Figure: 34 TAC §9.4031(n)

Standard Deviation

The standard deviation is the square root of the average squared difference between the individual observations and the average value. The first step in the calculation of the standard deviation is to average the data arithmetically. The arithmetic average or “mean” value is denoted as z. An equation to calculate the mean value, z, of a data set is as follows:

$$z = 1/n(x1 + x2 + x3 + ... + xn)$$

where:

z = mean value of a data set of n values

x1 = unique value in data set

n = total number of values in data set

The standard deviation, usually denoted by the symbol, S, would be calculated using the following equation:

$$S = (((x1 - z)^2 + ... + (xn - z)^2)/(n-1))^{.5}$$

where:

S = standard deviation of a data set with n values

x1 = unique value in data set

xn = nth value in data set

n = total number in data set

Example: Procedure for calculating the standard deviation of a data set that has 10 sales with various internal rates of return (IRR).

Sale No.		IRR (%)	(x - z)	(x - z)^2
1	x1	11.0	-4.7	22.09
2	x2	25.0	9.3	86.49
3	x3	6.0	-9.7	94.09
4	x4	16.0	0.3	0.09
5	x5	16.0	0.3	0.09
6	x6	22.0	6.3	39.69
7	x7	9.0	-6.7	44.89
8	x8	14.0	-1.7	2.89
9	x9	13.0	-2.7	7.29
10	x10	25.0	9.3	86.49
		157.0		**384.10**

Calculate the arithmetic average, z:

$$z = 157.0/10 = 15.7 \text{ IRR\%}$$

Calculate the standard deviation, S:

$$S = (384.1/(10-1))^{.5} = 6.5 \text{ IRR\%}$$

Range of 1 standard deviation

$$= 15.7 \pm 6.5 = 9.2 < 15.7 < 22.2$$

Range of 2 standard deviations

$$= 15.7 \pm 6.5(2) = 2.7 < 15.7 < 28.7$$

28.7%/year could be used as an upper limit to the discount rate range for high-risk properties.