UCRL-ID-126923

Estimation of I^{131} Levels in Milk (Salt Lake City Milkshed): Cabriolet Event Fired in Summer

H. A. Tewes

April 6, 1966

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.

Howard Tewes

22/9

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6 April 1966

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MEMORANDUM

TO: Distribution

FROM: Howard A. Tewes

SUBJECT: Estimation of I^{131} Levels in Milk (Salt Lake City Milkshed): Cabriolet Event Fired in Summer

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The attached graph (Figure 1) was prepared in order to achieve a rough predictive capability for estimating I^{131} in milkshed milk for the case of Cabriolet fired under summer conditions (i.e., all cows grazing). The following inputs and assumptions have been used in the preparation of the figure:

a) I^{131} concentrations measured on Palanquin for single cows were halved to approximate milkshed conditions.

b) I^{131} concentrations resulting from complete rainout of Palanquin and Sedan cloud burdens were assumed to be a factor of ten larger than for the case of dry deposition. This roughly corresponds to complete deposit of the clouds, but without "hot spot" formation. The calculation is roughly confirmed by dry deposition vs. rainout results observed from tower shots.

c) Data from tower shots (both dry deposition and rainout) were obtained from A. Tamplin's memo of March 31, 1966 (COVV-33); however, data from only those clouds having a north-easterly trajectory were included. In order to apply tower shot data to a cratering event, it was conservatively assumed that 20% of the I^{131} produced in a cratering event is present in the cloud, whereas 100% of the I^{131} from a tower shot is in the cloud. Thus, the I^{131} concentrations

Classification (Declassification/Review Date) Changed to:

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(Signature of person verifing this is the correct document or model) given in COVV-33 were divided by five; to convert the deposition per square meter to concentration in milkshed milk, deposition per square meter was divided by the usual factor of six.

Using Figure 1 to predict possible I^{131} concentrations in milk from the Salt Lake City milkshed leads to the results summarized in Table I.

It will be noted that predictions of I^{131} concentrations in milk have been largely based on Palanquin data which has been appropriately scaled, rather than on observations obtained on tower shot fallout. The primary reasons for this choice are:

1) Palanquin is the only cratering event for which several observations of I^{131} concentrations in the milk from grazing cows are available. Thus, despite the atypical venting mechanism of this event, it represents the closest available approximation to Cabriolet.

2) Tower shot fallout data (with the exception of Smallboy) consist exclusively of gross beta activity per unit area; converting these observations to I^{131} levels in milk involves several assumptions, including: no fractionation of fallout, known availability of I^{131} to cows, and normal secretion by cows of I^{131} in milk. Thus, these data are inherently more uncertain than are directly measured concentrations of I^{131} in milk.

In the case of Smallboy I^{131} in milk data, there appears to be some question as to the contribution of the rainout mechanism to the high concentrations observed.

It is interesting to note that Nerva tests run to date have been expelling I^{131} equivalent to that resulting from a few tenths of tons to a few tons of fission. The numbers shown in Table I appear to be consistent with very preliminary observations of I^{131} levels in milk which have resulted from Nerva clouds

HAT:ca

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TABLE I

	Cloud Trajectory	Venting Mode	Meteorology[1]	I^{131} in Milkshed Milk[2] (pCi/l)	Comments
1.[3]	Not over milkshed	--	---	Background (10-20)	[illegible]
2.[3]	Partially over milkshed	Normal Cratering	Dry - Normal	6 - 24[5]	(6)
3.[3]	Over milkshed	"	Dry - Normal	30 - 300	(7, [illegible])
4.[3]	Over milkshed	"	Scattered showers - Normal	150 - 1000	(5, [illegible])
5.[3]	Over milkshed	"	Widespread rain - normal	300 - 2000	(10)
6.	Over milkshed	"	Rain - abnormal	1000 - 6000	(11)
7.	Over milkshed	Stemming failure	Dry - normal	100 - 600	(12)
8.	Over milkshed	"	Scattered showers - normal	500 - 3000	(8)
9.[3]	Over milkshed	"	Widespread rain - normal	1000 - 6000	(10,13)
10.	Over milkshed	"	Rain - abnormal	3000 - 20000	(11)

(1) Normal meteorology is defined as those meteorological conditions which lead to normal diffusion of the vented radioactivity. An abnormal condition is one in which the diffusion rate is unusually small, leading to conditions favorable for "hot spot" formation.

(2) Travel time of the cloud to the Salt Lake City milkshed area has been assumed to be 18-24 hours. I^{131} concentrations in milk at H+18 hrs. have been taken, and appropriate ranges of values assumed. Note: Present standards assume 4,200 pCi/l of I^{131} in milk will deliver 0.5 rad to a 2 gram infant thyroid.

(Table I continued)

(3) These values were quoted to Mr. John Kelly in the telephone conversation of April 5, 1966.

(4) Although it is possible that the Cabriolet cloud will miss the Salt Lake City milkshed area, desirable firing conditions for Summer indicate a 70 - 80% probability that the cloud will pass over the area in question.

(5) Above background.

(6) Scaled directly from Sedan observations (See UCRL-7716). Presumably, the Sedan cloud did not pass directly over Salt Lake City milkshed area.

(7) For the normal cratering cases, Palanquin observations have been divided by a factor of three.

(8) Scattered showers have been assumed to scavange only half of the I^{131} from the cloud; hence, the milk concentration is only five times the dry deposition value.

(9) Expected values.

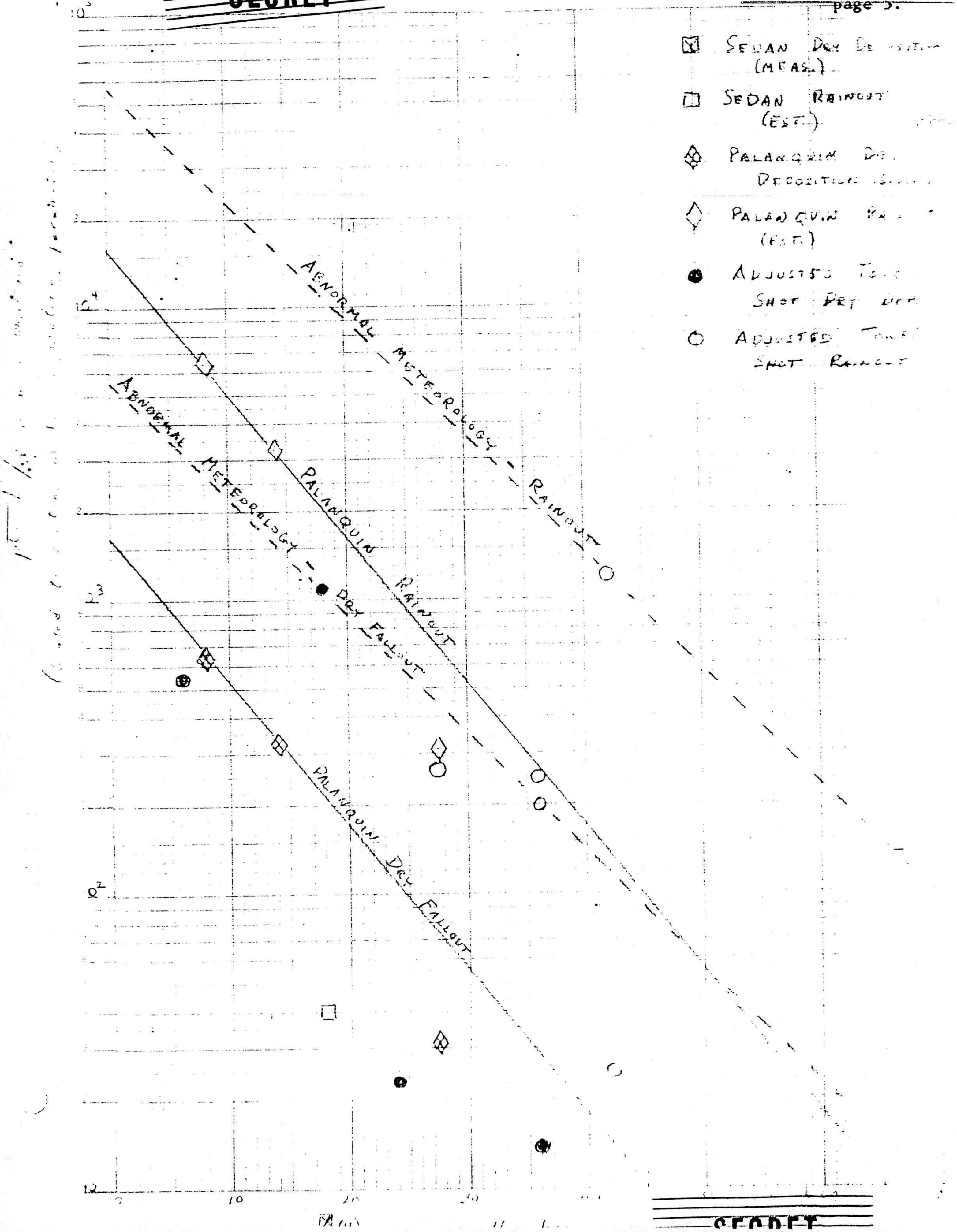
(10) Complete rainout of the I^{131} leads to the number quoted here.

(11) Abnormal rainout conditions (as observed in the case of Diablo) are assumed to lead to "hot spots" which are roughly a factor of three higher than is the case for normal rainout.

(12) For the stemming failure cases, Palanquin observations have been scaled directly.

(13) Maximum credible values.

FIGURE 1


SEDAN DRY DEPOSITION (MEAS.)
SEDAN RAINOUT (EST.)
PALANQUIN DRY DEPOSITION
PALANQUIN RAINOUT (EST.)
ABNORMAL METEOROLOGY - RAINOUT
PALANQUIN RAINOUT
ABNORMAL METEOROLOGY - DRY FALLOUT
PALANQUIN DRY FALLOUT
10