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HW-18409

1-31-86 RLO-CG-3-REV1

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March 14, 1986  
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DE86 008452

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July 25, 1950

FEASIBILITY OF REDUCTION OF COOLING TIME -  
SEPARATIONS PROCESS

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Upon short notice, the writer has recently offered some comparatively off-the-cuff opinions on the feasibility of operation at reduced cooling time. To avoid future misinterpretation, the limited bases for these opinions is documented.

Opinion 1

The current cooling time of about 90 days, with scrubber removal of <sup>131</sup>I, the dissolver off-gas is proper.

Basis:

- A. The significant hazard is the ingestion by animals of <sup>131</sup>I deposited on vegetation.
- B. In general, the belt Benton City - Richland - Kennewick - Pasco is a representative area of maximum contamination outside the reservation.
- C. The permissible contamination is  $\sim 10 \mu\text{Ci } ^{131}\text{I/gm}$  of vegetation. This is the value which will cause thyroid irradiation in the average case of about 300 mrep per week. A primary function of the Experimental Animal Farm is to determine whether this value is realistic. The writer

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suspects that it is unduly conservative, but sees no justification for causing it to be exceeded over an extended period of time. Experimental results will not be available for several years, except in the remote contingency that this limit is rapidly shown to be damaging.

- D. Over the past 18 months, the average contamination in the reference belt has been about 2-3  $\mu\text{pc}/\text{gm}$ . The value is uncertain because it is at the limit of resolution of present sampling methods.
- E. Individual samples at certain times show about 5 times the above activity density.

#### Opinion 2

Temporary reduction of cooling time to 75 days for a few months is permissible, especially in the summer months.

##### Basis:

- A. The emitted activity would increase by a factor of 4.
- B. The average activity density would become 8-12  $\mu\text{pc}/\text{gm}$ .
- C. Individual readings could be 5 times higher.
- D. On the average, the long-term permissible concentration would hardly be exceeded. Actual tests at the new level would demonstrate adequacy of control or otherwise, and correction would be simple.
- E. In the summer and early fall, the deposition in this belt is lower than the annual average.
- F. The summer is not a normal reproduction time for the important animals (for example- sheep), and damage to young stock will be avoided.

#### Opinion 3

As far as people outside the reservation is concerned, the cooling time could be reduced to about 10 days.

##### Basis:

- A. The significant exposure to humans will be either by inhalation or by direct radiation from contaminated ground.
- B. The permissible atmospheric contamination by  $\text{I}^{131}$  is  $10^{-9}$   $\mu\text{c}/\text{cc}$ .
- C. The current average contamination in the reference belt is  $\sim 10^{-13}$   $\mu\text{c}/\text{cc}$ . This would increase by a factor of 1000 to  $10^{-10}$   $\mu\text{c}/\text{cc}$ .

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- D. The ground contamination would go to  $\sim 3$   $\mu\text{pc}/\text{gm}$ . With a standard load of 2 kg vegetation/sq.meter, this would give  $\sim 7$  mr/week external irradiation.
- E. The  $\text{Xe}^{133}$  concentration would have to be considered - present data are not sound enough to exclude this categorically. There is an apparent safety margin greater than 100.
- F. Within the plant areas, very serious but perhaps not insuperable, protection problems would arise.

Note: It was determined that other operating problems would preclude use of this short cooling time. A time of 50 days was then proposed.

#### Opinion 4

A cooling time of 50 days would be safe with respect to humans off the reservation, could be managed for plant personnel, and would properly require a willingness on the part of the AEC to compensate for possible injury to animals over a wide area.

#### Basis:

- A. The most direct evidence is that such a cooling time was successfully handled as regards plant personnel.
- B. At that time, range animals were heavily overexposed in terms of the revised permissible exposure.
- C. The reduction increases all exposure values by a factor of 32. Ground contamination is  $\sim 60$ -100  $\mu\text{pc}/\text{gm}$ , with isolated locations at times going to 300-500  $\mu\text{pc}/\text{gm}$ . This is considered unjustifiable overexposure, without arrangements for compensation.
- D. This value can be crudely checked by the single "green run" of December 1949. At 16 days cooling, this gave  $\sim 200$   $\mu\text{pc}/\text{gm}$ . Continuous operation at 50 days is equivalent to 2 runs per day.

Decay factor 16  $\rightarrow$  50 days =  $\sim 20$

Steady state versus single run = 11.5

$\therefore$  expected deposition =  $\frac{200 \times 11.5 \times 2}{20} = 230$   $\mu\text{pc}/\text{gm}$ .

if meteorological conditions were unchanged.

Correcting for scrubber efficiency (scrubber off during test)

gives  $\sim 40$   $\mu\text{pc}/\text{gm}$ .

This is a reasonable check on (C) above.

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Use of the proposed silver reactor would make 50 days feasible probably without potential damage to animals.

Basis:

- A. Calculations on the reactor are dubious, because the partition of evolution between dissolver and other stages, and the efficiency of the scrubbers are relatively uncertain. The following data are used:

dissolver = 50% release of  $I^{131}$   
 canyon stages release 10% available  $I^{131}$  = 5% batch  $I^{131}$   
 scrubber efficiency = 85%  
 sand filter efficiency for  $I^{131}$  removal = 50%  
 silver reactor efficiency = 99.9%

With X curies in the dissolver, the effective emission is:

<u>With scrubber</u>	<u>With silver reactor</u>
dissolver = 0.075 X	dissolver = 0.0005 X
canyon ventilation = 0.025 X	canyon ventilation = 0.025 X
Total = 0.1 X	Total = ~ 0.025 X
Improvement = factor of 4	= 16 days cooling

It is believed possible to persuade as much as 90% of the  $I^{131}$  to come off the dissolver, by sparging. In this case -

total emission = 0.005X  
 Improvement = factor of 20 = ~ 34 days

If proved feasible, this action would reduce the cooling time from 90 days to 50 days, with no substantial change in environmental hazard.

If such a reduction is deemed advisable, it is strongly recommended that appropriate development in this direction be initiated.

NOTE: In all the above, it was assumed that the cooling time is now 90 days. The average over the past year has been 88.5 days. A possible increase in output by 20% was also ignored. The output of  $I^{131}$  at a given cooling time is not necessarily proportional to the output of plutonium. This preliminary scoping did not justify consideration of such factors.

HM Parker:swc

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