A COMPARISON OF METHODS FOR MONITORING
LOW AIRBORNE CONCENTRATIONS OF ARGON-41 AND
TRITIUM, WITH MIT-PFC DESIGN APPLICATIONS

by

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ABSTRACT

Two primary methods, GM- and NaI-detection, of airborne
$^{41}$Ar monitoring were compared experimentally to determine the
lowest resolvable concentration given reasonable sample sizes.
NaI-detectors provided a lower resolvable concentration than
GM tubes, primarily due to energy resolution, which greatly
reduced background noise.

Airborne $^3$H collection was compared for two primary
collection (water bath and dessicant traps) and one ancillary
method (direct condensation). All $^3$H detection was performed
via liquid scintillation. Tritium collection with water baths
yielded higher collection efficiencies than dessicant traps
for short ($\leq 24$ hrs) sampling durations. As the length of the
sampling duration increased, water traps yielded lower
collection efficiencies than dessicant traps, primarily due to
evaporation of water (including $^3$H) from the water traps.
Direct condensation (with dry ice as a coolant) as a
collection method of airborne $^3$H was found unsuitable, since
large amounts of gas were initially condensed, yet evaporated
as the sample’s coolant was removed.

$^{41}$Ar detection for the MIT-PFC was determined to be best
provided by a low $^{40}$K NaI crystal shielded with lead and steel.
A Marinelli beaker was used as a monitoring volume to hold the
effluent sample. $^3$H monitoring at the MIT-PFC was fulfilled
with dessicant traps to catalytically separate the [HTO] and
[HT] fractions without the use of a carrier gas for the [HT].

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