25 Apparent Exposure Reduction Potential (ARP)

In order to separate areas of nuclear plant operations and maintenance activities for which exposures are ALARA from those for which exposures may not be ALARA, a method of ranking areas according to their potential for exposure reduction is needed.

Experience dictates that the two most influential factors in affecting potential for exposure reduction are: dose (rem) and dose rate (rem/h):

Note that a low dose rate area, if frequently occupied, may involve a large total exposure usage. Conversely, a high dose rate area may involve no exposure at all if no time is spent there. The dose factor, then, plays a larger part in determining the potential for exposure reduction than does the dose rate term.

Thus, an expression for the Apparent exposure Reduction Potential (ARP) for an area may be written as follows:

$$ARP = \alpha\, ED^{n}$$

The variables are defined as follows:

α = a dimensioned constant
E = exposure (rem)
D = dose rate (rem/hr)
n = a constant exponent less than unity.

The factor, α, and the exponent, n, in the ARP equation were defined to provide the desired range of values and the necessary comparability. Values for α and n were experimentally derived in NUREG/CR-0446[1], which suggested the most appropriate value for "α" as 1, and for "n" as 1/3.

It is desirable that the rankings provided by the ARP equation fall in a reasonable range (0-100), approximately satisfying the following criteria:

ARP	Potential for Dose Reduction
< 1.0	Small scope for dose reduction
≈ 1.0	Chance for dose reduction
> 1.0	Warrants dose reduction

To properly use the ARP equation, it would be necessary to prepare a table with the job title, total exposure, dose rate, and ARP value. The scope of the ARP equation would be to examine a number of jobs over a time frame or from a group of activities. For example, jobs carried out during a month, quarter, year, etc.,

[1]T.M. Hall, A.M. Dodd, and R.F. Haight, "Determining Effectiveness of ALARA Design and Operational Features", NUREG/CR-0446, April 1979, Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7982.

or any group of activities may be so examined. The ARP equation provides a quick and easy way to identify those jobs which have a potential for dose reduction.

Once a specific job with a good ARP value has been identified, then the various options available to improve the performance of that job may be analyzed. Such analysis could be based, for example, on a cost-benefit approach.