# Attachment C

## Fermilab Radiation Guide Tables 1,2A, and 2B (November 1989)

A

ıe design is approved by the appropriate Department and The hazards analysis shall be a written description which ions and measurements of possible radiation exposures, g, beam optics and other relevant information. Also to ıre circumstances and controls which serve to limit the maximum beam loss and/or its duration. The hazard e forwarded to the Safety Section Head for a timely onstruction and/or operation of the beam.

ossible beam power loss is to be calculated multiplying ssible beam current (particles/pulse) times the maximum cy (pulses/hour) times the maximum possible energy In general, this beam power level (GeV/hour) will be one may normally expect.

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**TABLE 2A**

**Control of "Outdoor" Radiation Areas Against "Accident Radiation Levels: Radiation Interlocks not Used**

| Maximum Dose/in One Hour (D) | Level of Precaution |
|---|---|
| $D < 1$ mrem | No precaution needed, no occupancy limit |
| $1 \leq D < 10$ mrem | No precaution needed, minimal occupancy |
| $10 \leq D < 100$ mrem | Signs and ropes, minimal occupancy |
| $100 \leq D < 500$ mrem | Signs and fences with locked gates. Access by authorized personnel only |
| $500 \leq D < 1000$ mrem | Signs and fences with interlocked gates. No beam-on access permitted. |
| $D \geq 1$ rem | Not permitted |

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Table 2B addresses controls for areas which are protected by radiation activated interlocks such as chipmunks. These areas must be searched and secured before the dose exceeds 250 mrem during any one hour period. For example, if the dose per interlock trip is 100 mrem, then the area must be searched before resetting if two interlock trips occur within one hour.

## TABLE 2B

### Control of "Outdoor" Radiation Areas Against "Accident" Radiation Levels: Radiation Interlocks Used

| Maximum Dose/Interlock Trip | Level of Precaution |
|---|---|
| D < 0.25 mrem | No precaution needed, no occupancy limit |
| 0.25 ≤ D < 2.5 mrem | No precaution needed, minimal occupancy |
| 2.5 ≤ D < 10 mrem | Signs and ropes, minimal occupancy |
| 10 ≤ D < 50 mrem | Signs and fences with locked gates. Access by authorized personnel only. |
| 50 ≤ D < 100 mrem | Signs and fences with interlocked gates. No access permitted with beam-on. |
| 100 ≤ D < 250 mrem | Signs, 8 ft. high fences with interlocked gates and hardware requiring a search and secure. The area must be searched and secured by authorized lab personnel before the beam is turned back on and after each interlocked trip. No access permitted with beam-on. |
| D ≥ 250 mrem | See Section 6.1.3.C.2 (Special Circumstances) |

C. Special Circumstances

1. Guard Coverage - with the prior approval of the Safety Section Head, continuous Site Patrol (guard) coverage may be used as a short-term substitute for fence and interlock requirements.

2. Higher Levels - the possibility of higher severity accident conditions could be permitted if the level of precaution taken is much greater, i.e., sufficient to make undetected entry extremely unlikely. For all such cases the prior approval of the Safety Section Head is required. An example of what might be considered satisfactory is given below:

   For cases where the maximum dose interlock trip is greater than 250 mrem but less than 1000 mrem, at least the following precautions shall apply: double fences (one being at least 8 ft. high with barbed wire on top), all gates interlocked, flashing lights warning of the

Requirements for posting high radiation areas are similar to the requirements for posting radiation areas except the sign must say "Caution - High Radiation Area, Personnel Monitoring Devices Required," or "Caution - High Radiation Area, No Access."

An area within a beam enclosure in which dose rates exceed 5 rem per hour during normal access conditions (controlled or open), is required to be posted locally with a sign that says "Danger - Very High Radiation Area, Dose Rate >5 rem."

If the radiation or radioactive materials area is bounded by fences, ribbons or ropes, additional signs shall be placed in a conspicuous manner around the perimeter spaced no more than about 50 feet apart.

Special signs denoting other or unusual radiation hazards shall be used as necessary (for example, to mark contaminated areas or contaminated water).

At times radiation may in fact not be present in what is posted as a radiation area because fixed rather than real time signs are used. However, as long as signs are present, their instructions and associated requirements are to be followed.

Radiation and radioactivity signs, used by the Laboratory, will be designed in accordance with ANSI Z53.1-1979, wherever possible. Black on yellow colors are the recommended standard.

6.1.3 Control of "Outdoor" Radiation Areas

A. Normal Operating Conditions - Outdoor Areas

The requirements of Table 1 apply to the posting, access control, and limitation of maximum dose rates under normal operating conditions in all "outdoor" radiation areas.

For beam-on radiation, the interlocks referred to in the table must remove the beam, and thus the radiation, if any of the gates are opened.

These requirements also apply to radiation resulting from residual radioactivity from accelerator components, etc., with the substitution of alarms for interlocks. Such alarms must sound locally and at the Site Patrol dispatcher's office.

The signs referred to in the Table must meet the requirements of section 6.1.2.