iodine, milk, soil, vegetation and water matrices, as part of the Teledyne Quality Control Spike Program. (Appendix D, Tables D-1 through D-3),

The PE samples, supplied by Analytics Inc., Environmental Resource Associates (ERA) and Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following acceptance criteria:

1. Analytics Evaluation Criteria

   Analytics' evaluation report provides a ratio of reported result and Analytics' known value. Since flag values are not assigned by Analytics, TBE evaluates the reported ratios based on internal QC requirements, which are based on the DOE MAPEP criteria.

2. ERA Evaluation Criteria

   ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the United States Environmental Protection Agency (USEPA), National Environmental Laboratory Conference (NELAC) performance testing (PT) program requirements or ERA's standard operating procedure (SOP) for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

3. DOE Evaluation Criteria

MAPEP's evaluation report provides an acceptance range with associated flag values.

The MAPEP defines three levels of performance: Acceptable (flag = "A"), Acceptable with Warning (flag = "W"), and Not Acceptable (flag = "N"). Performance is considered acceptable when a mean result for the specified analyte is ± 20% of the reference value. Performance is acceptable with warning when a mean result falls in the range from ± 20% to ± 30% of the reference value (i.e., 20% < bias < 30%). If the bias is greater than 30%, the results are deemed not acceptable.

Teledyne Brown Engineering

For the TBE laboratory, 178 out of 185 analyses performed met the specified acceptance criteria. Seven analyses (Sr-89 and Sr-90 in milk, Co-57, Zn-65 and Sr-90 in soil, Cs-134 in air particulate and Sr-90 in vegetation [two low warning in a row]) did not meet the specified acceptance criteria or internal QA requirements for the following reasons:

1. Teledyne Brown Engineering's Analytics September 2013 Sr-89 in milk result of 63.9 pCi/L was lower than the known value of 96.0 pCi/L. The failure was a result of analyst error and was specific to the Analytics sample. Client samples for the associated time period were evaluated and no client samples were affected by this failure. NCR 13-15

2. Teledyne Brown Engineering's Analytics September 2013 Sr-90 in milk result of 8.88 pCi/L was lower than the known

value of 13.2 pCi/L. The failure was a result of analyst error and was specific to the Analytics sample. Client samples for the associated time period were evaluated and no client samples were affected by this failure. NCR 13-15

3. & 4. Teledyne Brown Engineering's MAPEP September 2013 Co-57 and Zn-65 in soil were evaluated as failing the false positive test. While MAPEP evaluated the results as failures, the gamma software listed the results as non identified nuclides. The two nuclides would never have been reported as detected nuclides to a client. MAPEP does not allow laboratories to put in qualifiers for the submitted data nor "less than" results. MAPEP evaluates results based on the relationship between the activity and the uncertainty. MAPEP spiked the soil sample with an extremely large concentration of Eu-152, which was identified by the gamma software as an interfering nuclide, resulting in forced activity results that were evaluated by MAPEP as detected Co-57 and Zn-65. No client samples were affected by these failures. NCR 13-14

5. Teledyne Brown Engineering's MAPEP September 2013 Sr-90 in soil result of 664 Bq/kg was higher than the known value of 460 Bq/kg, exceeding the upper control limit of 598 Bq/kg. An incorrect Sr-90 result was entered into the MAPEP database. The correct Sr-90 activity of 322 Bq/kg would have been evaluated as acceptable with warning. No client samples were affected by this failure. NCR 13-14

6. Teledyne Brown Engineering's MAPEP September 2013 Cs-134 in air particulate activity of -0.570 Bq/sample was evaluated as a failed false positive test, based on MAPEP's

evaluation of the result as a significant negative value at 3 standard deviations. A negative number would never have been reported as a detected nuclide to a client, therefore no client samples were affected by this failure. NCR 13-14

7. Teledyne Brown Engineering's MAPEP September 2013 Sr-90 in vegetation result was investigated due to two low warnings in a row. It appears the September sample was double spiked with carrier, resulting in a low activity. With a recovery of around 50% lower, the Sr-90 result would have fallen within the acceptance range. No client samples were affected by this issue. NCR 13-14

In addition, PPL's REMP Laboratory Spike Program provided independently procured Analytics spiked samples as part of PPL's Quality Control Spike Program.

The criteria for the acceptability of the spiked analysis results were established by PPL and are based on criteria originally developed by the NRC. The criteria are based on an empirical relationship that combines prior experience and accuracy needs. As the resolution of the measurement process improves, the criteria for determining acceptability become tighter. Conversely, as the resolution of the process becomes poorer, the criteria for determining acceptability become wider.

The TBE laboratory performed 141 analyses of Performance Evaluation (PE) containing spiked samples of air particulate, air iodine, milk, soil and water matrices. (Appendix D, Table D-4)

For the TBE laboratory, 140 out of 141 analyses performed met the specified acceptance criteria. One analysis (Cr-51 in an air

particulate) did not meet the specified acceptance criteria or internal QA requirements for the following reason:

1. Teledyne Brown Engineering's PPL provided Analytics December 2013 Cr-51 in an air particulate result of 294 pCi was higher than the known value of 225 pCi, was evaluated as a failure with a ratio of 1.31. The failure is under investigation. NCR 14-01

IV. Results and Discussion

The analytical results of the 2013 REMP samples are divided into categories based on exposure pathways: atmospheric, direct radiation, terrestrial, and aquatic. The analytical results for the 2013 REMP are summarized in Appendix A, Program Summary. The data for individual samples are presented in Appendix C, Data Tables. The data are compared to the formal preoperational environmental monitoring program data (April 1972 to September 1982) and to historical data during operations. The data collected demonstrates that the SSES REMP was conducted in compliance with the TRM and the SSES ODCM.

A. Atmospheric

Atmospheric REMP sampling includes the collection of air particulate, air iodine and direct radiation samples.

1. Air Particulates

Air particulate samples were collected weekly at four indicator locations (3S2, 12E1, 12S1 and 13S6) and two control locations (6G1 and 8G1). Each of the samples collected for the year were analyzed for gross beta. Quarterly composites of the weekly samples from each location were analyzed for specific gamma emitters.

Gross Beta

Gross beta activity was detected in 212 of 212 of the indicator location samples at concentrations ranging from 6 to 33 E-3 pCi/m^3 with an average concentration of 14 E-3 pCi/m^3, and in 106 of 106 of the control location samples at concentrations ranging from 5 to 29 E-3 pCi/m^3 with an average of 13 E-3 pCi/m^3. The maximum preoperational level detected was 102 E-3 pCi/m^3 with an average concentration of 62 E-3 pCi/m^3. (Table C–1, Appendix C); Historical levels of gross beta are shown in Figure C-1. Results for gross beta analysis from 1974 to current year are plotted.

Gamma Spectrometry

Gamma spectroscopy was performed on each of the 24 quarterly composite samples.

Beryllium-7, attributed to cosmic ray activity in the atmosphere, was detected in all 16 indicator location composites at concentrations ranging from 63 E-3 to 133 E-3 pCi/m^3 with an average concentration of 107 E-3 pCi/m^3, and in the eight control location composites ranging in concentration from 70 to 119 E-3 pCi/m^3 with an average concentration of 101 E-3 pCi/m^3. The maximum preoperational level detected was 85 E-3 pCi/m^3 with an average concentration of 74 E-3 pCi/m^3. (Table C–2, Appendix C)

All other gamma emitters were less than the LLD.

2. Air Iodine

Filtered air iodine samples were collected weekly at four indicator locations (3S2, 12E1, 12S1 and 13S6) and two control locations (6G1 and 8G1). Each of the samples collected for the year were analyzed for I-131.

Iodine-131

Iodine-131 was not detected in any indicator location samples or control location samples. Preoperational data is not available for comparison. (Table C–3, Appendix C)

B. Direct Radiation

Ambient radiation levels in the environs were measured with a pair of optically stimulated luminescent dosimeters (OSLD) composed of aluminum oxide crystals supplied and processed by Landauer. Packets containing OSLDs for quarterly exposure were placed in the owner-controlled area and around the Site at various distances and in each land based meteorological sector. Emphasis was placed on special interest areas such as population centers, nearby residences, and schools.

A total of 57 locations were monitored for direct radiation during 2013, including 30 site boundary locations, 16 outer distance locations, six special interest locations and five control locations.

The average dose rate for the 208 indicator dosimeters was 18.2 milliroentgen per standard quarter. The average control dose rate for the 18 control dosimeters was 15.5 milliroentgen per standard quarter.

The preoperational average for the quarterly direct radiation readings was 17.6 milliroentgen per standard quarter. The results of the direct

radiation measurements for 2013 confirmed that the radiation levels in the vicinity of the SSES were similar to previous years. (Table C–4, Appendix C); Figure C-2 – Ambient Radiation Levels Based on Environmental Dosimetry Data from 1973 to current year are plotted as quarterly averages.

C. Terrestrial

Terrestrial REMP sampling includes the collection of milk, groundwater, drinking water, vegetation and soil samples.

1. Milk

Milk samples were collected semi-monthly when cows were on pasture and monthly when cows were not grazing on open pasture. Animals are considered on pasture from April to October of each year. Samples were collected in new polyethylene containers and transported in ice chests with no preservatives added to the milk.

Milk samples were collected at local dairy farms from 3 indicator locations (5E2, 10D3 and 13E3) and one control location (10G1). Each sample was analyzed for I-131 and gamma emitters.

<u>Iodine-131</u>

Iodine-131 was not detected above minimum detectable concentration in any of the 67 samples analyzed. Preoperational data is not available for comparison. (Table C–5, Appendix C); Figure C-3 – Iodine-131 Activity in Milk results from 1976 to 2013 are plotted.

Gamma Spectrometry

Naturally occurring K-40 was detected in all 67 samples with concentrations for the 47 indicator location samples ranging from 1,196 to 1,582 pCi/L with an average concentration of 1,369 pCi/L, and the 20 control location sample concentrations ranging from 1,247 to 1,535 pCi/L with an average concentration of 1,357 pCi/L. The maximum preoperational level detected was 1,500 pCi/L with an average concentration of 1,358 pCi/L. Naturally occurring Th-228 was detected in one of the 20 control location samples at a concentration of 21 pCi/L. Preoperational data is not available for comparison. (Table C–5, Appendix C)

All other gamma emitters were less than the LLD.

2. GroundWater

An expanded groundwater monitoring network was initiated in 2006 for the SSES as part of a site-wide hydrogeological investigation in accordance with the Nuclear Energy Institute (NEI) Groundwater Protection Initiative (GPI). The additional groundwater monitoring wells are sampled as part of the Radiological Environmental Monitoring Program (REMP) to regularly assess groundwater quality and provides early detection of any inadvertent leaks or spills of radioactive materials that could reach groundwater. Groundwater is sampled quarterly and analyzed for H-3 and gamma activity. Additionally, precipitation sampling was initiated in 2007 and analyzed for H-3 activity to assess the influence of station airborne H-3 emissions on groundwater H-3 activities.

Precipitation washout monitoring data is not used in dose

calculations; however, the data does give a gross indication of H-3 concentrations which makes its way into surface water and soil where it eventually seeps into shallow groundwater. The annual average H-3 concentration in precipitation, perimeter drain manholes, groundwater monitoring wells and surface water is summarized in Table C-7 and graphically depicted in Figure C-4 - Annual Average Tritium Activity (pCi/L) in precipitation, Perimeter Drain, Surface Water Versus Ground Water.

Ground water samples were collected quarterly at 14 indicator locations (2S2, 4S4, 6S10, 11S2, 1S3, 4S8, 4S9, 8S4, 7S10, 13S7, 2S8, 6S11A, 6S12 and 7S11) and one control location, (12F3). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected above the minimum detectable concentration in 13 of the 55 indicator location samples with concentrations ranging from 142 to 292 pCi/L with an average concentration of 189 pCi/L. Tritium was not detected in any of the four control location samples. The maximum preoperational level detected was 119 pCi/L. (Table C–6, Appendix C); Figure C-4 – Annual Average Tritium Activity (pCi/L) in precipitation, Perimeter Drain, Surface Water Versus Ground Water results from 2007 to 2013 are plotted.

Gamma Spectrometry

All gamma emitters were less than the LLD.

3. Drinking Water

Drinking water samples were collected monthly from one location (12H2). Each sample was analyzed for gross beta, H-3 and gamma emitters.

Gross Beta

Gross beta activity was detected in three of the 12 drinking water samples. Sample concentrations ranged from 2.4 to 2.9 pCi/L with an average concentration of 2.6 pCi/L. The maximum preoperational level detected was 3.2 pCi/L with an average concentration of 2.7 pCi/L. (Table C–8, Appendix C); Figure C-5 – Gross Beta Activity in Drinking Water results from 1977 to 2013 are plotted.

Tritium

Tritium activity was not detected in any of the drinking water samples. The maximum preoperational level detected was 194 pCi/L with an average of 132 pCi/L. (Table C–8, Appendix C)

Gamma Spectrometry

Naturally occurring K-40 was detected in one of the 12 drinking water samples at a concentration of 56 pCi/L. Preoperational data is not available for comparison. (Table C–8, Appendix C)

All other gamma emitters were less than the LLD.

4. Food Products

Food products from four indicator locations (8C1, 10B5, 11D1 and 12F7) and one control location (15G1) were collected

throughout the growing season. All samples (vegetable and broadleaf) were analyzed for gamma emitters and included green beans, pumpkin, soy beans, field corn, kale, swiss chard, lettuce and beet greens. In 2013, green beans, potatoes and field corn were irrigated with Susquehanna River water at location 12F7, and pumpkin and soy beans were irrigated with Susquehanna River water at location 11D1.

Gamma Spectrometry

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in five of the 18 indicator location samples with concentrations ranging from 232 to 427 pCi/kg wet with an average concentration of 311 pCi/kg wet, and in three of the five control location samples with concentrations ranging from 73 to 577 pCi/kg wet with an average concentration of 330 pCi/kg wet. Preoperational data is not available for comparison.

Naturally occurring K-40 was detected in all 18 indicator location samples with concentrations ranging from 2,333 to 18,450 pCi/kg wet with an average concentration of 6,385 pCi/kg wet, and in all five control location samples with concentrations ranging from 2,398 to 4,972 pCi/kg wet with an average concentration of 3,376 pCi/kg wet. The maximum preoperational level detected was 4,800 pCi/kg wet with an average concentration of 2,140 pCi/kg wet. (Table C–9, Appendix C)

Naturally occurring Ac-228 was detected in one of the 18 indicator location samples with a concentration of 134 pCi/kg

wet. No Ac-228 was detected in any of the five control location samples. Preoperational data is not available for comparison. Naturally occurring Th-228 was detected in one of the 18 indicator location samples with a concentration of 55 pCi/kg wet. No Th-228 was detected in any of the five control location samples. Preoperational data is not available for comparison.

All other gamma emitters were less than the LLD.

5. Soil

Soil samples were collected annually from one indicator location (12S1) and one control location (8G1). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all three indicator location samples at concentrations ranging from 12,250 to 13,980 pCi/kg dry with an average concentration of 12,840 pCi/kg dry, and in all three control location samples at concentrations ranging from 10,410 to 12,980 pCi/kg dry with an average concentration of 11,317 pCi/kg dry. The maximum preoperational level detected was 1,100 pCi/kg dry with an average concentration of 9,800 pCi/kg dry.

Cesium-137 was detected in one of the three indicator location samples at a concentration of 131 pCi/kg dry. No Cs-137 was detected in any of the three control location samples. The maximum preoperational level detected was 1,200 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ra-226 was detected in all of the three indicator location samples at concentrations ranging from 2,287

to 2,648 pCi/kg dry with an average concentration of 2,421 pCi/kg dry, and in two of the three control location samples at concentrations of 2,644 and 2,708 pCi/kg wet. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry.

Naturally occurring Ac-228 was detected in all of the three indicator location samples at concentrations ranging from 887 to 1,031 pCi/kg dry with an average concentration of 946 pCi/kg dry, and in all of the three control location samples at concentrations ranging from 806 to 1,143 pCi/kg dry with an average concentration of 967 pCi/kg dry. Preoperational data is not available for comparison.

Naturally occurring Th-228 was detected in all of the three indicator location samples at concentrations ranging from 908 to 1,178 pCi/kg dry and an average concentration of 1,001 pCi/kg dry, and in all of the three control location samples at concentrations ranging from 758 to 1,018 pCi/kg dry with an average concentration of 896 pCi/kg dry. The maximum preoperational level detected was 1,300 pCi/kg dry with an average concentration of 1,100 pCi/kg dry. (Table C–10, Appendix C)

All other gamma emitters were less than the LLD.

D. Aquatic

Aquatic samples include surface water, fish and sediment samples.

1. Surface Water

Surface water samples were collected routinely at seven

indicator locations (6S5, 2S7, LTAW, 4S7, 5S9, 5S12 and 7S12) and one control location (6S6). Each sample was analyzed for H-3 and gamma emitters.

Tritium

Tritium activity was detected in 16 of 43 indicator location samples with concentrations ranging from 144 to 12,500 pCi/L with an average concentration of 2,591 pCi/L. The range of H-3 levels in surface water are biased high due to inclusion of samples from the cooling tower blowdown line (CTBD; location 2S7). Routine station operation includes infrequent batch releases of slightly radioactive water which are discharged into the CTBD. When the H-3 concentration from CTBD samples is averaged with those obtained from Susquehanna River downstream monitoring locations, the result is an overall indicator location average that is higher than the actual average H-3 levels of the downstream river water. No radioactivity attributable to station operations was identified above analysis detection levels in any samples from the Susquehanna River in 2013. Tritium was not detected in any of the 13 control location samples. The maximum preoperational level detected was 319 pCi/L, with an average concentration of 140 pCi/L. (Table C-11, Appendix C) [Figure C-6 – Tritium Activity in Surface Water, results from 1972 to 2013 are plotted.]

Gamma Spectrometry

Naturally occurring K-40 was not detected in any of the 43 indicator location samples but was detected in one of 13 control location samples at a concentration of 42 pCi/L. Preoperational data is not available for comparison. Naturally occurring

Th-228 was detected in two of the 43 indicator location samples with concentrations of 5 and 24 pCi/L with an average concentration of 14 pCi/L. Preoperational data is not available for comparison. (Table C-11, Appendix C)

Iodine-131

Iodine-131 was not detected in any of the indicator or control samples. The maximum preoperational level detected was 0.43 pCi/L, with an average concentration of 0.33 pCi/L. (Table C-11, Appendix C)

All other gamma emitters were less than the LLD.

2. Fish

Edible species of fish were collected in the spring and fall of 2013 at two indicator locations (IND [Susquehanna River] and LTAW) and one control location (2H [Susquehanna River]). Each sample was analyzed for gamma emitters.

Gamma Spectrometry

Naturally occurring K-40 was detected in all eight indicator location samples at concentrations ranging from 3,261 to 4,917 pCi/kg wet with an average concentration of 3,979 pCi/kg wet, and in all seven control location samples at concentrations ranging from 3,359 to 4,130 pCi/kg wet with an average concentration of 3,775 pCi/kg wet. The maximum preoperational level detected was 3,600 pCi/kg dry with an average concentration of 3,200 pCi/kg dry. (Table C–12, Appendix C)

All other gamma emitters were less than the LLD.

3. Shoreline Sediment

Sediment samples were collected from the Susquehanna River in the spring and fall at two indicator locations (7B and 12F) and one control location (2B). Each sample was analyzed for gamma emitters.

Gamma Spectroscopy

Naturally occurring K-40 was detected in five of five indicator location samples at concentrations ranging from 8,239 to 15,740 pCi/kg dry with an average concentration of 12,238 pCi/kg dry, and in both of the control location samples with concentrations of 18,280 and 19,070 pCi/kg dry with an average concentration of 18,675 pCi/kg dry. The maximum preoperational level detected was 11,000 pCi/kg dry with an average concentration of 8,500 pCi/kg dry.

Cesium-137 was not detected in any of the samples. The maximum preoperational level detected was 210 pCi/kg dry with an average concentration of 110 pCi/kg dry.

Naturally occurring Ra-226 was detected in all of the five indicator location samples at concentrations ranging from 1,415 to 2,399 pCi/kg dry with an average concentration of 2,048 pCi/kg dry, and in both control location samples with concentrations of 3,334 and 3,692 p/Ci/kg dry with an average concentration of 3,513 pCi/kg dry. The maximum preoperational level detected was 1,900 pCi/kg dry with an average concentration of 700 pCi/kg dry.

Naturally occurring Ac-228 was detected in all five indicator

location samples at concentrations ranging from 748 to 1,295 pCi/kg dry with an average concentration of 1,074 pCi/kg dry, and in one of two control location samples at a concentration of 1,211 pCi/kg dry. Preoperational data is not available for comparison. (Table C-13, Appendix C)
Naturally occurring Th-228 was detected in all of the five indicator location samples at concentrations ranging from 790 to 1,368 pCi/kg dry with an average concentration of 1,214 pCi/kg dry, and in both control location samples at concentrations of 1,507 and 1,521 pCi/kg dry with an average concentration of 1,514 pCi/kg dry. The maximum preoperational level detected was 3,200 pCi/kg dry with an average concentration of 1,300 pCi/kg dry.

All other gamma emitters were less than the LLD.

E. Land Use Census

SYNOPSIS OF 2013 LAND USE CENSUS

Ecology III, Inc. conducted a Land Use Census during the 2013 growing season around SSES to comply with the ODCM. The purpose of the survey was to document the nearest milk animal, residence and garden greater than 50 m^2 (approximately 500 ft^2) producing broad leaf vegetation within a distance of 8 km (approximately 5 miles) in each of the 16 meteorological sectors surrounding the SSES.

Meteorological Sector		Distance in Miles from the PPL Reactor Buildings		
		Nearest Residence Sept, 2013 miles	Nearest Garden Sept, 2013 miles	Nearest Dairy Farm Sept, 2013 miles
1	N	1.3	3.2	>5.0
2	NNE	1.0	2.3 [a,c,e]	>5.0
3	NE	0.9	2.7	>5.0
4	ENE	2.1	2.4 [a,b,c]	>5.0
5	E	1.4	1.8	4.5 [d]
6	ESE	0.5	3.1	>5.0
7	SE	0.5	0.6	>5.0
8	SSE	0.6	2.9	>5.0
9	S	1.0	2.7	>5.0
10	SSW	0.9	1.3	>5.0
11	SW	1.5	1.9	>5.0
12	WSW	1.3	1.3	1.7 [d]
13	W	1.2	2.0	5.0
14	WNW	1.1	1.3	>5.0
15	NW	0.8	0.9 [a,c]	>5.0
16	NNW	0.6	4.0	>5.0

a Chickens raised for consumption at this location

b Ducks raised for consumption at this location

c Eggs consumed from chickens at this location

d Fruits/vegetables raised for consumption at this location

e Beef cattle raised for consumption at this location

The 2013 Land Use Census results are summarized in the above table. There were two changes in the nearest residence, two changes in the nearest garden and one change in the dairy farms within the 5 mile radius. New residences were found for sectors 14 and 15. Both residences were vacant upon attempts to interview the owners. For the nearest garden, two new owners were identified for sectors 13 and 15. One dairy farm went out of business in 2013 in sector 10.

V. Annotations to Previous AREOR

There are no annotations to previous AREOR.

VI. Conclusions

The Radiological Environmental Monitoring Program for SSES was conducted during 2013 in accordance with the SSES TRM and ODCM. The LLD values required by the TRM and ODCM were achieved for this reporting period (See Appendix A and Appendix C). The objectives of the program were also met during this period. The data collected assists in demonstrating that SSES was operated in compliance with TRM and ODCM requirements.

The concentration of radioactive material in the environment that could be attributable to SSES operations was only a small fraction of the concentration of naturally occurring and man-made radioactivity. Since these results were comparable to the results obtained during the preoperational phase of the program, which ran from 1972 to 1982, and with historical results collected since commercial operation, it is concluded that operation of the SSES had no significant radiological impact on the health and safety of the public or the environment.

From the results obtained, it can be concluded that the levels and fluctuations of radioactivity in environmental samples were as expected for the environment surrounding the SSES.

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