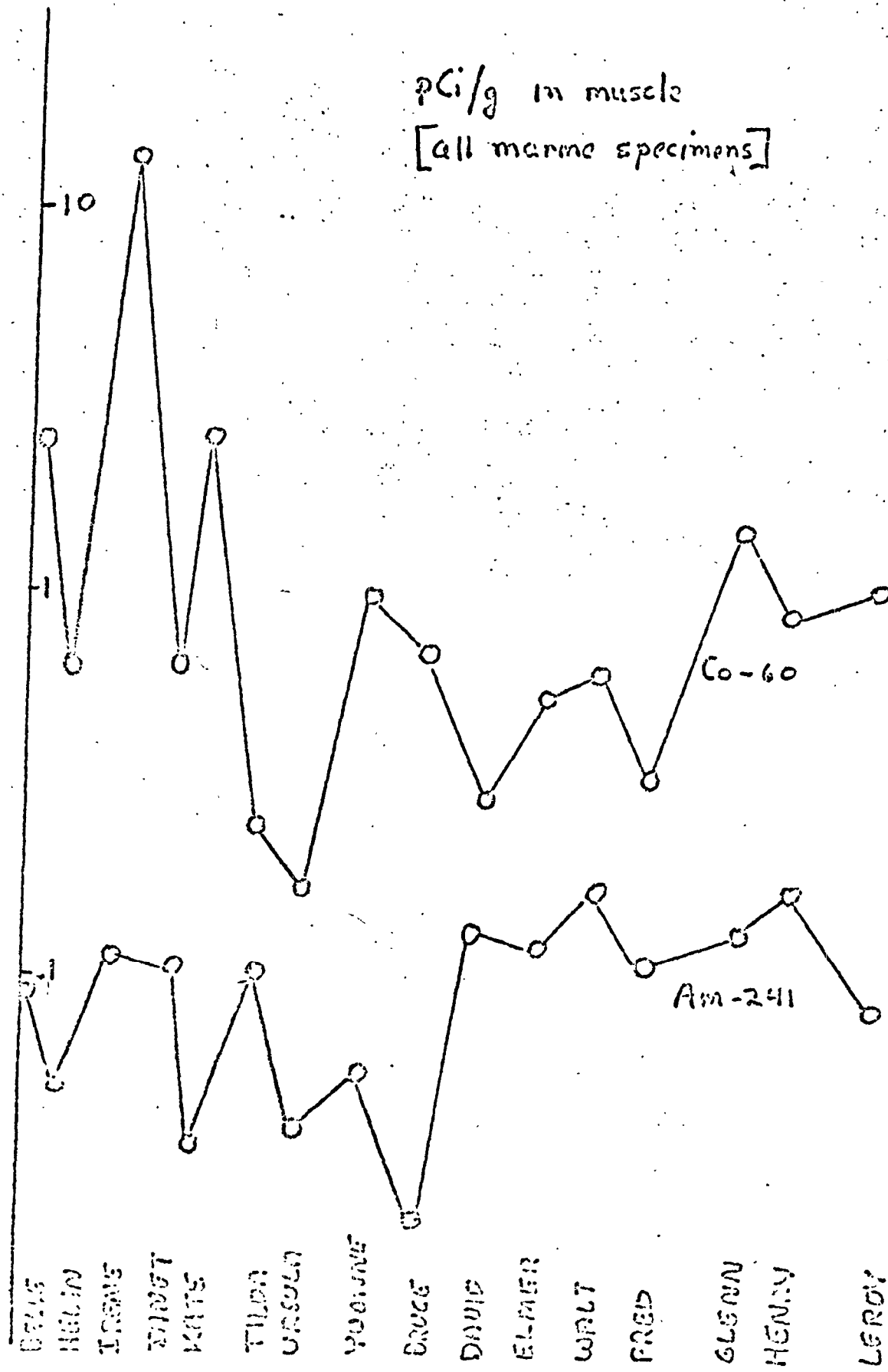
pCi/g in muscle
[all marine specimens]

Cs-137



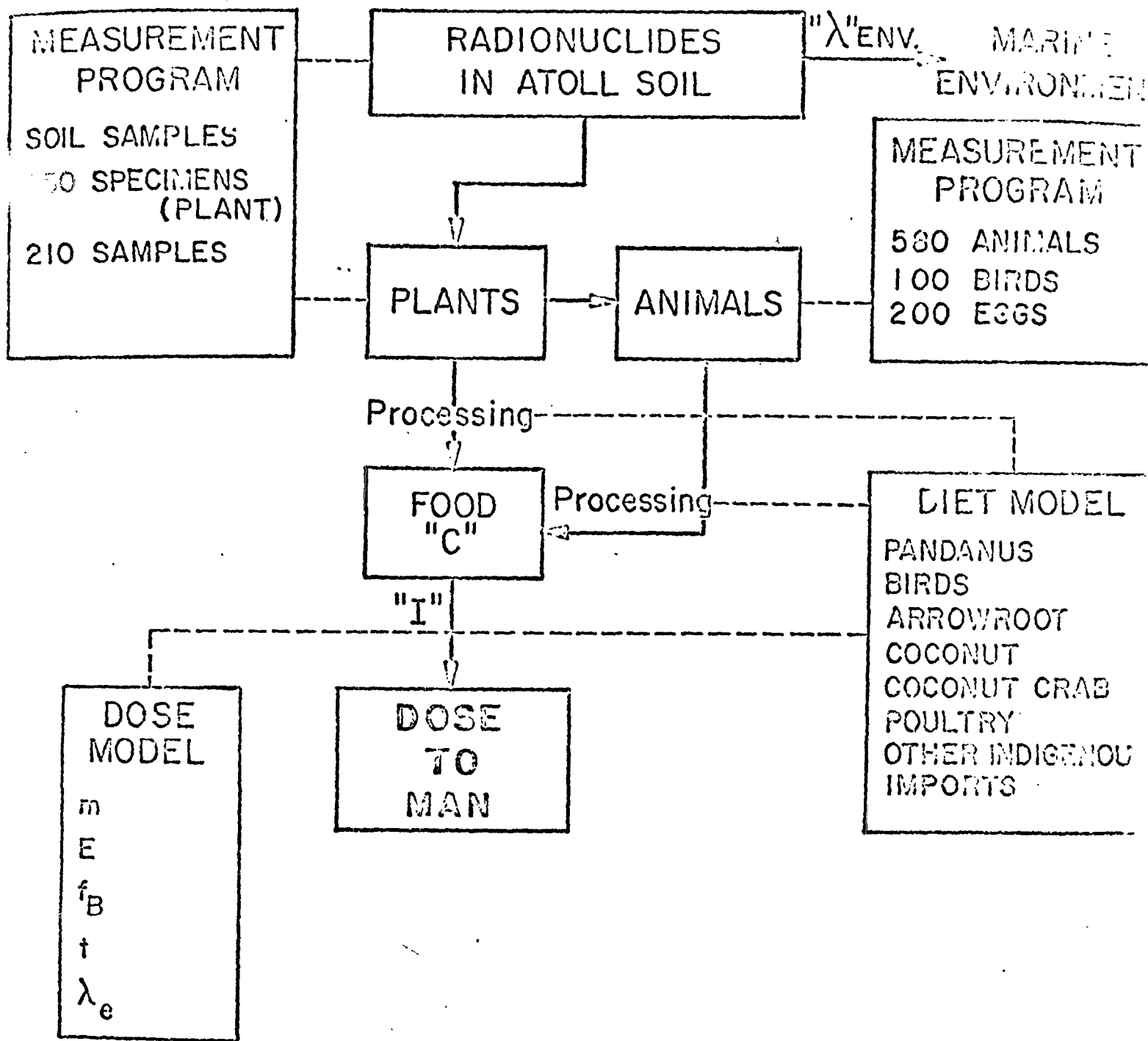
2957

pCi/g in muscle
 [all marine specimens]



2960

TERRESTRIAL FOOD CHAIN



2961

Terrestrial Biota Sampling

Plant types taken:

Cocos, Guettarda, Messerschmidia, Morinda, Pandanus, Pisonia,
Scaveola, Tacca

Animal types taken:

Birds: common noddy, white capped noddy, fork tailed
sandpiper, reef heron, sooty tern, tropic bird,
noddy and tern eggs

Rats: rice rat, roof rat

Crabs: coconut crab, hermit crab

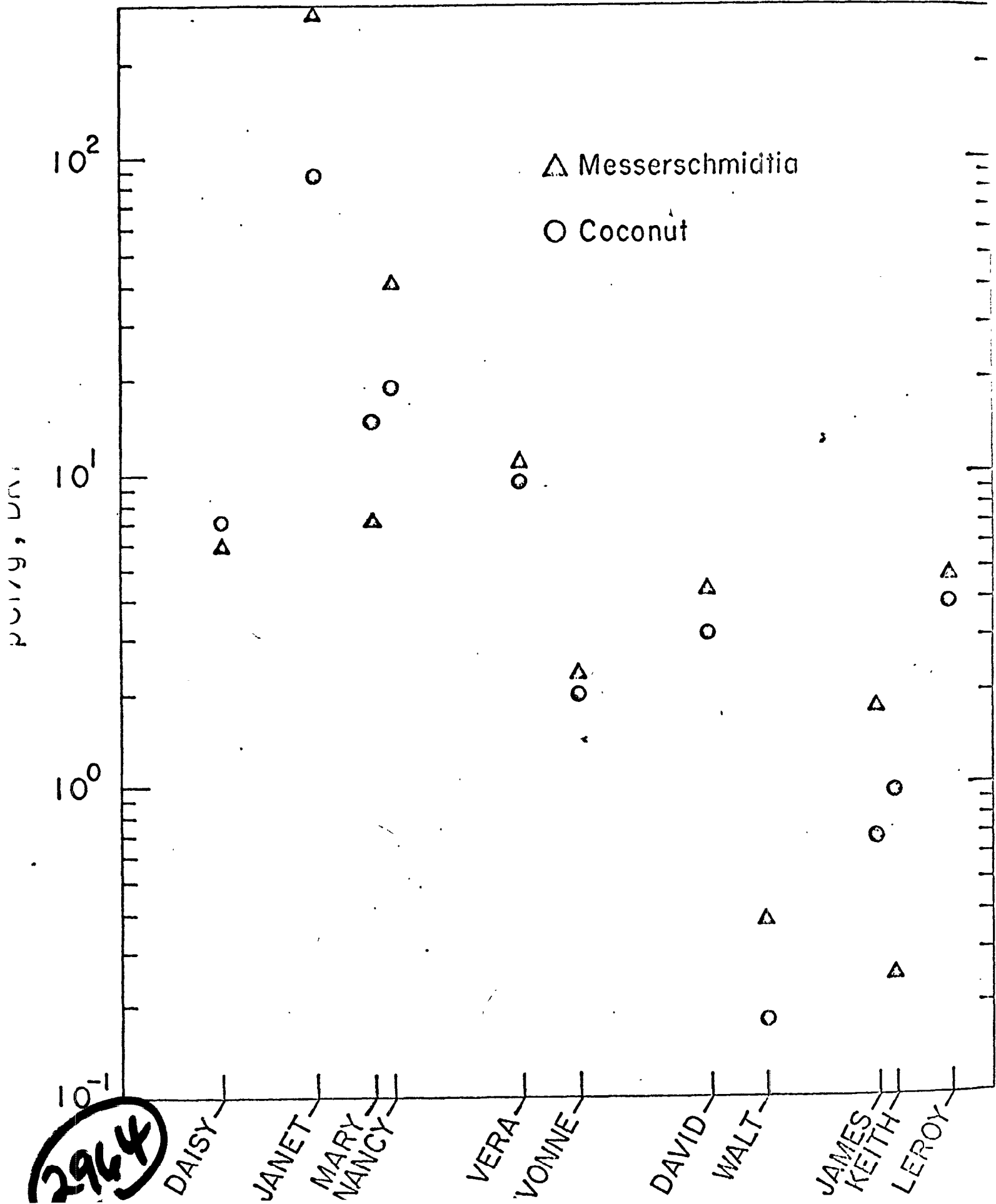
2962

EDIBLE PLANTS SAMPLED - TERRESTRIAL BIOTA SURVEY

<u>Island</u>	<u>Coconut</u>	<u>Pandanus fruit</u>	<u>Morinda fruit</u>	<u>Tacca root</u>
Alice		X		
Daisy	X			
Irene	X			
Janet	X			
Mary	X		X	
Nancy	X			
Olive			X	
Vera	X			
Yvonne	X			
David	X			X
Elmer	X			
Fred	X			
Glenn	X		X	
Henry	X		X	
Irwin	X			
James			X	
Keith	X	X		
Leroy	X		X	

2963

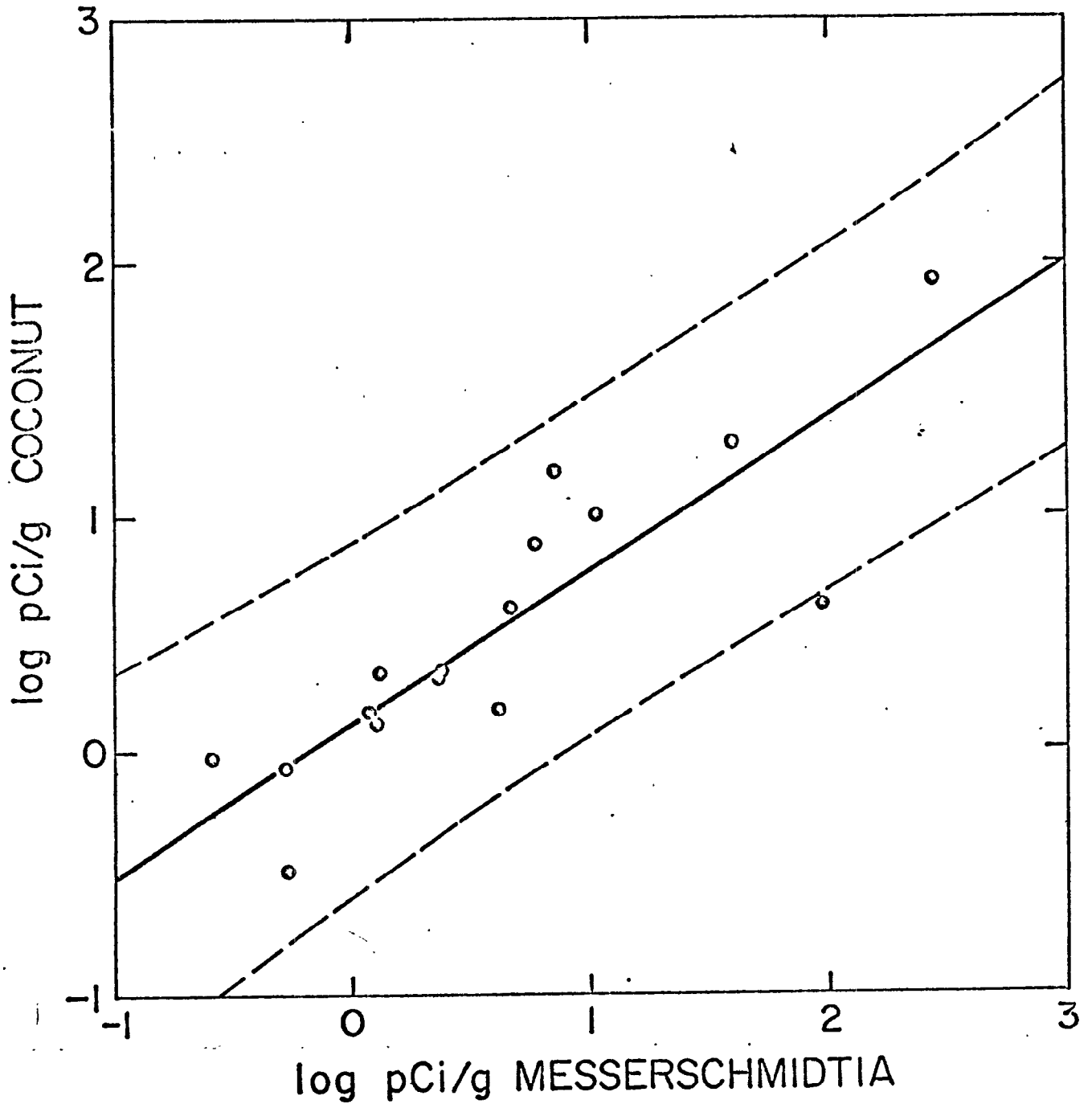
¹³⁷Cs IN VEGETATION BY ISLAND



2964

CORRELATION LOG-LOG BETWEEN ^{137}Cs IN
COCONUT AND MESSERSCHMIDTIA _____...

$$\log \text{ pCi/g Coconut} = 0.12 + 0.63 \log \text{ pCi/g Messerschmidtia}$$



2965

CESIUM-137 IN EDIBLE PLANTS

		<u>Coconut</u>	<u>Pandanus</u>	<u>Tacca</u>
Keith	1972	0.95	0.86	
David	1972	1.50		8.96
Bikini	1964	12		27
Bikini	1967	114	52	92
Bikini	1969	50	110	0.65*

* Processed

2966

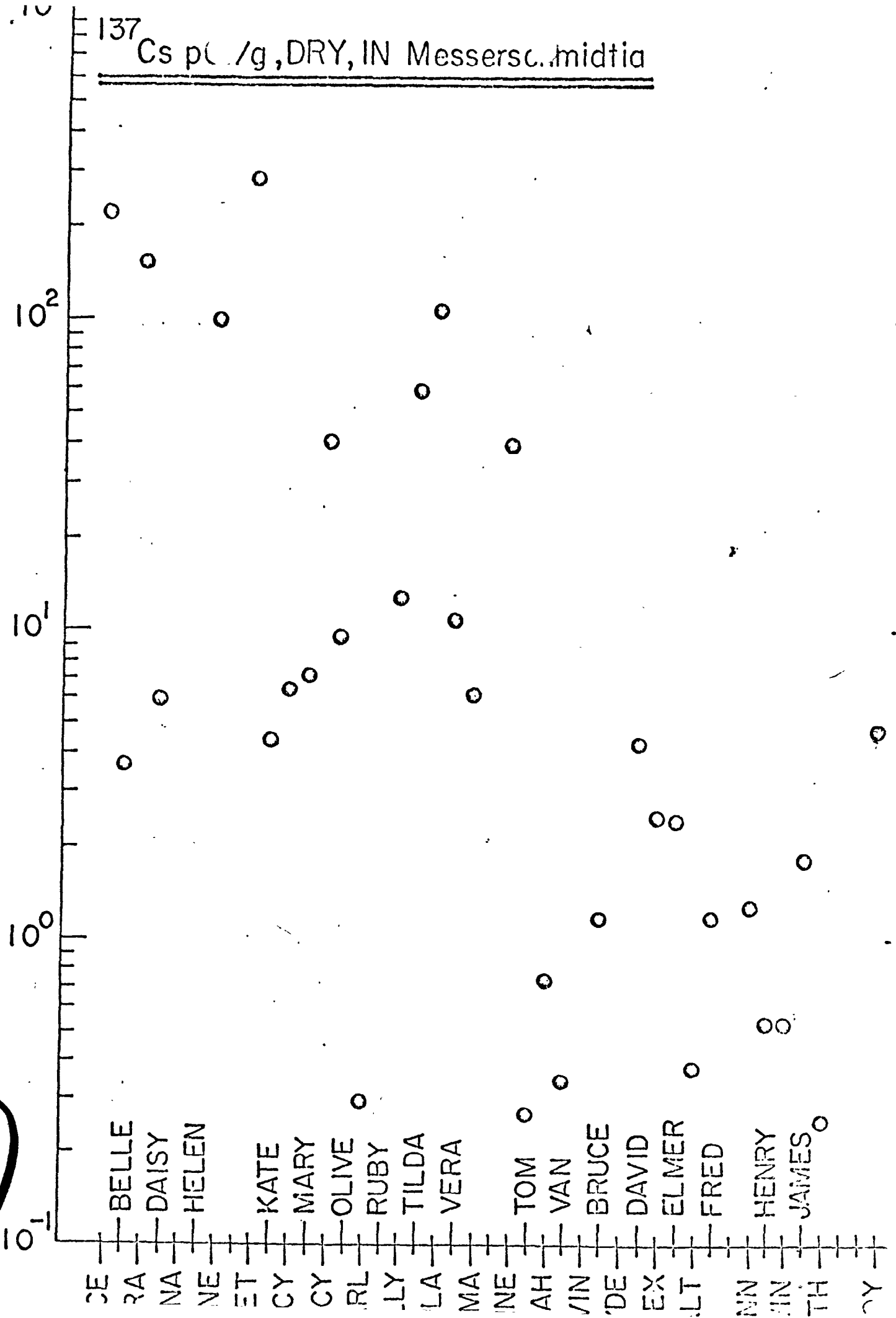
CESIUM-137 IN EDIBLE PLANTS

		<u>Coconut</u>	<u>Pandanus</u>	<u>Tacca</u>
Keith	1972	0.95	0.86	
David	1972	1.50		8.96
Bikini	1964	12		27
Bikini	1967	114	52	92
Bikini	1969	50	110	0.65*

* Processed

2967

296A



AIR SAMPLER CHARACTERISTICS

FILTER MATERIAL: "Delbag" polystyrene Absolute filter (99.8% collection efficiency for 0.3μ).

HIGH VOLUME: 2 units used simultaneously at two sites.

Q = $1800\text{ m}^3/\text{hr}$.

Unattended endurance = 36 hrs.

Q total = $65,000\text{ m}^3$.

Filter Area = 1.25 m^2 .

LOW VOLUME: 5 units: two site pairs; Polumbo Shipboard.

Q = $8\text{ m}^3/\text{hr}$.

Unattended endurance = 5 days.

Q = $1000\text{ m}^3/5\text{ days}$.

Filter Area = 0.032 m^2 .

CASCADE IMPACTORS: 2 units used at two sites.

Q = $34\text{ m}^3/\text{hr}$.

Unattended endurance = 5 days.

Q = $4100\text{ m}^3/5\text{ days}$.

5 fiberglass filters each with particle separations: $> 7\mu$; $3.3-7.0\mu$; $2.0-3.3\mu$; $1.1-2.0\mu$; $.01-1.1\mu$.

RECORDING WEATHER STATIONS: Portable station at Yvonne and Coast Guard at ENT.

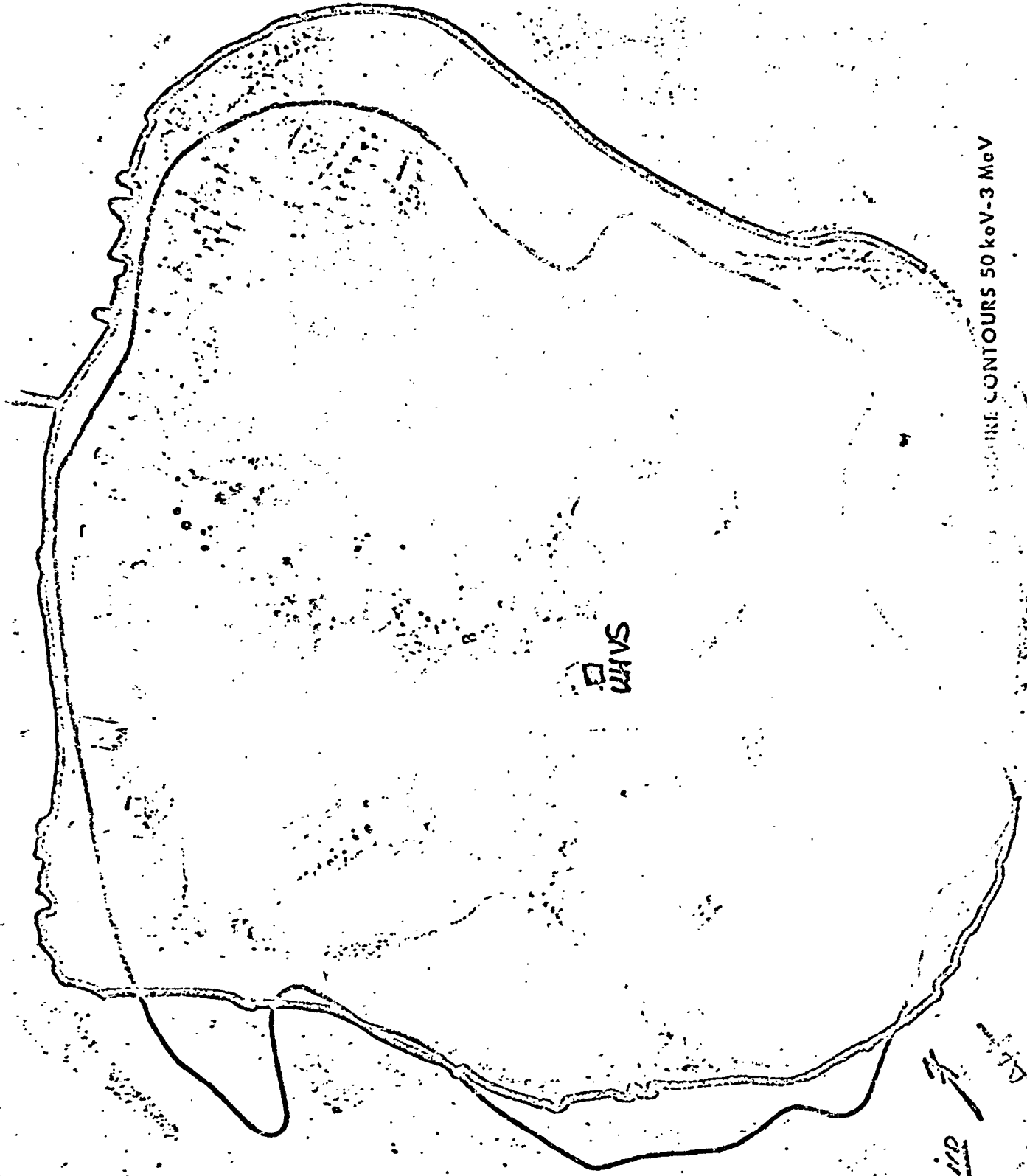
2969

DAVID

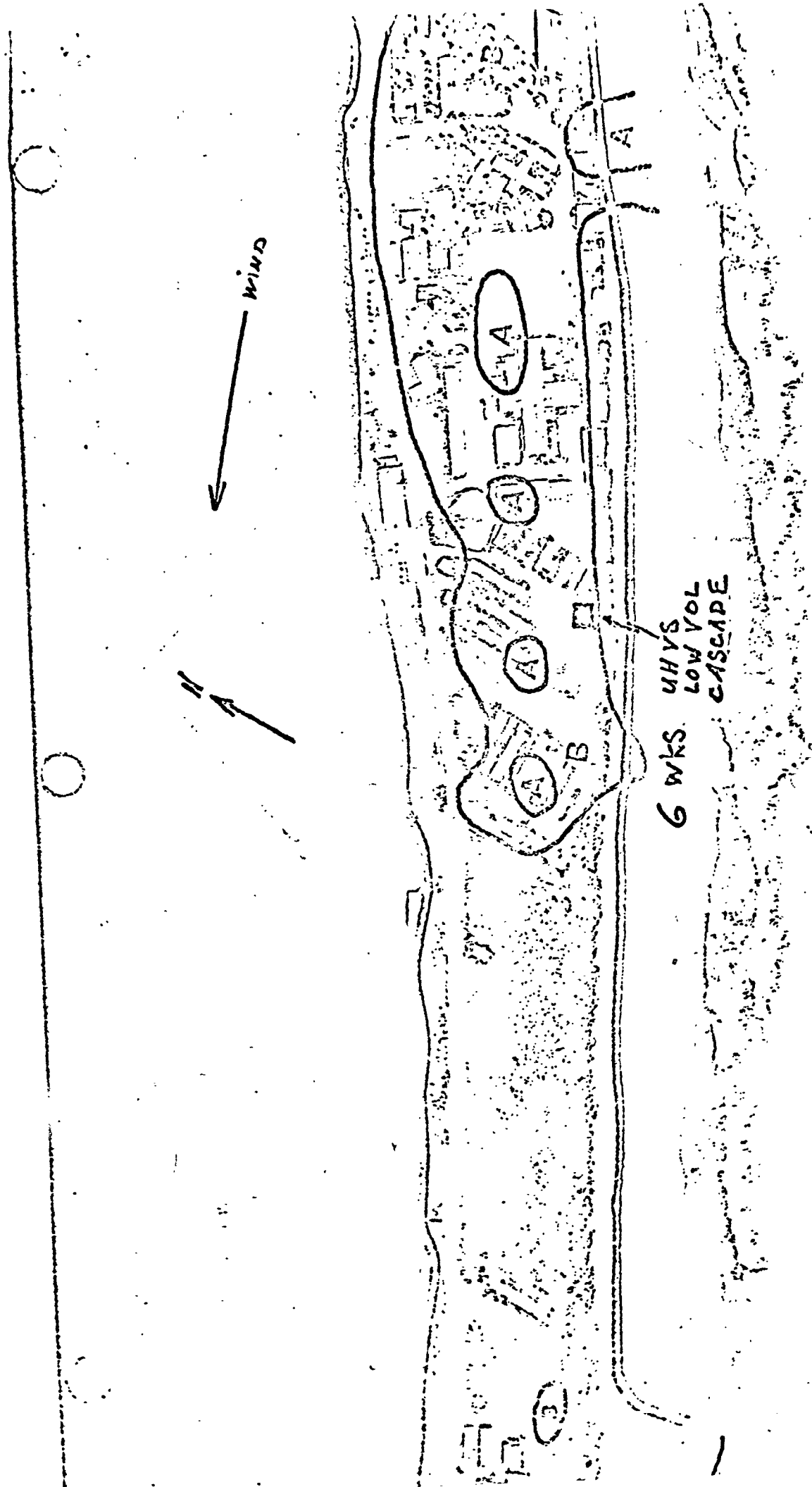
ISLAND NAME DAVID

DATE OF SURVEY 10 NOV 1972

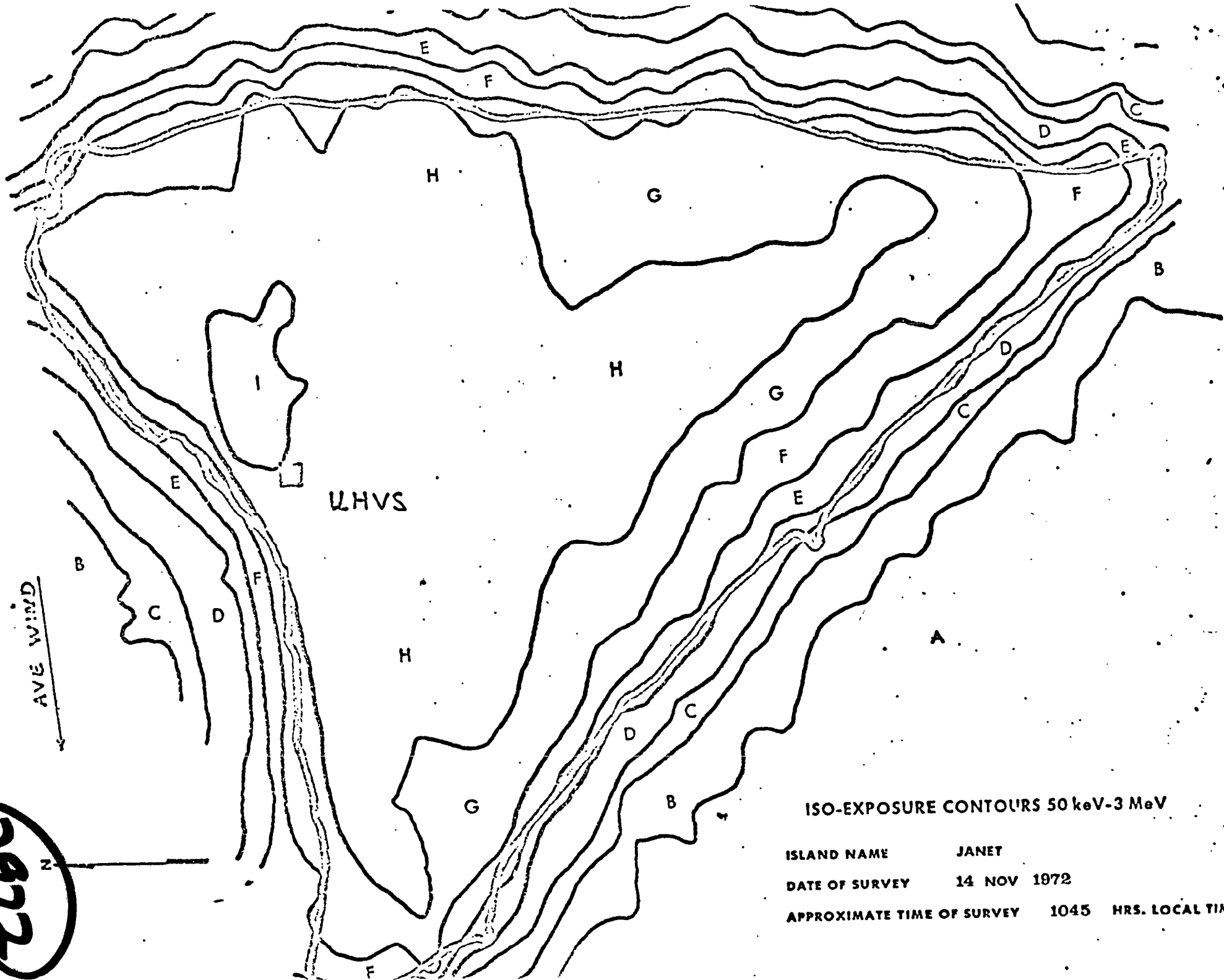
CONTOURS 50 kv-3 MeV



2970

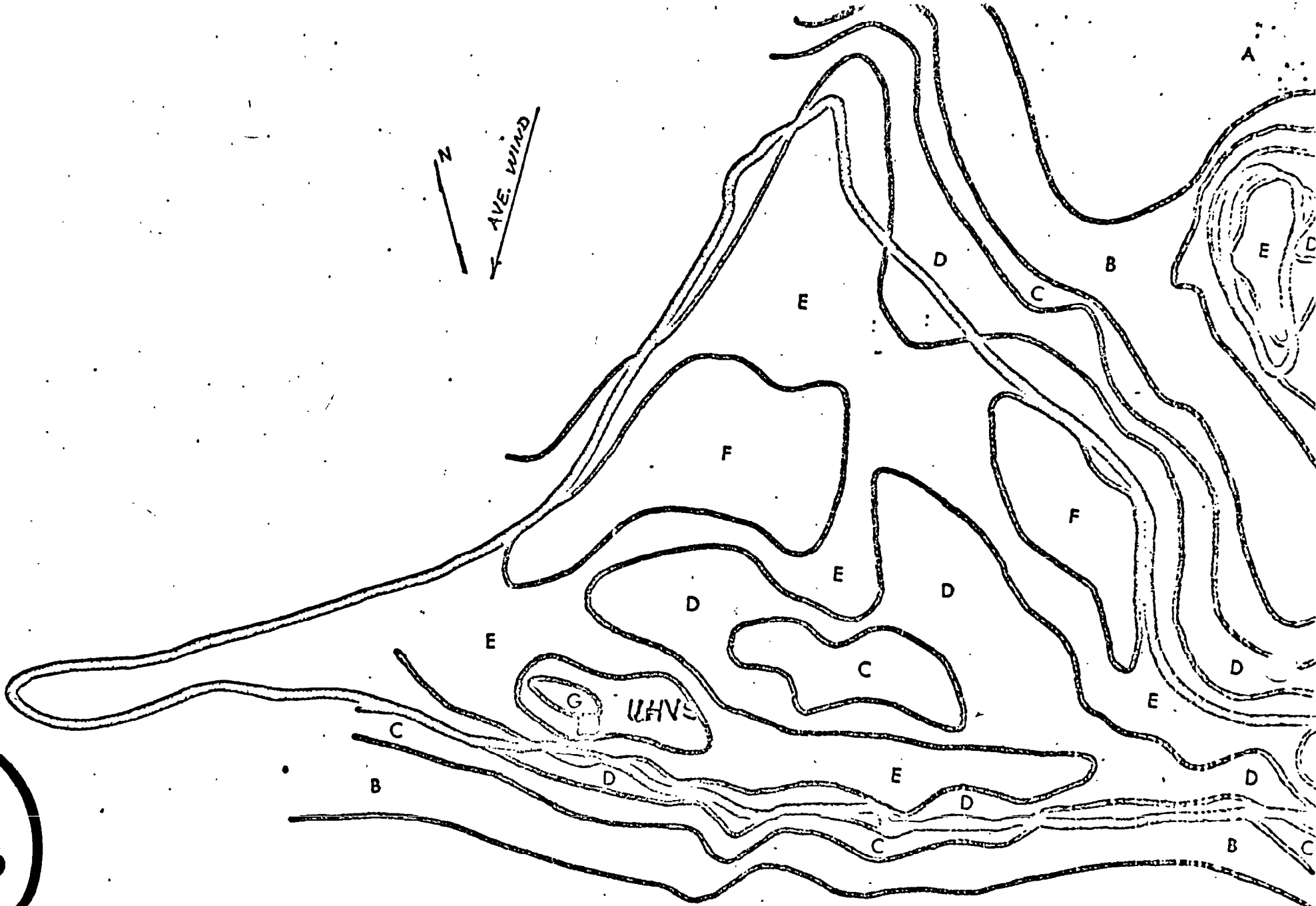


1297



ISO-EXPOSURE CONTOURS 50 keV-3 MeV

ISLAND NAME	JANET
DATE OF SURVEY	14 NOV 1972
APPROXIMATE TIME OF SURVEY	1045 HRS. LOCAL TIME



2973

ISO-EXPOSURE CONTOURS 50 keV-3 MeV

ISLAND NAME SALLY
 DATE OF SURVEY 14 NOV 1972
 APPROXIMATE TIME OF SURVEY 1228 HRS. LOCAL TIME

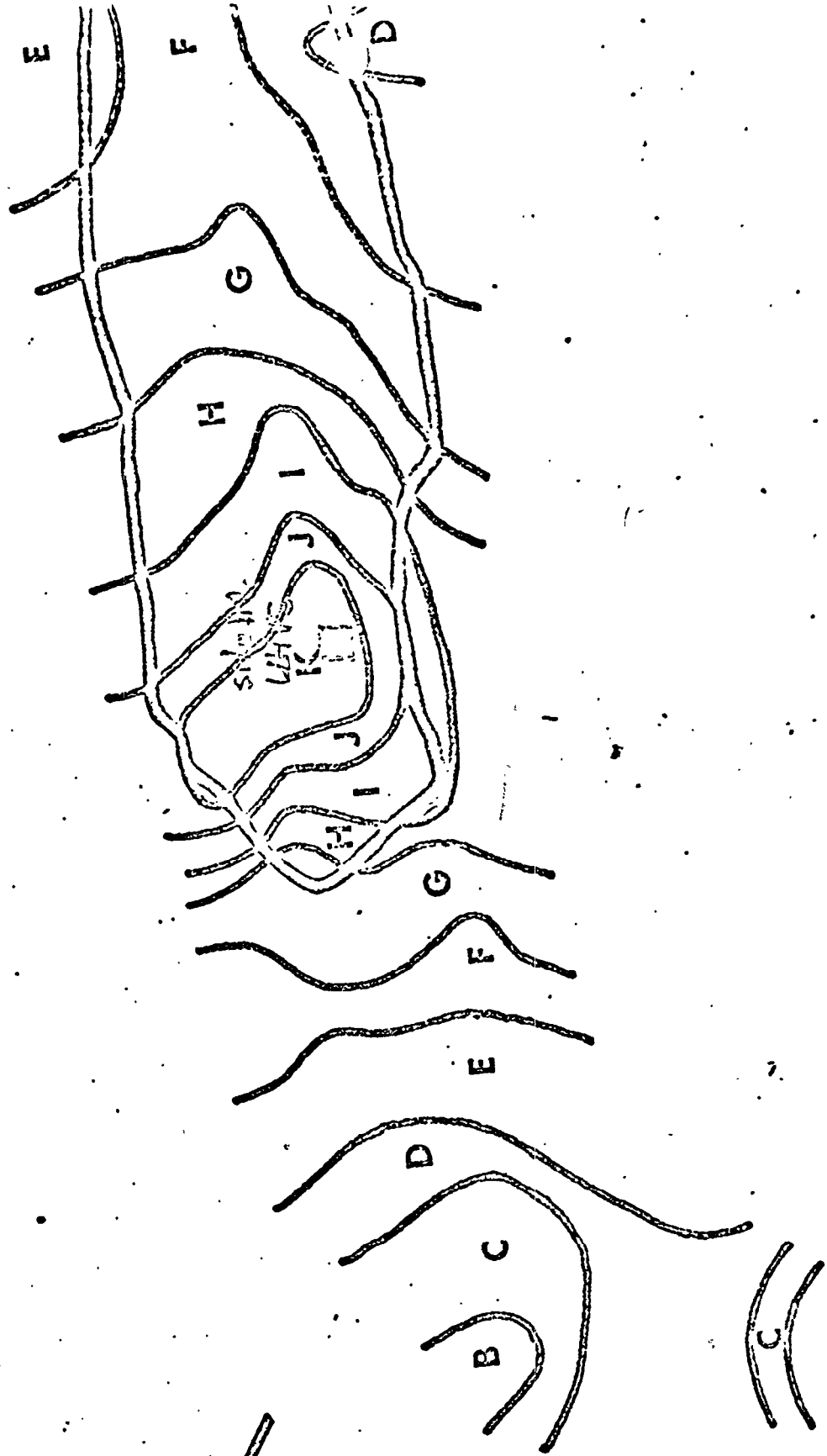
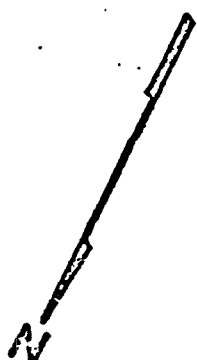
ISO-EXPOSURE CONTOURS 50 keV-3 MeV

ISLAND NAME YVONNE

DATE OF SURVEY 14 NOV 1972

APPROXIMATE TIME OF SURVEY 1420 HRS. LOCAL TIME

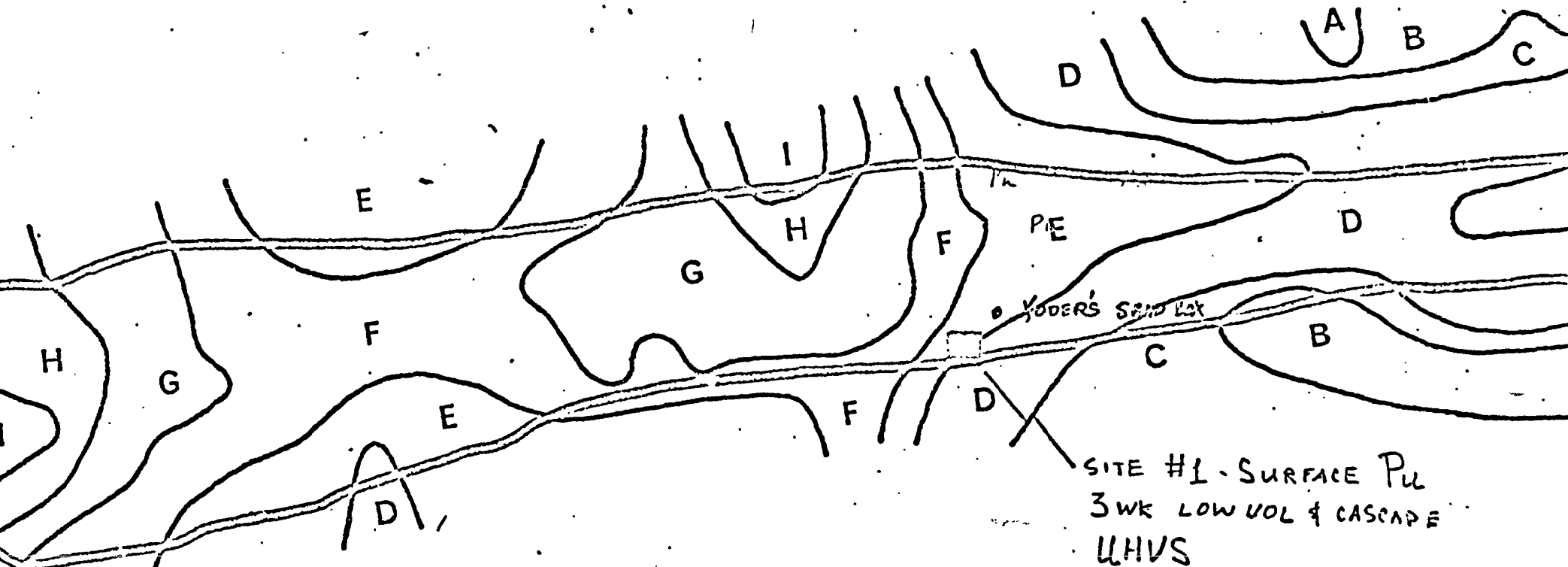
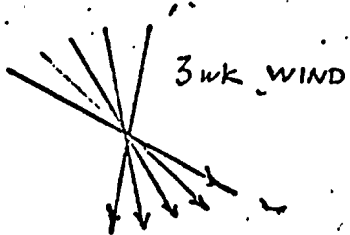
← AVE. WIND



2974

ISO-EXPOSURE CONTOURS 50 keV-3 MeV

ISLAND NAME YVONNE
DATE OF SURVEY 14 NOV 1972
APPROXIMATE TIME OF SURVEY 1420 HRS. LOCAL TIME



SITE #1 - SURFACE Pu
3WK LOW VOL & CASCADE
UHVS

2975

CONTROL AIR ANALYSIS

SAMPLER	NUCLIDE	OBSERVED pCi/m ³ @ 40,000 / 6000 m ³	LIVERMORE
UHVS blank	K ⁴⁰	.011	-
	Pu ²³⁹⁻⁴⁰	(3.5) 10 ⁻⁵ ± 48%	(1.1-5.8) 10 ⁻⁵
	Pu ²³⁸	< (.43) 10 ⁻⁵	(5.1-42) 10 ⁻⁷
<hr/>			
LOW VOL ‡	Pu ²³⁹⁻⁴⁰	< (.54) 10 ⁻⁶	(1.1-5.8) 10 ⁻⁵
CASCADE ‡	Pu ²³⁸	< (.5) 10 ⁻⁶	(5.1-42) 10 ⁻⁷
PALUMBO	Be ⁷	.03 - .19	.09 - .19
	MN ⁵⁴	(.3) 10 ⁻³	-
	Cs ¹³⁷	(9) 10 ⁻⁴	(6-32) 10 ⁻⁴

2976

RADIONUCLIDES OBSERVED IN AIR (EXCEPT Y. S. YVONNE)

<u>Nuclide</u>	<u>Observed Range</u> <u>pCi/m³</u>	<u>At Livermore</u> <u>pCi/m³</u>	<u>RCG</u> <u>pCi/m³</u>
Be ⁷	< .004 - .18	.09 - .25	(4)10 ⁴
K ⁴⁰	< .004 - .010		
Mn ⁵⁴	(< 5 - 1600)10 ⁻⁶		10 ⁴
Zr ⁹⁵	(< .6 - 40)10 ⁻⁵	(.49 - 44)10 ⁻⁵	10 ³
Ru ¹⁰⁶	(< 8 - 300)10 ⁻⁴	(1.4 - 40)10 ⁻⁴	200
Cs ¹³⁷	(< 1.7 - 41)10 ⁻⁴	(6.3 - 32)10 ⁻⁴	500
Ce ¹⁴⁴	(< 8 - 51)10 ⁻⁴	(2.4 - 31)10 ⁻⁴	200
Pu ²³⁸	(< 8 - 43)10 ⁻⁷	(5.1 - 42)10 ⁻⁷	1
Pu ^{238, 240}	(< .04 - 2.1)10 ⁻⁵	(1.1 - 5.0)10 ⁻⁵	1

(2977)

YVONNE AIR DATA

JHVS 34,000 m³ 16-17 Dec at Yoder's S.B. ENE 20-25 KN 0.03" rain.

<u>Nuclide</u>	<u>Observed</u>	<u>At Livermore pCi/m³</u>
Be ⁷	0.193	.09-.25
Sb ¹²⁵	3.4(10 ¹⁴)	(4-23)10 ⁻⁴
Cs ¹³⁷	(8.2)10 ⁻⁴	(6.3-32)10 ⁻⁴
Ce ¹⁴⁴	(86)10 ⁻⁴	(2.4-31)10 ⁻⁴
Pu ²⁴⁰	(2.65)10 ⁻³	(1.1-5.8)10 ⁻⁵
Am ²⁴¹	(3.0)10 ⁻⁴	

8268

YVONNE AIR DATA (Y'S SAND BOX)

UHVS 34,000 m³ 17-18 Dec ENE 22-24 KN 0.03" rain.

<u>Nuclide</u>	<u>Observed</u>	<u>Remaining Atoll</u>	<u>Livermore</u>	<u>RCG</u>
Be ⁷	.143	.011 - .18	.09 - .25	(4)10 ⁴
Zr ⁹⁵	(40)10 ⁻⁵	(.6 - 40)10 ⁻⁵	(.49 - 44)10 ⁻⁵	10 ³
Ru ¹⁰³	(2.4)10 ⁻⁴	0	(2.9 - 340)10 ⁻⁴	(3)10 ³
Sb ¹²⁵	(34)10 ⁻⁵	0	(4 - 23)10 ⁻⁵	900
Ru ¹⁰⁶	(16)10 ⁻⁴	(8 - 30)10 ⁻⁴	(1.4 - 29)10 ⁻⁴	200
Cs ¹³⁷	(8.2)10 ⁻⁴	(1.7 - 41)10 ⁻⁴	(6.3 - 32)10 ⁻⁴	500
Ce ¹⁴⁴	(86)10 ⁻⁴	(8 - 51)10 ⁻⁴	(2.4 - 31)10 ⁻⁴	200
Pu ²³⁹⁻⁴⁰	(265)10 ⁻⁵	(.04 - 2.1)10 ⁻⁵	(1.1 - 5.8)10 ⁻⁵	1
Am ²⁴²	(30)10 ⁻⁵	0	0	

Low Vol 3-9 Dec 3280 m³ NE 0.91" rain.

Be ⁷	.14 - .19
Pu ²³⁹	(4.1)10 ⁻⁴
Pu ²³⁸	< (2.1)10 ⁻⁵

2979

YVONNE - CACTUS ENE 22-24 KN 0.01"

U.HVS 21,400 m³ 18-19 DEC

NUCLIDE	OBSERVED pCi/m ³	Remaining Atoll
Be ⁷	0.14	.011 - .158
K ⁴⁰	0.025	.004 - .010

2980

ENGEBI AIR DATA

Two IHVS 4-9 Dec 72 80,000 m³

E 8-15/KN 0.82" rain

NUCLIDE

OBSERVED

LIVERMORE

pCi/m³

Be⁷

.004-.022

.09-.25

MN⁵⁴

(1.6) 10⁻³

-

Cs¹³⁷

(7.1-21) 10⁻⁴

(6.3-32) 10⁻⁴

Pu²³⁹⁻⁴⁰

(.58-1.8) 10⁻⁵

(1.1-5.8) 10⁻⁵

1862