EG&G

EGG 1183-1528
Technical Report No. L-1040
Revised 10 August 1971

AERIAL RADIOLOGICAL MEASURING SURVEYS (ARMS)

DRESDEN

SEPTEMBER 1968

ORIGINAL ISSUE 1 FEBRUARY 1970

By

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Approved for Publication

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ABSTRACT

The Aerial Radiological Measuring System (ARMS), operated for the U. S. Atomic Energy Commission, was used to perform aerial surveys of several operational and non-operational reactor sites during the summer months of 1968.

The data collected on these surveys included aerial photographs of the installations. Aerial radiation survey data consisting of exposure rates normalized to 3 feet above the ground plus gamma ray spectral charts, effluent characterization for operational sites (intensity rates and isotope constituents), and pertinent descriptive information of the installation.

This report contains the data for the Dresden reactor-site survey.

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1. INTRODUCTION

The Aerial Radiological Measuring System (ARMS), operated for the U. S. Atomic Energy Commission, was used to perform aerial surveys of several operational and non-operational reactor sites during the summer months of 1968.

The data collected on these surveys provided a catalog file of characteristics of each nuclear installation. Information included in the catalog consists of 1) aerial photographs of the installation, 2) aerial radiation survey data consisting of of exposure rates normalized to 3 feet above the ground plus gamma ray spectral charts, 3) effluent characterization for operational sites (intensity rates and isotope constituents), and 4) pertinent descriptive information of the installation. The data included and discussed in this report is considered to be the catalog file for the Dresden reactor site. The ARMS equipment and procedures employed to conduct this survey and evaluate the results are described in an EG&G technical report.*

*Boyns, P. K.; Cleland, J. R.; Doyle, J. F.; and Sevart, M. D.; "Aerial Radiological Measuring Systems (ARMS) - Systems and Procedures Employed Through FY70," AEC Report No. CEX-70.6., 1971.

2. DRESDEN REACTOR AND SITE CHARACTERISTICS

The Dresden reactor site is located in northeast Illinois, approximately 10 miles east of the community of Morris. Currently operating at the site is Dresden I*, a boiling water reactor with a capacity of 200 MW(e), owned and operated by the Commonwealth Edison Company. In addition, construction has begun at the same site for Dresden II and III, each to have an 800 MW(e) capability. The vicinity within a 10- to 15-mile radius of the Dresden reactor site can be considered sparsely populated. With the exception of the town of Joliet, the remainder of the communities lying within the survey area have populations of less than 10,000 people. Table 2-1 presents a breakdown of the population of the region in terms of radial distance and direction from the reactor site. It is readily seen that only 20 percent of the population lives within a 10-mile radius of the reactor installation. The terrain within the survey area is comprised mainly flat farmland areas interrupted occasionally by the strip mines and their associated gravel pits. Major water bodies lying within the survey boundaries are the Illinois, Des Plaines, and Kankakee Rivers. Numerous smaller streams are also in evidence.

The known hazards to low-level survey flights are transmission towers in the Joliet area and next to the reactor site itself. Small airfields are at a minimum within the area and Joliet is the only airfield within the survey region with significant activity.

Numerous airfields are available close to the survey area for refueling purposes. Suitable sites include the Chicago aerodromes as well as those at Kankakee and Joliet. These airfields have suitable facilities to provide routine servicing and major repair service to the survey aircraft.

*Technical information on this reactor is contained in public document rooms under docket 50 - 10.

Table 2-1. Population distribution-Dresden survey area.

Town	Dir. From Reactor	Radial Distance From Reactor (miles)		
		0-5	5-10	10-15
Coal City	S		2852	
Morris	W		7935	
Braidwood	SSE		1944	
Troy	NNE		1778	
Wilmington	ESE		4210	
Central City	S		1422	
Platville	SSE		125	
Rockdale	NE			1272
Joliet	NE			69500
Ingalls Park	ENE			5000
Forest Park	NE			1442
Ridgewood	NE			5500
Fairmont	NE			2000
Totals			20,266	84,714
Area Population Total: 104,980				

3. PLANNED SURVEY AREA

The survey area planned for the Dresden site consisted of a 25-mile square centered on the reactor installation as shown in Figure 3-1. Flight lines were planned to provide flight paths spaced across the survey area at 1-mile intervals. As a result, 26 flight lines, approximately 25 miles in length and oriented in a north-south direction, were included within the survey boundaries. These lines constituted the programmed gross-count and spectral environmental radiation survey.

Preplanning for the effluent tracking and neutron sensing surveys consisted of locating the reactor site on appropriate topographic maps used for visual navigation, and making a real-time analysis of local meteorological conditions.

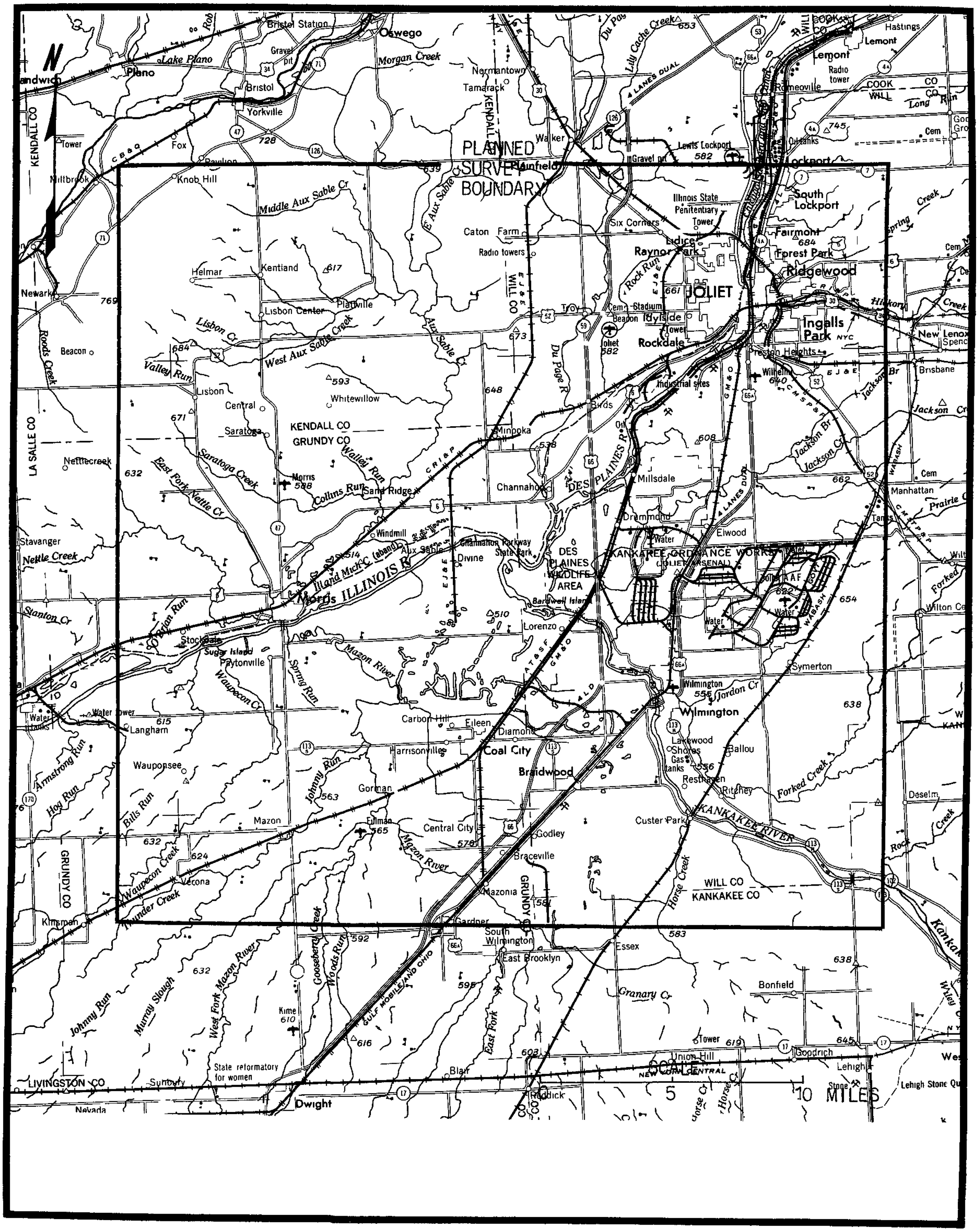


Figure 3-1. Planned survey area.

4. TERRESTRIAL RADIATION SURVEY

The terrestrial radiation survey to collect gross-count and spectral data of the Dresden area was conducted during the time period of 21 September 1968 to 26 September 1968. Three missions were required to complete this survey effort. All missions originated and terminated at the base of operations, Dubuque, Iowa.

The selected flight altitude was 300 feet above the terrain to provide simultaneous collection of gross-count and spectral data. All flight lines were flown similarly to those programmed. Slight variations were required in the Joliet, Illinois, area due to the high-density population. The remainder of the programmed flight lines were flown the total length of the grid previously described. Figure 4-1 shows the actual flight lines plotted from the recorded position data.

Spectral collections were accumulated over a 4-minute live time period. A flight line distance of approximately 12 miles was covered during this time interval; consequently, two collections were recorded along each of the flight lines.

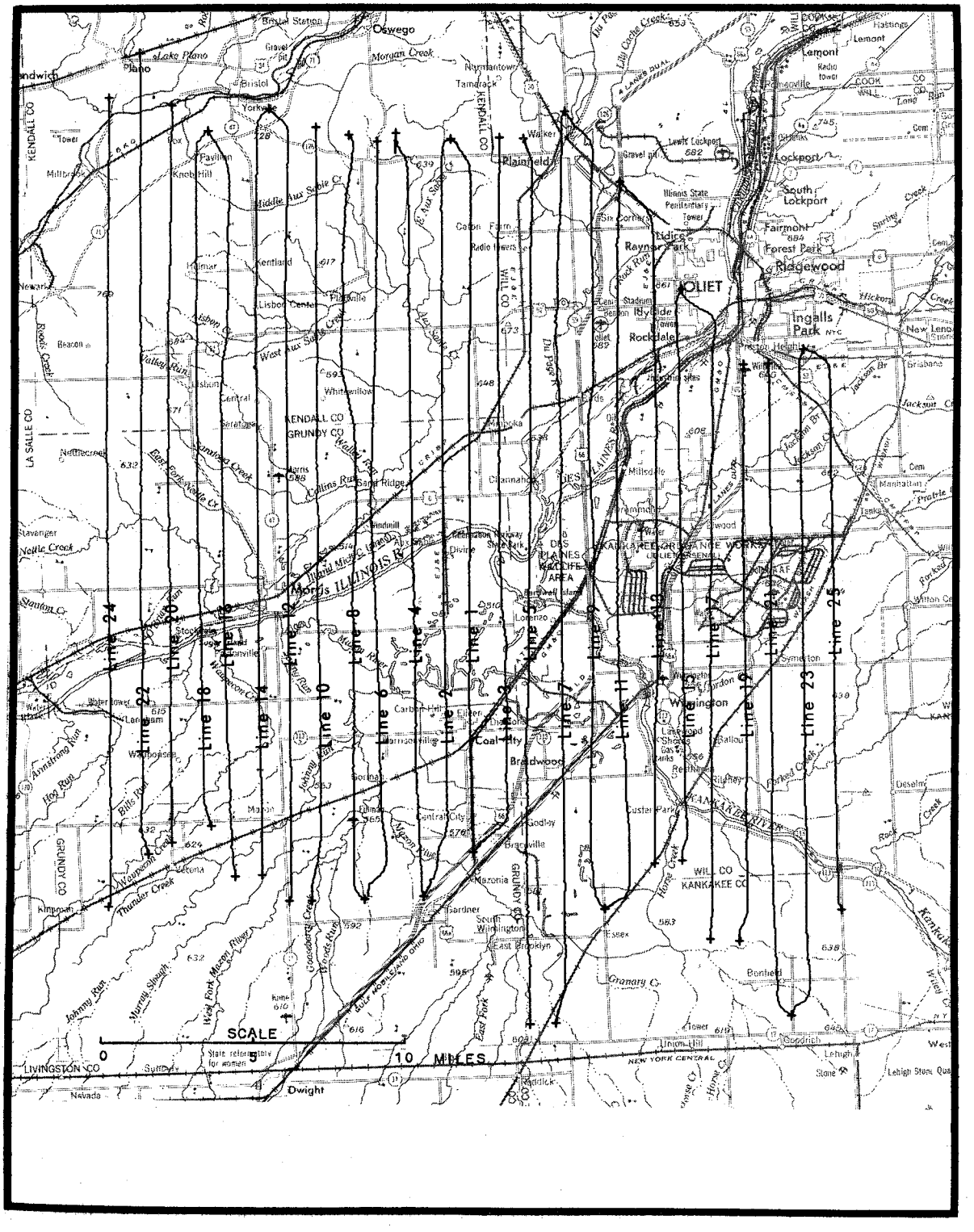


Figure 4-1. Flight lines flown, Dresden survey area.

5. EFFLUENT CHARACTERIZATION

Two separate missions were flown to document the characteristics and radiation signature of the effluent emitted from the reactor stack.

The first of these missions consisted of in-plume neutron measurements to determine neutron activity of the effluent for comparison with activity in an area upwind of the installation.

The second mission consisted of tracking the effluent plume utilizing the gamma ray detection system to define the boundaries and to document the gross-gamma intensities. Gamma ray spectral data and air filter samples were collected along the effluent centerline and periphery.

6. DATA ANALYSIS AND DISCUSSION

The data recorded on all survey missions have been analyzed to provide a summary of the environmental and man-made radiation characteristics relevant to the Dresden reactor site, Morris, Illinois. These results as recorded will provide the baseline data for this area.

6.1 TERRESTRIAL RADIATION SURVEY

Three missions were flown to map the environmental radiation levels and isotopic contributions. These missions were flown on 21 September 1968, 25 September 1968, and 26 September 1968.

6.1.1 Gross-Count Data

Figure 6-1 shows the resultant terrestrial radiation pattern mapped from the data recorded. The units are shown as exposure rate values in μR/hr to reflect the intensity at 3 feet above ground.

The data in Figure 6-1 clearly show the heterogeneities present. The average exposure rate for most of the survey area appears to be in the 6 to 10 μR/hr range. These average ranges seemed to persist over the relatively undisturbed farmland areas that dominate the survey area. Deviations below and above this range were recorded in several locations. The areas of decreased activity, 2 to 6 μR/hr, can be attributed to water bodies or marshy areas. This is clearly evidenced by the low exposure rates that follow the Illinois and Des Plaines river beds. A very significant decrease in exposure-rate values is seen to exist along the entire portion of the rivers included in the survey area. An exception to this case is the Kankakee River. This river is too narrow to resolve the lower exposure rates and therefore the river body itself appears to have exposure rates similar to that of the surrounding land-mass area. The presence of the radioactive plume emitted from the reactor stack was readily distinguishable when flying the survey lines downwind of the installation. Consequently, the exposure rates immediately below the plume traverse were undefined. The area where plume effect masked the terrestrial radiation component is included in Figure 6-1. Almost all of the anomalies having higher than normal exposure rates can be attributed to strip mining operations. Two anomalies other than strip mines were also recorded. One of these occurred in the area of a small pond located approximately 2-1/2 miles south of Morris, Illinois. The results of spectral collections, which will be discussed later, will show the isotopic variations in the anomalous areas as compared with the considered average range. Anomalous activity was

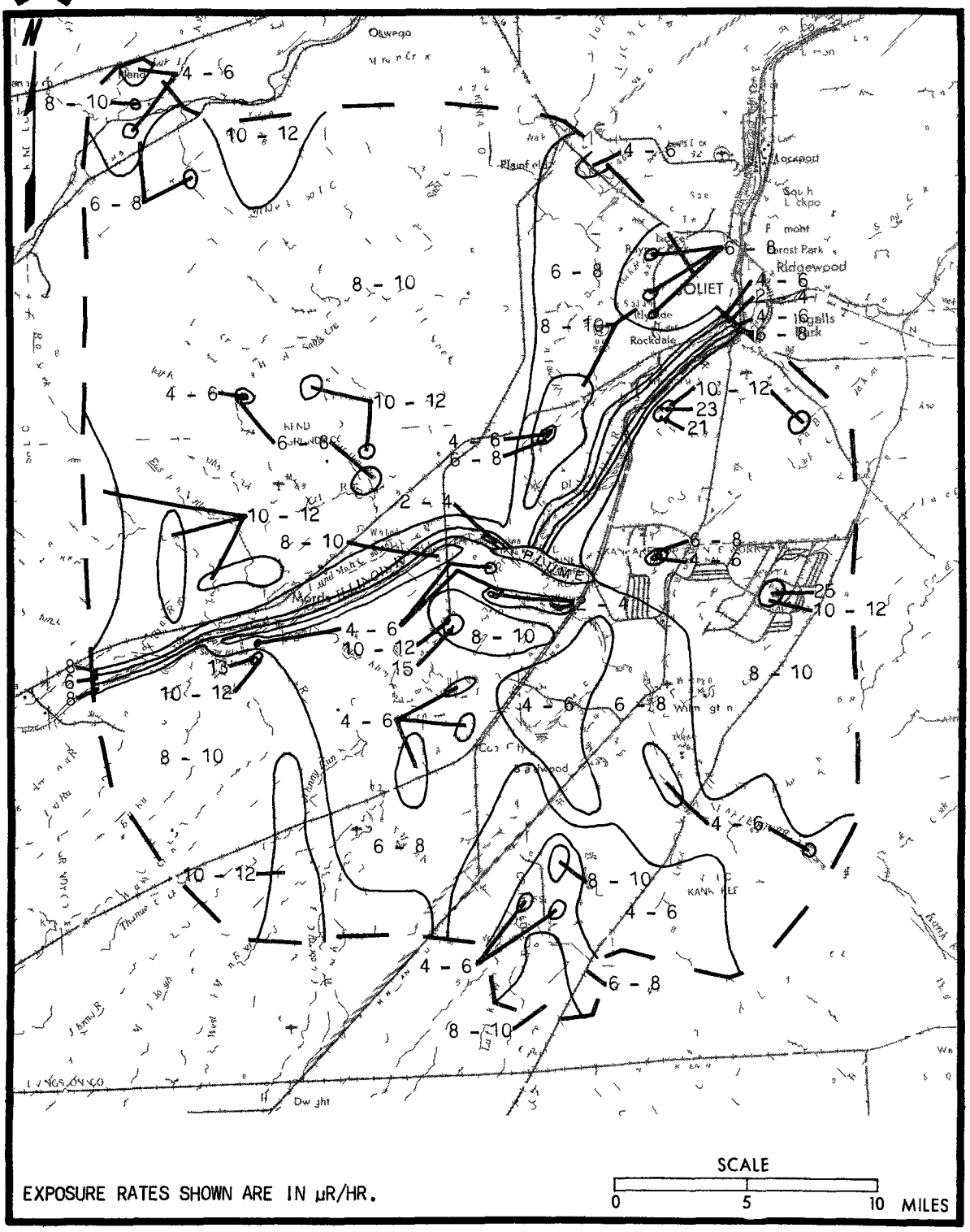


Figure 6-1. Exposure rate units, Dresden survey area.

also recorded when flying over the Joliet Arsenal (Kankakee Ordnance Depot). This activity appeared as a point source contributor and further investigation was not made.

By examining the spectral data, all areas of increased activity could readily be attributed to some natural or known phenomena. From the data collected. it is indicated that reactor operations at Dresden I have not affected the natural radiation signature of this area.

The exposure rate data is a composite of the gamma rays eminating from the terrestrial surface plus the cosmic ray contribution which normally constitutes approximately 2 to 4 μR/hr of the total.

6.1.2 Spectral Data

The spectral data collection provides this catalog with a characteristic isotopic contribution from each flight line. These spectral traces are included in the Appendix and the table preceding the traces lists the energies and isotopes that are found in all of these charts. The isotopic constituents appear to be consistent between the charts, although the individual contributions vary in some instances. Only the significant photopeak energies of each nuclide have been included in the tabulation of energies and nuclides.

Several additional spectral collections were made to obtain the representative gamma-ray energies of the strip mine areas and to better define the anomalous area slightly south of Morris, Illinois. The strip mine selected was a large, open pit area located approximately 3 miles southwest of Joliet, Illinois. A 1-minute, live-time collection was recorded over this area and an additional collection was obtained several miles away over an area having national exposure rates. The collection over the mine is shown in Figure 6-2, while Figure 6-3 shows the collection recorded over the average exposure-rate area. When comparing these two traces, an increase in radium and thoreum daughter activity (Bi-214 and T1-208) can be seen. This suggests that increased exposure rates in the strip mine vicinities are caused by exposed geologic formations that vary significantly from the undisturbed overburden. The special spectral collection over the area slightly south of Morris, Illinois, was conducted in a similar manner. A 1-minute, live-time collection was concentrated over the area of increased activity and an additional collection was made over the nearby vicinity for comparison. Interpretation of the two collections, Figures 6-4 and 6-5, suggests a definite increase in thorium daughter activity, namely Thallium 208, in the spectral trace recorded over the area of increased activity. Therefore, it appears that the concentration of the thorium daughter nuclides, as compared with the surrounding area, is responsible for the existance of the anomalous condition.

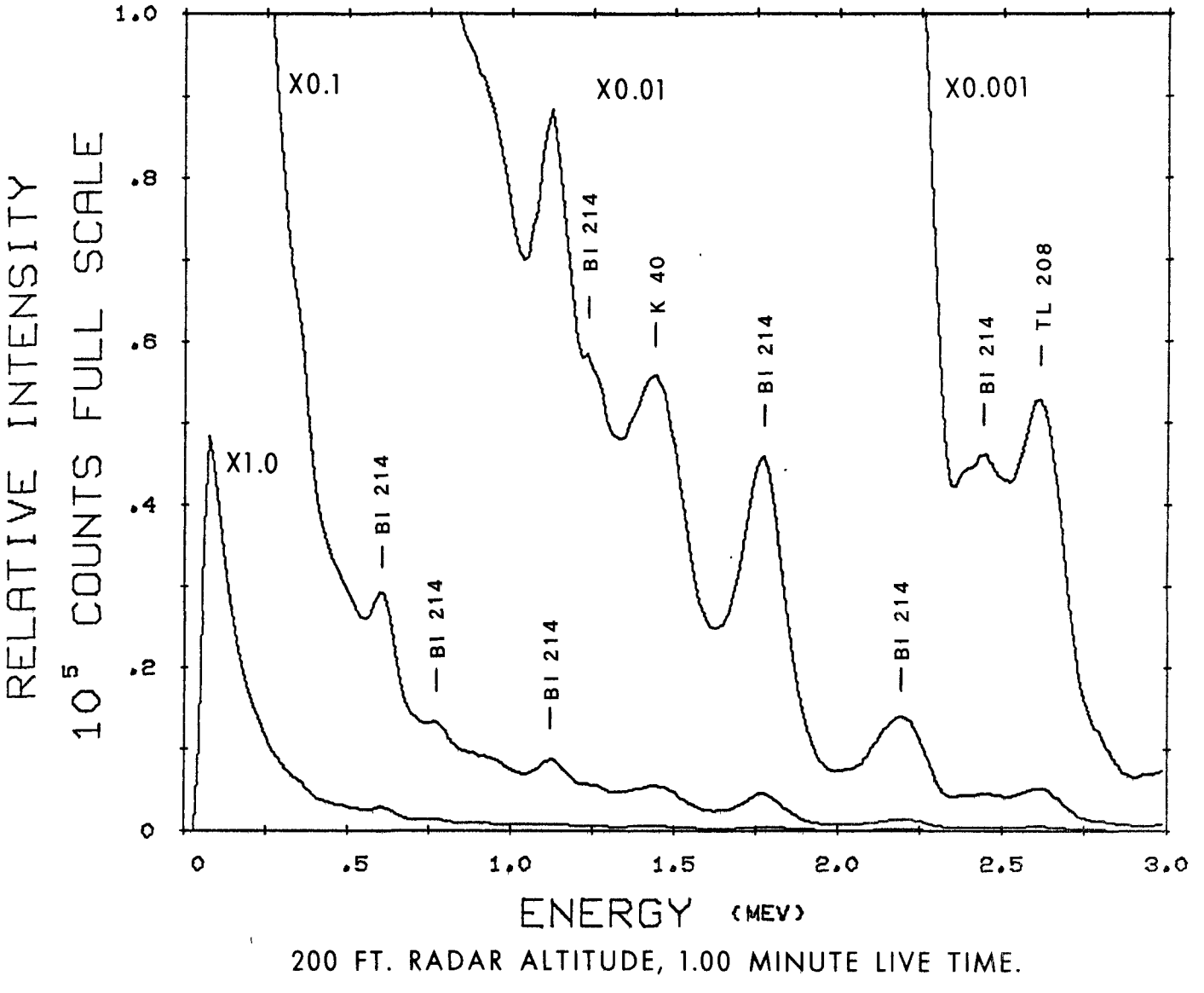


Figure 6-2. Gamma-ray spectrum collection over strip mine.

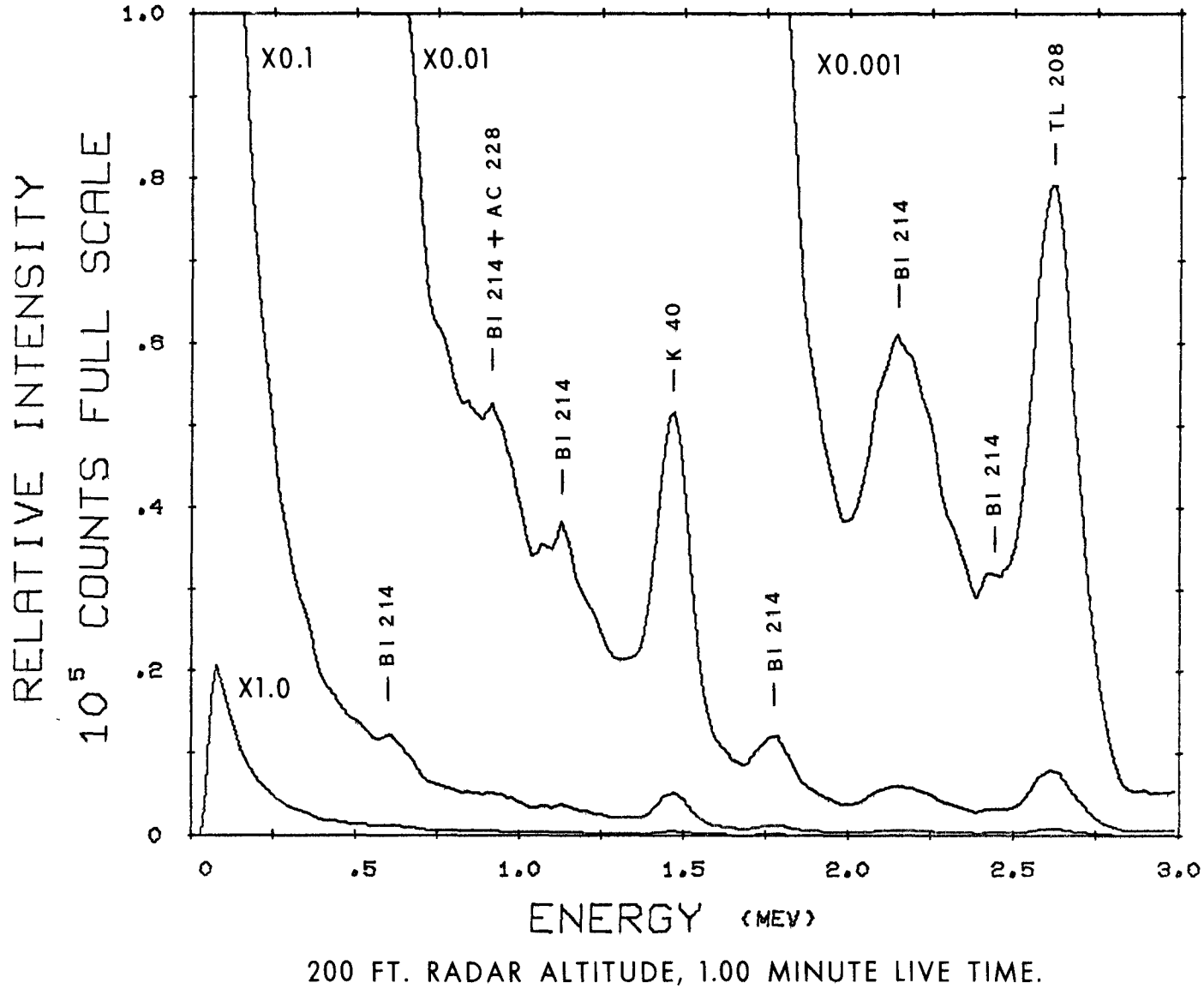


Figure 6-3. Gamma-ray spectrum collection near strip mine.

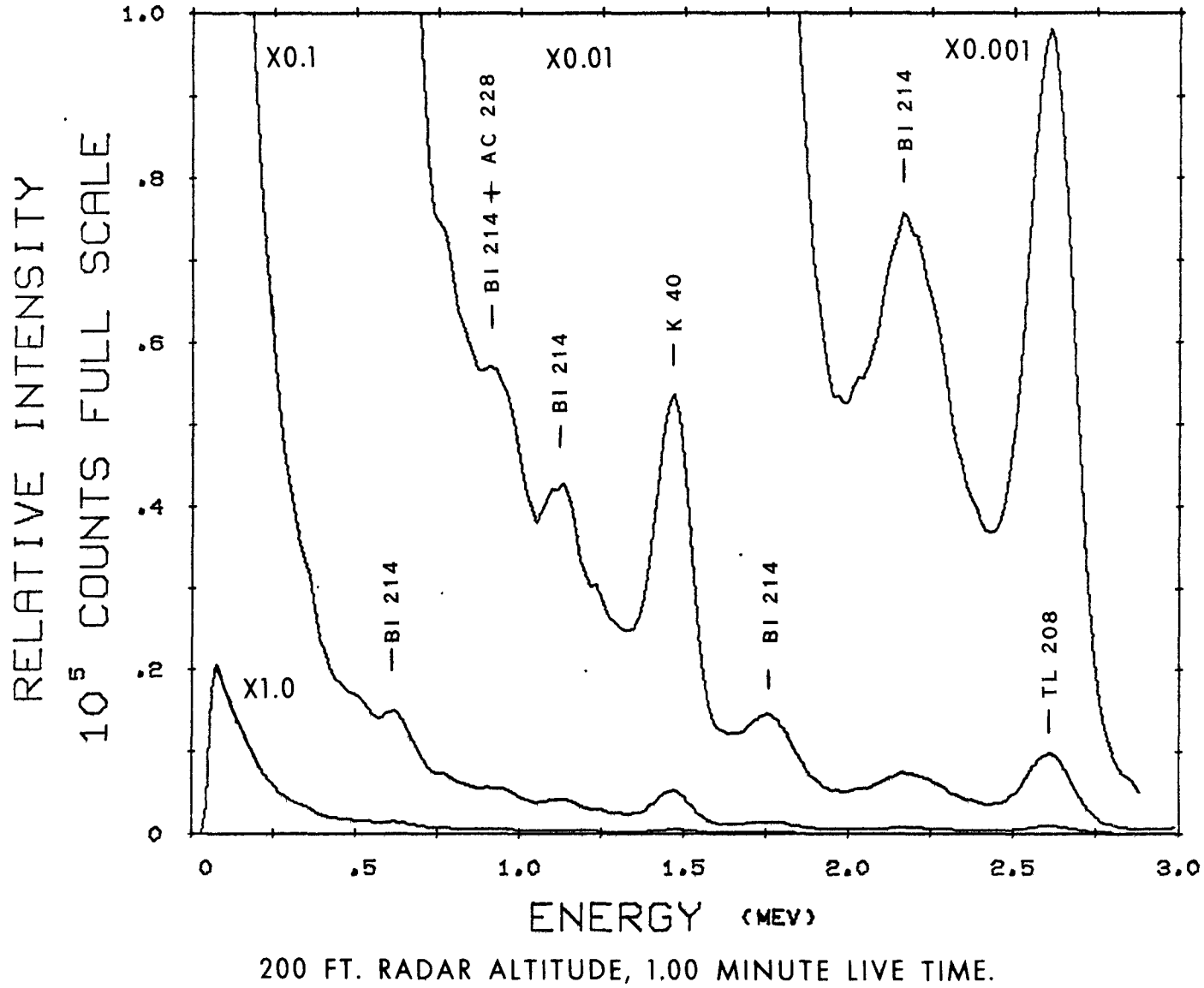


Figure 6-4. **Gamma-ray spectrum collection over anomaly south of Morris, Ill.**

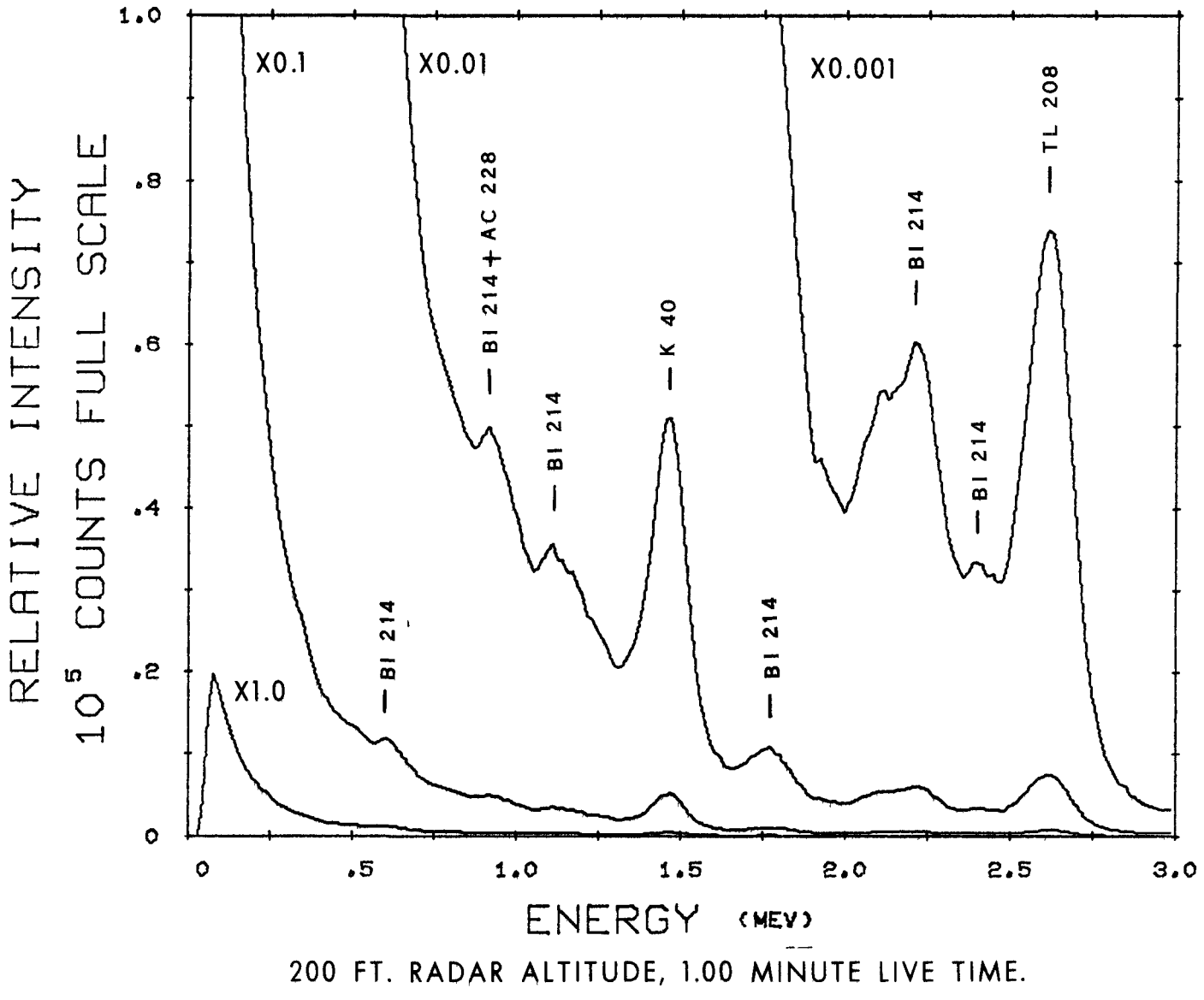


Figure 6-5. Gamma-ray spectrum collection near anomaly south of Morris, Ill.

Background spectral collections were recorded prior to each survey mission at altitudes free from terrestrial effects. A typical background spectra collected at the 4500-foot altitude is shown in Figure 6-6 and Table 6-1 lists the nuclides and energies consistent with those in the spectral trace.

6.2 EFFLUENT CHARACTERIZATION

Two missions were flown to document the characteristic behavior and radioactive contribution of the effluent plume released from the Dresden I reactor stack.

6.2.1 Neutron Sensing

Since the presence of delayed neutron emitters in the downwind effluent would suggest a possible filter failure, it is believed that neutron measurements in the plume could be a meaningful contribution to the characterization endeavor. The mission to obtain these measurements was flown on 10 July 1968. The results of the collections made in the effluent showed an absence of the delayed neutron emitters. The neutron activity appeared very consistent with the background collections made in the areas remote from the effluent. Figure 6-7 illustrates the neutron counting rate versus altitude that was recorded several miles upwind of the reactor installation. This curve is representative of the neutron background activity for the Dresden area. The data reveals the absence of any delayed neutron emitters in the effluent from the Dresden power station.

6.2.2 Gamma-Ray Measurements

On 1 October 1968, a mission was flown to obtain measurements that would provide a gamma-ray signature of the effluent emitted from the reactor stack. Figure 6-8 shows the effluent plume as tracked and defined utilizing circumnavigational techniques. The pattern mapped on this date provided typical data results. The pattern will vary with meteorological conditions and reactor release rates.

After completing the peripheral track, penetrations along the centerline were made to record gross-count intensities, collect air filter samples, and accumulate spectral information. The maximum gross-count intensity recorded along the centerline was approximately 25 to 30 times the background. The stack offgas release rate for the period when data were taken was approximately 10,000 μCi/sec.

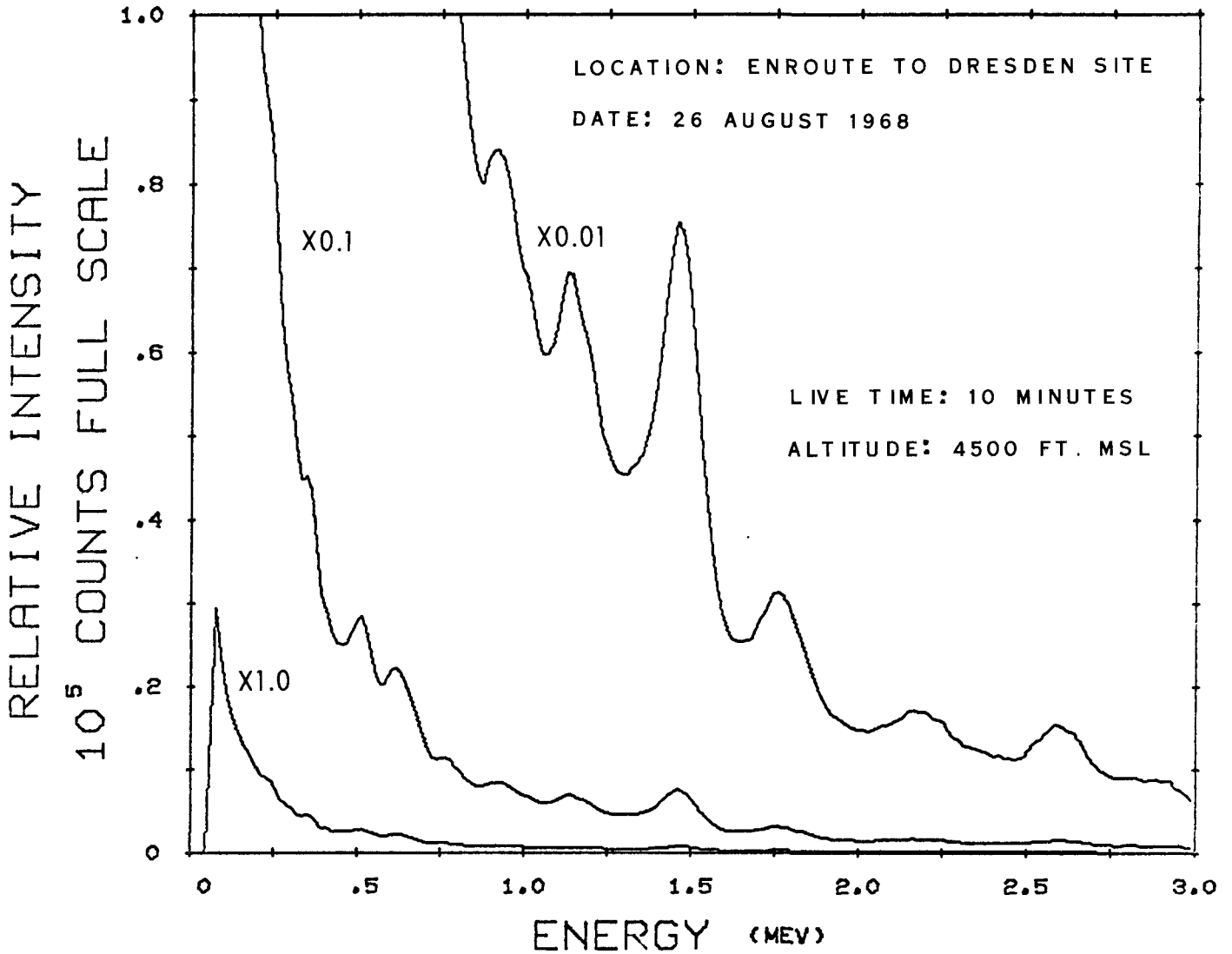


Figure 6-6. Aircraft background spectrum.

Table 6-1. Isotopic identification of photopeak energies in Figure 6-6.

OBS. Energy (MEV)	Radionuclides Consistent with Spectral Photopeaks		
	Fission Products	Activation Products	Background
0.25			Pb 212
0.35			Pb 214
0.51			Annih.
0.61			Bi 214
0.77			Bi 214
0.93			Bi 214
1.12			Bi 214
1.46			K 40
1.76			Bi 214
2.20			Bi 214
2.62			Tl 208

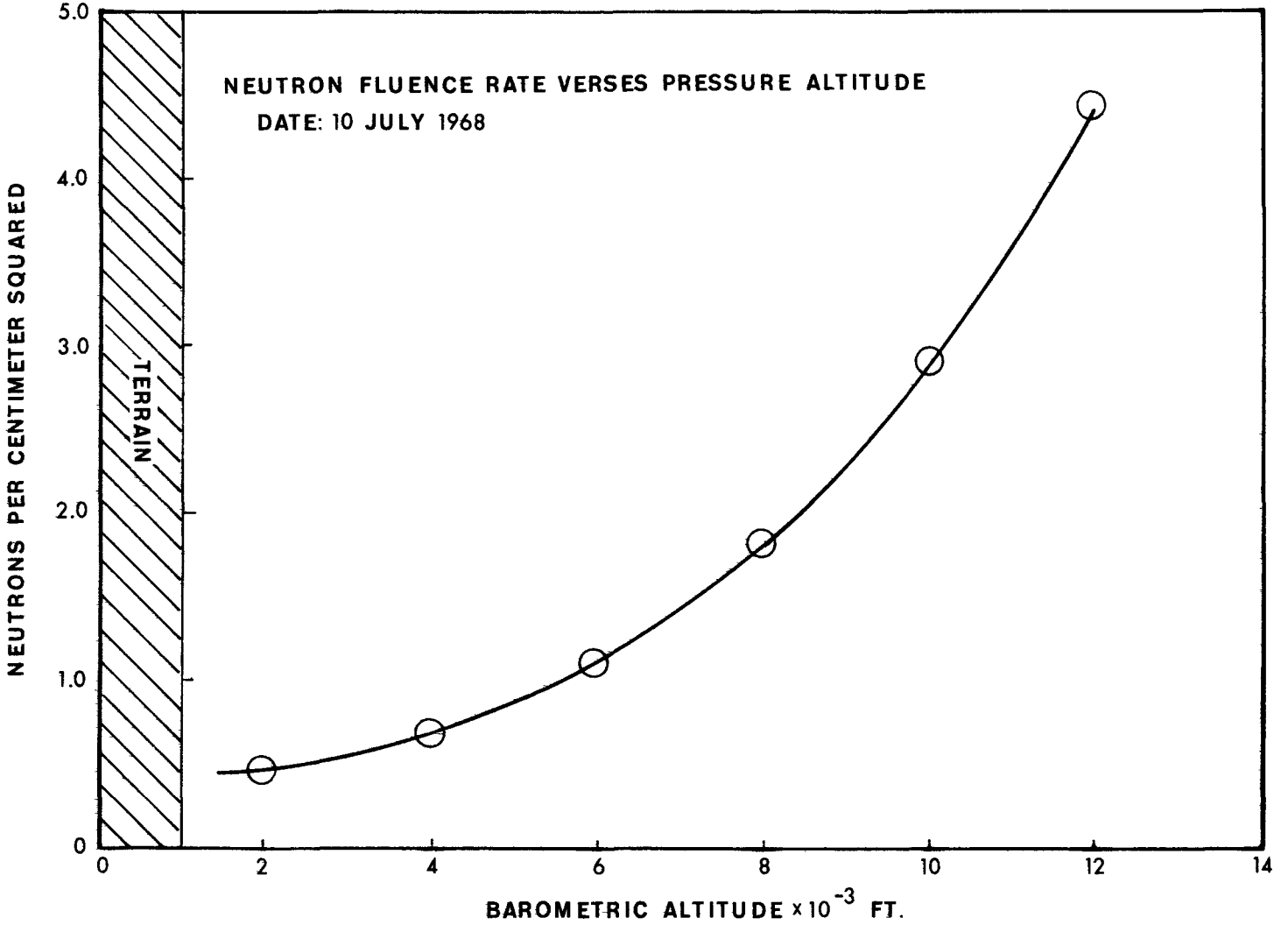
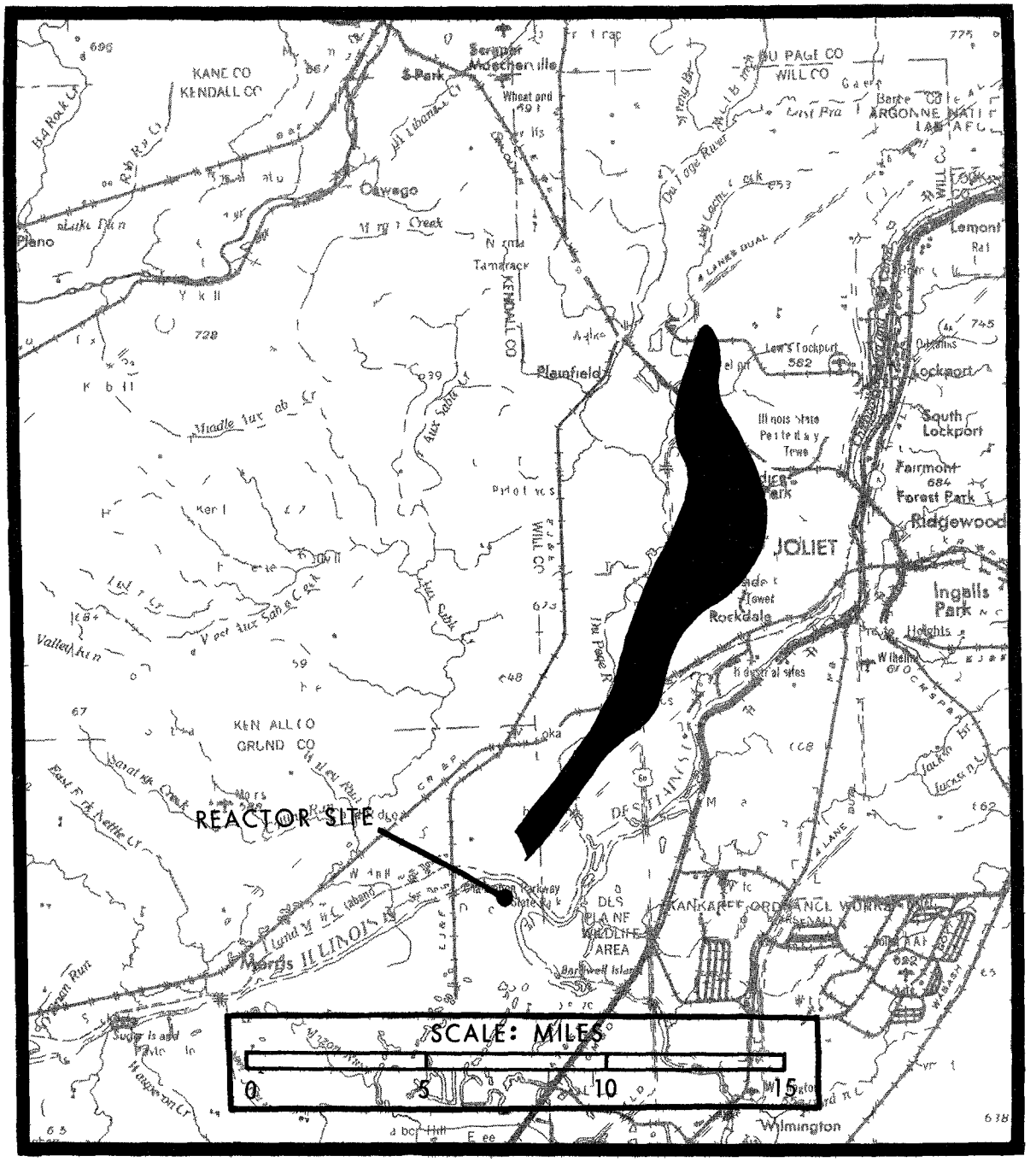


Figure 6-7. Typical neutron background for both upwind and downwind spirals.

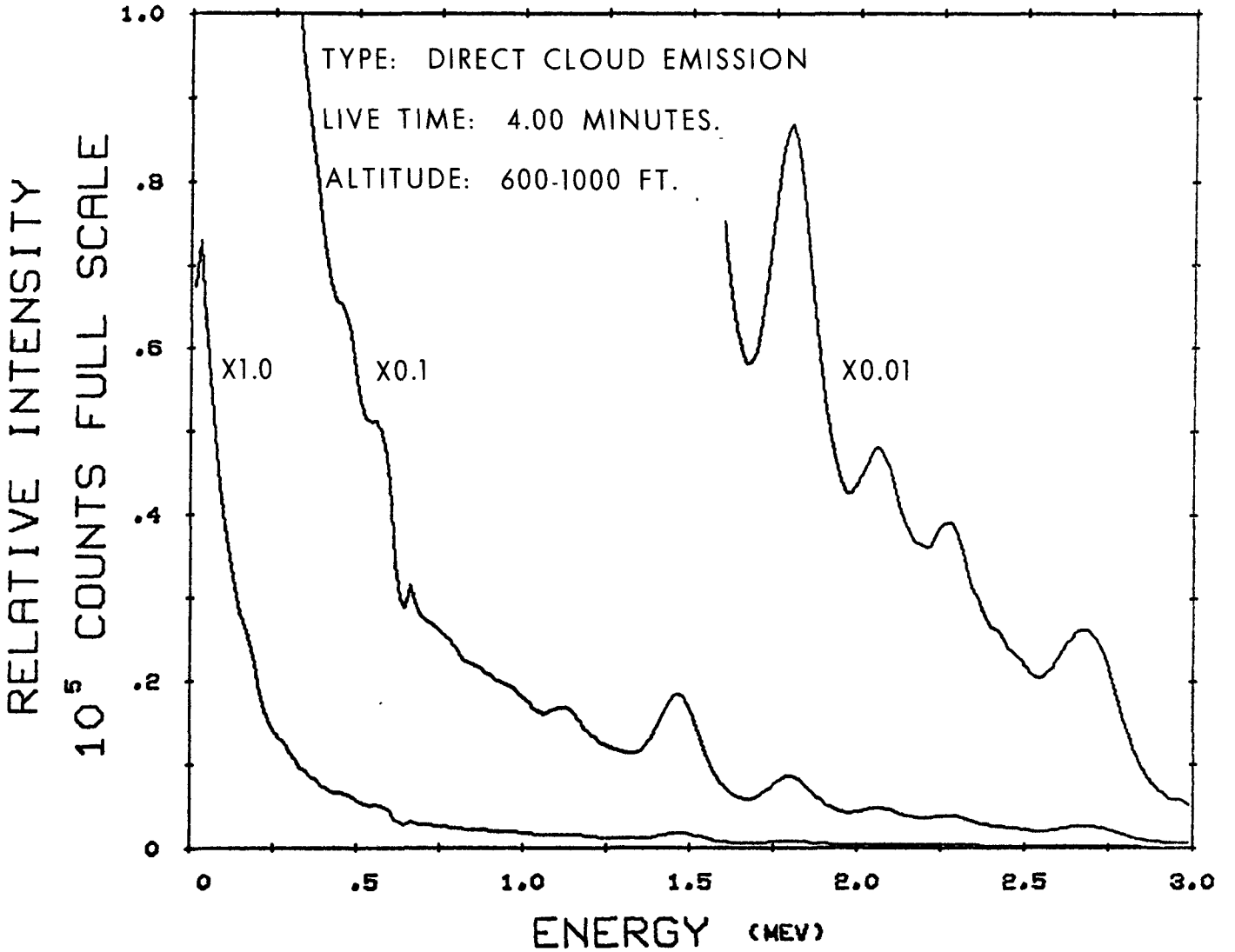


Dresden Power Reactor
600 - 1000 ft. Radar Altitude
1 October 1968

Figure 6-8. Effluent track.

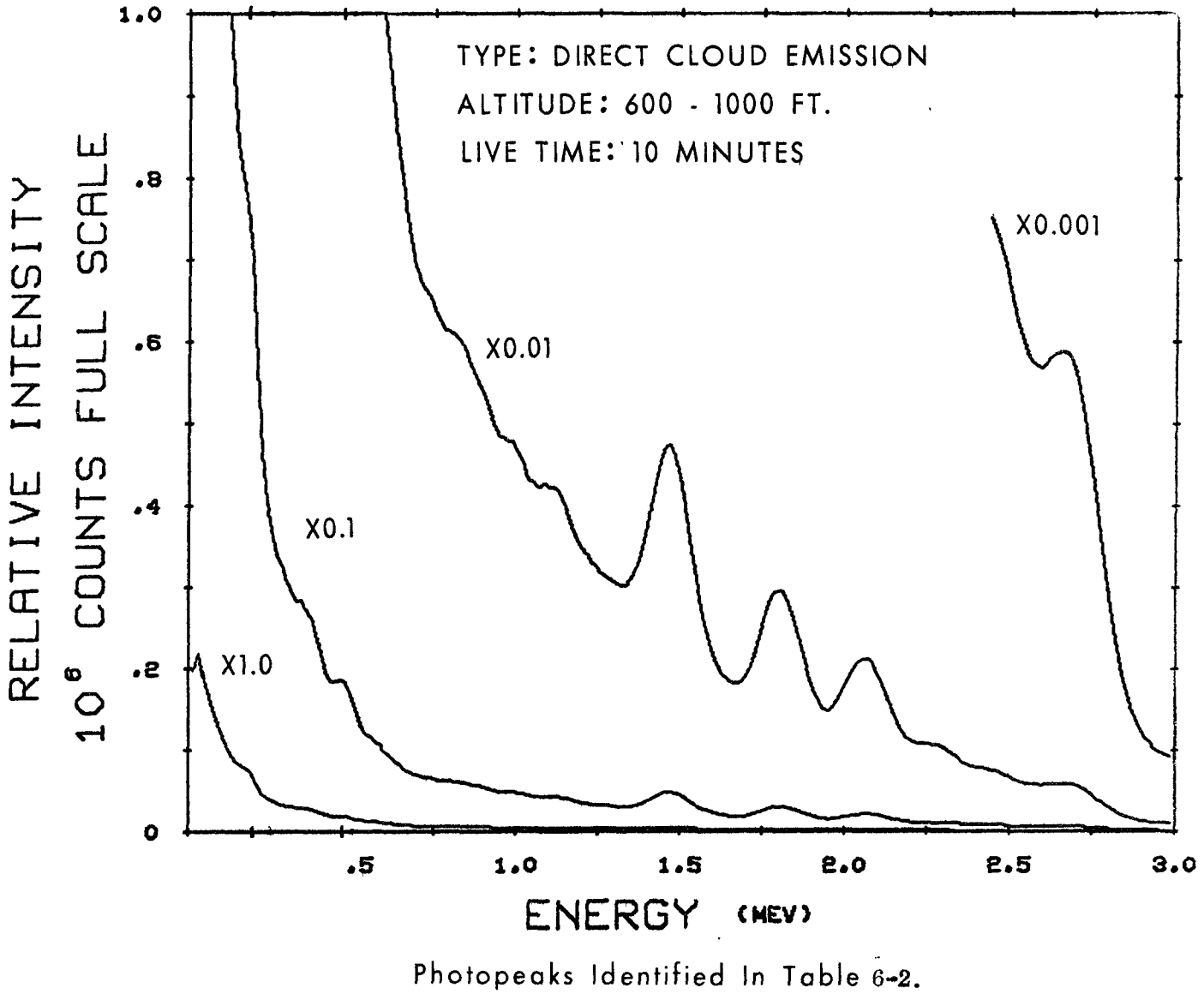
The spectral charts recorded along the effluent periphery and centerline are shown as Figures 6-9 and 6-10. Table 6-2 lists the isotopes identified from the energies present in these spectral traces. The natural contributors are seen to be present also as a result of the flight altitudes maintained in tracking the plume. Gamma-ray analysis of the exposed air-filter samples were performed immediately upon removal from the air stream. The resultant spectral trace is shown as Figure 6-11 and Table 6-3 lists the photopeak energies and nuclides observed. These filter samples were returned to the laboratory for recounting to search for possible long-lived contributors. This analysis was performed approximately 2 weeks after collection and showed no fission product activity. The isotopes detected in the effluent plume were indicative of typical fresh fission products derived from the decay of the iodines and bromines; i.e., Xe 138 and daughter Cs 138, KR 88 and daughter Rb 88, Xe 135, and Kr 87.

The complex direct emission spectra obtained during effluent characterization makes a qualitative isotopic interpretation difficult because of the resolution of sodium iodide crystals. The direct emission spectra contains both gaseous and particulate isotopes; however, the air filter spectra contains only the particulate isotopes. This enhances the capability of interpretation of the complex direct emission spectra. Also, the identification of prominent members of decay series aids in the identification of other members of the series, which must be present and are not as easily recognized from the spectral data.



Photopeaks Identified In Table 6-2.

Figure 6-9. Gamma-ray spectrum collection for effluent periphery of Dresden plume.

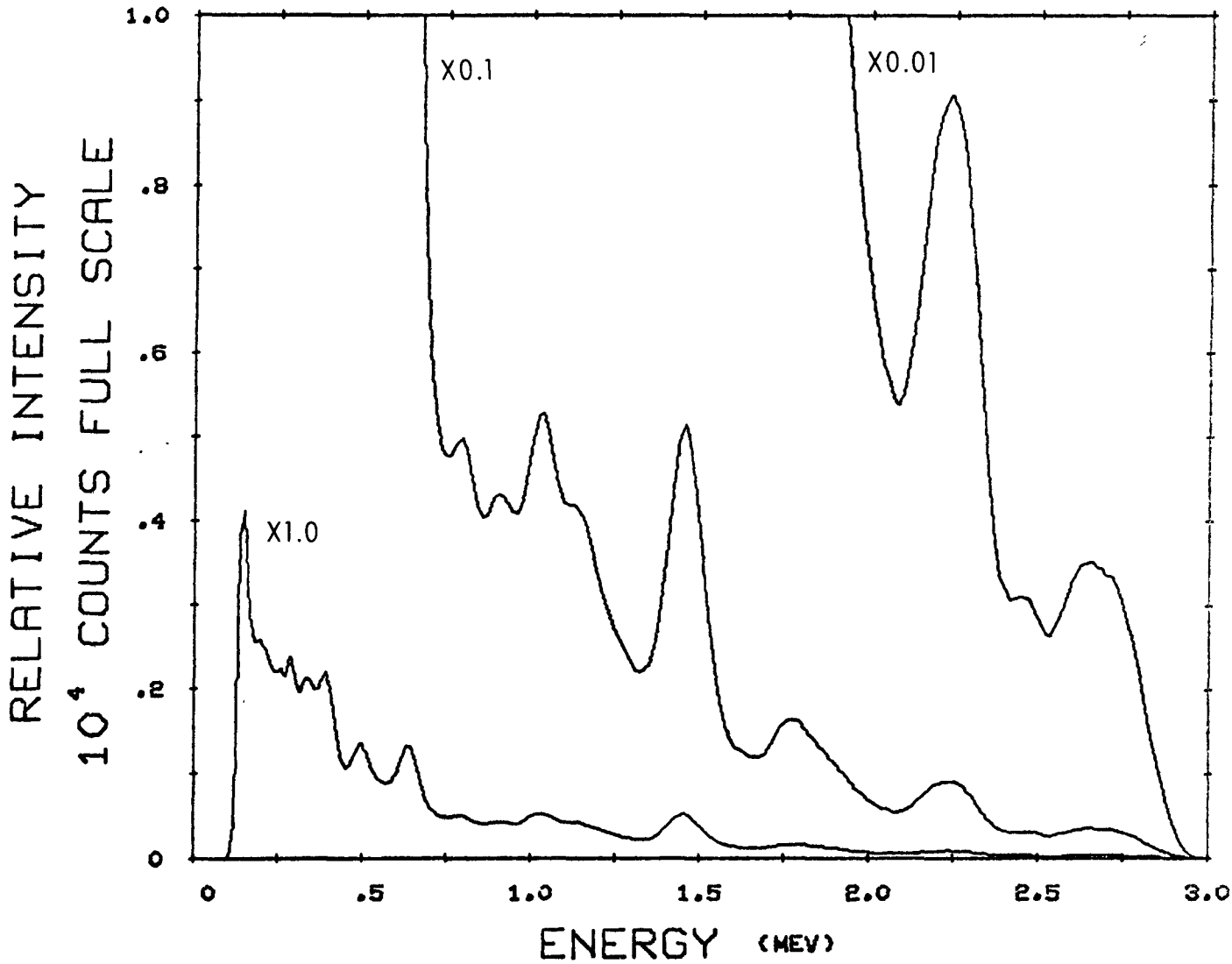


Photopeaks Identified In Table 6-2.

Figure 6-10. Gamma-ray spectrum collection for effluent centerline of Dresden plume.

Table 6-2. Isotopic identification of photopeak energies in Figures 6-9 and 6-10.

OBS. Energy (MEV)	Radionuclides Consistent with Spectral Photopeaks		
	Fission Products	Activation Products	Background
0.25	Xe 135		
0.40 - 0.46	Kr 87, Xe 138, Cs 138		
0.51 - 0.55	Xe 138, Xe 135m, Cs 138		Annih.
0.61	Xe 135		Bi 214
0.65 - 0.66	Rb 89, Sr 91		
0.75	Sr 91		
0.85 - 0.91	Kr 87, Kr 88, Rb 88		
1.02 - 1.05	Sr 91, Rb 89		
1.12			Bi 214
1.42 - 1.55	Cs 138, Kr 88, Sr 91		K 40
1.75 - 1.85	Kr 87, Rb 88, Xe 138		Bi 214
2.01 - 2.11	Rb 88, Kr 87, Xe 138		
2.20	Rb 89, Cs 138		Bi 214
2.40	Kr 88		
2.57 - 2.68	Kr 87, Rb 88, Rb 89, Cs 138		



Photopeaks Identified In Table 6-3.

Figure 6-11. Gamma-ray spectrum of air filter sample collection for effluent centerline of Dresden plume.

Table 6-3. Isotopic identification of photopeak energies in Figure 6-11.

OBS. Energy (MEV)	Radionuclides Consistent with Spectral Photopeaks		
	Fission Products	Activation Products	Background
0.23 - 0.26	Sr 92, Y 93		Pb 214, Pb 212
0.29 - 0.35			Pb 214
0.44 - 0.46	Cs 138, Sr 92, Y 92		
0.61			Bi 214
0.66	Sr 91, Rb 89, Y 93		
0.75	Sr 91		Bi 214
0.91 - 0.93	Rb 88, Sr 91, Y 93, Y 92		
1.02 - 1.05	Sr 91, Rb 89		
1.12			Bi 214
1.26	Rb 89		
1.41 - 1.46	Cs 138, Y 92, Sr 91		K 40
1.76			Bi 214
1.85 - 1.88	Rb 88, Y 92, Y 93		
2.11	Rb 88, Y 93		
2.20	Cs 138, Rb 89		Bi 214
2.40	Y 92		
2.59 - 2.68	Cs 138, Rb 88, Rb 89		

7. SUMMARY AND CONCLUSIONS

The Dresden I operational power reactor site was surveyed from the air during normal operation. Results of the survey can be summarized as follows:

1. In conducting the terrestrial radiation survey, no apparent anomalies were detected that could be attributed to Dresden I reactor operations.

2. No significant indication of delayed neutron emitters were detected in the downwind effluent.

3. The effluent plume was tracked 15 to 20 miles downwind of the reactor stack. Effluent characteristics were obtained by spectral analysis and air-filter sample collections. The air-filter samples collected in the radioactive plume were returned to the laboratory for analysis. No significant indication of long-lived fission product activity was observed on these filters (approximately 2 weeks after collection).

4. The exposure rates mapped during the terrestrial radiation surveys were predominantly in the 6 to 10 μR/hr range. Deviations from normal could readily be attributed to natural contributors or phenomena.

APPENDIX

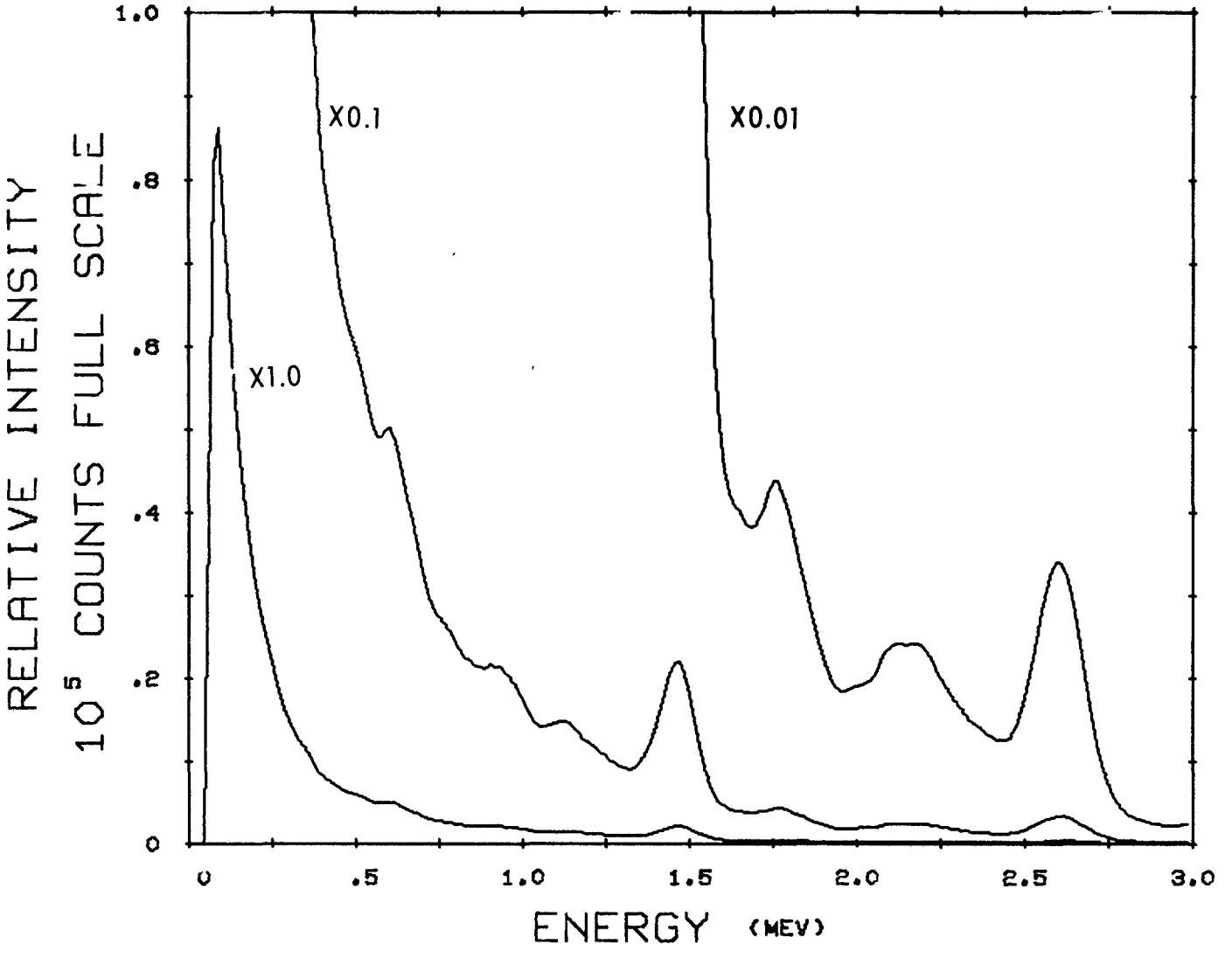
GAMMA-RAY SPECTRAL CHARTS

The gamma-ray spectral charts that constitute this section of the report are included in this catalog file to show the energy characteristics of each of the individual flight lines making up the Dresden survey area.

The tabulation preceding the total group of spectra shows the energies present in all the charts and lists the isotopic contributor associated with the photopeaks observed.

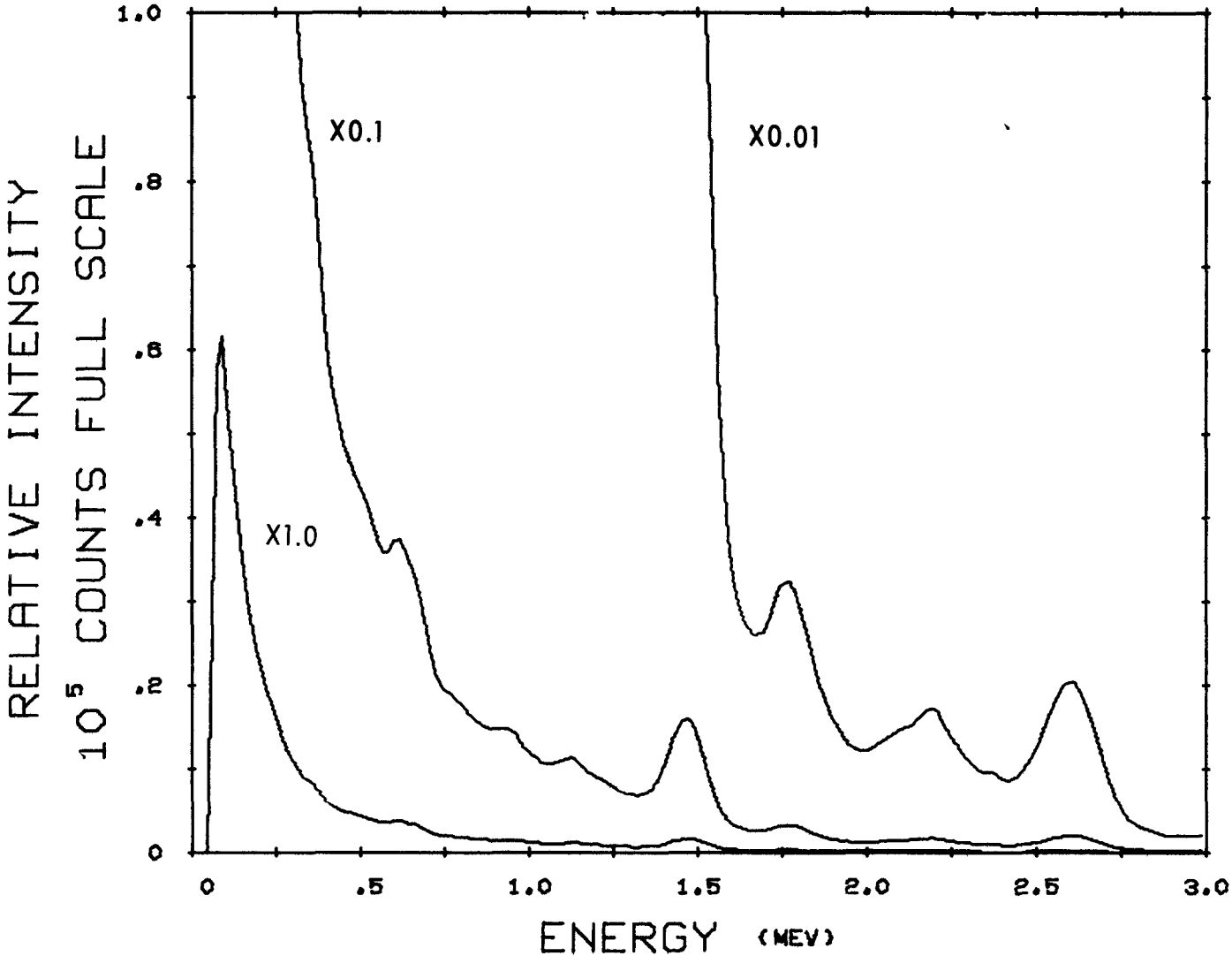
Gamma-ray energy and isotope tabulation.

OBS. Energy (MEV)	Radionuclides Consistent with Spectral Photopeaks		
	Fission Products	Activation Products	Background
0.35			Pb 214
0.61			Bi 214
0.91-0.96			Bi214, Ac228
1.12			Bi 214
1.46			K 40
1.76			Bi 214
2.20			Bi 214
2.62			Tl 208



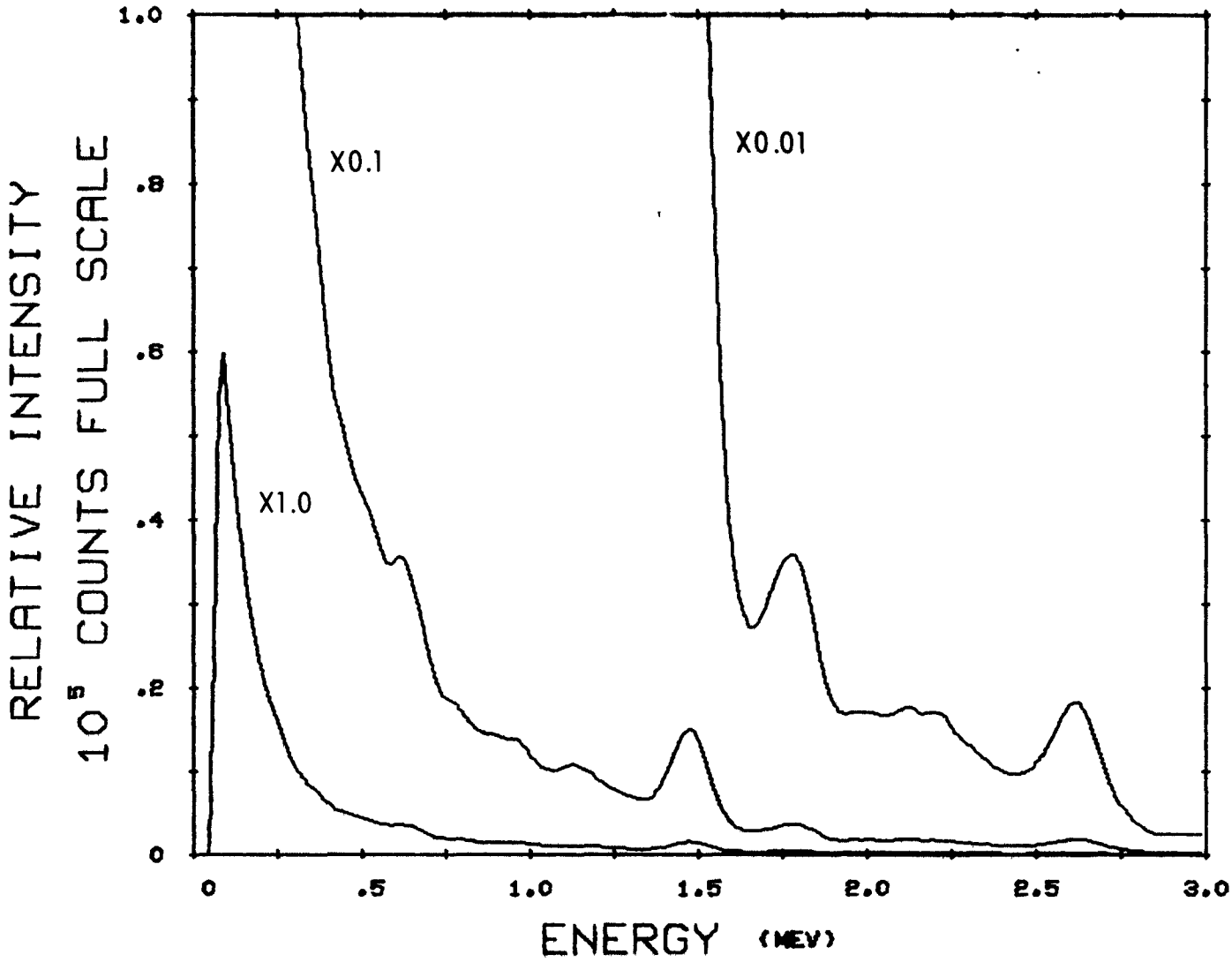
LOCATION: LINE 1 (NORTHERN HALF)

SPECTRUM NO. 230
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 1011465
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



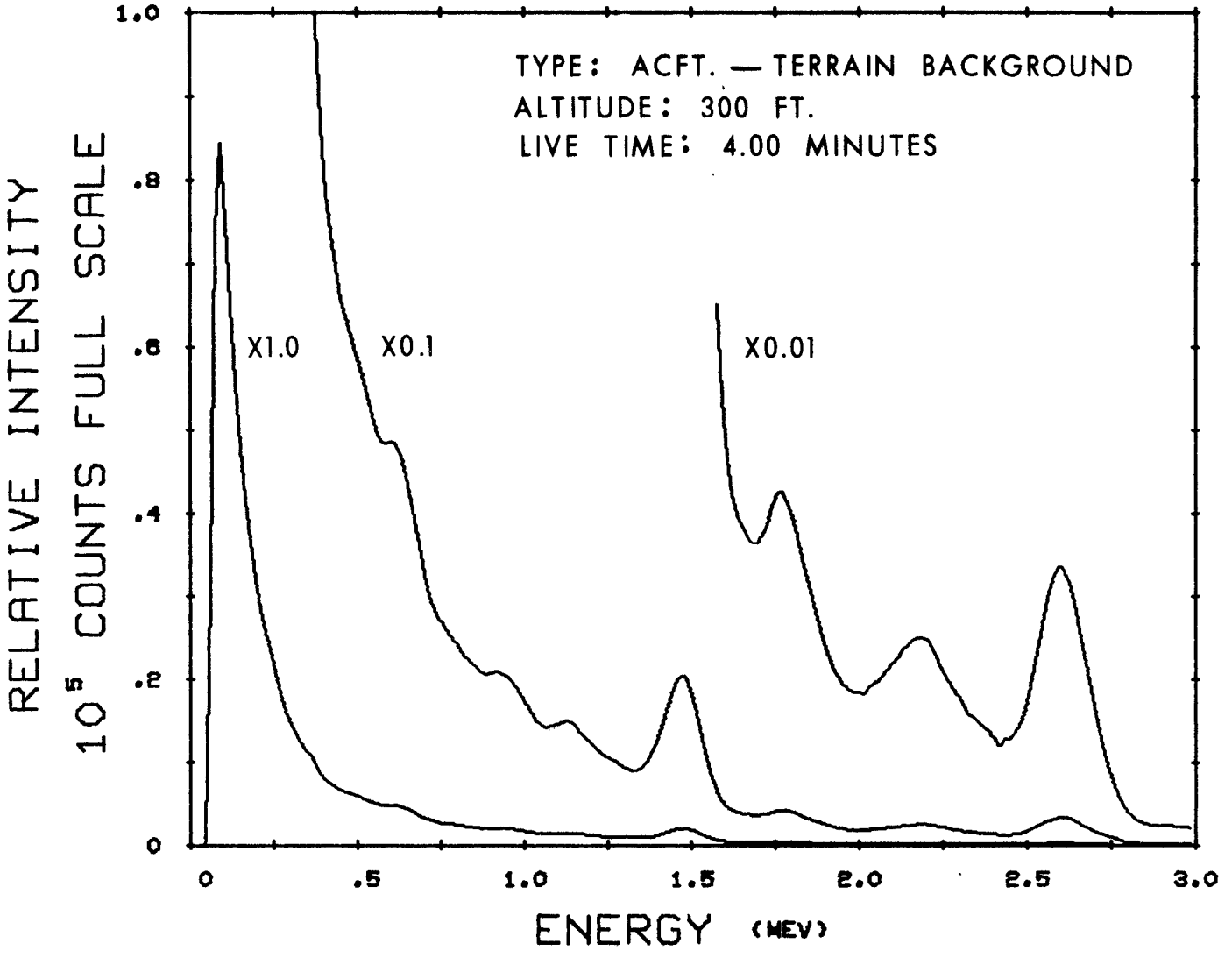
LOCATION: LINE 1 (SOUTHERN HALF)

SPECTRUM NO. 231
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 732075
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



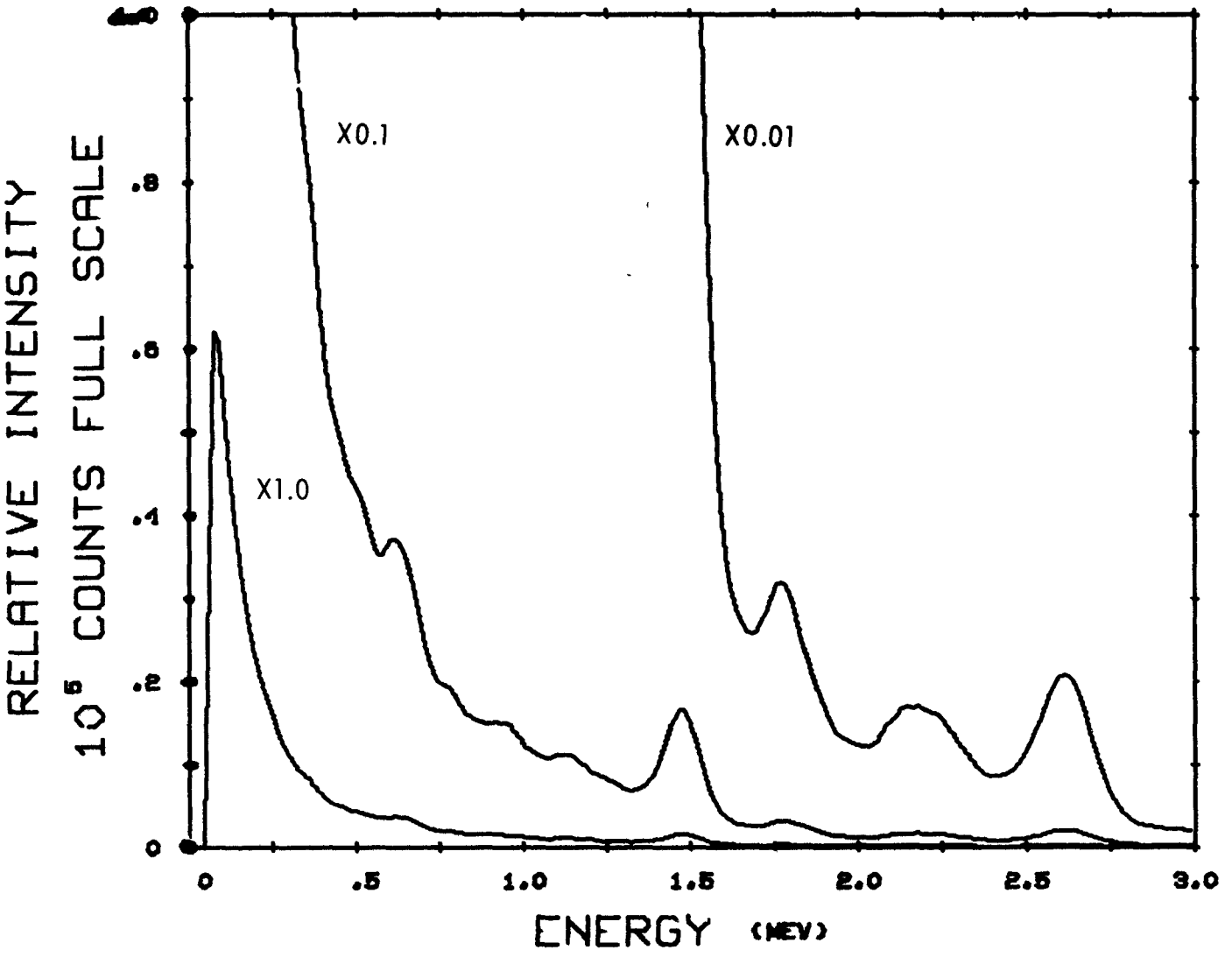
LOCATION: LINE 2 (SOUTHERN HALF)

SPECTRUM NO. 232
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 712274
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



LOCATION: LINE 2 (NORTHERN HALF)

SPECTRUM NO. 233
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 985325
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



LOCATION: LINE 3 (SOUTHERN HALF)

SPECTRUM NO. 228
DATE 09-25-68
LIVE TIME 4.00
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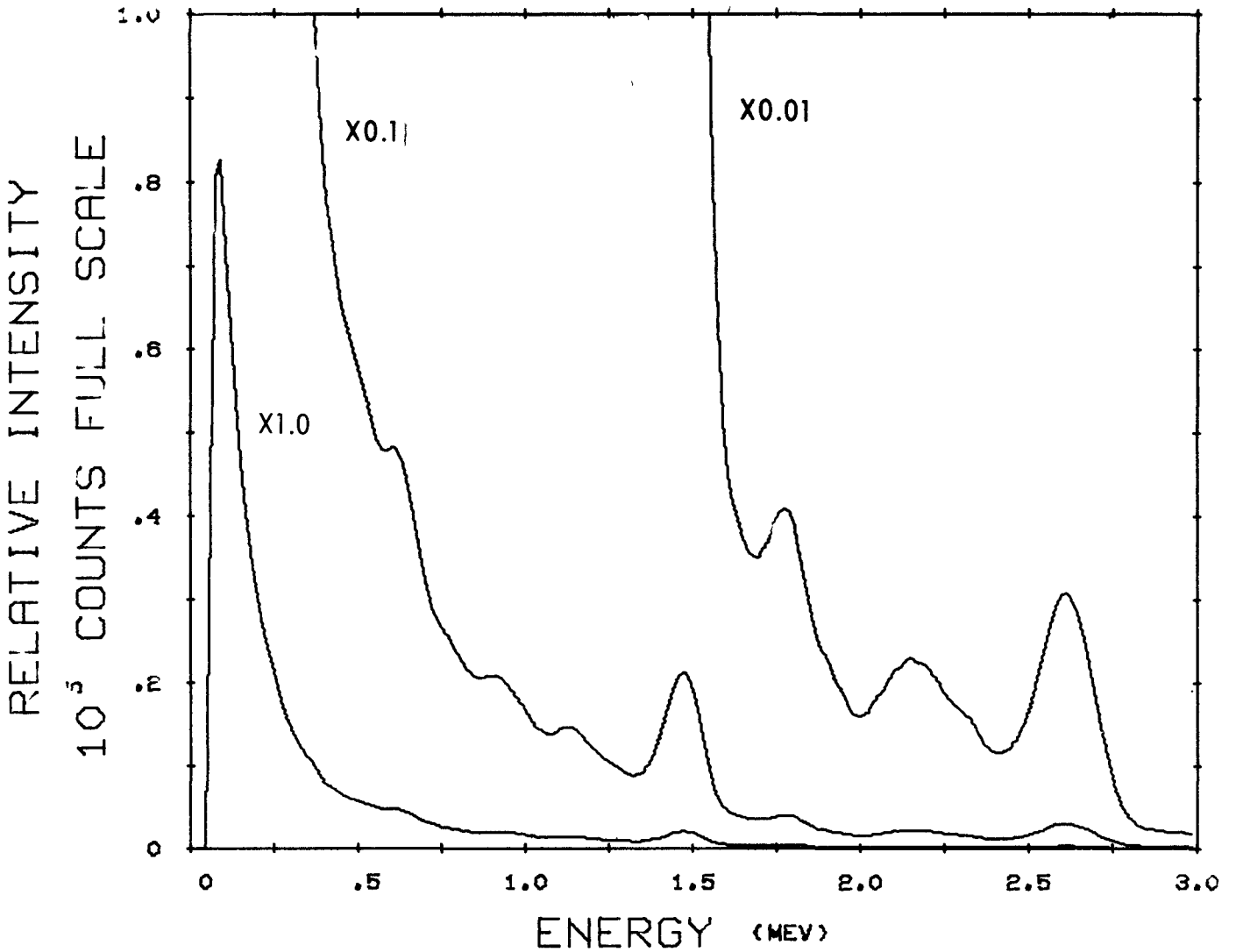
ALTITUDE 300
AIRCRAFT (ARMS)



LOCATION: LINE 3 (NORTHERN HALF)

SPECTRUM NO. 229
DATE 09-25-68
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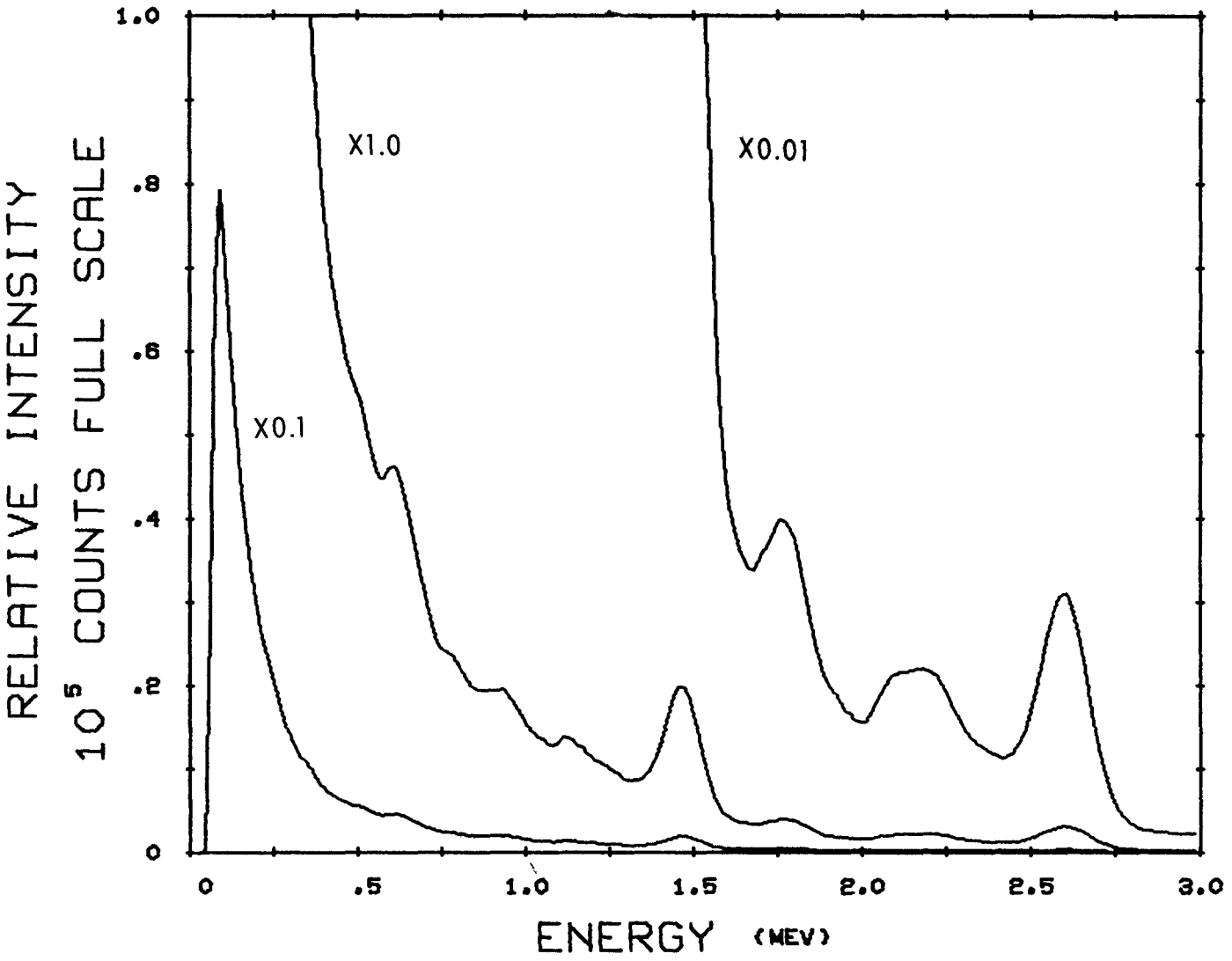
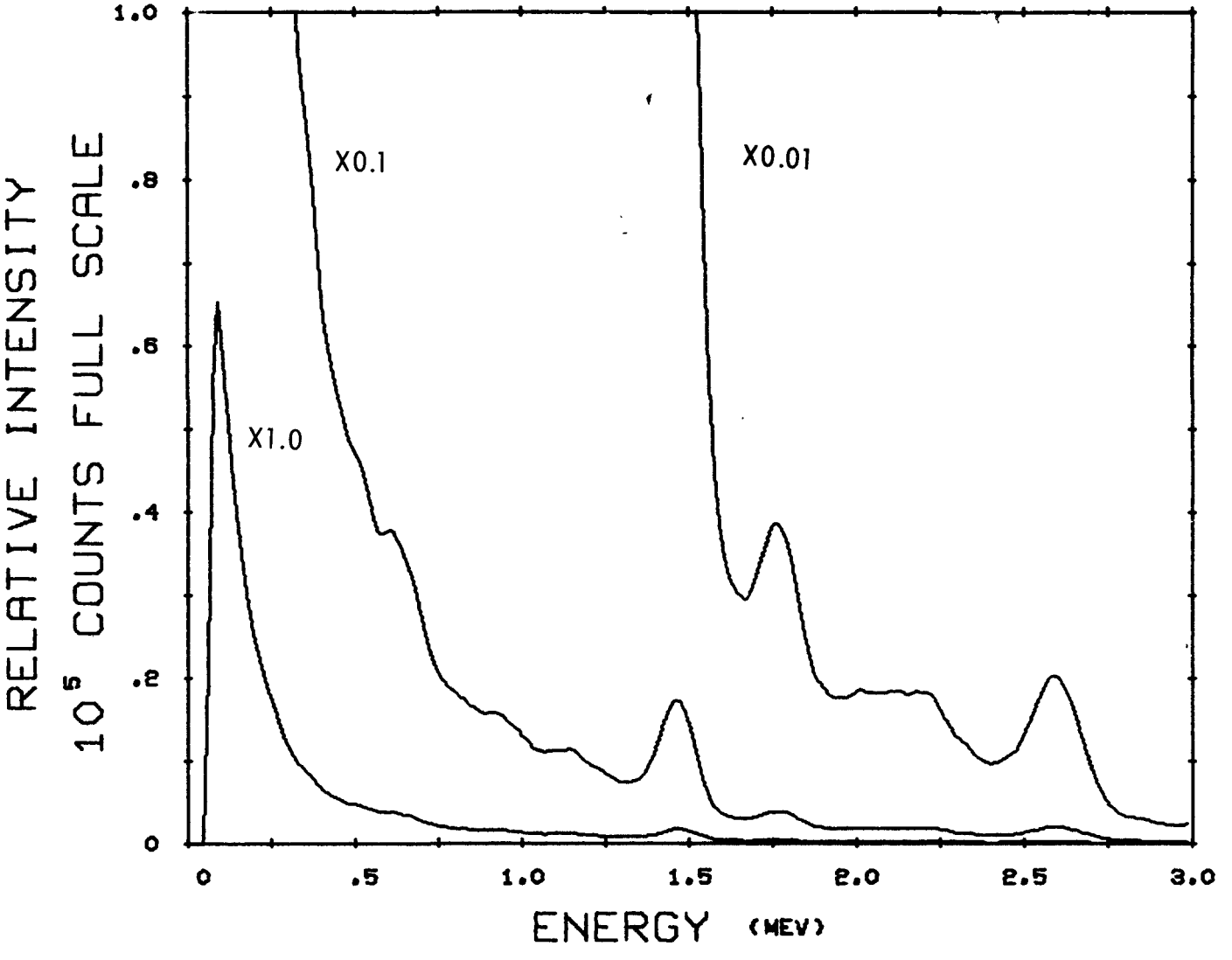
INTEGRATED CT. 980632
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



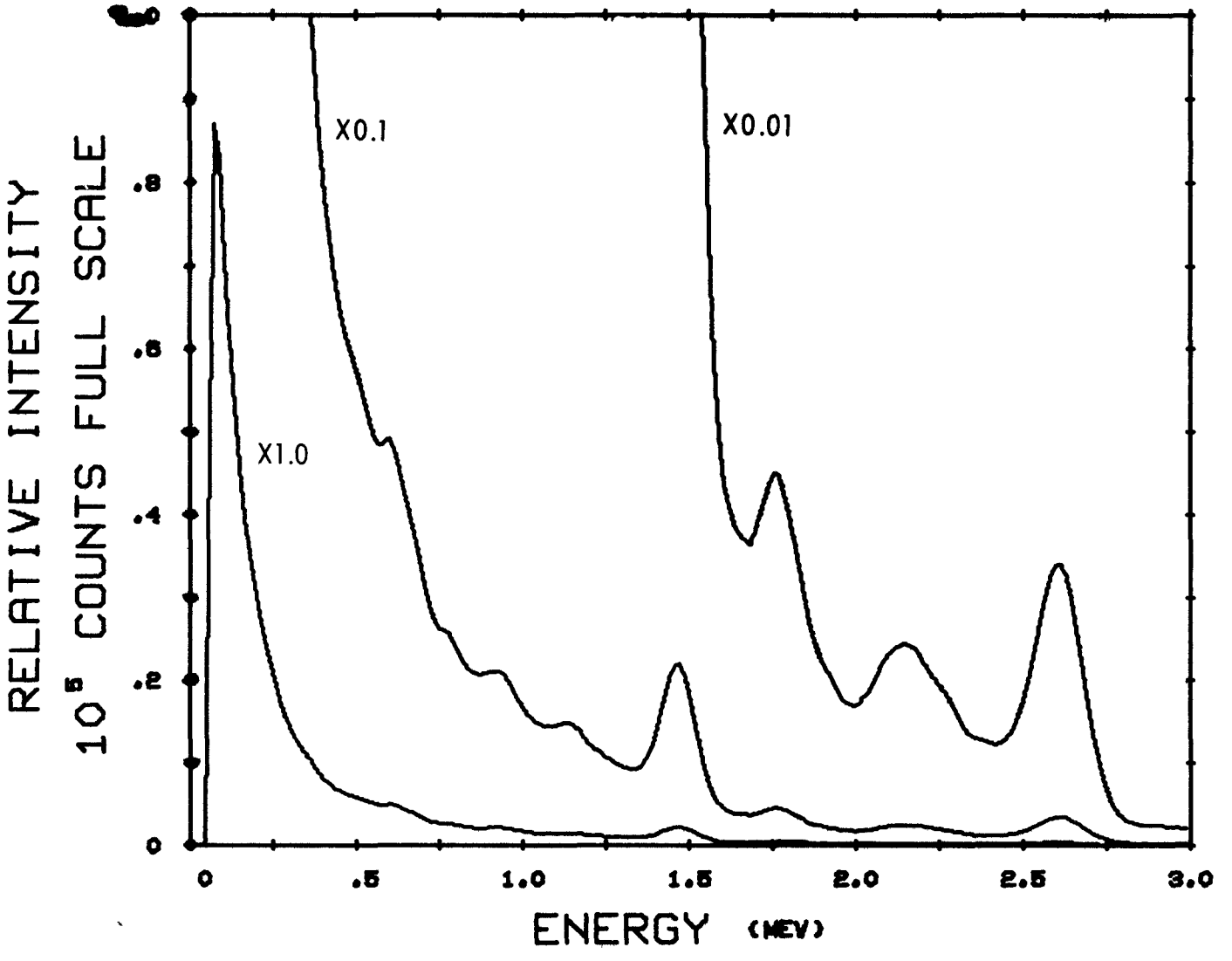
LOCATION: LINE 4 (NORTHERN HALF)

SPECTRUM NO. 234
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 917853
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



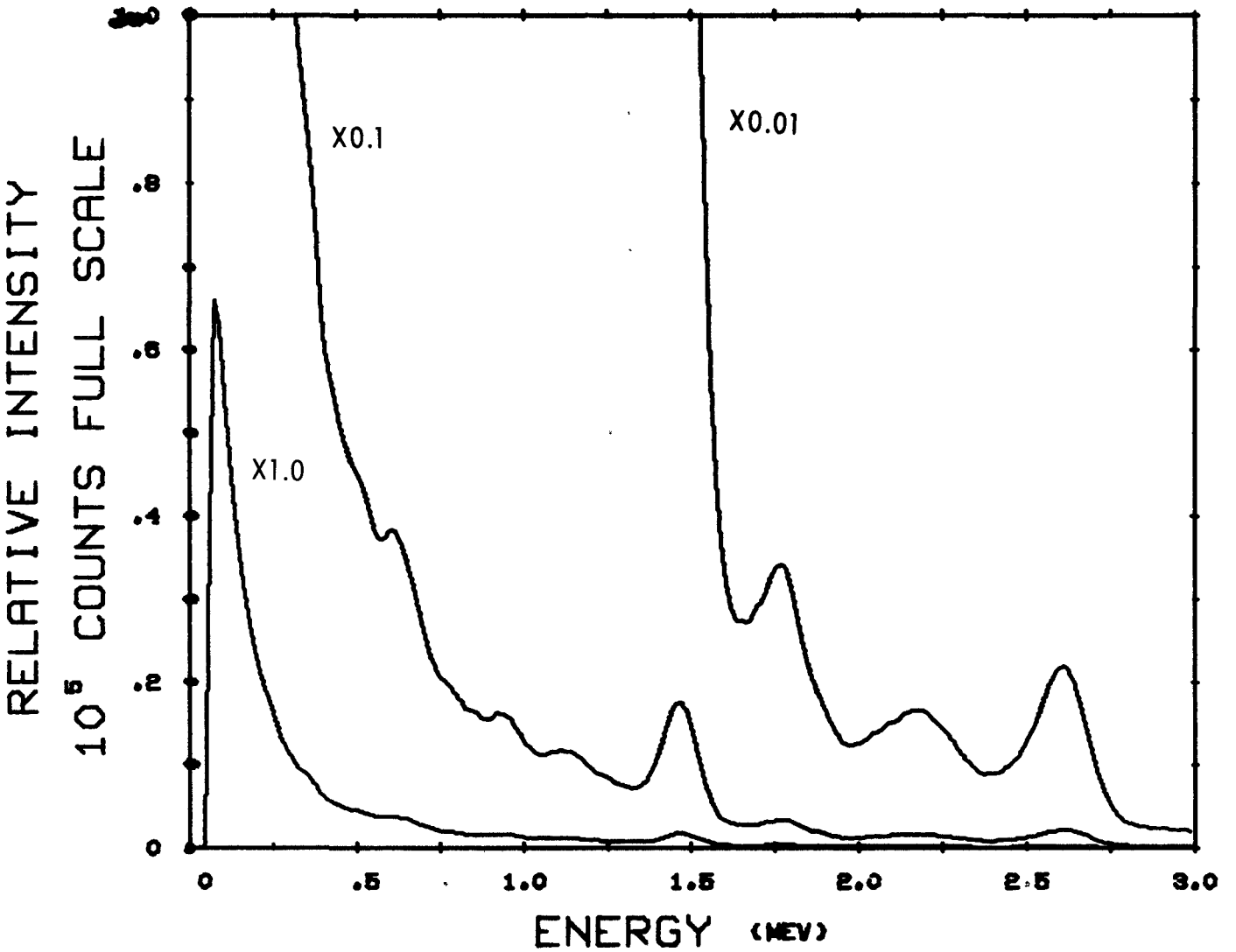
LOCATION: LINE 4 (SOUTHERN HALF)

SPECTRUM NO. 235
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 768980
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



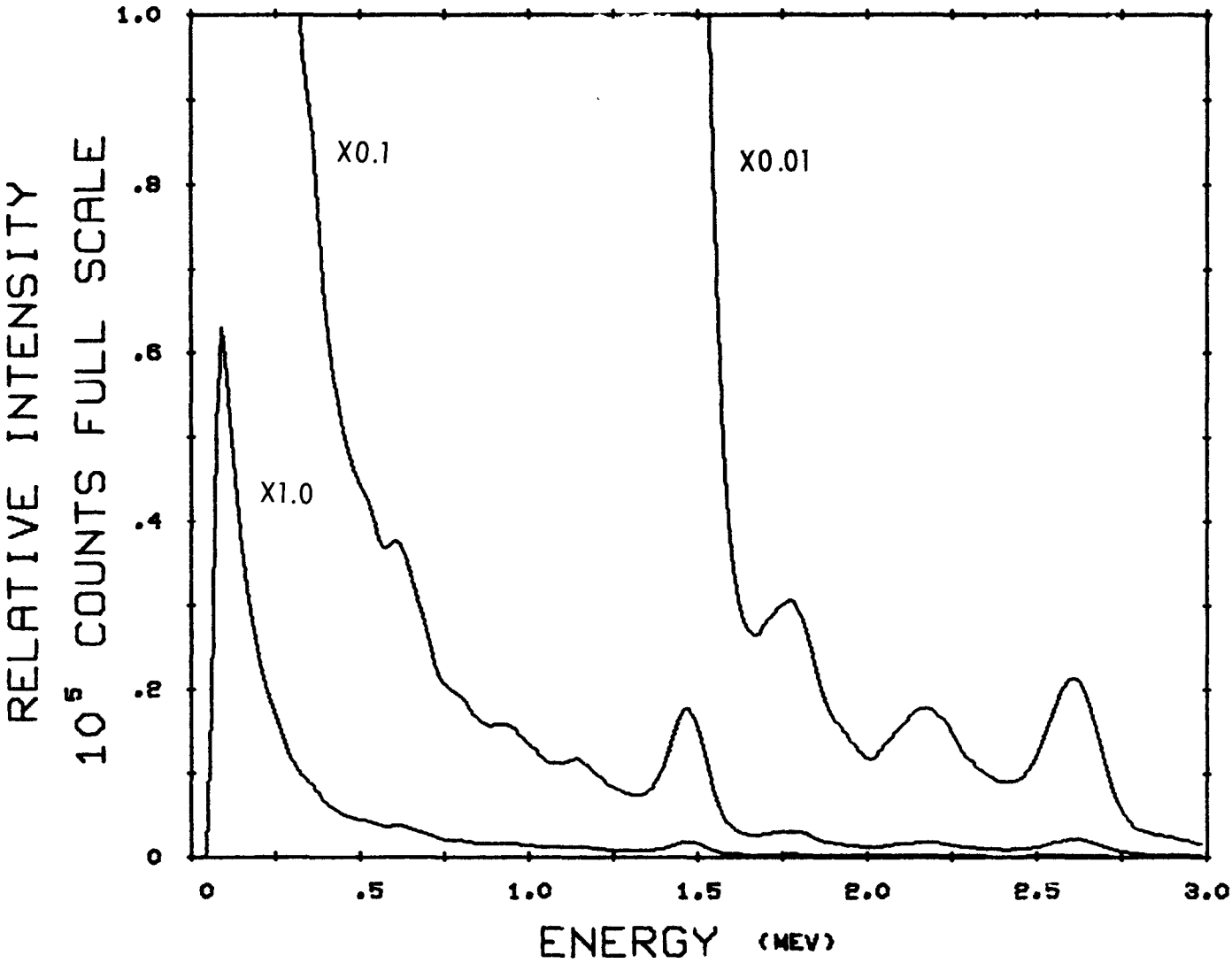
LOCATION: LINE 5 (NORTHERN HALF)

SPECTRUM NO. 226
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 989978
TYPE - ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



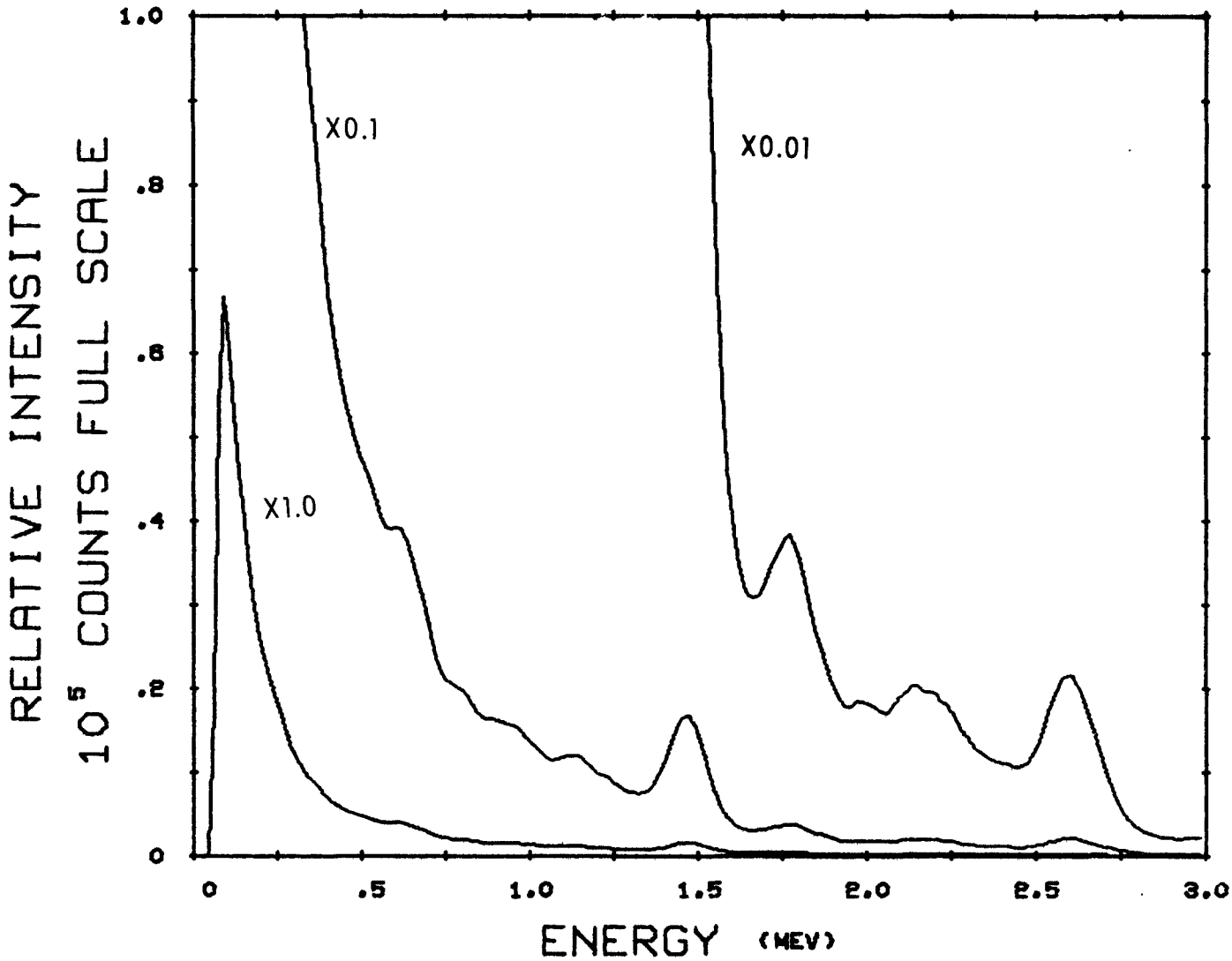
LOCATION: LINE 5 (SOUTHERN HALF)

SPECTRUM NO. 227
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 763212
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



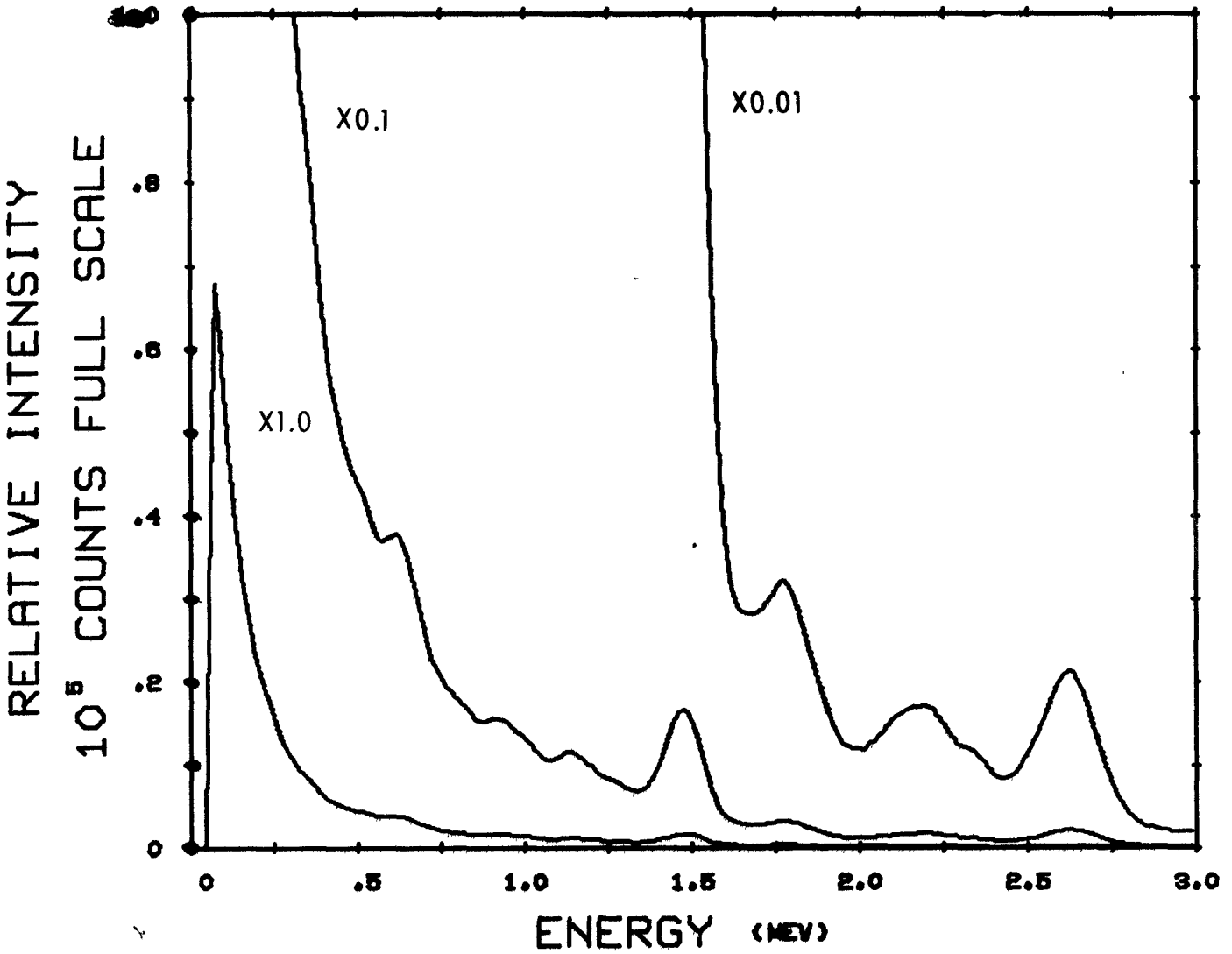
LOCATION: LINE 6 (SOUTHERN HALF)

SPECTRUM NO. 236
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 746156
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



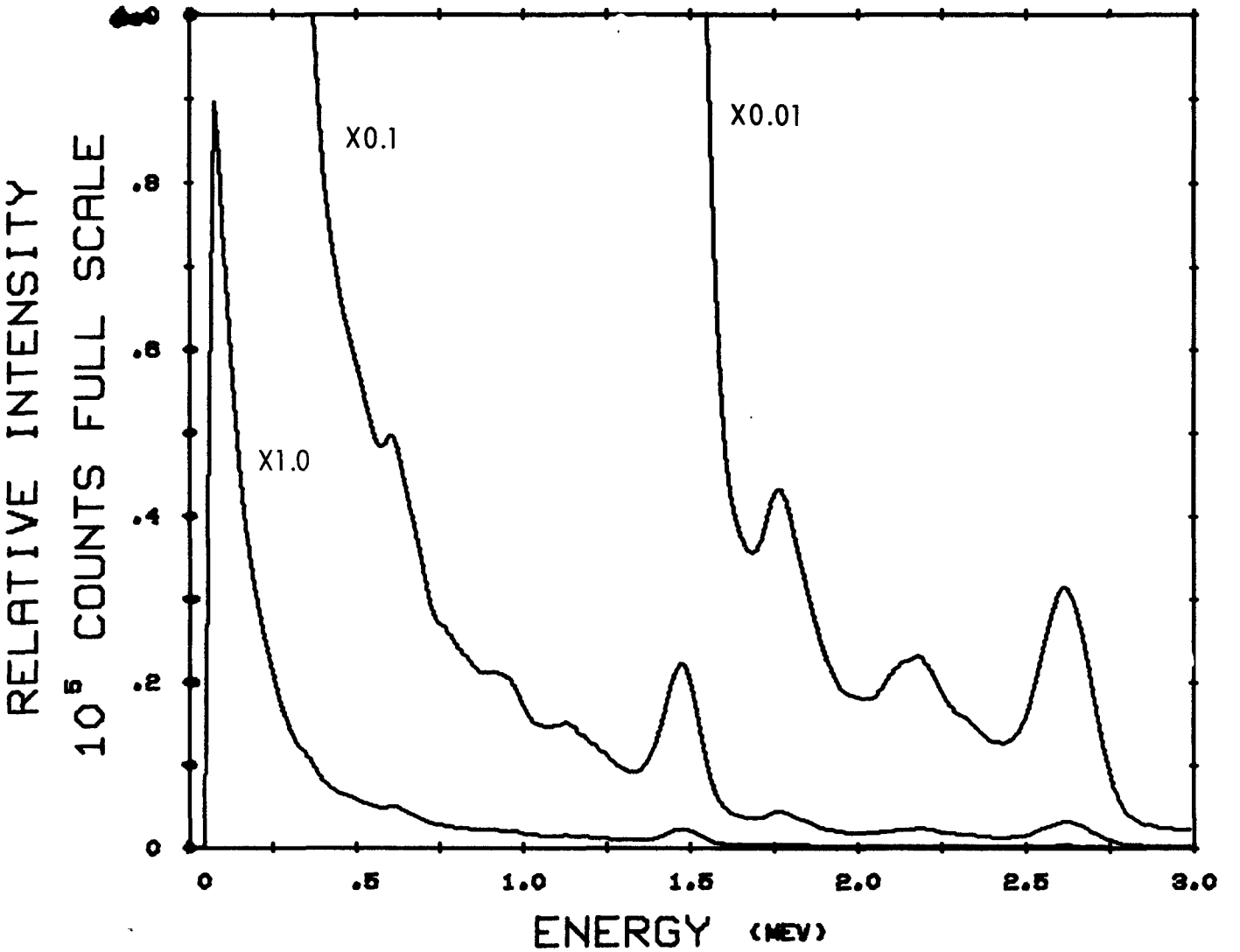
LOCATION: LINE 6 (NORTHERN HALF)

SPECTRUM NO. 237
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 786836
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



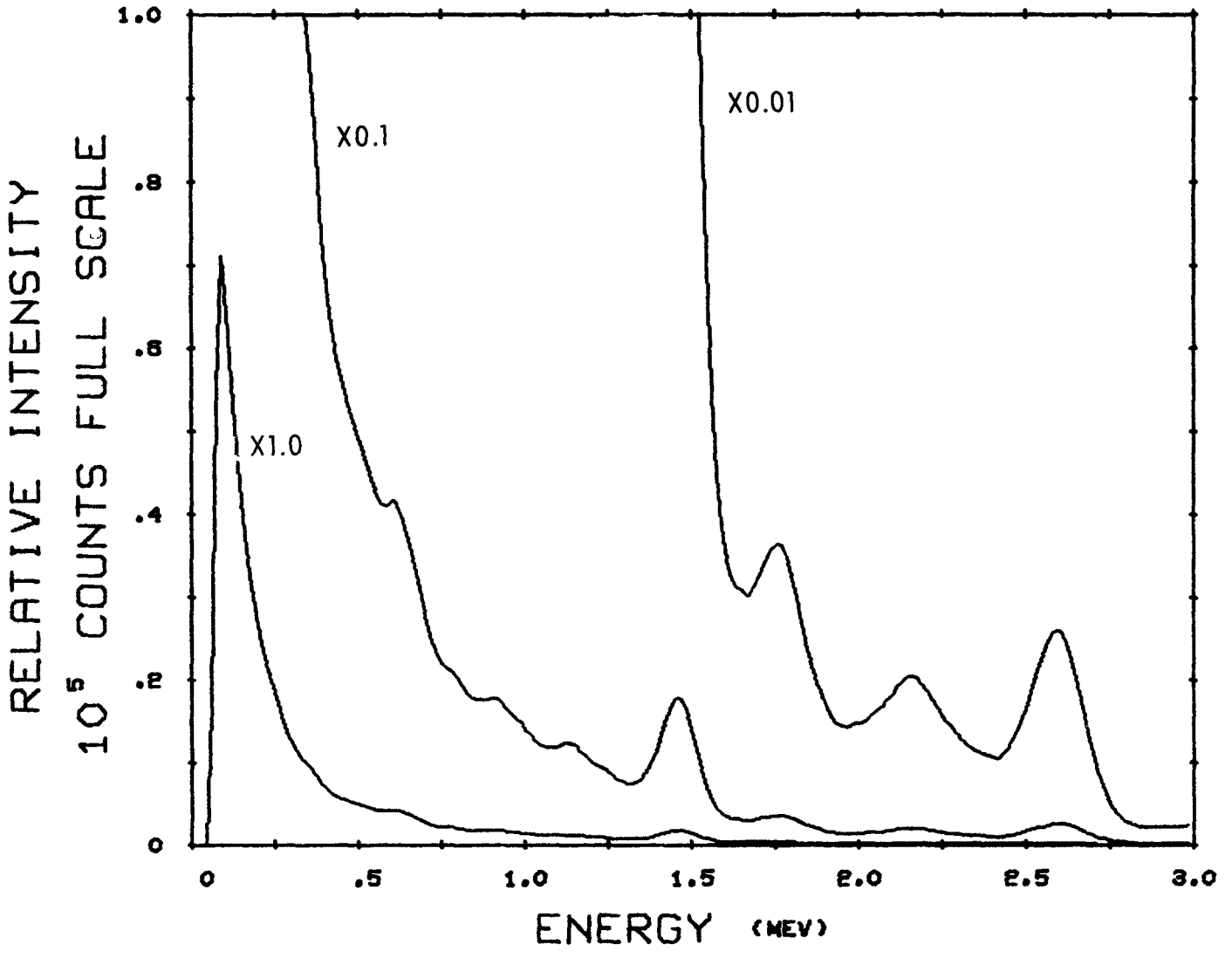
LOCATION: LINE 7 (SOUTHERN HALF)

SPECTRUM NO. 224
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 753797
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



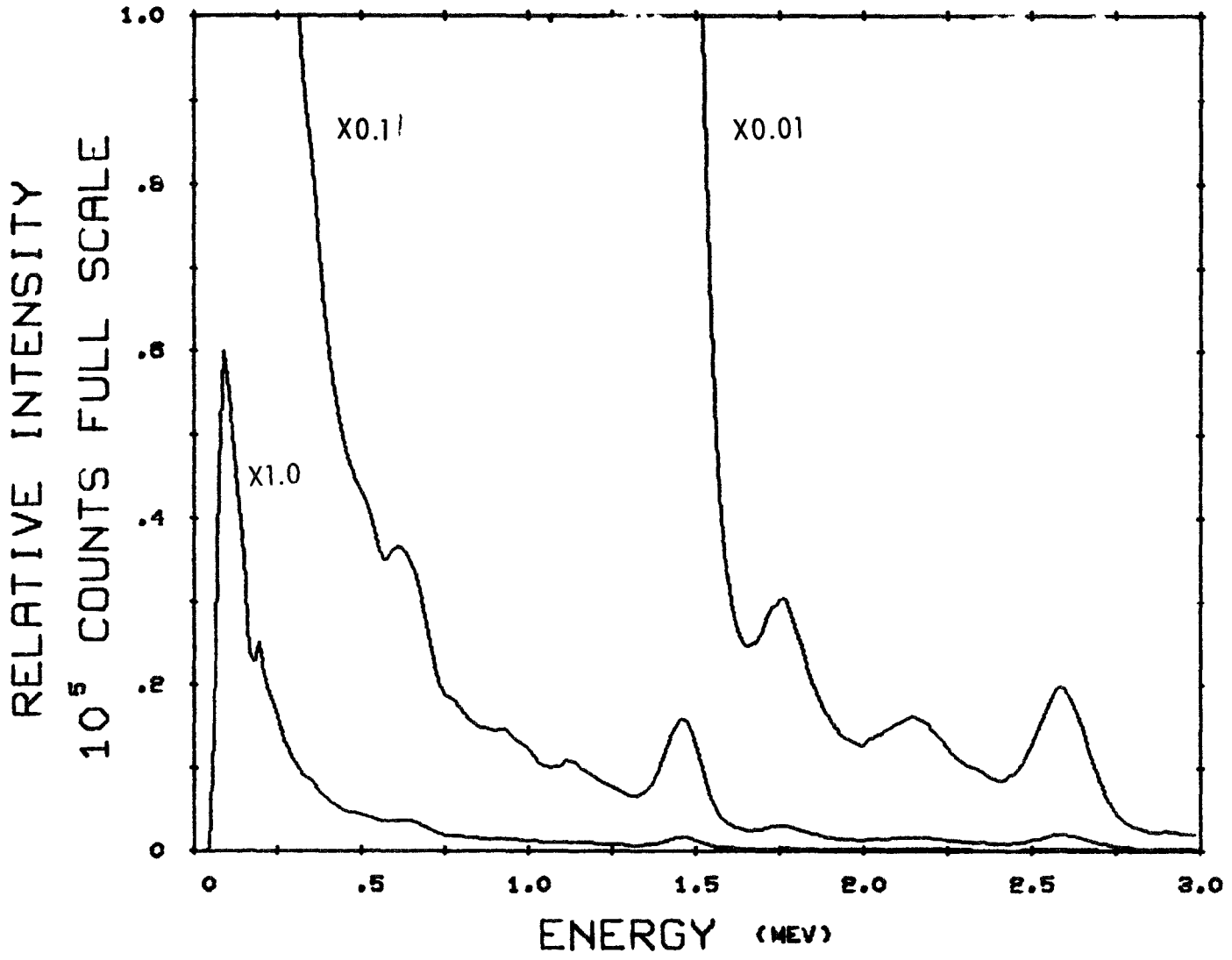
LOCATION: LINE 7 (NORTHERN HALF)

SPECTRUM NO. 225
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 1009958
TYPE - ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



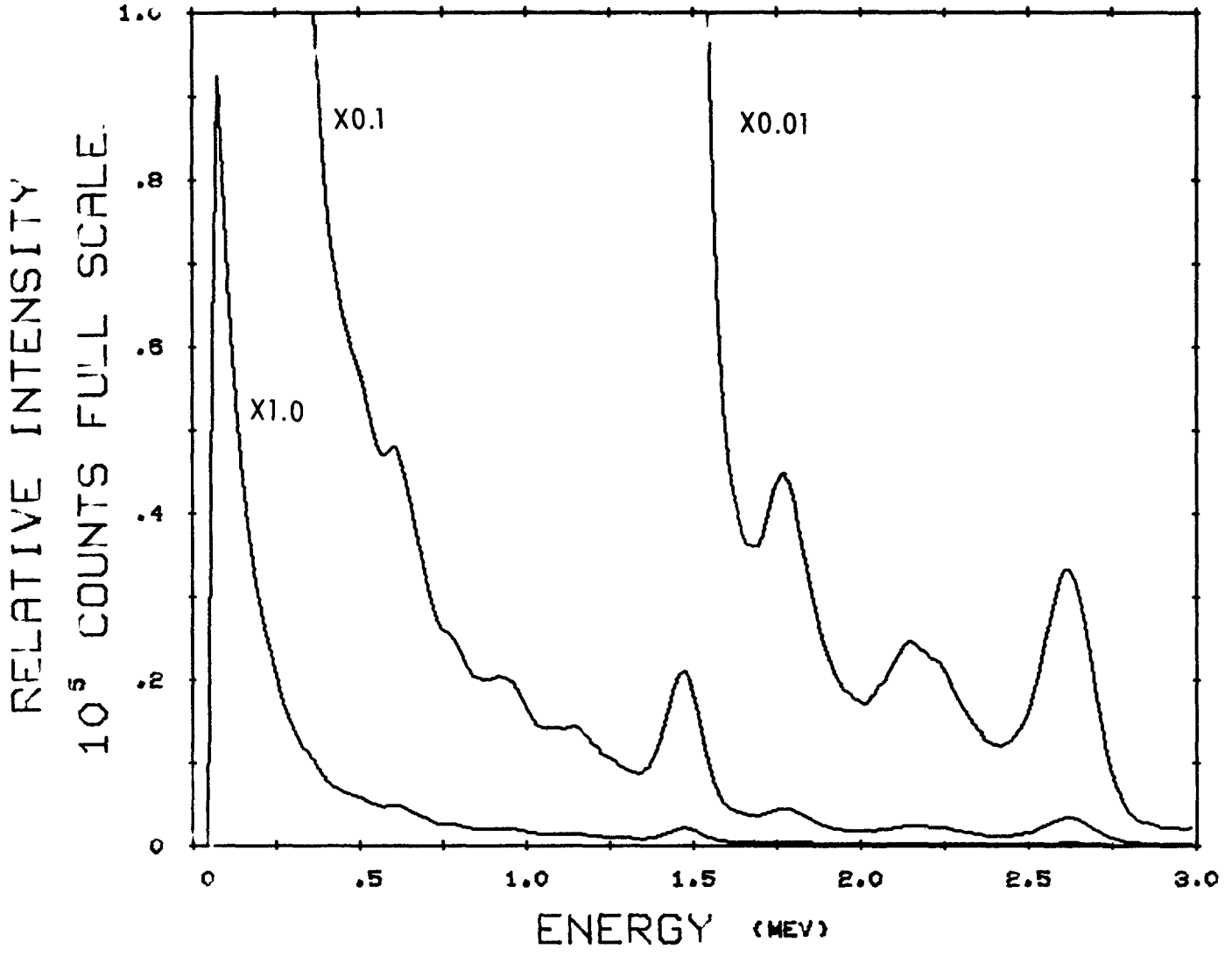
LOCATION: LINE 8 (NORTHERN HALF)

SPECTRUM NO. 238
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 818851
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



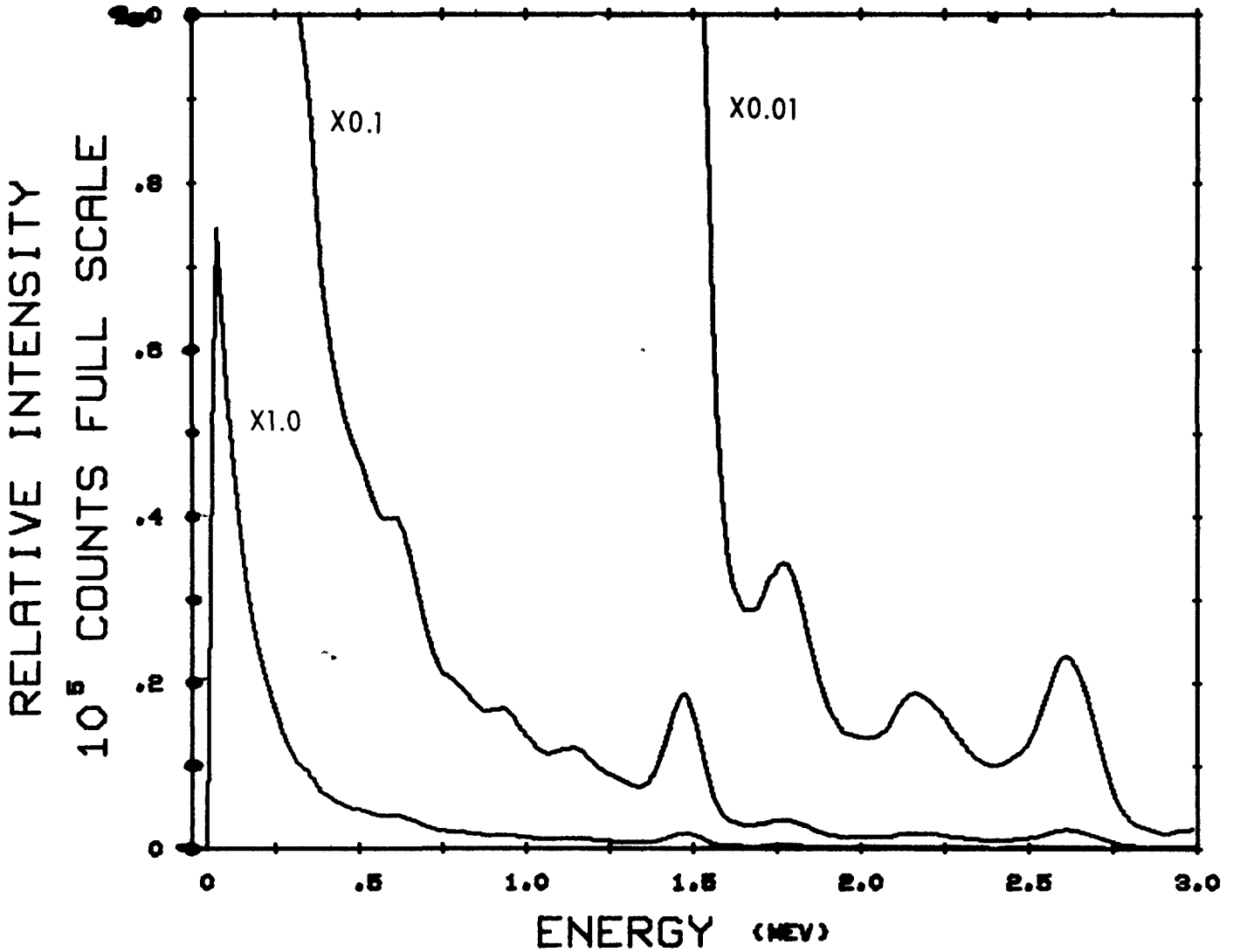
LOCATION: LINE 8 (SOUTHERN HALF)

SPECTRUM NO. 239
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 695444
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



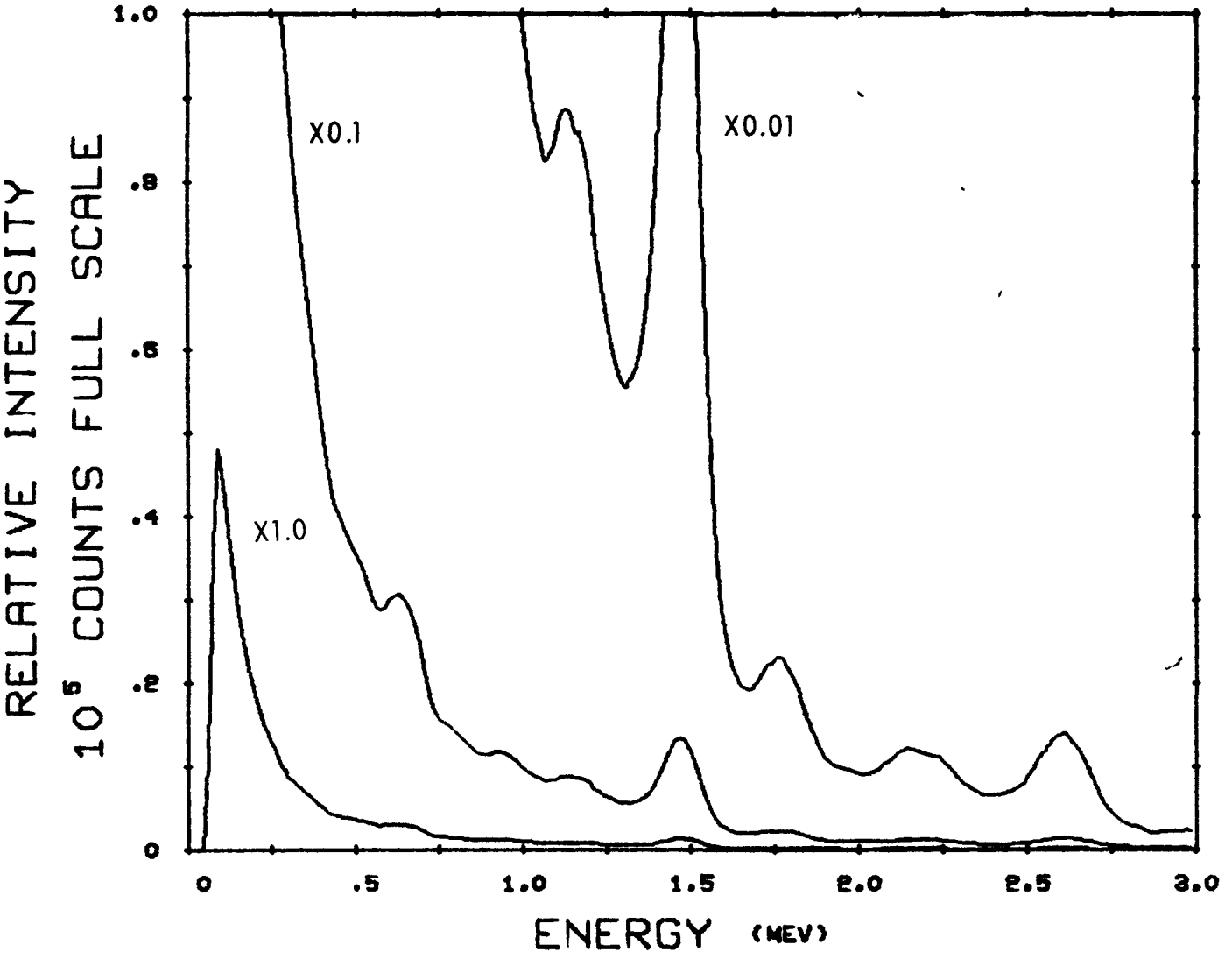
LOCATION: LINE 9 (NORTHERN HALF)

SPECTRUM NO. 222
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 983639
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



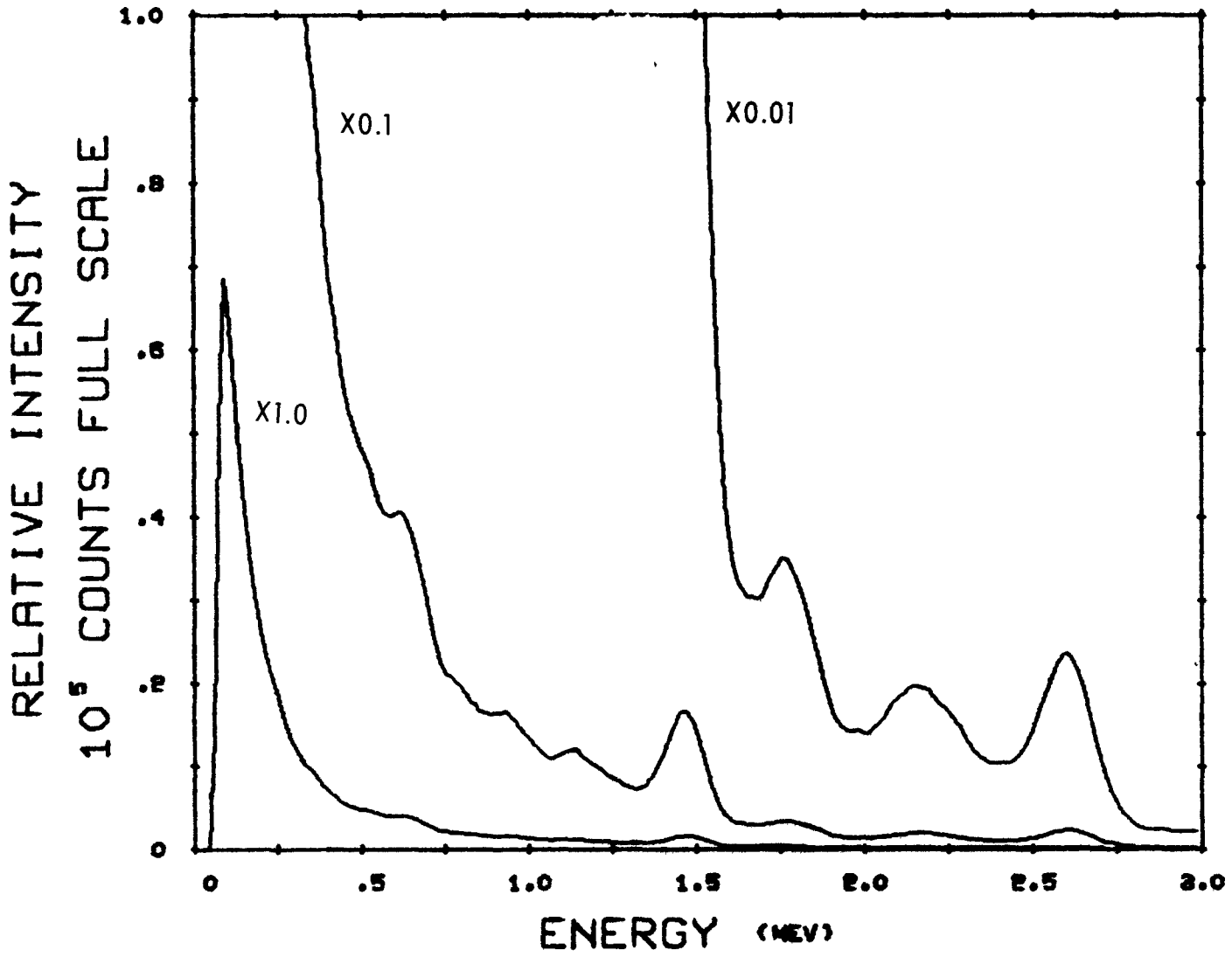
LOCATION: LINE 9 (SOUTHERN HALF)

SPECTRUM NO. 223
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 804854
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



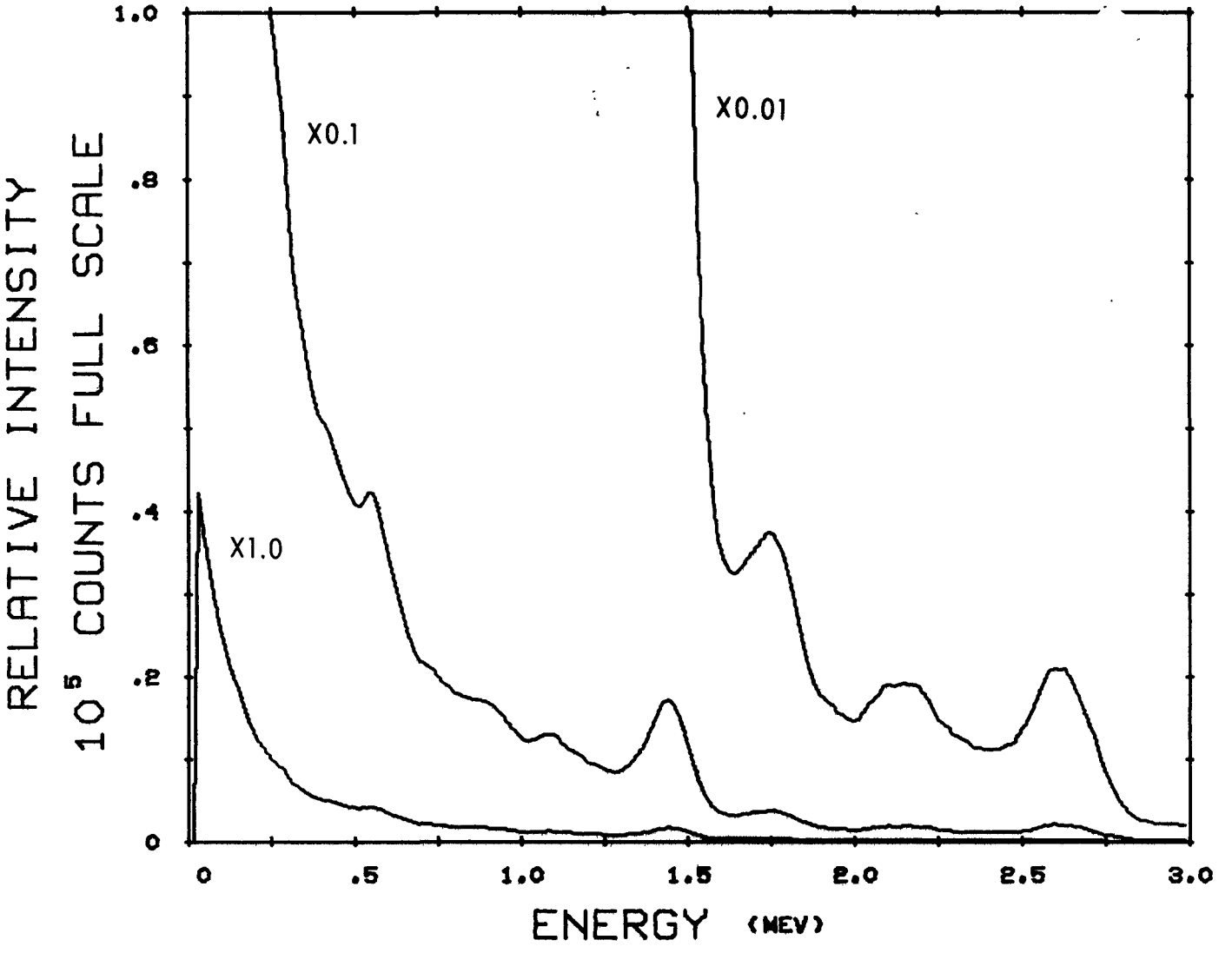
LOCATION: LINE 10 (SOUTHERN HALF)

SPECTRUM NO. 240
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 570164
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



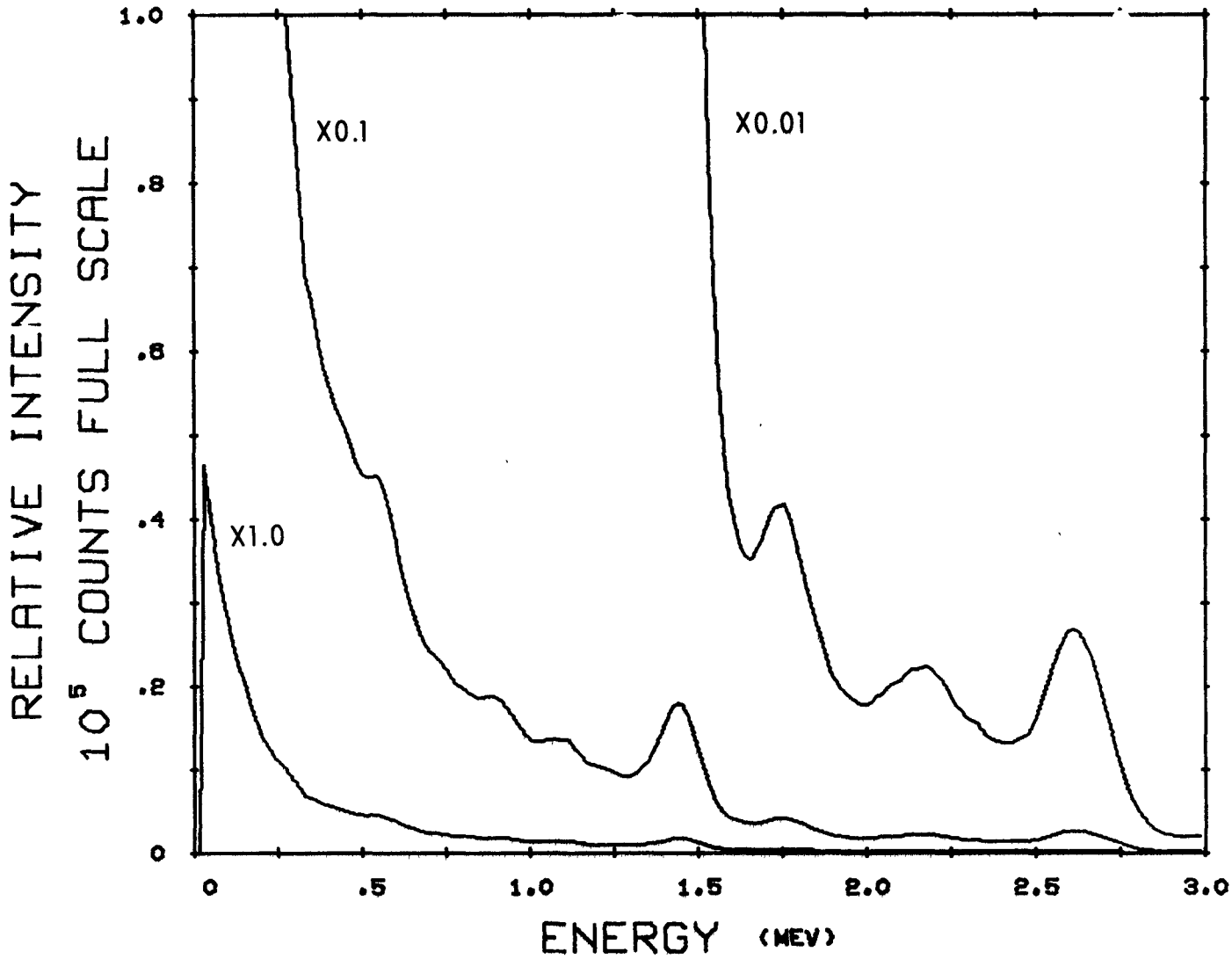
LOCATION: LINE 10 (NORTHERN HALF)

SPECTRUM NO. 241
DATE 09-25-68
LIVE TIME 4.00
INTEGRATED CT. 798513
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



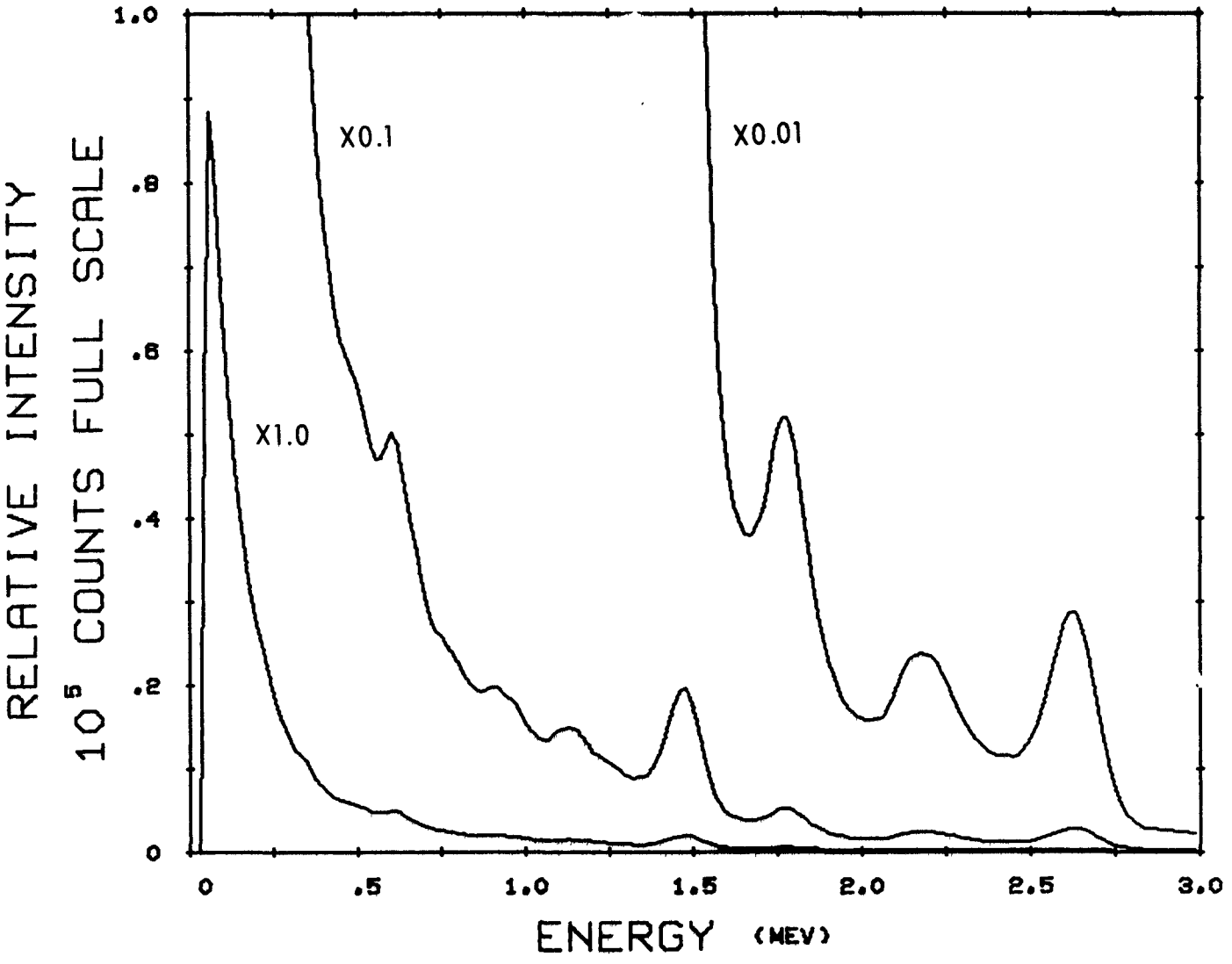
LOCATION: LINE 11 (SOUTHERN HALF)

SPECTRUM NO. 217
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1253699
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



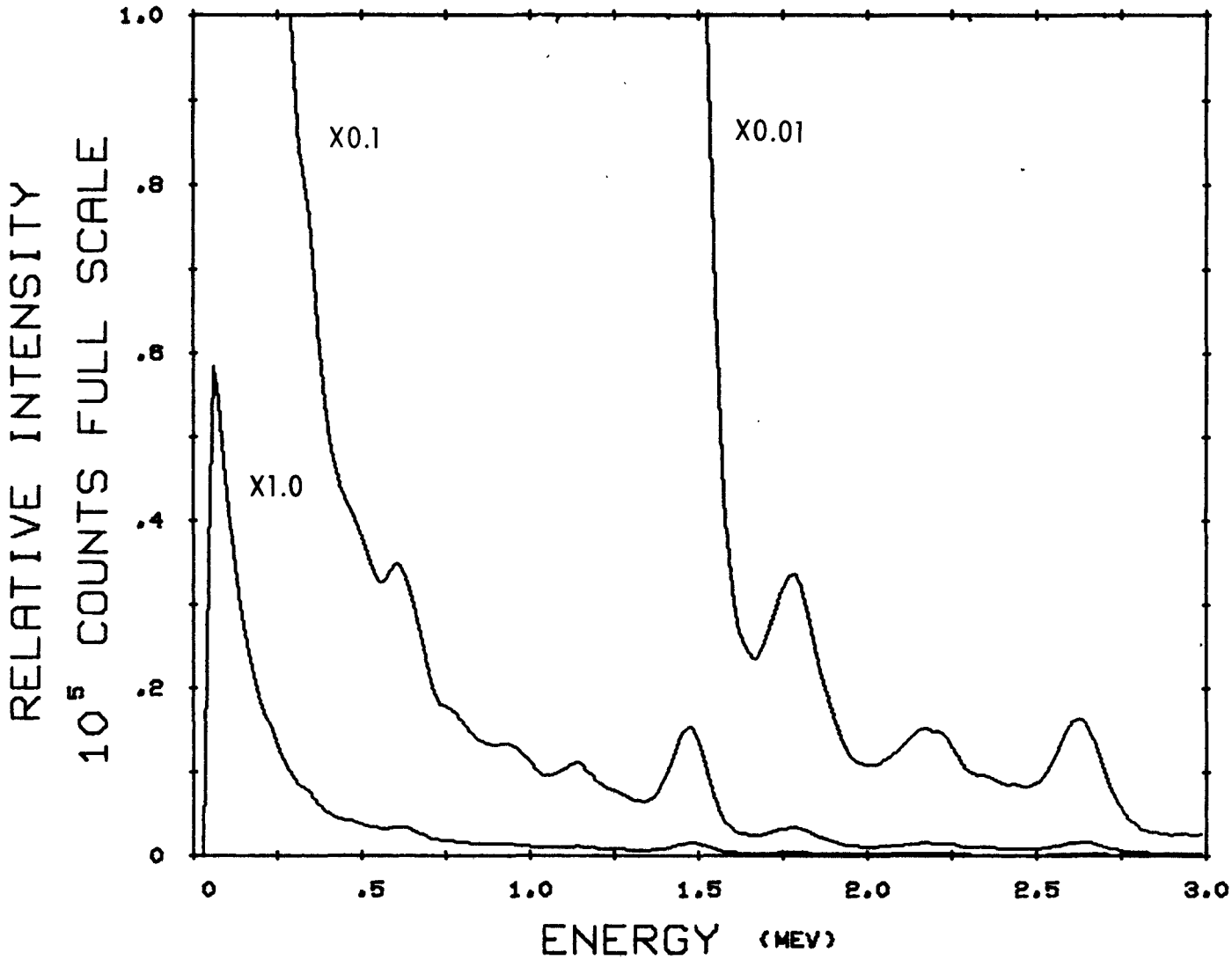
LOCATION: LINE 11 (NORTHERN HALF)

SPECTRUM NO. 218
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1336069
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



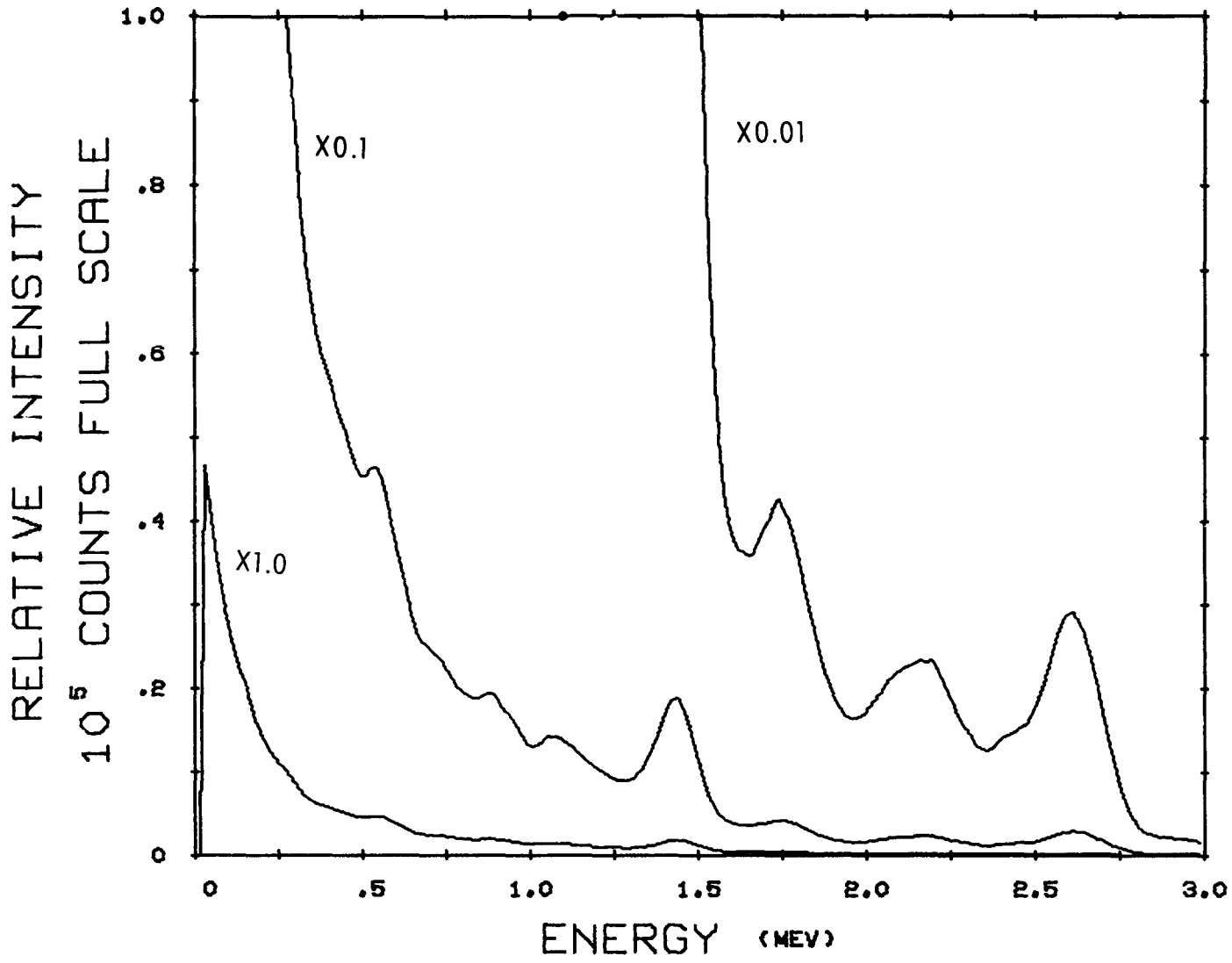
LOCATION: LINE 12 (NORTHERN HALF)

SPECTRUM NO. 244
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 999784
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



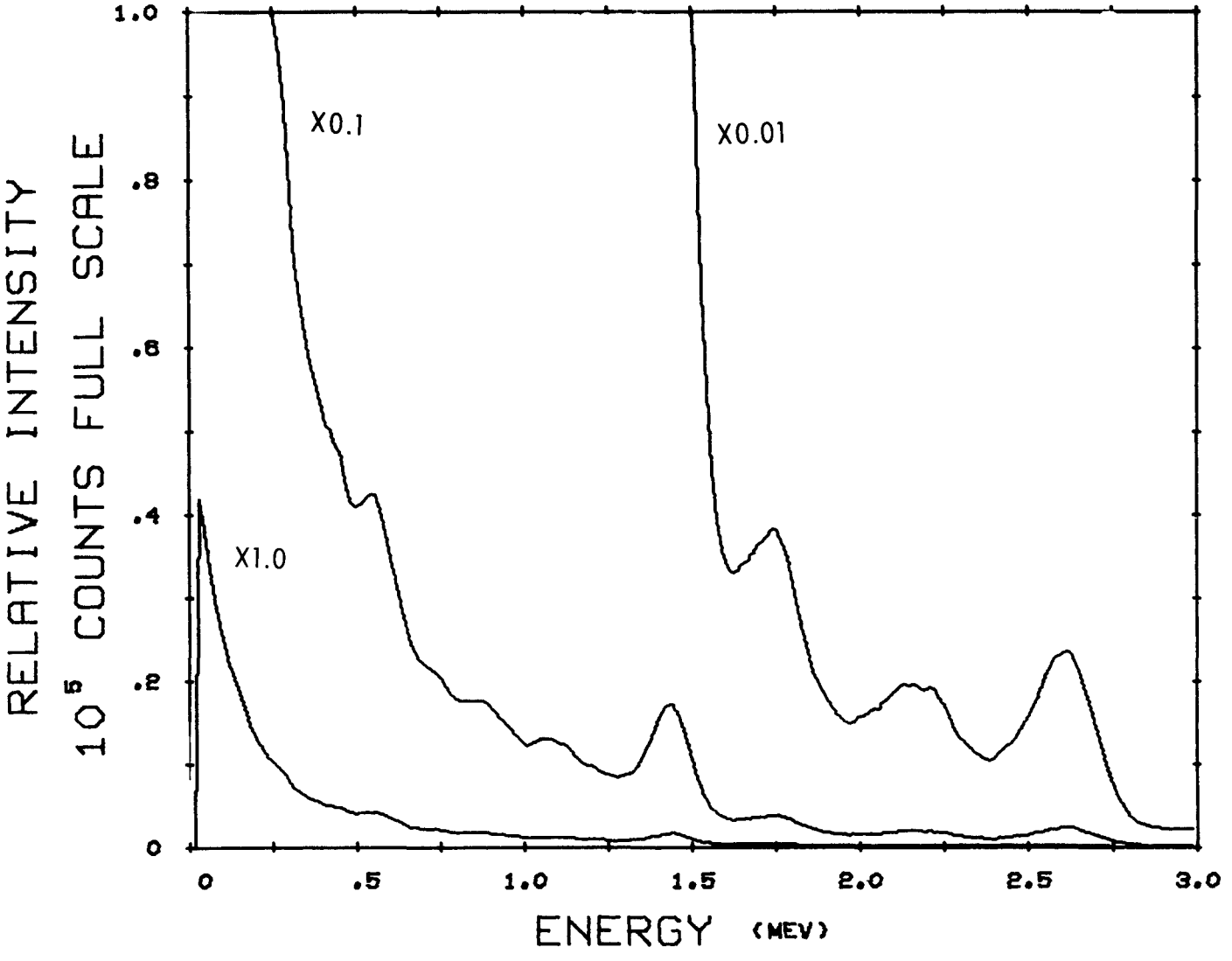
LOCATION: LINE 12 (SOUTHERN HALF)

SPECTRUM NO. 245
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 681393
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



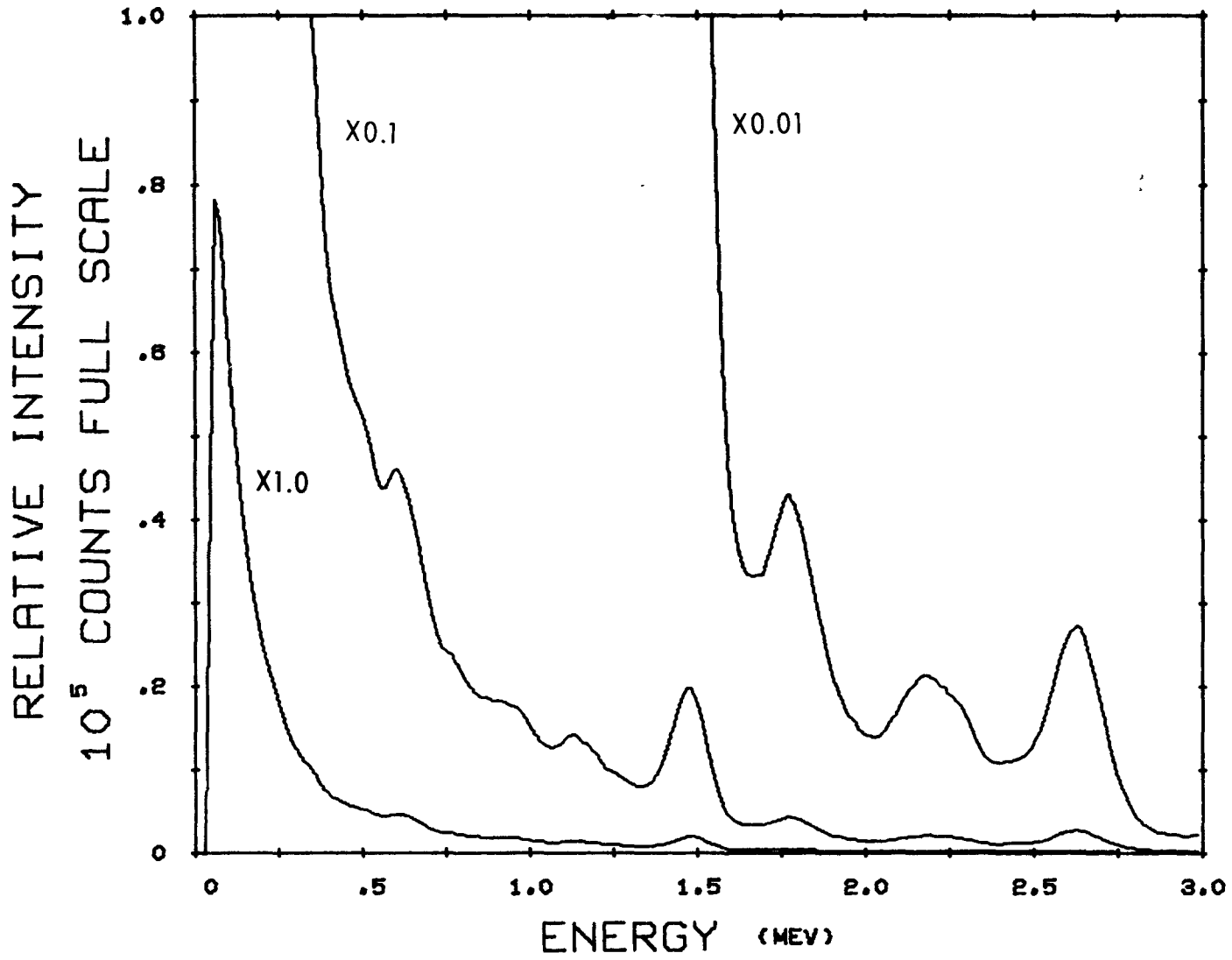
LOCATION: LINE 13 (NORTHERN HALF)

SPECTRUM NO. 215
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1388103
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



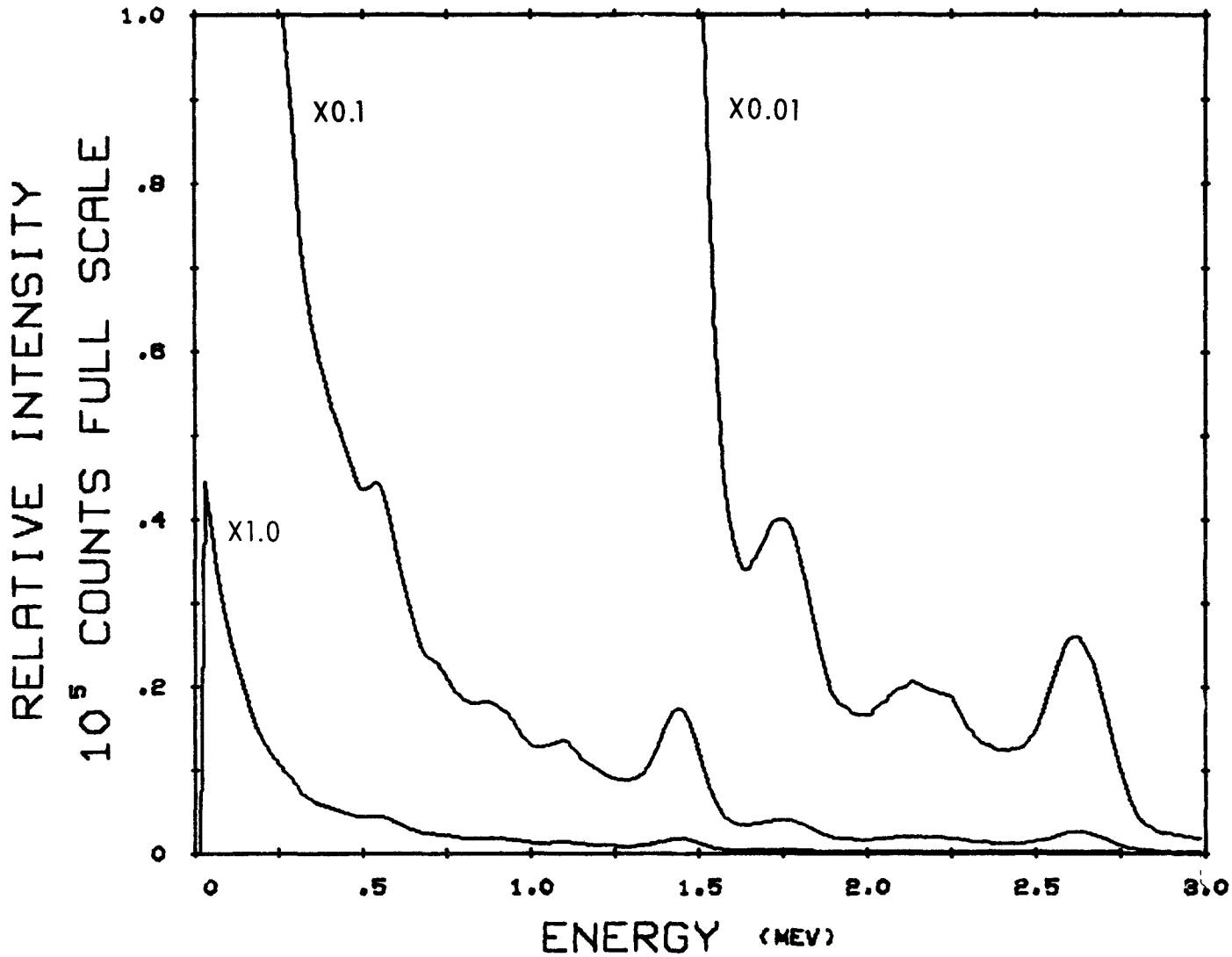
LOCATION: LINE 13 (SOUTHERN HALF)

SPECTRUM NO. 216
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1296229
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



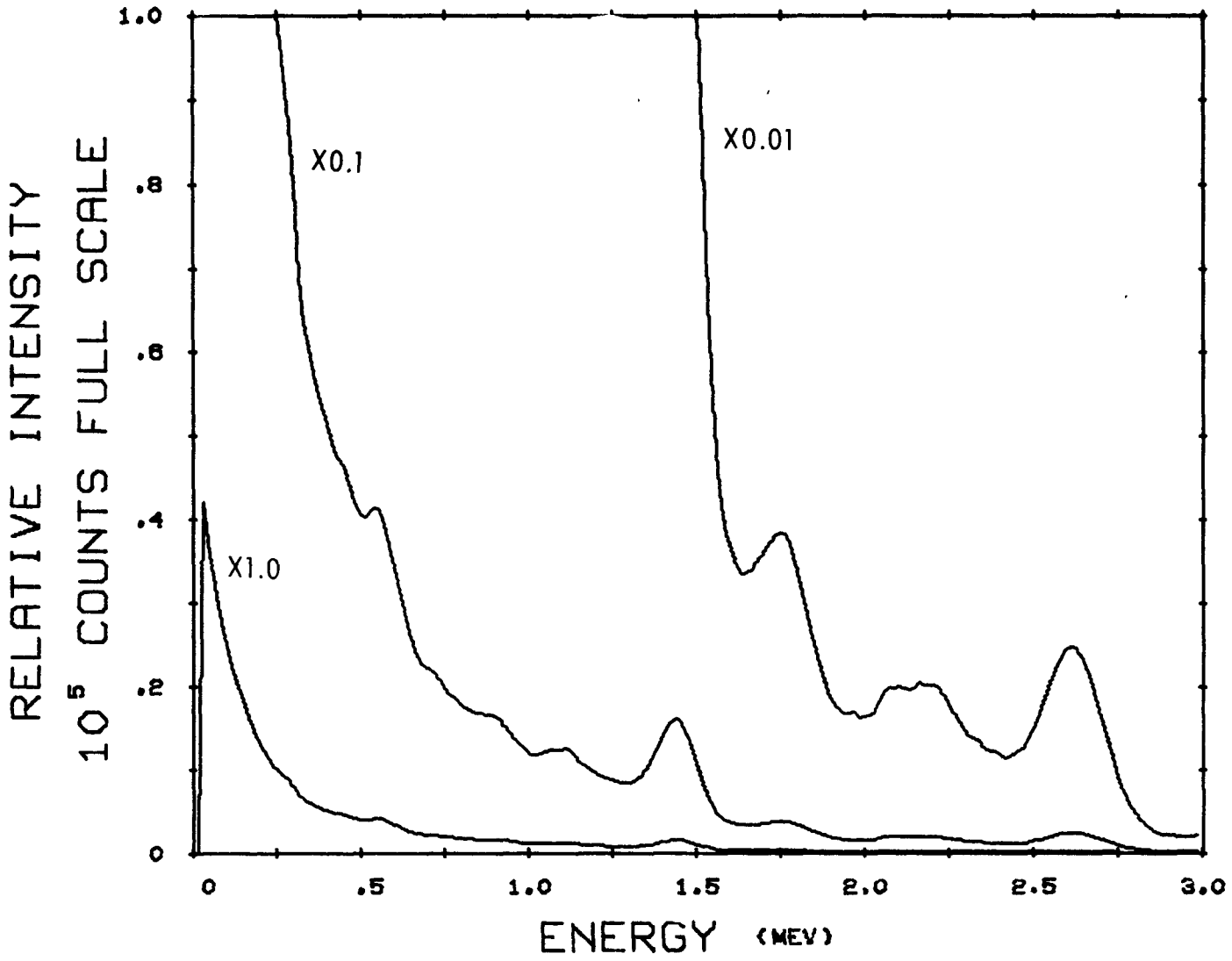
LOCATION: LINE 14 (ENTIRE FLIGHT LINE)

SPECTRUM NO. 246
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 926136
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



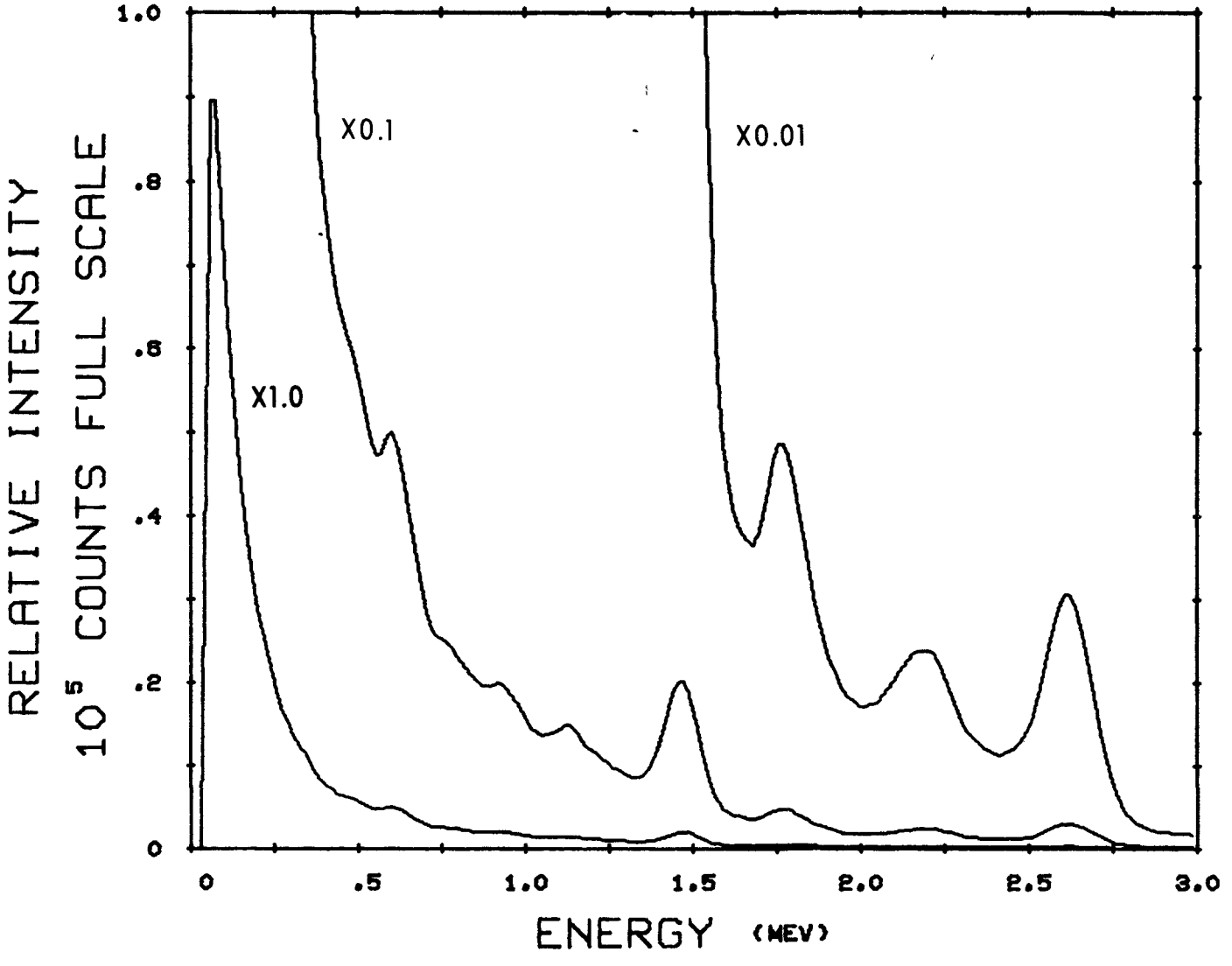
LOCATION: LINE 15 (SOUTHERN HALF)

SPECTRUM NO. 213
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1313068
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



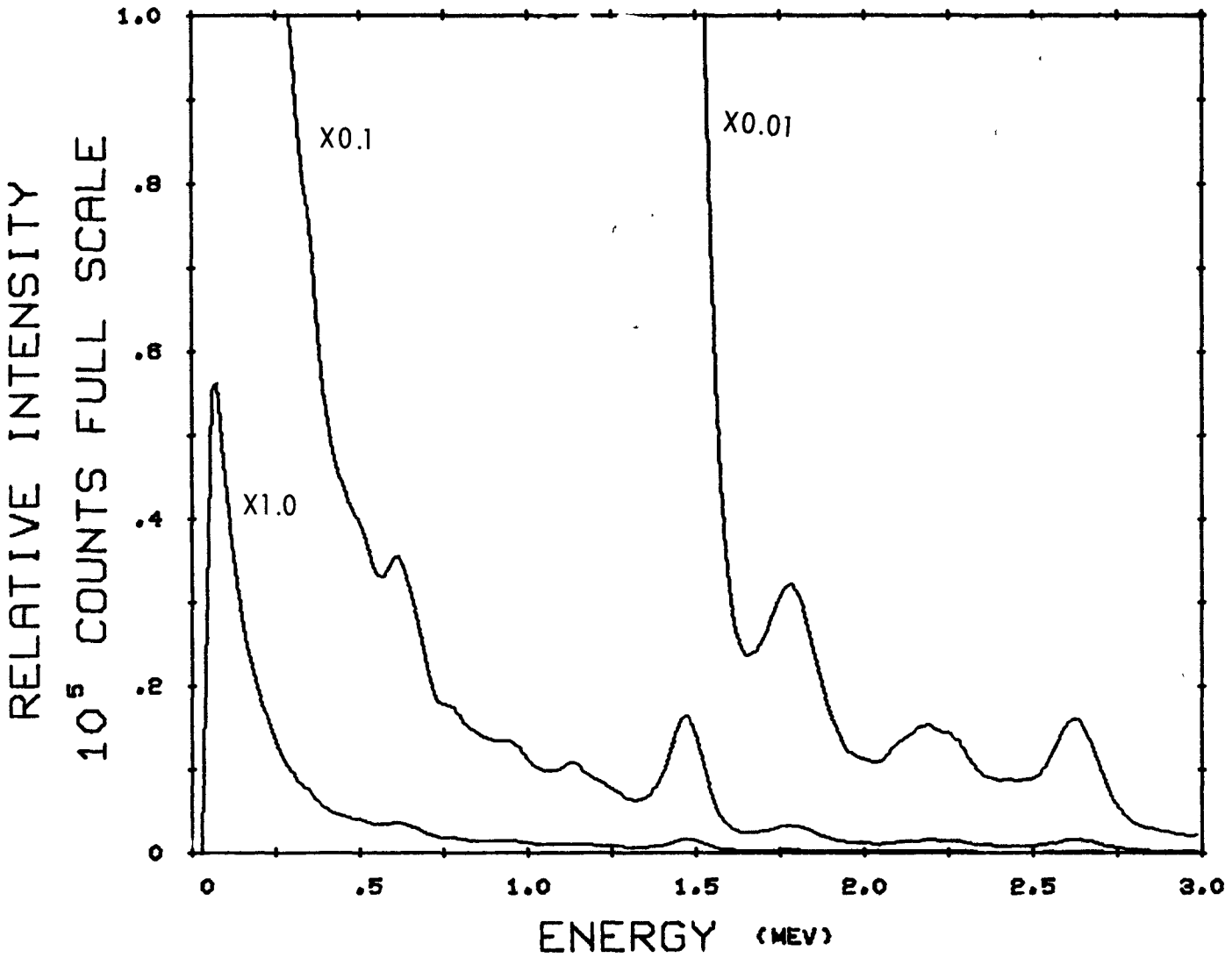
LOCATION: LINE 15 (NORTHERN HALF)

SPECTRUM NO. 214
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1256774
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



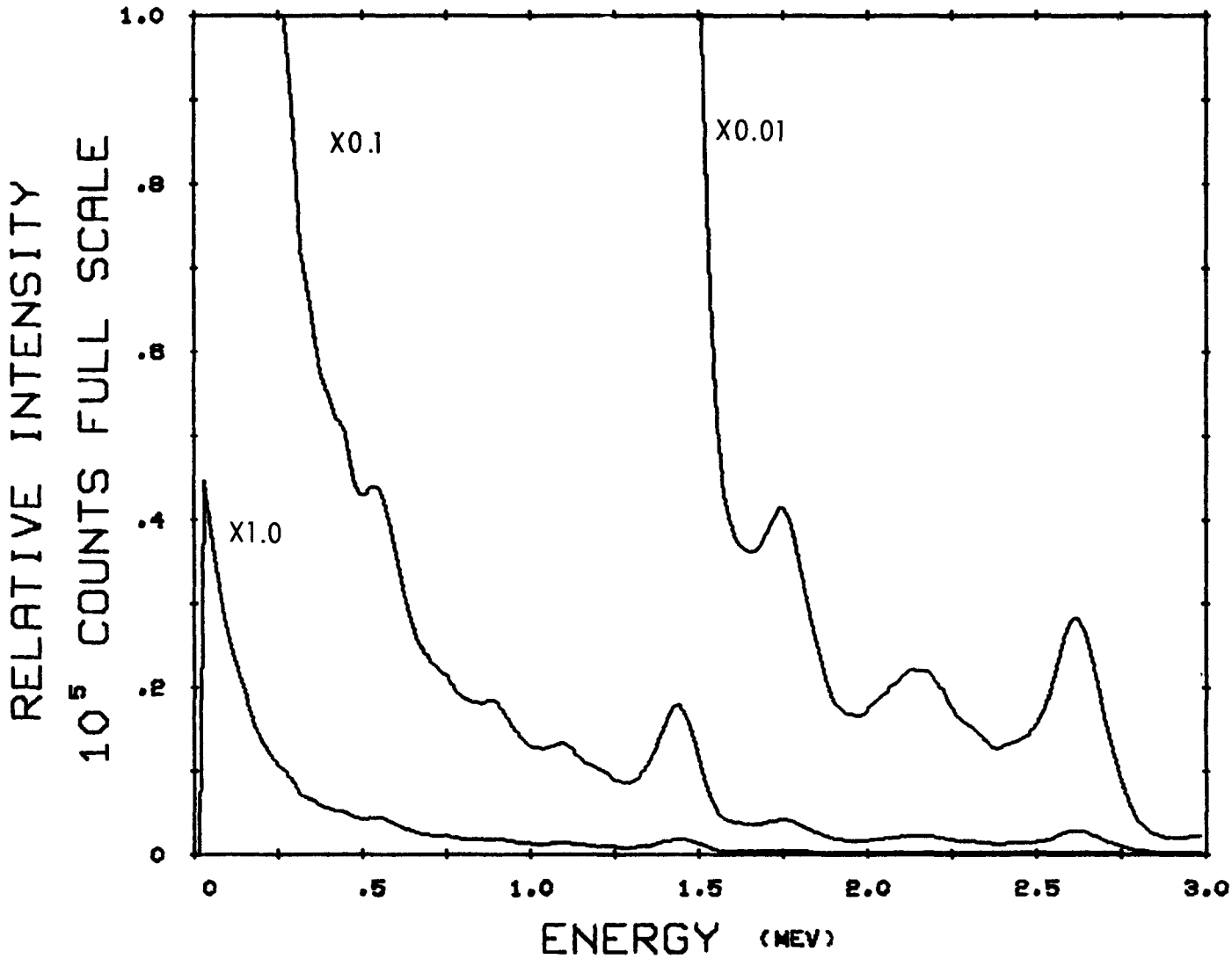
LOCATION: LINE 16 (NORTHERN HALF)

SPECTRUM NO. 247
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 1045547
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



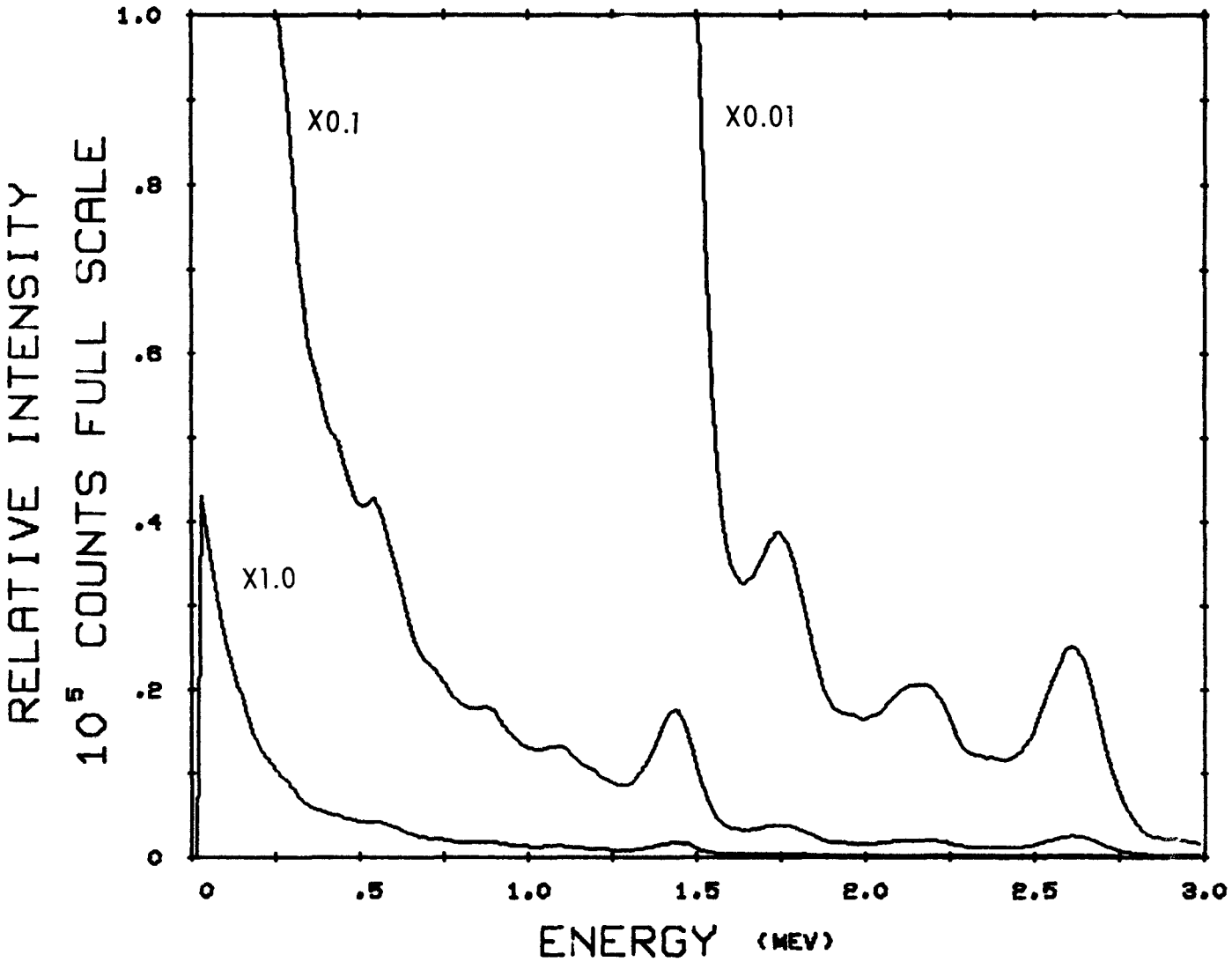
LOCATION: LINE 16 (SOUTHERN HALF)

SPECTRUM NO. 248
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 688335
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



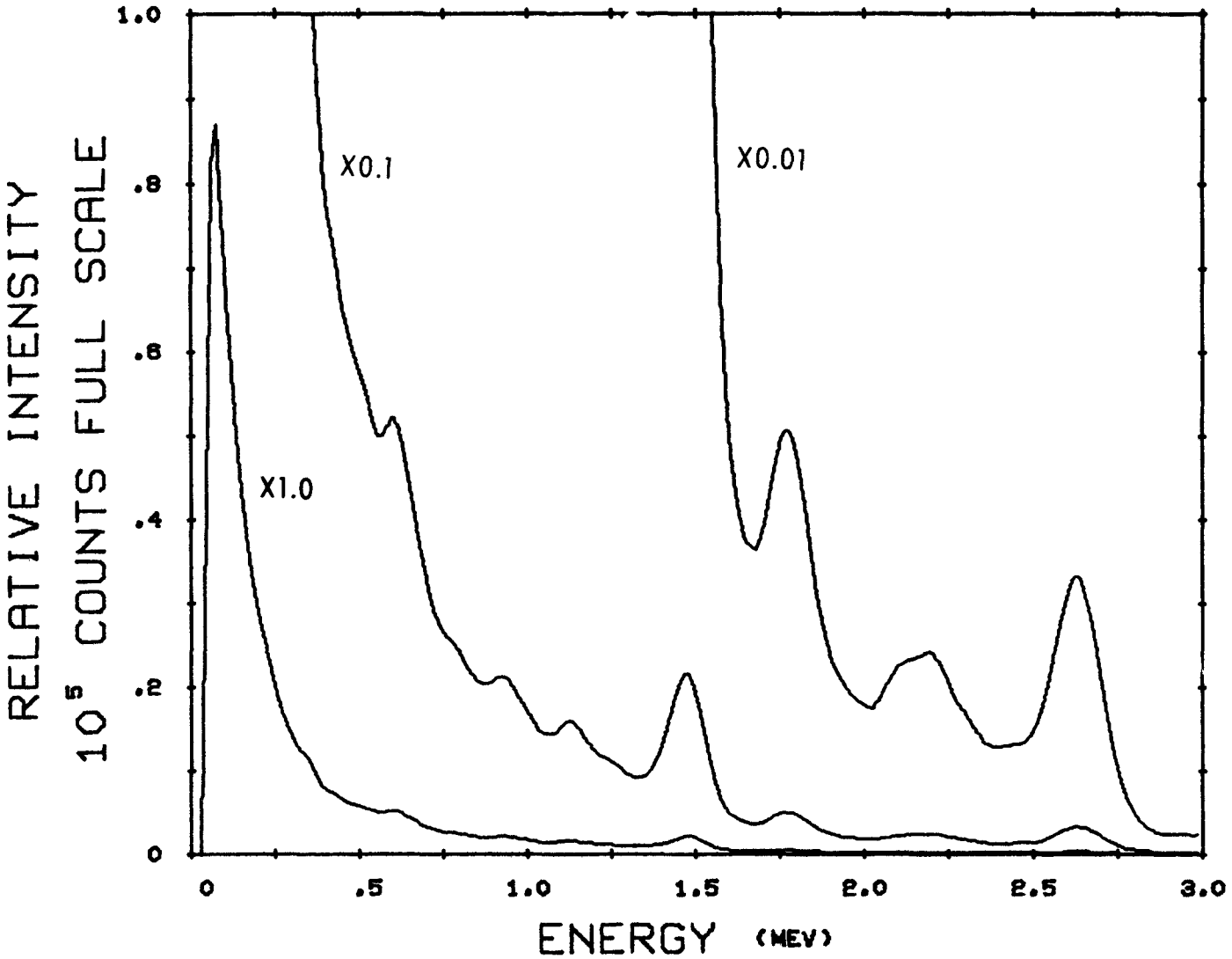
LOCATION: LINE 17 (NORTHERN HALF)

SPECTRUM NO. 211
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1357828
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



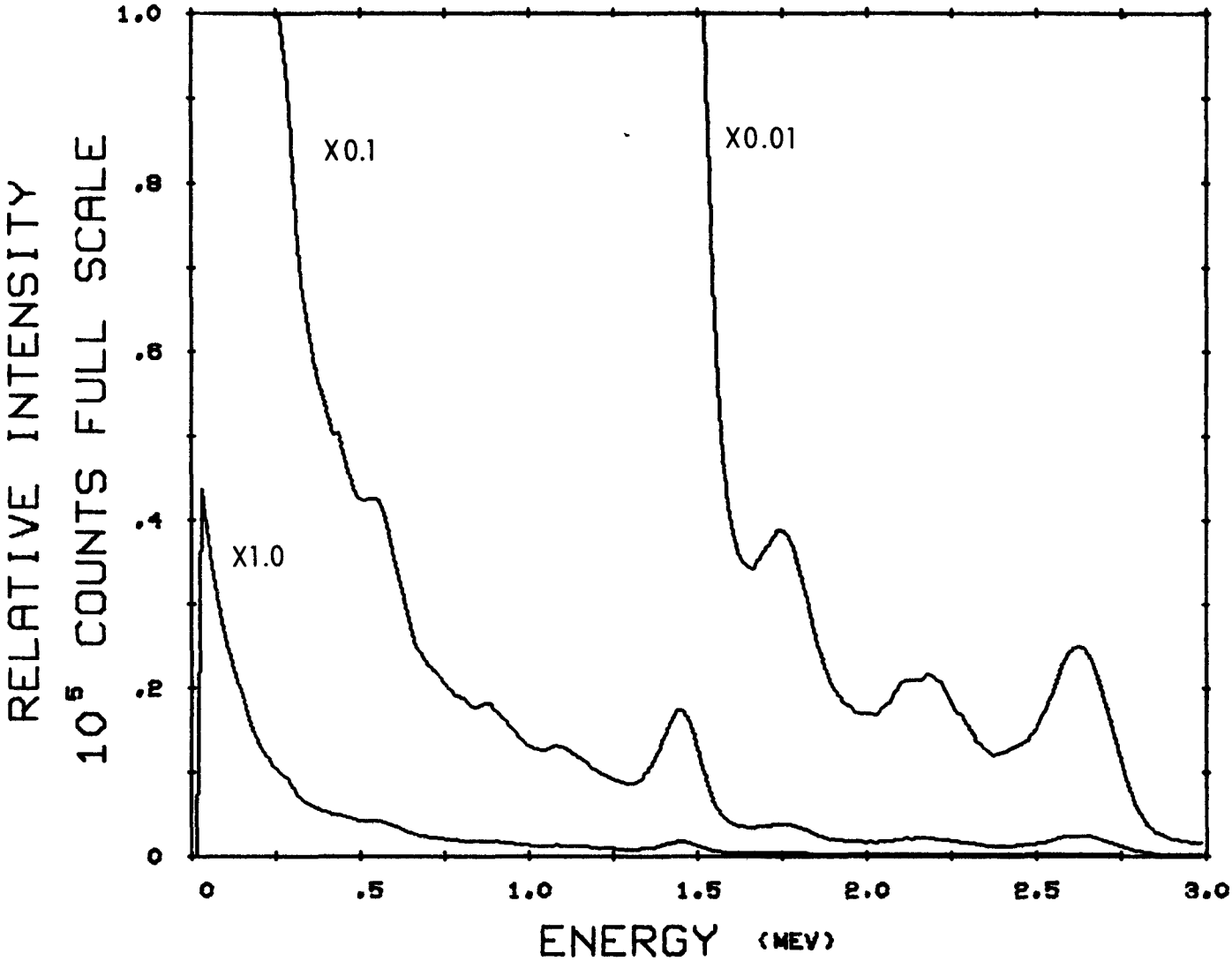
LOCATION: LINE 17 (SOUTHERN HALF)

SPECTRUM NO. 212
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1330077
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



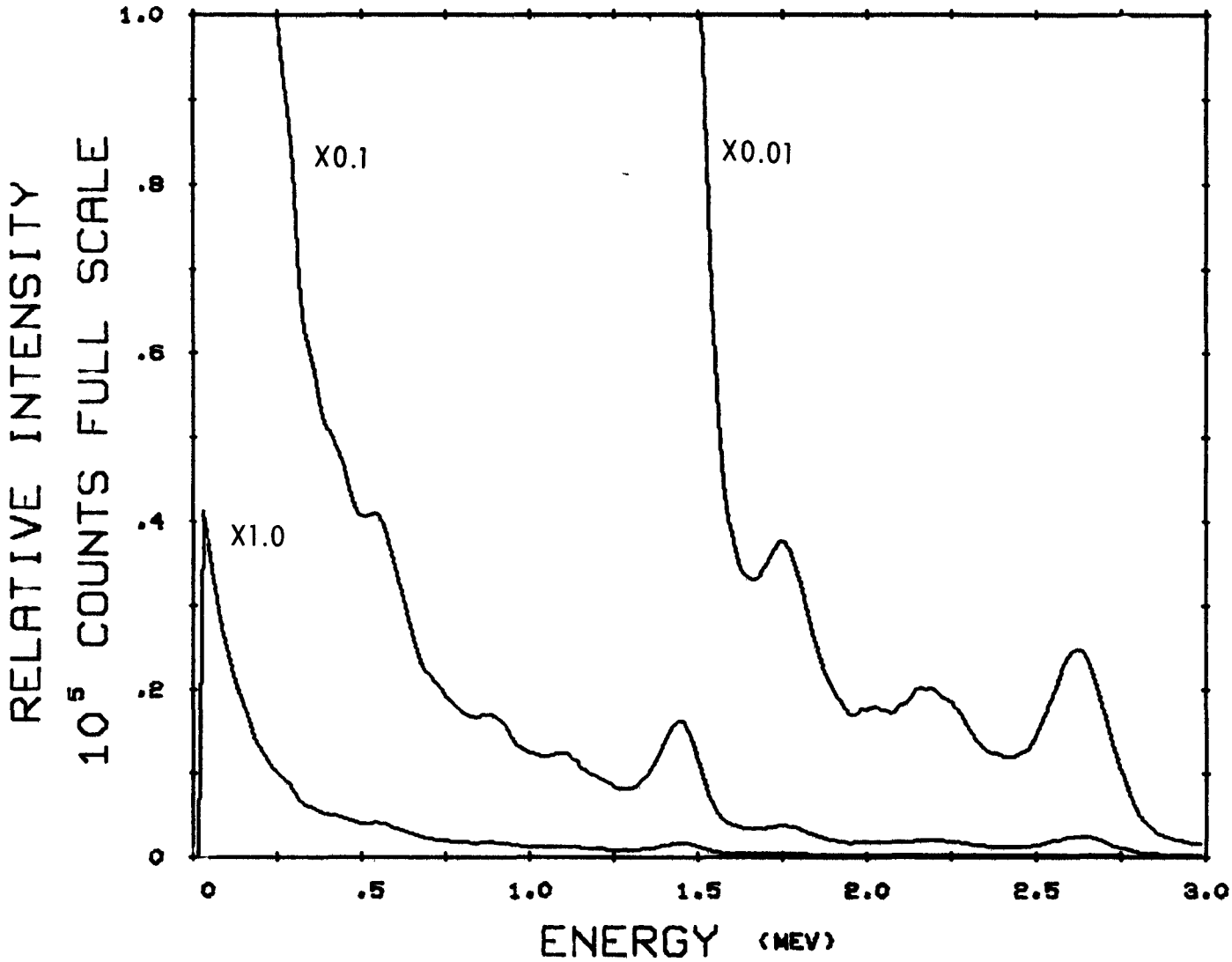
LOCATION: LINE 18 (ENTIRE FLIGHT LINE)

SPECTRUM NO. 249
DATE 09-26-68
LIVE TIME 4.00
INTEGRATED CT. 1040372
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



LOCATION: LINE 19 (SOUTHERN HALF)

SPECTRUM NO. 209
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1312501
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)



LOCATION: LINE 19 (NORTHERN HALF)

SPECTRUM NO. 210
DATE 09-21-68
LIVE TIME 4.00
INTEGRATED CT. 1260050
TYPE ACFT TERRAIN BKG.-GND. DEPO.
ALTITUDE 300
AIRCRAFT (ARMS)