Extension of UCRL-50936 (13 Case Studies) as Requested by PNE, USAEC

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MEMORANDUM

TO: Distribution

FROM: Kendall R. Peterson

SUBJECT: Extension of UCRL-50936 (13 Case Studies) as Requested by PNE, USAEC.

Kra Canal Project

DECLASSIFICATION
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An attachment contains a reassessment of the Kra Canal Project as prepared by K-Division in December 1972. (This report is included with only Dr. Fleming's copy of this memorandum.)

This latest assessment differs from the original study in UCRL-50936 in that:

1. Thirty-four salvos with a total yield of about 170 MT were assumed.
2. "Acceptable" firing days were selected from actual meteorological data when the winds at all levels up to the expected debris cloud top blew toward the west, ± 30 degrees.
3. The lead in the devices was assumed to be from monazite sand.

The doses are considerably less than those estimated in UCRL-50936. The reasons for this are:

1. A longer trajectory to Sumatra was assumed such that the debris clouds travelled 1600 Km before crossing the west coast of Sumatra.
 2. Residents of the Nicobar Islands and Sumatra to our knowledge do not consume milk; hence the forage-cow-milk pathway is not included.
 3. The use of lead from monazite sands reduced the total dose.
- [REDACTED] [REDACTED]

4. Some of the latest dose conversion constants used are smaller than those in UCRL-50936.
5. The effects of precipitation scavenging were based on an improved assessment.

Advantage of Lead From Monazite Sand

The dose reduction from using lead from monazite sand in device construction was examined for both the Kra Canal and Central American Canal projects. The use of regular lead increases doses from Pb-203, Hg-203, and Tl-202 by factors of 23, 5.9, and 71 respectively. As mentioned, the latest assessment of the Kra Canal assumes that monazite lead is used. The total dry deposition doses (in rem) from using standard lead are shown in Table 1. The numbers in parenthesis indicate the magnitude of the fractional increases.

Table 1. Total doses (rem) from nuclear construction of a sea level Kra Canal when standard lead is used in device construction. Values in parentheses are the fractional increases in dose compared to doses from lead from monazite sand.

<u>Pathway</u>	<u>Nicobar Islands</u>	<u>Sumatra</u>
External Gamma	0.017 (6.3)	0.0010 (6.3)
Inhalation	0.0087 (3.6)	0.00051 (3.6)
Pasture-Meat	(no cattle industry)	0.096 (1.0)
Seafood	0.00056 (2.8)	0.000031 (2.6)
Total dose (standard lead)	0.026	0.098
(monazite lead)	0.0053	0.096

The external gamma dose at the Nicobar Islands should include an additional 0.07 rem contributed by fallout of gravitationally settling particles.

Table 1 shows that a substantial dose decrease from monazite lead is possible at the Nicobar Islands, but not at Sumatra. This is because the former has no dose from the Pasture-Meat pathway, while in Sumatra the dose from tritium via this pathway is the primary contributor to the total dose, thereby negating the effect of lead from monazite sand.

Wet deposition in Sumatra would give a somewhat better comparison since tritium is scavenged by rainfall at a slower rate than lead. However, for 34 salvos rainout would occur in, at most, only one-third of the cases.

The second case examined from this viewpoint was the Central American Canal, assuming as in UCRL-50936, a single salvo of ten 650 Kt devices. In this application the forage-cow-milk and pasture-meat pathways must be considered in western Colombia. The soil-root and seafood pathways have been ignored since their contribution to total dose is relatively minor. It has been assumed as in UCRL-50936, that the lower half of the base surge cloud enters Colombia at 500 Km downwind. Wet deposition processes are also assumed. The latest dose conversion constants have been employed; also the tritium dose is reduced by using the improved rainout calculational technique developed by Dickerson and Crawford of LLL (UCRL-51283, in press).

Table 2 shows a comparison of doses using devices with and without lead from monazite sand.

Table 2. Total dose (rem) from nuclear construction of a Central American Canal using standard lead. Values in parentheses are fractional increases in dose compared to using lead from monazite sand.

<u>Pathway</u>	<u>Colombia (Northwest Coast)</u>
External Gamma	0.017 (7.1)
Forage-Cow-Milk	0.035 (1.1)
Pasture-Meat	0.0058 (1.6)
Total dose (standard lead)	0.058
(monazite lead)	0.038

For this case, the dose reduction using lead from monazite sand is approximately two-thirds. The contribution of I-131 and I-133 via the forage-cow-milk pathway is dominant and tends to reduce the effect of employing special lead.

From these two cases, it appears that the advantage of using lead from monazite sand depends upon the specific PNE application and the pathways that must be considered. If the forage-cow-milk pathway does not

exist at and beyond the entrance border, the effect of using special lead is significant for both dry and wet deposition. Exclusion of the pasture-meat pathway for an application that assumes dry deposition at the entrance border also markedly reduces the dose from devices using lead from monazite sand.

Possible Plowshare Applications Applying 10% ICRP at Entrance Borders.

The procedure used to prepare the UCRL-50936 global maps was reviewed; dose conversion constants were updated, an improved method of calculating wet deposition tritium doses was employed, and the Pasture-Meat pathway was substituted for the Soil-Root path. These changes were largely self-cancelling with the result that, within the limits of the assumptions and calculations, the 2% and 100% ICRP maps prepared for UCRL-50936 are still valid for climatological assessments. It turns out that 10% ICRP is approximately half way between the 2% and 100%. Table 3 shows cloud travel times for 10% ICRP. On this basis, new 10% ICRP global maps were prepared and are shown in Figure 1-7. The same precautions set forth in UCRL-50936 are applicable to these maps also. These are based on average wind directions and speeds, all pathways of dose-to-man are considered, and standard lead was assumed in device construction. Feasibility studies for specific applications would make many "excluded zones" possible under a 10% ICRP criterion.

Table 3. Minimum cloud-travel times (hours) to entrance border for detonation of five 170-kt explosives.

Percent of ICRP	Base Surge deposition		Main Cloud deposition	
	<u>Dry</u>	<u>Wet</u>	<u>Dry</u>	<u>Wet</u>
10	5	24	8	36

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Figure 1. Various possible Plowshare applications, North America, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 2. Various possible Plowshare applications, Middle America, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 3. Various possible Plowshare applications, South America, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 4. Various possible Plowshare applications, Europe, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 5. Various possible Plowshare applications, Africa, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 6. Various possible Plowshare applications, Northern Asia and the Middle East, as a result of applying 10% ICRP (the white areas) at entrance borders.

Figure 7. Various possible Plowshare applications, Far East, as a result of applying 10% ICRP (the white areas) at entrance borders.