a) Material Price Variance

(Actual inputs x Std. price) - (Actual inputs x Actual price)

A	(610 x 100) - 60,000 =	61,000 -	60,000 =	$1,000	F
B	(1,550 x 5) - 8,000 =	7,750 -	8,000 =	250	U
C	(240 x 20) - 4,200 =	4,800 -	4,200 =	600	F
Total material price variance				$1,350	F

Material Efficiency Variance

(Std. inputs allowed - Actual inputs) x Std. price

The normal yield of a batch is 12,000 units x 40 molds = 480,000 units of which 98% or 470,000 units would normally pass inspection. The most recent batch actually yielded only 458,640 units which passed inspection. The standard amounts of inputs allowed to produce 458,640 good units is calculated as follows:

A	(600/470,400) x 458,640 =	585 kg.
B	(1,600/470,400) x 458,640 =	1,560 kg.
C	(200/470,400) x 458,640 =	195 kg.
Total standard inputs allowed		2,340 kg.

The efficiency variance, therefore, is calculated as follows:

A	(585 - 610) x 100 = -25 x 100 =	$2,500	U
B	(1,560 - 1,550) x 5 = 10 x 5 =	50	F
C	(195 - 240) x 20 = -45 x 20 =	900	U
Total material efficiency variance		$3,350	U

Material Yield Variance

Difference in units of input x Budgeted average price per unit of input

Budgeted average price per kg. of input:

$72,000/(600 + 1,600 + 200) = $72,000/2,400 = $30

The yield variance, therefore, is calculated as follows:

A	(585 - 610) x 30 = -25 x 30 =	$ 750	U
B	(1,560 - 1,550) x 30 = 10 x 30 =	300	F
C	(195 - 240) x 30 = -45 x 30 =	1,350	U
Total material yield variance		$1,800	U

The following is an alternative method for calculating the yield variance:

(Actual output - Standard output) x Standard cost/unit of output

= (458,640 - 470,400) x $.15306*
= -11,760 x $.15306*
= $1,800 U

*Standard cost/unit of output:

A	$100 x 600 =	$60,000
B	5 x 1,600 =	8,000
C	20 x 200 =	4,000
Total cost		$72,000/470,000 units = $.15306/unit of output

Material Mix Variance

Difference in units of input x (Budgeted individual price per unit of input - Budgeted average price per unit of input)

A	-25 x (100 - 30) = -25 x 70 =	$1,750	U
B	10 x (5 - 30) = 10 x -25 =	250	U
C	-45 x (20 - 30) = -45 x -10 =	450	F
Total material mix variance		$1,550	U

Total Flexible Budget Variance

(Std. inputs allowed x Std. price) - (Actual inputs x Actual price)

A	(585 x 100) - 60,000 =	58,500 -	60,000 =	$1,500	U
B	(1,560 x 5) - 8,000 =	7,800 -	8,000 =	200	U
C	(195 x 20) - 4,200 =	3,900 -	4,200 =	300	U
Total flexible budget variance				$2,000	U

The production foreman's actions resulted in a total unfavorable flexible budget variance of $2,000. The favorable price variance was more than offset by the unfavorable mix and yield variances. Even if the yield for this batch was right on standard (i.e., 470,400 units of Zap passing inspection), there would have been a mix variance as follows:

A	(600 - 610) x (100 - 30) = -10 x 70 =	$ 700	U
B	(1,600 - 1,550) x (5 - 30) = 50 x -25 =	1,250	U
C	(200 - 240) x (20 - 30) = -40 x -10 =	400	F
Total material mix variance		$1,550	U

This material mix variance would have more than offset the favorable price variance creating a total unfavorable flexible budget variance of $200 U. Without further information, it can be concluded that the production foreman's actions were unwise.

b) Do Not Investigate

If the material mix was the cause of the increase in the rejection rate, the company will save $1,000 in variable costs per batch, but it will lose the contribution margin for the extra rejected output:

Standard good output per batch	470,400	
Actual good output per batch	458,640	
Decrease in good output per batch	11,760	
Incremental sales per batch ($.50 x 11,760)		$ (5,880)
Incremental variable cost per batch		1,000
Decrease in contribution per batch		(4,880)
x 6 batches		x 6
Total decrease in contribution		$(29,280)

If the cause was a machinery malfunction, the decrease in contribution will be the same as if the cause was the material mix.

If random factors were the cause, the rejection rate will return to 2% and the net total savings in contribution will be $1,000 x 6 = $6,000 over the next six batches.

The total cost of not investigating is as follows:

[$29,280 x (.2 + .7)] - $6,000 x .1 = $26,352 - $600 = $25,752

Investigate

If it is found that the material mix is the cause, the mix will be returned to standard and the cost saving of $1,000 per batch will not be realized.

If the cause is found to be a machinery malfunction, it will cost $10,000 to make repairs, but the new mix of materials will be used resulting in a total variable cost saving over the next 6 batches of $6,000. The net cost would be $10,000 - $6,000 = $4,000.

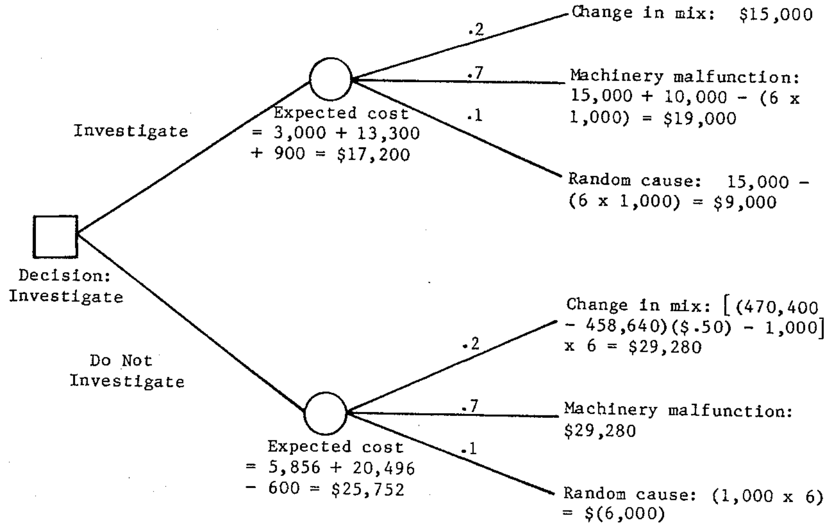
If random factors are found to be the cause, the rejection rate will return to 2% and the net total variable cost savings over the next six batches will be $6,000.

The total cost of investigating is as follows:

$15,000 + (0 x .2) + ($4,000 x .7) + (-6,000 x .1)
= $15,000 + $2,800 - $600
= $17,200

The cost of investigating is $25,752 - $17,200 = $8,552 less than not investigating; therefore, the process should be investigated now.

The decision analysis may be represented as a decision tree. An example is as follows:



The decision analysis may also be represented as a decision table as follows:

Actions	Random Factors (10%)	Change In Mix (20%)	Machinery Malfunction (70%)	Expected Value
Investigate	C = $15,000	$C + M_1$ = $15,000 + 6,000 = $21,000	$C + M_2$ = $15,000 + 10,000 = $25,000	$23,200
Do Not Investigate	0	L = $29,280 + 6,000 = $35,280	L = $29,280 + 6,000 = $35,280	$31,752

C = cost of investigation

M_1 = cost of correction if change in mix is found to be the cause of the variance

M_2 = cost of correction if machinery malfunction is found to be the cause of the variance

L = cost of allowing the variance to continue