

|  |   |                             |
|--|---|-----------------------------|
| Hematite<br>Decommissioning<br>Project | Procedure: HDP-PR-FSS-701, Final Status Survey Plan Development |                             |
|  | Revision: 10  | Appendix P-4<br>Page 1 of 1 |

**APPENDIX P-4  
FSS SAMPLE & MEASUREMENT LOCATIONS & COORDINATES**

|                     |        |                        |                               |
|---------------------|--------|------------------------|-------------------------------|
| <b>Survey Area:</b> | LSA 03 | <b>Description:</b>    | Plant Open Land Area          |
| <b>Survey Unit:</b> | 01     | <b>Description:</b>    | West of Site Pond in "Area 5" |
| <b>Survey Type:</b> | FSS    | <b>Classification:</b> | Class 3                       |

| Measurement or Sample ID | Surface or CSM | Type | Start Elevation* | End Elevation* | Northing** (Y Axis) | Easting** (X Axis) | Remarks / Notes       |
|--------------------------|----------------|------|------------------|----------------|---------------------|--------------------|-----------------------|
| L03-01-01-P-S-S-00       | Uniform        | S    | 430.3            | 429.8          | 863957              | 826599             | Surface 6-inch grab   |
| L03-01-02-P-R-S-00       | Uniform        | S    | 429.8            | 425.3          | 863957              | 826599             | Root 5-foot composite |
| L03-01-04-P-S-S-00       | Uniform        | S    | 430.1            | 429.6          | 864105              | 826617             | Surface 6-inch grab   |
| L03-01-05-P-R-S-00       | Uniform        | S    | 429.6            | 425.2          | 864105              | 826617             | Root 5-foot composite |
| L03-01-07-P-S-S-00       | Uniform        | S    | 438.0            | 437.5          | 864187              | 826457             | Surface 6-inch grab   |
| L03-01-08-P-R-S-00       | Uniform        | S    | 437.5            | 433.1          | 864187              | 826457             | Root 5-foot composite |
| L03-01-10-P-S-S-00       | Uniform        | S    | 437.4            | 436.9          | 864219              | 826534             | Surface 6-inch grab   |
| L03-01-11-P-R-S-00       | Uniform        | S    | 436.9            | 432.5          | 864219              | 826534             | Root 5-foot composite |
| L03-01-13-P-S-S-00       | Uniform        | S    | 435.2            | 434.7          | 864261              | 826593             | Surface 6-inch grab   |
| L03-01-14-P-R-S-00       | Uniform        | S    | 434.7            | 430.2          | 864261              | 826593             | Root 5-foot composite |
| L03-01-16-P-S-S-00       | Uniform        | S    | 431.9            | 431.4          | 864281              | 826670             | Surface 6-inch grab   |
| L03-01-17-P-R-S-00       | Uniform        | S    | 431.4            | 426.9          | 864281              | 826670             | Root 5-foot composite |
| L03-01-19-P-S-S-00       | Uniform        | S    | 433.4            | 432.9          | 864337              | 826639             | Surface 6-inch grab   |
| L03-01-20-P-R-S-00       | Uniform        | S    | 432.9            | 428.5          | 864337              | 826639             | Root 5-foot composite |
| L03-01-22-P-S-S-00       | Uniform        | S    | 437.5            | 437.1          | 864366              | 826559             | Surface 6-inch grab   |
| L03-01-23-P-R-S-00       | Uniform        | S    | 437.1            | 432.6          | 864366              | 826559             | Root 5-foot composite |
| L03-01-01-P-S-Q-00       | Uniform        | Q    | 430.3            | 429.8          | 863957              | 826599             | Root 5-foot composite |
| L03-01-05-P-R-Q-00       | Uniform        | Q    | 429.6            | 425.2          | 864105              | 826617             | Surface 6-inch grab   |
| L03-01-25-P-S-B-00       | Uniform        | B    | 436.7            | 436.2          | 864274              | 826568             | Surface 6-inch grab   |

Green shaded samples are the samples at each sample location, for use in WRS test.

\*Elevations are in feet above mean sea level.  
 \*\* Missouri - East State Plane Coordinates [North American Datum (NAD) 1983] (Open Land Area) OR  
 Distance in feet from lower left corner of the surface (Structures); each surface has it's own (X,Y) = (0,0); OR  
 For piping the distance from the beginning of the survey unit.  
 Surface: Floor = F; Wall = W; Ceiling = C; Roof = R  
 CSM: Three-Layer (Surface-Root-Deep) or Uniform  
 Type: Systematic = S, Biased = B; QC =Q; Investigation = I

HDP-PR-FSS-721 Final Status Survey Data Evaluation  
 Steps 8.3 Preliminary Data Review and 8.4 Calculation of the Sum-of-Fractions (SOF)

| Sample ID                      | Sample Depth (ft) | Type<br>(Systematic, Bias, QC) | TestAmerica Analytical Results |             |       |           |             |                  |             |                  |             |       |           |        |             |       |           |              |                  |        |             |     |           |        |             |       |           |        |             |       |           |  |
|--------------------------------|-------------------|--------------------------------|--------------------------------|-------------|-------|-----------|-------------|------------------|-------------|------------------|-------------|-------|-----------|--------|-------------|-------|-----------|--------------|------------------|--------|-------------|-----|-----------|--------|-------------|-------|-----------|--------|-------------|-------|-----------|--|
|                                |                   |                                | Ra-226                         |             |       |           |             |                  | Tc-99       |                  |             |       |           | Th-232 |             |       |           |              | Inferred U-234   |        |             |     | U-235     |        |             |       | U-238     |        |             |       |           |  |
|                                |                   |                                | Result                         | Uncertainty | MDC   | Qualifier | Net Result* | Corrected Result | Result      | Corrected Result | Uncertainty | MDC   | Qualifier | Result | Uncertainty | MDC   | Qualifier | Net Result** | Corrected Result | Result | Uncertainty | MDC | Qualifier | Result | Uncertainty | MDC   | Qualifier | Result | Uncertainty | MDC   | Qualifier |  |
| L03-01-01-P-S-S-00             | 0.49              | S                              | 1.180                          | 0.165       | 0.073 | NA        | 0.110       | 0.110            | 1.070       | 1.070            | 2.560       | 0.335 | NA        | 1.070  | 0.157       | 0.115 | NA        | 0.070        | 0.070            | 1.655  | NA          | NA  | NA        | 0.081  | 0.120       | 0.262 | U         | 1.710  | 0.527       | 0.751 | NA        |  |
| L03-01-02-P-R-S-00             | 4.43              | S                              | 1.230                          | 0.161       | 0.053 | NA        | 0.160       | 0.160            | 0.565       | 0.565            | 1.150       | 0.381 | NA        | 1.110  | 0.173       | 0.103 | NA        | 0.110        | 0.110            | 1.635  | NA          | NA  | NA        | 0.084  | 0.105       | 0.209 | U         | 1.110  | 0.448       | 0.682 | NA        |  |
| L03-01-04-P-S-S-00             | 0.49              | S                              | 1.200                          | 0.182       | 0.070 | NA        | 0.130       | 0.130            | 0.295       | 0.295            | 0.677       | 0.310 | U         | 1.170  | 0.223       | 0.124 | NA        | 0.170        | 0.170            | 1.519  | NA          | NA  | NA        | 0.072  | 0.144       | 0.277 | U         | 1.780  | 0.897       | 1.080 | NA        |  |
| L03-01-05-P-R-S-00             | 4.43              | S                              | 1.060                          | 0.150       | 0.069 | NA        | -0.010      | 0.000            | 0.096       | 0.096            | 0.275       | 0.367 | U         | 1.130  | 0.167       | 0.068 | NA        | 0.130        | 0.130            | 1.210  | NA          | NA  | NA        | 0.062  | 0.135       | 0.223 | U         | 0.852  | 0.289       | 0.809 | NA        |  |
| L03-01-07-P-S-S-00             | 0.49              | S                              | 0.819                          | 0.119       | 0.054 | NA        | -0.251      | 0.000            | 0.143       | 0.143            | 0.514       | 0.346 | U         | 0.742  | 0.130       | 0.085 | NA        | -0.258       | 0.000            | 1.387  | NA          | NA  | NA        | 0.074  | 0.107       | 0.130 | U         | 0.650  | 0.231       | 0.664 | U         |  |
| L03-01-08-P-R-S-00             | 4.43              | S                              | 1.170                          | 0.165       | 0.072 | NA        | 0.100       | 0.100            | -0.026      | 0.000            | 0.179       | 0.372 | U         | 1.050  | 0.167       | 0.084 | NA        | 0.050        | 0.050            | 2.289  | NA          | NA  | NA        | 0.125  | 0.155       | 0.236 | U         | 0.784  | 0.270       | 0.677 | NA        |  |
| L03-01-10-P-S-S-00             | 0.49              | S                              | 1.050                          | 0.149       | 0.072 | NA        | -0.020      | 0.000            | 0.021       | 0.021            | 0.252       | 0.343 | U         | 0.903  | 0.131       | 0.096 | NA        | -0.097       | 0.000            | 2.919  | NA          | NA  | NA        | 0.158  | 0.137       | 0.178 | U         | 1.180  | 0.474       | 0.720 | NA        |  |
| L03-01-11-P-R-S-00             | 4.43              | S                              | 1.220                          | 0.180       | 0.077 | NA        | 0.150       | 0.150            | -0.027      | 0.000            | 0.158       | 0.356 | U         | 1.090  | 0.191       | 0.162 | NA        | 0.090        | 0.090            | 1.886  | NA          | NA  | NA        | 0.096  | 0.161       | 0.243 | U         | 1.400  | 0.562       | 0.849 | NA        |  |
| L03-01-13-P-S-S-00             | 0.49              | S                              | 0.945                          | 0.130       | 0.052 | NA        | -0.125      | 0.000            | 0.031       | 0.031            | 0.268       | 0.329 | U         | 0.897  | 0.141       | 0.109 | NA        | -0.103       | 0.000            | 1.398  | NA          | NA  | NA        | 0.068  | 0.136       | 0.236 | U         | 1.320  | 0.487       | 0.728 | NA        |  |
| L03-01-14-P-R-S-00             | 4.43              | S                              | 1.080                          | 0.154       | 0.070 | NA        | 0.010       | 0.010            | -0.090      | 0.000            | 0.042       | 0.339 | U         | 0.821  | 0.135       | 0.086 | NA        | -0.179       | 0.000            | 1.183  | NA          | NA  | NA        | 0.063  | 0.096       | 0.214 | U         | 0.634  | 0.255       | 0.681 | U         |  |
| L03-01-16-P-S-S-00             | 0.49              | S                              | 1.120                          | 0.149       | 0.052 | NA        | 0.050       | 0.050            | -0.021      | 0.000            | 0.113       | 0.339 | U         | 0.855  | 0.129       | 0.086 | NA        | -0.145       | 0.000            | 1.941  | NA          | NA  | NA        | 0.104  | 0.142       | 0.216 | U         | 0.917  | 0.304       | 0.734 | NA        |  |
| L03-01-17-P-R-S-00             | 4.43              | S                              | 1.180                          | 0.181       | 0.085 | NA        | 0.110       | 0.110            | 0.378       | 0.378            | 0.996       | 0.385 | U         | 1.180  | 0.176       | 0.086 | NA        | 0.180        | 0.180            | 3.615  | NA          | NA  | NA        | 0.199  | 0.157       | 0.201 | U         | 0.966  | 0.321       | 0.905 | NA        |  |
| L03-01-19-P-S-S-00             | 0.49              | S                              | 1.040                          | 0.147       | 0.063 | NA        | -0.030      | 0.000            | 0.511       | 0.511            | 1.150       | 0.380 | NA        | 0.957  | 0.148       | 0.104 | NA        | -0.043       | 0.000            | 2.250  | NA          | NA  | NA        | 0.118  | 0.121       | 0.232 | U         | 1.340  | 0.609       | 0.782 | NA        |  |
| L03-01-20-P-R-S-00             | 4.43              | S                              | 1.060                          | 0.151       | 0.063 | NA        | -0.010      | 0.000            | 0.253       | 0.253            | 0.528       | 0.392 | U         | 1.060  | 0.174       | 0.136 | NA        | 0.060        | 0.060            | 0.746  | NA          | NA  | NA        | 0.033  | 0.099       | 0.232 | U         | 1.030  | 0.465       | 0.714 | NA        |  |
| L03-01-22-P-S-S-00             | 0.49              | S                              | 0.747                          | 0.113       | 0.051 | NA        | -0.323      | 0.000            | 0.135       | 0.135            | 0.372       | 0.342 | U         | 0.802  | 0.128       | 0.113 | NA        | -0.198       | 0.000            | 1.610  | NA          | NA  | NA        | 0.085  | 0.115       | 0.194 | U         | 0.915  | 0.462       | 0.725 | NA        |  |
| L03-01-23-P-R-S-00             | 4.43              | S                              | 1.100                          | 0.165       | 0.073 | NA        | 0.030       | 0.030            | 0.056       | 0.056            | 0.089       | 0.343 | U         | 1.180  | 0.203       | 0.085 | NA        | 0.180        | 0.180            | 2.812  | NA          | NA  | NA        | 0.154  | 0.143       | 0.182 | U         | 0.869  | 0.316       | 0.871 | U         |  |
| L03-01-01-P-S-Q-00             | 0.49              | Q                              | 1.000                          | 0.145       | 0.068 | NA        | -0.070      | 0.000            | -0.005      | 0.000            | 0.154       | 0.385 | U         | 0.930  | 0.168       | 0.127 | NA        | -0.070       | 0.000            | 4.400  | NA          | NA  | NA        | 0.243  | 0.150       | 0.183 | NA        | 0.888  | 0.309       | 0.854 | NA        |  |
| L03-01-05-P-R-Q-00             | 4.43              | Q                              | 1.190                          | 0.168       | 0.071 | NA        | 0.120       | 0.120            | -0.026      | 0.000            | 0.074       | 0.341 | U         | 1.040  | 0.176       | 0.110 | NA        | 0.040        | 0.040            | 1.310  | NA          | NA  | NA        | 0.064  | 0.140       | 0.225 | U         | 1.270  | 0.540       | 0.825 | NA        |  |
| L03-01-25-P-S-B-00             | 0.49              | B                              | 0.926                          | 0.131       | 0.060 | NA        | -0.144      | 0.000            | -0.012      | 0.000            | 0.200       | 0.386 | U         | 0.829  | 0.148       | 0.131 | NA        | -0.171       | 0.000            | 4.012  | NA          | NA  | NA        | 0.221  | 0.122       | 0.163 | NA        | 1.030  | 0.501       | 0.782 | NA        |  |
| Systematic Minimum             |                   |                                |                                |             | 0.000 |           |             |                  |             | 0.000            |             |       |           |        |             | 0.000 |           |              |                  | 0.746  |             |     |           |        | 0.033       |       |           |        | 0.634       |       |           |  |
| Systematic Maximum             |                   |                                |                                |             | 0.160 |           |             |                  |             | 1.070            |             |       |           |        |             | 0.180 |           |              |                  | 3.615  |             |     |           |        | 0.199       |       |           |        | 1.780       |       |           |  |
| Systematic Mean                |                   |                                |                                |             | 0.053 |           |             |                  |             | 0.222            |             |       |           |        |             | 0.065 |           |              |                  | 1.879  |             |     |           |        | 0.099       |       |           |        | 1.091       |       |           |  |
| Systematic Median              |                   |                                |                                |             | 0.020 |           |             |                  |             | 0.116            |             |       |           |        |             | 0.055 |           |              |                  | 1.645  |             |     |           |        | 0.085       |       |           |        | 0.998       |       |           |  |
| Systematic Standard Deviation  |                   |                                |                                |             | 0.062 |           |             |                  |             | 0.292            |             |       |           |        |             | 0.070 |           |              |                  | 0.743  |             |     |           |        | 0.043       |       |           |        | 0.343       |       |           |  |
| With ingrowth, use Ra226 bkg = |                   |                                | 1.07                           |             |       |           |             |                  | Th232 bkg = |                  |             |       |           |        | 1.0         |       |           |              |                  |        |             |     |           |        |             |       |           |        |             |       |           |  |

NOTES:  
 Gross results in units of pCi/g.  
 \* Background with ingrowth, 1.07 pCi/g subtracted from gross result.  
 \*\*Background, 1.0 pCi/g subtracted from gross result.  
 U Qualifier: Result is less than the sample detection limit.  
 All uncertainty values are reported at the 2-sigma confidence level.

HDP-PR-FSS-721 Final Status Survey Data Evaluation  
 Steps 8.3 Preliminary Data Review and 8.4 Calculation of the Sum-of-Fractions (SOF)

| Sample ID          | Sample Depth (ft) | Type (Systematic, Bias, QC) | Enr.                          | SOF <sub>N</sub> | Root Stratum SOF Verification (unexcavated/not backfilled only) |                           |   | root count | excavation count | surface count |
|--------------------|-------------------|-----------------------------|-------------------------------|------------------|---|---------------------------|---|------------|------------------|---------------|
|                    |                   |                             | Enrichment (%)                | SOF <sub>N</sub> | Is Sample In the Root Stratum?                                  | Is ROOT Sample SOF > 0.5? |   |            |                  |               |
| L03-01-01-P-S-S-00 | 0.49              | S                           | 0.8                           | 0.16             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-02-P-R-S-00 | 4.43              | S                           | 1.2                           | 0.18             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-04-P-S-S-00 | 0.49              | S                           | 0.7                           | 0.18             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-05-P-R-S-00 | 4.43              | S                           | 1.2                           | 0.08             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-07-P-S-S-00 | 0.49              | S                           | 1.8                           | 0.02             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-08-P-R-S-00 | 4.43              | S                           | 2.5                           | 0.10             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-10-P-S-S-00 | 0.49              | S                           | 2.1                           | 0.03             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-11-P-R-S-00 | 4.43              | S                           | 1.1                           | 0.14             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-13-P-S-S-00 | 0.49              | S                           | 0.8                           | 0.02             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-14-P-R-S-00 | 4.4               | S                           | 1.6                           | 0.02             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-16-P-S-S-00 | 0.49              | S                           | 1.8                           | 0.04             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-17-P-R-S-00 | 4.43              | S                           | 3.2                           | 0.19             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-19-P-S-S-00 | 0.49              | S                           | 1.4                           | 0.04             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-20-P-R-S-00 | 4.43              | S                           | 0.5                           | 0.05             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-22-P-S-S-00 | 0.49              | S                           | 1.5                           | 0.02             | SURFACE   | good                      |   |            |                  | 1             |
| L03-01-23-P-R-S-00 | 4.43              | S                           | 2.7                           | 0.13             | ROOT  | good                      | 1 |            |                  |               |
| L03-01-01-P-S-Q-00 | 0.49              | Q                           | 4.1                           | 0.03             |   | good                      |   |            |                  |               |
| L03-01-05-P-R-Q-00 | 4.43              | Q                           | 0.8                           | 0.10             |   | good                      |   |            |                  |               |
| L03-01-25-P-S-B-00 | 0.49              | B                           | 3.3                           | 0.03             |   | good                      |   |            |                  |               |
|                    |                   |                             | <b>1.6</b>                    | <b>0.02</b>      | 16  |                           |   | 8          | 0                | 8             |
|                    |                   |                             | <b>Average Enrichment (%)</b> | <b>0.19</b>      | count tot   |                           |   |            |                  |               |
|                    |                   |                             |                               | <b>0.09</b>      |   |                           |   |            |                  |               |
|                    |                   |                             |                               | <b>0.07</b>      |   |                           |   |            |                  |               |
|                    |                   |                             |                               | <b>0.07</b>      |   |                           |   |            |                  |               |

| MDC SOF |
|---------|
| 0.15    |
| 0.12    |
| 0.15    |
| 0.15    |
| 0.12    |
| 0.10    |
| 0.13    |
| 0.12    |
| 0.17    |
| 0.13    |
| 0.12    |
| 0.13    |
| 0.15    |
| 0.12    |
| 0.12    |
| 0.14    |
| 0.14    |
| 0.14    |

DCLG<sub>w</sub>, Measure Tc-99, All SEAs

|        | Uniform |
|--------|---------|
| U-234  | 195.4   |
| U-235  | 51.6    |
| U-238  | 168.8   |
| Tc-99  | 25.1    |
| Th-232 | 2.0     |
| Ra-226 | 1.9     |

|                              |      |     |    |
|------------------------------|------|-----|----|
| weighted SOF <sub>MEAN</sub> | 0.09 |     |    |
| fractions                    | SS   | RS  | ES |
|                              | 0.5  | 0.5 | 0  |

SOF<sub>MEAN</sub> Re-use Backfill Material  
 0.17 Stockpile 8b

SOF<sub>MEAN</sub> Groundwater  
 0.16

SOF ≤ 1  
 SOF<sub>MEAN, SU</sub> 0.42 **PASS**

Calculate the dose contribution for the SU by multiplying SOF<sub>MEAN, SU</sub> (including contribution from Re-use backfill and Groundwater) by 25 mrem.  
 10.4 mrem

| Infer U234             |            |       |      |
|------------------------|------------|-------|------|
| U-238/U235             | U-234/U235 | U-234 | %    |
| 21.2                   | 20.6       | 1.7   | 0.8  |
| 13.2                   | 19.4       | 1.6   | 1.2  |
| 24.7                   | 21.1       | 1.5   | 0.7  |
| 13.7                   | 19.4       | 1.2   | 1.2  |
| 8.7                    | 18.7       | 1.4   | 1.8  |
| 6.3                    | 18.3       | 2.3   | 2.5  |
| 7.5                    | 18.5       | 2.9   | 2.1  |
| 14.6                   | 19.6       | 1.9   | 1.1  |
| 19.4                   | 20.6       | 1.4   | 0.8  |
| 10.1                   | 18.8       | 1.2   | 1.6  |
| 8.8                    | 18.7       | 1.9   | 1.8  |
| 4.9                    | 18.2       | 3.6   | 3.2  |
| 11.4                   | 19.1       | 2.3   | 1.4  |
| 31.4                   | 22.7       | 0.7   | 0.5  |
| 10.8                   | 18.9       | 1.6   | 1.5  |
| 5.6                    | 18.3       | 2.8   | 2.7  |
| 3.7                    | 18.1       | 4.4   | 4.1  |
| 19.9                   | 20.6       | 1.3   | 0.8  |
| 4.7                    | 18.2       | 4.0   | 3.3  |
| Average Enrichment (%) |            |       | 1.56 |

Infer U-234 MDC using U-235 MDC \* ratio of U-234:U-235 @ that sample's enrichment

|      |
|------|
| 5.39 |
| 4.05 |
| 5.84 |
| 4.32 |
| 2.43 |
| 4.32 |
| 3.29 |
| 4.76 |
| 4.85 |
| 4.03 |
| 4.03 |
| 3.65 |
| 4.42 |
| 5.27 |
| 3.68 |
| 3.32 |
| 3.31 |
| 4.63 |
| 2.96 |

**HDP-PR-FSS-721 Final Status Survey Data Evaluation**

**Steps 8.3 Preliminary Data Review and 8.4 Calculation of the Sum-of-Fractions (SOF)**

| Ave Conc. Ra-226, SS | Ave Conc. Tc-99, SS | Ave Conc. Th-232, SS | Ave Conc. U-234, SS | Ave Conc. U-235, SS | Ave Conc. U-238, SS |
|----------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| 0.110                | 1.070               | 0.070                | 1.655               | 0.081               | 1.710               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.130                | 0.295               | 0.170                | 1.519               | 0.072               | 1.780               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.143               | 0.000                | 1.387               | 0.074               | 0.650               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.021               | 0.000                | 2.919               | 0.158               | 1.180               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.031               | 0.000                | 1.398               | 0.068               | 1.320               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.050                | 0.000               | 0.000                | 1.941               | 0.104               | 0.917               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.511               | 0.000                | 2.250               | 0.118               | 1.340               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.135               | 0.000                | 1.610               | 0.085               | 0.915               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| <b>0.036</b>         | <b>0.276</b>        | <b>0.030</b>         | <b>1.835</b>        | <b>0.095</b>        | <b>1.227</b>        |
| <hr/>                |                     |                      |                     |                     |                     |
| Ave Conc. Ra-226, RS | Ave Conc. Tc-99, RS | Ave Conc. Th-232, RS | Ave Conc. U-234, RS | Ave Conc. U-235, RS | Ave Conc. U-238, RS |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.160                | 0.565               | 0.110                | 1.635               | 0.084               | 1.110               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.096               | 0.130                | 1.210               | 0.062               | 0.852               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.100                | 0.000               | 0.050                | 2.289               | 0.125               | 0.784               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.150                | 0.000               | 0.090                | 1.886               | 0.096               | 1.400               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.010                | 0.000               | 0.000                | 1.183               | 0.063               | 0.634               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.110                | 0.378               | 0.180                | 3.615               | 0.199               | 0.966               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.000                | 0.253               | 0.060                | 0.746               | 0.033               | 1.030               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| 0.030                | 0.056               | 0.180                | 2.812               | 0.154               | 0.869               |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| <b>0.070</b>         | <b>0.169</b>        | <b>0.100</b>         | <b>1.922</b>        | <b>0.102</b>        | <b>0.956</b>        |
| <hr/>                |                     |                      |                     |                     |                     |
| Ave Conc. Ra-226, ES | Ave Conc. Tc-99, ES | Ave Conc. Th-232, ES | Ave Conc. U-234, ES | Ave Conc. U-235, ES | Ave Conc. U-238, ES |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| -                    | -                   | -                    | -                   | -                   | -                   |
| <b>0.000</b>         | <b>0.000</b>        | <b>0.000</b>         | <b>0.000</b>        | <b>0.000</b>        | <b>0.000</b>        |

**HDP-PR-FSS-721 Final Status Survey Data Evaluation**  
**Step 8.5 Performance of Statistical Tests**

| <b>WRS TEST</b>  |                               |   |                        |             |                      |
|--|-------------------------------|---|------------------------|-------------|----------------------|
| SAMPLE ID  | AREA (Reference, Survey Unit) | Gross SOF ( $X_{i,ref}$ , $Y_{i,SU, gross}$ ) | ADJUSTED SOF ( $Z_i$ ) | RANKS       | REFERENCE AREA RANKS |
| 9574-SS-140910-01-01   | Reference                     | 1.31  | 2.310                  | 46          | 46                   |
| 9574-SS-140910-01-02   | Reference                     | 1.18  | 2.179                  | 37          | 37                   |
| 9574-SS-140910-01-03   | Reference                     | 1.06  | 2.064                  | 32          | 32                   |
| 9574-SS-140910-01-04   | Reference                     | 1.10  | 2.101                  | 33          | 33                   |
| 9574-SS-140910-01-05   | Reference                     | 1.29  | 2.293                  | 45          | 45                   |
| 9574-SS-140910-01-07   | Reference                     | 1.34  | 2.339                  | 47          | 47                   |
| 9574-SS-140910-01-08   | Reference                     | 1.15  | 2.154                  | 36          | 36                   |
| 9574-SS-140910-01-09   | Reference                     | 1.18  | 2.182                  | 38          | 38                   |
| 9574-SS-140910-01-10   | Reference                     | 1.23  | 2.227                  | 43          | 43                   |
| 9574-SS-140910-01-11   | Reference                     | 1.38  | 2.380                  | 48          | 48                   |
| 9574-SS-140910-01-12   | Reference                     | 1.05  | 2.055                  | 31          | 31                   |
| 9574-SS-140910-01-13   | Reference                     | 0.94  | 1.941                  | 21          | 21                   |
| 9574-SS-140910-01-14   | Reference                     | 1.12  | 2.119                  | 34          | 34                   |
| 9574-SS-140910-01-15   | Reference                     | 1.15  | 2.152                  | 35          | 35                   |
| 9574-SS-140910-01-16   | Reference                     | 1.03  | 2.028                  | 28          | 28                   |
| 9574-SS-140910-01-17   | Reference                     | 0.44  | 1.443                  | 17          | 17                   |
| 9574-SS-140910-01-18   | Reference                     | 1.19  | 2.188                  | 40          | 40                   |
| 9574-SS-140910-01-20   | Reference                     | 0.76  | 1.757                  | 18          | 18                   |
| 9574-SS-140910-01-21   | Reference                     | 1.02  | 2.023                  | 27          | 27                   |
| 9574-SS-140910-01-22   | Reference                     | 1.02  | 2.018                  | 26          | 26                   |
| 9574-SS-140910-01-23   | Reference                     | 1.00  | 2.002                  | 23          | 23                   |
| 9574-SS-140910-01-24   | Reference                     | 0.87  | 1.873                  | 20          | 20                   |
| 9574-SS-140910-01-25   | Reference                     | 1.04  | 2.040                  | 30          | 30                   |
| 9574-SS-140910-01-26   | Reference                     | 0.96  | 1.959                  | 22          | 22                   |
| 9574-SS-140910-01-27   | Reference                     | 1.20  | 2.204                  | 41          | 41                   |
| 9574-SS-140910-01-28   | Reference                     | 1.01  | 2.007                  | 25          | 25                   |
| 9574-SS-140910-01-29   | Reference                     | 1.22  | 2.223                  | 42          | 42                   |
| 9574-SS-140910-01-30   | Reference                     | 1.03  | 2.035                  | 29          | 29                   |
| 9574-SS-140910-01-31   | Reference                     | 1.00  | 2.005                  | 24          | 24                   |
| 9574-SS-140910-01-32   | Reference                     | 0.86  | 1.865                  | 19          | 19                   |
| 9574-SS-140910-01-33   | Reference                     | 1.24  | 2.238                  | 44          | 44                   |
| 9574-SS-140910-01-34   | Reference                     | 1.19  | 2.185                  | 39          | 39                   |
| L03-01-01-P-S-S-00   | Survey Unit                   | 1.22  | 1.219                  | 13          | 0                    |
| L03-01-02-P-R-S-00   | Survey Unit                   | 1.24  | 1.241                  | 14          | 0                    |
| L03-01-04-P-S-S-00   | Survey Unit                   | 1.25  | 1.248                  | 15          | 0                    |
| L03-01-05-P-R-S-00   | Survey Unit                   | 1.14  | 1.139                  | 9           | 0                    |
| L03-01-07-P-S-S-00   | Survey Unit                   | 0.82  | 0.820                  | 2           | 0                    |
| L03-01-08-P-R-S-00   | Survey Unit                   | 1.16  | 1.160                  | 10          | 0                    |
| L03-01-10-P-S-S-00   | Survey Unit                   | 1.03  | 1.030                  | 5           | 0                    |
| L03-01-11-P-R-S-00   | Survey Unit                   | 1.21  | 1.207                  | 12          | 0                    |
| L03-01-13-P-S-S-00   | Survey Unit                   | 0.96  | 0.963                  | 3           | 0                    |
| L03-01-14-P-R-S-00   | Survey Unit                   | 0.99  | 0.990                  | 4           | 0                    |
| L03-01-16-P-S-S-00   | Survey Unit                   | 1.03  | 1.034                  | 6           | 0                    |
| L03-01-17-P-R-S-00   | Survey Unit                   | 1.25  | 1.254                  | 16          | 0                    |
| L03-01-19-P-S-S-00   | Survey Unit                   | 1.07  | 1.068                  | 7           | 0                    |
| L03-01-20-P-R-S-00   | Survey Unit                   | 1.11  | 1.109                  | 8           | 0                    |
| L03-01-22-P-S-S-00   | Survey Unit                   | 0.81  | 0.815                  | 1           | 0                    |
| L03-01-23-P-R-S-00   | Survey Unit                   | 1.19  | 1.194                  | 11          | 0                    |
| <b>Rank Sums</b>   |                               |   |                        | <b>1176</b> | <b>1040</b>          |
| <b># Reference Area Measurements</b>   |                               |   |                        | <b>m</b>    | <b>32</b>            |
| <b># Survey Unit Measurements</b>  |                               |   |                        | <b>n</b>    | <b>16</b>            |
| <b>Total Number of Measurements</b>  |                               |   |                        | <b>N</b>    | <b>48</b>            |
| <b>(1-<math>\alpha</math>) percentile of a standard normal distribution (MARSSIM Pg. I-10)</b> |                               |   |                        | <b>z</b>    | <b>1.645</b>         |
| <b>WRS Critical Value (MARSSIM Pg. I-10, Eq. I.1)</b>  |                               |   |                        | <b>CV</b>   | <b>860</b>           |

Min adjusted bkg SOF: 1.44

|                       |                       |
|-----------------------|-----------------------|
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |
| No WRS test necessary | No WRS test necessary |

TEST: PASS

$\alpha = 0.05$

**HDP-PR-FSS-701 Final Status Survey Plan Development**  
**Appendix P-1 Step 8. Calculate the Number of Samples in the Statistical Survey Population**

| Uniform DCGL Criteria Evaluation   |                                |
|--|--------------------------------|
| N/2 Value Verification   |                                |
| Isotope(s)   | SOF (Ra/Tc/Th/Iso U)           |
| St. Dev.   | 0.07                           |
| DCGL <sub>SOF</sub>  | 1                              |
| LBGR (Mean)  | 0.09                           |
| Shift  | 0.91                           |
| Relative Shift ( $\Delta/\sigma$ )   | 13.69                          |
| MARSSIM Table 5.1 ( $P_r$ )  | 1.000000                       |
| N  | 12                             |
| N + 20%  | 14.4                           |
| N/2  | 8                              |
| FSS N/2  | 8                              |
| Verification Check   | <b>SUFFICIENT MEASUREMENTS</b> |
| "N/2" Corresponds to the number of survey unit measurement locations required for the WRS Test |                                |

**MARSSIM Table 5.1**

| $\Delta/\sigma$ | $P_r$    |
|-----------------|----------|
| 0.1             | 0.528182 |
| 0.2             | 0.556223 |
| 0.3             | 0.583985 |
| 0.4             | 0.611335 |
| 0.5             | 0.638143 |
| 0.6             | 0.664290 |
| 0.7             | 0.689665 |
| 0.8             | 0.714167 |
| 0.9             | 0.737710 |
| 1.0             | 0.760217 |
| 1.1             | 0.781627 |
| 1.2             | 0.801892 |
| 1.3             | 0.820978 |
| 1.4             | 0.838864 |
| 1.5             | 0.855541 |
| 1.6             | 0.871014 |
| 1.7             | 0.885299 |
| 1.8             | 0.898420 |
| 1.9             | 0.910413 |
| 2.0             | 0.921319 |
| 2.25            | 0.944167 |
| 2.5             | 0.961428 |
| 2.75            | 0.974067 |
| 3.0             | 0.983039 |
| 3.5             | 0.993329 |
| 4.0             | 0.997658 |
| 4.01            | 1.000000 |

**MARSSIM Table 5.2,  $\alpha = 0.05$ ,  $\beta = 0.10$**

| $\alpha$ (or $\beta$ ) | $Z_{1-\alpha}$ (or $Z_{1-\beta}$ ) |
|------------------------|------------------------------------|
| 0.005                  | 2.576                              |
| 0.01                   | 2.326                              |
| 0.015                  | 2.241                              |
| 0.025                  | 1.960                              |
| 0.05                   | 1.645                              |
| 0.10                   | 1.282                              |
| 0.15                   | 1.036                              |
| 0.2                    | 0.842                              |
| 0.25                   | 0.674                              |
| 0.30                   | 0.524                              |

$\alpha$   
 $\beta$

|                                  |  |  |             |
|----------------------------------|--|--|-------------|
| Hematite Decommissioning Project | Procedure: HDP-PR-FSS-703, Final Status Survey Quality Control |  |             |
|                                  |  |  | Revision: 2 |
| Page 1 of 1                      |  |  |             |

**FORM HDP-PR-FSS-703-1**  
**FIELD DUPLICATE SAMPLE ASSESSMENT**

| Survey Unit No.:   | LSA 03-01                 |                    |                            |        | Survey Unit Description:       | Class 3 Survey Unit West of Site Pond in "Area 5" |  |                      |                        |               |               |                                |  |
|--------------------|---------------------------|--------------------|----------------------------|--------|--------------------------------|---|--|----------------------|------------------------|---------------|---------------|--------------------------------|--|
| Sample ID          | Field Duplicate Sample ID | Radionuclide       | Sample (pCi/g)             |        | Field Duplicate Sample (pCi/g) |   | Average Activity ( $\bar{x}$ ) (pCi/g) | Nuclide DCGL (pCi/g) | Statistic <sup>2</sup> | Warning Limit | Control Limit | Statistic Exceeds Limit? (Y/N) |  |
|                    |                           |                    | Activity (x <sub>i</sub> ) | MDC    | Activity (x <sub>i</sub> )     | MDC   |  |                      |                        |               |               |                                |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | Ra-226             | 1.180                      | 0.0725 | 1.000                          | 0.068   | 1.09                                   | 1.9                  | 0.18                   | 0.269         | 0.403         | N                              |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | Tc-99              | 1.07                       | 0.335  | -0.00462                       | 0.385   | 0.53269                                | 25.1                 | NA                     | 3.552         | 5.321         | NA                             |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | Th-232             | 1.07                       | 0.115  | 0.930                          | 0.127   | 1.000                                  | 2.0                  | 0.140                  | 0.283         | 0.424         | N                              |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | U-234 <sup>1</sup> | 1.655                      | NA     | 4.400                          | NA  | 3.027                                  | 195.4                | 2.745                  | 27.649        | 41.425        | N                              |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | U-235              | 0.0805                     | 0.262  | 0.243                          | 0.183   | 0.162                                  | 51.6                 | NA                     | 7.301         | 10.939        | NA                             |  |
| L03-01-01-P-S-S-00 | L03-01-01-P-S-Q-00        | U-238              | 1.71                       | 0.751  | 0.888                          | 0.854   | 1.299                                  | 168.8                | 0.822                  | 23.885        | 35.786        | N                              |  |

Comments:

1. U-234 is inferred, no MDC available.
2. Duplicate assessment is not necessary if the result of either sample is < MDC

Performed by: Thomas Yardy \_\_\_\_\_

Reviewed by: Clark Evers \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Quality Record

|                                  |  |  |  |  |  |  |  |             |             |
|----------------------------------|--|--|--|--|--|--|--|-------------|-------------|
| Hematite Decommissioning Project | Procedure: HDP-PR-FSS-703, Final Status Survey Quality Control |  |  |  |  |  |  | Revision: 2 | Page 1 of 1 |
|----------------------------------|--|--|--|--|--|--|--|-------------|-------------|

**FORM HDP-PR-FSS-703-1**  
**FIELD DUPLICATE SAMPLE ASSESSMENT**

| Survey Unit No.:   | LSA 03-01                 |                    |                            |        | Survey Unit Description:       | Class 3 Survey Unit West of Site Pond in "Area 5" |  |                      |                        |               |               |                                |
|--------------------|---------------------------|--------------------|----------------------------|--------|--------------------------------|---|--|----------------------|------------------------|---------------|---------------|--------------------------------|
| Sample ID          | Field Duplicate Sample ID | Radionuclide       | Sample (pCi/g)             |        | Field Duplicate Sample (pCi/g) |   | Average Activity ( $\bar{x}$ ) (pCi/g) | Nuclide DCGL (pCi/g) | Statistic <sup>2</sup> | Warning Limit | Control Limit | Statistic Exceeds Limit? (Y/N) |
|                    |                           |                    | Activity (x <sub>i</sub> ) | MDC    | Activity (x <sub>i</sub> )     | MDC   |  |                      |                        |               |               |                                |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | Ra-226             | 1.06                       | 0.0686 | 1.19                           | 0.071   | 1.125                                  | 1.9                  | 0.13                   | 0.269         | 0.403         | N                              |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | Tc-99              | 0.0962                     | 0.367  | -0.0256                        | 0.341   | 0.0353                                 | 25.1                 | NA                     | 3.552         | 5.321         | NA                             |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | Th-232             | 1.13                       | 0.0676 | 1.04                           | 0.11  | 1.085                                  | 2.0                  | 0.090                  | 0.283         | 0.424         | N                              |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | U-234 <sup>1</sup> | 1.210                      | NA     | 1.310                          | NA  | 1.260                                  | 195.4                | 0.100                  | 27.649        | 41.425        | N                              |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | U-235              | 0.0624                     | 0.223  | 0.0637                         | 0.225   | 0.063                                  | 51.6                 | NA                     | 7.301         | 10.939        | NA                             |
| L03-01-05-P-R-S-00 | L03-01-05-P-R-Q-00        | U-238              | 0.852                      | 0.809  | 1.27                           | 0.825   | 1.061                                  | 168.8                | 0.418                  | 23.885        | 35.786        | N                              |

Comments:

1. U-234 is inferred, no MDC available.
2. Duplicate assessment is not necessary if the result of either sample is < MDC

Performed by: Thomas Yardy \_\_\_\_\_

Reviewed by: Clark Evers \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

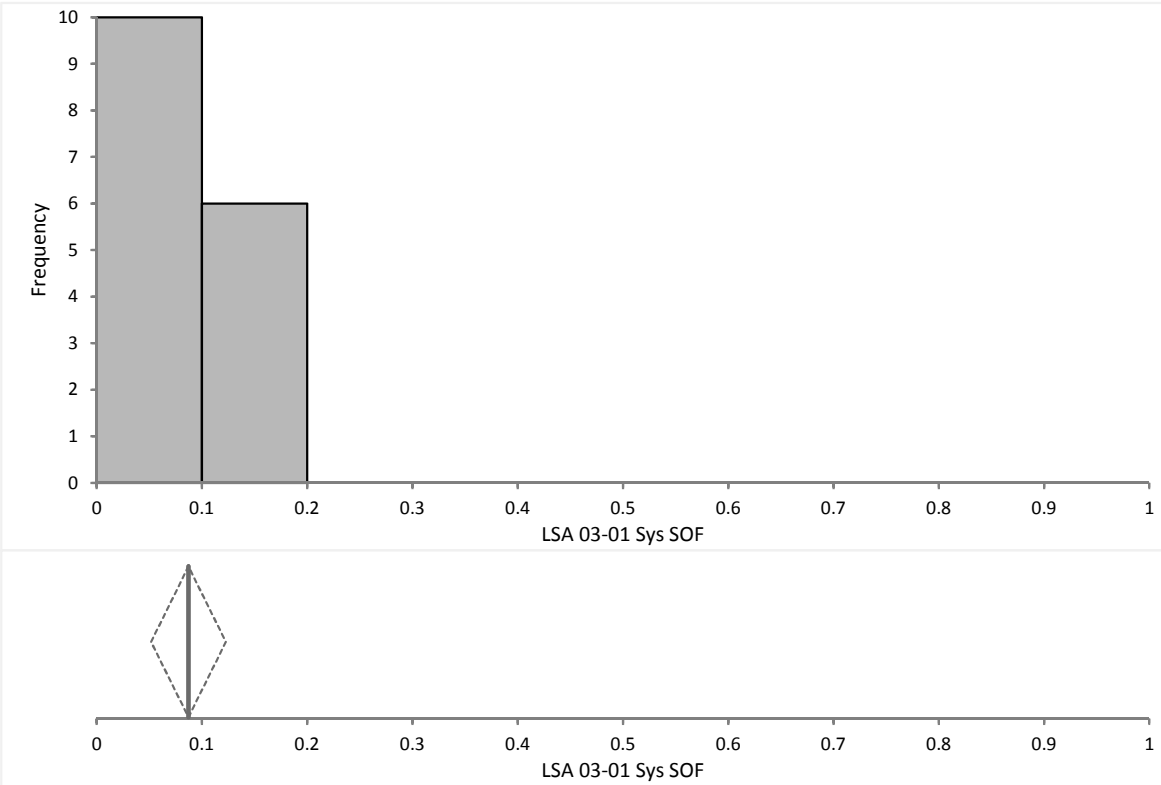
Quality Record



LSA 03-01 Sys SOF

0.2  
0.2  
0.2  
0.1  
0.0  
0.1  
0.0  
0.1  
0.0  
0.0  
0.0  
0.0  
0.2  
0.0  
0.1  
0.0  
0.1

Descriptives



|                   |         |              |         |              |              |          |          |
|-------------------|---------|--------------|---------|--------------|--------------|----------|----------|
| N                 | 16      |              |         |              |              |          |          |
| LSA 03-01 Sys SOF | Mean    | 95% CI       | Mean SE | SD           | Variance     | Skewness | Kurtosis |
| LSA 03-01 Sys SOF | 0.09    | 0.05 to 0.12 | 0.017   | 0.07         | 0.00         | 0.4      | -1.56    |
| LSA 03-01 Sys SOF | Minimum | 1st quartile | Median  | 97.87% CI    | 3rd quartile | Maximum  | IQR      |
| LSA 03-01 Sys SOF | 0.02    | 0.02         | 0.07    | 0.02 to 0.16 | 0.15         | 0.2      | 0.13     |