APPENDIX J

BIOLOGICAL ASSESSMENT FOR THE ORR BIOSOLIDS LAND APPLICATION SITES

Endangered Species Act

BIOLOGICAL ASSESSMENT

City of Oak Ridge
Sanitary Biosolids Land Application on the
Oak Ridge Reservation
Anderson and Roane Counties, Tennessee

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BIOLOGICAL ASSESSMENT FOR THREATENED AND ENDANGERED SPECIES UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT FOR THE CITY OF OAK RIDGE SANITARY BIOSOLIDS LAND APPLICATION SITES ON THE OAK RIDGE RESERVATION

SUMMARY

This biological assessment (BA) assesses potential impacts on federally listed plant and animal species that could result from the increase in lifetime application site soil radionuclide limits from a cumulative dose of 4 to 10 mrem/yr by the Department of Energy (DOE) on TDEC-approved, EPA-permitted sites on the Oak Ridge Reservation (ORR). The species considered in this BA are those listed in the letter from the U.S. Fish and Wildlife Service to the U.S. Department of Energy, dated May 10, 2001 (FWS 2001a) and included in Section 8.0 of the Draft Environmental Assessment for the proposed project (DOE 2001). These listed species are the endangered gray and Indiana bats.

DOE staff concludes, for the reasons described in the main text of this BA, that the project is not likely to adversely affect either species. Also, since no proposed or designated critical habitats are present on the site, none would be affected. This BA is intended to finalize concurrence.

INTRODUCTION AND PROJECT DESCRIPTION

The City of Oak Ridge, Tennessee, owns and operates a publicly owned treatment works (POTW) that receives wastewater from a variety of industrial, commercial, and residential generators in the Anderson/Roane County area. One of the chief contributors, with approximately 20% of the POTW's total influent (DOE/EA-1042 1996), is the U.S. Department of Energy (DOE) Y-12 Plant. All industrial generators are required by Oak Ridge City Ordinance Number 9-91 to obtain an industrial discharge permit (IDP) from the City, which prescribes discharge limits and monitoring/reporting requirements.

Under a land-lease agreement (DOE 2001) with DOE, the City of Oak Ridge has been applying municipal biosolids as a beneficial soil amendment on the ORR since 1983 (DOE/EA-1042 1996). To date, no spills or traffic accidents have occurred since the program began. The City of Oak Ridge Biosolids Land Application Program has been recognized for excellence in beneficial re-use and program management by the Tennessee/Kentucky Water Environment Association (WEA) in 1997 and EPA, Region IV in 1999.

In October 1996 the ORR Biosolids Land Application Program underwent an Environmental Assessment (EA) (DOE/EA-1042 1996) that evaluated total site capacity, the addition of ORNL and ETTP sanitary wastewater treatment plant biosolids and the establishment of application site soil and biosolids radionuclide limits based upon a 4 mrem/yr cumulative dose modeling scenario. Upon completion of the EA, a Finding of No Significant Impact (FONSI) was issued in November 1996.

Municipal biosolids are not considered a Resource Conservation and Recovery Act (RCRA) waste but are regulated under the provisions of 40 *Code of Federal Regulations* (CFR) Part 503 of the Clean Water Act (CWA). EPA establishes standards for biosolids use and disposal, including risk-based, metal-loading criteria for the receiving soil, as specified in 40 CFR Part 503. Non-radiological program requirements are imposed by the State of Tennessee via the city's NPDES permit, State Land Application Approval, EPA permit #TNL024155 and EPA regulations listed in 40 CFR Part 503 (EPA 1993).

Although Oak Ridge biosolids contains trace amounts of heavy metals and radionuclides, as do most municipal biosolids, levels are well within prescribed limits as mandated by the Tennessee Department of Environment and Conservation (TDEC), EPA and DOE. For example, the most heavily loaded site, the Rogers Site in operation since 1988, has achieved only 6.5% of the prescribed EPA lifetime loading limit for mercury.

Biosolids recycling and land application, which are the terms EPA uses for biosolids applied to land for its beneficial properties (58 *FR* 9321 Standards for the Use or Disposal of Biosolids; Final Rule 1993), consists of distributing liquid, solid, or composted biosolids on or just below the soil surface where it is employed as a fertilizer or soil conditioner. For example, beneficial uses may include improving tree growth for hardwood reforestation, increasing organic matter and enhancing soil tilth for hay production or growth of native species, or helping to restore disturbed areas by providing nutrients for new seedlings.

In the past, the City produced a Class B, liquid biosolids product which contained some residual pathogenic organisms that were destroyed by exposure to UV rays and the environment upon application at the ORR sites. The City of Oak Ridge is in the process of implementing a new de-watering and thermal treatment system that will increase the solids content and sterilize the biosolids hauled and dispersed at the ORR land application sites, resulting in a more manageable, safer Class A (i.e., no pathogens) material. This material will be applied using manure spreading equipment in a calibrated dispersion pattern during daylight hours.

There are six active land application sites totaling 133 ha (329 acres) on the ORR (***Table 1.1***).

Table 1.1. Oak Ridge Reservation Biosolids Land Application Sites

Site #	Site Name	Status	Acres (Ac)	Hectares (ha)
1	Upper Hayfield #1	Active	30	12.15
2	Upper Hayfield #2	Active	27	10.93
3	High Pasture	Active	46	18.62
4	Rogers	Active	32	12.96
5	Watson Road	Active	117	47.37
6	Scarboro Road	Active	77	31.17

Because there are currently no applicable federal biosolids radioactivity standards, the state, the City of Oak Ridge and DOE established conservative biosolids land application site soil limits for 23 specific radionuclides based upon a 4 mrem/yr, 365-day per year homesteader (i.e. living on site) utilizing 9 pathways of exposure for a human in the previously approved EA. Residual Radioactivity (RESRAD) modeling of the previously-approved EA summarizes the methodology for establishing dose-based radionuclide limits for the land application program. In addition, the City of Oak Ridge operates an on-site gamma spectrometer system that analyzes biosolids that are land applied each day. This system has established action levels that prevent the land application of biosolids in excess of acceptable radionuclide levels. The city also contracts with ORNL to perform independent radionuclide analyses as a cross-check to ensure compliance with the established 4 mrem/yr criteria. Since many of the 23 radionuclides are not present in the City of Oak Ridge biosolids, analytical action levels are only established for known, key radionuclides to prevent the inadvertent application of biosolids confirmed to contain elevated levels of radionuclides. To date, no action levels have been triggered. A proposed radionuclide limit increase from 4 to 10 mrem/yr for a human dose is required to assist the City of Oak Ridge in commercial and government industrial development. It is important to note that the proposed increase is not expected to be achieved because the lifetime nitrogen loading limit of 50 tons/acre will be attained within the next 7 to 8 years and site radionuclide soil concentrations are presently found at extremely low levels.

A Threatened and Endangered Species Study (TN & Associates 1997) was performed on all active Oak Ridge Reservation Biosolids Land Application Sites for vertebrates in 1997.

ECOLOGICAL DESCRIPTION OF THE SITES

The following brief description is taken from descriptions of each application site as described in the 1997 T&E species survey (TN & Associates 1997). In addition, a wetlands survey (SAIC 1996) was also performed in 1996 that specifically identified all bodies of water (***Table 1.2***) present on the active biosolids land application sites. ORR application sites were selected specifically to avoid perennial streams, lakes and other bodies of water. As noted in ***Table 1.2,*** some very small ponds exist which have been appropriately flagged and have a 500 foot buffer zone surrounding the perimeter of each water body prohibiting the application of biosolids.

Table 1.2 ORR Biosolids Land Application Site Designated Wetlands

Application Site	Wetland Type	Wetland Size (acres)
Rogers	Pond	0.9
High Pasture	Pond	0.3
Scarboro	Pond	0.4
	Pond	0.2
	Pond	0.07
	Pond	0.07
	Pond	0.1
	Pond	0.7
Watson Road	None	-
Upper Hayfield #1	Pond	0.7
	Pond	0.3
Upper Hayfield #2	Pond	0.05
	Pond	0.7

Watson Road

Biosolids application on the Watson Road site is generally defined by Watson Road on the north, Old County Road on the west, and East Fork Road on the south. This site is completely forested:

- a cutover loblolly pine plantation (42 ac) is located on both sides of Watson Road,
- a natural pine and cedar stand which receives biosolids is located along the eastern side of Old County Road (6 ac),
- and a mature upland forest (41 ac) stand is located north of East Fork Road.

From the northern entrance, Old County Road forks to the right and Watson Road forks to the left. Biosolids are applied into the woods on both sides of Watson Road. From the fork to the utility right-of-way there is a short stretch of mature white oak, white pine, and poplar, with subcanopy development, and herbaceous understory and leaf litter. From the power line to the eastern boundary, the overstory consists of remnants of the loblolly stand that is undergoing secondary succession. Where the canopy was completely killed, the understory is dominated by blackberry and where the canopy still shades the understory poison ivy is dominant. U-shaped Biosolids application roads have been bulldozed off Watson Road into the loblolly stand.

From the northern entrance, Old County Road forks to the right. Biosolids are applied only to the left side of this road, away from the turnpike. The overstory is dominated by oak with scattered eastern red cedar and naturally occurring pine. The understory contains an abundance of woody seedlings. Poison ivy and honeysuckle dominated the understory.

Rogers

The Rogers application area is bounded on the east by an access road and farm pond, on the north by the High Pasture site, on the west by Roger's Quarry, and on the south by Bethel Valley Road. Most of the site is rolling pasture land dominated by fescue, blackberry, and strips of planted cottonwood, and black walnut. The forested slope at the back of the site contains mature upland hardwood species of red oak, white oak, hickory, red maple, hophornbeam, and ash.

There is little subcanopy development and the ground cover is dominated by weedy invaders of honeysuckle and nepal grass. The base of the slope has extensive pawpaw, mayapple, skullcap and heartleaf violet.

High Pasture

The High Pasture site consists of two hayfields on a fairly flat ridgetop. The fields are connected by a short road through a hardwood stand. The fields are mowed in the late summer and winter. The most northern field is bounded on the northwest by a mature upland hardwood stand. The closed canopy consists of chestnut oak, hickory, and yellow poplar. Honeysuckle vine was the dominant understory species. The southern boundary runs along the top of the ridge slope above the Rogers Quarry site. The eastern boundary is the access road. The second field is a clearly defined ridgetop bounded by a steep-sloped forest.

Upper Hayfield # 1

Upper Hayfield # 1 is bounded by upland hardwood forests on the east, south and west, and by a road to the north. The eastern boundary forest has three canopy layers: overstory, subcanopy, and a sapling layer, as well as a diverse herb layer of commonly occurring species. The mature hardwood forest on the western boundary was unusual because of the size of the trees (~70 cm dbh), the extent of the forest, and the lack of disturbance. Species include Southern red oak, white oak, beech, and sugar maple. The soil is cherty, with practically no understory.

Upper Hayfield # 2

Upper Hayfield # 2 is on a hilltop bounded by access roads on the east, south and west. The western boundary forest is mature, upland hardwoods. The southern boundary forest is younger, on a fairly steep slope which gets drier as it progresses towards Scarboro Road. Virginia pine has established in the canopy in this area.

Scarboro

The Scarboro site is a rolling hayfield bounded by mesic forest on the west and Scarboro Road on the east. The lower portion of the field is not used because of proximity to Bethel Valley Road. There is a hardwood forest remnant with limestone outcroppings in the south cental part of the site.

This forest has 100% canopy coverage, species include black walnut, poplar, cherry, white oak, and hackberry. The understory is disturbed, and Nepal grass is dominant. The upland forest on the western boundary is dry, on a west-facing slope. It is out of the Biosolids application range and contains an abundance of native species, including ferns, rattlesnake plaintain, little brown jugs, and heartleaf violets.

LISTED SPECIES AND POTENTIAL IMPACTS OF THE PROJECT

The general ecology of federally listed species that may occur on the site (FWS 1999a) and the expected impacts from the project on them are summarized below. Unless otherwise noted or referenced, general biological information on the species is derived from Harvey (1992) and Webb (2000).

Gray Bat (*Myotis grisescens*)

The endangered gray bat is concentrated in cave regions of Arkansas, Missouri, Kentucky, Tennessee, and Alabama. Although the population is over 1.5 million and improving, about 95 percent hibernate in only eight known caves, two of which are located in Tennessee. During the summer gray bats are usually found in caves, though frequently different caves than those used for hibernation. Females form maternity colonies of at least several hundred individuals, while males and non-reproductive females form smaller summer bachelor colonies. Summer caves, especially for maternity colonies, are rarely more than three km (two miles) and usually less than 1.6 km (one mile) from the rivers and lakes used as foraging areas. During the spring and autumn transient periods the bats occupy a wider variety of caves. During all seasons males and yearling females seem less restricted to specific caves and roost types. In general, bats enter hibernation in September through October and emerge in late March and April; timing depends on age and gender. Young are born in late May or early June. Bats forage over water, mostly along rivers, large creeks, and lakes, primarily within about five m (15 feet) above the surface. Gray bat populations are on the upswing as a result of improved breeding success due to better protection measures, such as cave gates, fences and informational signs near caves.

There are no caves physically located on any of the application sites or in wooded areas that serve as boundaries for the open hay fields. The closest caves on the ORR are the Walker Branch cave and Big and LittleTurtle caves, were surveyed by Mitchell et al. (1996) and no gray bats were found. There have been a number of unverified reports of gray bats roosting on the ORR but no positive identification could be made (J.W. Webb 2000).

Although the ORR Biosolids Application Sites could provide suitable foraging habitat, this is unlikely due to the fact that five of the six application sites are open hayfields devoid of caves, bordered by mature tree stands. The other application site is a mature tree stand that has been drastically affected by the infestation of the Pine Beetle. This application site is also devoid of caves. In addition, all bodies of water physically located on the application sites are very small and have a 500 foot buffer zone prohibiting the application of biosolids per TDEC requirements. Biosolids land application operations are performed during daylight hours and normally conclude by 4:00 pm in the afternoon so any foraging by Gray bats would therefore not be disrupted.

Trace radionuclides in the City of Oak Ridge biosolids are monitored daily prior to application on the ORR application sites. Action levels have been established to prevent the application of biosolids that are in excess of established radionuclide levels **before** application operations occur. To date, no radionuclide action levels have been triggered. Site soils and vegetation are also thoroughly monitored through sampling and analysis performed by ORNL. Historical radionuclide levels observed in application site soils and vegetation have been extremely low and are routinely reported to TDEC and EPA by February 19 of each year in the Annual Biosolids Management Report (City of Oak Ridge 2001). ***Table 1.3*** provides a summary of soil radionuclide data collected and reported to EPA and TDEC annually. Note that soil samples were also collected for comparison from adjacent areas that had not received biosolids application. A comparison of the biosolids treated soils vs. non-treated soils indicates a slight increase in the concentration of some radionuclides within the site soils while others demonstrated levels lower than those observed in the non-applied areas. ***Table 1.4*** also provides a summary of radionuclide data from random vegetation collected since 1998. Vegetative radionuclide levels were extremely low and in most cases were non-detectable.

Table 1.3 ORR Application Site Soil Radionuclide Monitoring Data for 2000

	^{60}Co (pCi/g, dry)		^{137}Cs (pCi/g, dry)		^{238}U (pCi/g, dry)		^{235}U (pCi/g, dry)	
Application Site	Biosolids Treated	Ref.	Biosolids Treated	Ref.	Biosolids Treated	Ref.	Biosolids Treated	Ref.
Rogers Site	.526	.009	.556	.215	2.73	.725	.156	.071
High Pasture	.045	.009	.371	.215	1.68	.725	.063	.071
Scarboro Road	.007	.009	.459	.415	1.37	1.05	.075	.102
Upper Hayfield #1	.029	.009	.575	.415	1.96	1.05	.123	.102
Upper Hayfield #2	.018	.009	.627	.415	2.18	1.05	.10	.102
Watson Road	.003	.010	.333	.498	1.55	.888	.087	.033

Table 1.4 ORR Application Site Vegetation Radionuclide Monitoring Data Since 1998

Application Site	^{60}Co (pCi/g, dry)	^{137}Cs (pCi/g, dry)	^{238}U (pCi/g, dry)	^{235}U (pCi/g, dry)
Rogers Site	0.014	0.056	2.34	N/D
Scarboro Road	N/D	0.619	N/D	N/D
Upper Hayfield #1	N/D	0.046	1.10	N/D
Watson Road	N/D	N/D	N/D	N/D

N/D - Non-detectable

Mist netting was conducted on the lower portion of East Fork Poplar Creek and its tributaries in May 1992 and again in May - June, 1997 (Harvey 1997). The 1997 survey included portions of lower Bear Creek near its confluence with lower East Fork Poplar Creek; this location is about 2 km from the closest biosolids land application site (Watson Road). The creeks in this area provided good gray bat foraging habitat and excellent Indiana bat summer roosting and foraging habitat at the time of the surveys. No Gray or Indiana bats were recorded among six species captured.

Accordingly, DOE staff concludes that the activity would be unlikely to adversely affect the endangered Gray bat. The reasons for our conclusion are:

- the absence of caves from the ORR application sites, reducing the likelihood of roosting habitat;
- the absence of large water bodies present on the application sites, reducing the likelihood of foraging habitat;
- the established buffer zone of 500 feet around existing bodies of water on the application sites prohibiting the application of biosolids, reducing the likelihood of direct or indirect contact with biosolids being applied if the Gray bat is present; and
- the rigorous radionuclide monitoring program in place and the extremely low to non-detectable levels of radionuclides found in application site soils and vegetation, reducing the likelihood of accumulation of radionuclides within insects that consume vegetation or live in application site soils that represent a food source for the Gray bat.

Indiana bat (*Myotis sodalis*)

The range of the endangered Indiana bat is in the eastern U.S. from Oklahoma, Iowa, and Wisconsin east to Vermont and south to northwestern Florida. Distribution is associated with major cave regions and areas north of cave regions. The present total population is estimated at ca. 352,000, with more than 85% hibernating at only nine locations — two caves and a mine in Missouri, three caves in Indiana, and three caves in Kentucky.

Indiana bats usually hibernate in large dense clusters of up to several thousand individuals, in sections of the hibernation cave where temperatures average 38 - 43°F and with relative humidities of 66 to 95 percent. They hibernate from October to April, depending on climatic conditions. Density in tightly packed clusters is usually estimated at 300 - 484 bats per square foot.

Female Indiana bats depart hibernation caves before males and arrive at summer maternity roosts in mid May. A single offspring, born during June, is raised under loose tree bark, primarily in wooded streamside habitat. Maternity colonies use multiple primary roost trees which are used by a majority of the bats most of the summer, and a number of secondary roosts that are used intermittently and by fewer bats, especially during periods of precipitation or extreme temperatures.

Thus, there may be more than a dozen roosts used by some Indiana bat maternity colonies (FWS 1999a). Kurta et al. (1996) found that female Indiana bats may change roosts about every three days, and a group of these bats may use more than 17 different trees in a single maternity season. During September they depart for hibernation caves. The summer roost of adult males is often near maternity roosts, but where most males spend the day is unknown. Other males remain near the hibernaculum. A few males can be found in caves during summer.

Until relatively recently, little was known about the summer habitat and ecology of the Indiana bat. The first maternity colony was discovered in 1974, under the loose bark on a dead butternut hickory tree in east-central Indiana. The colony, numbering about 50 individuals, also used an alternate roost under the bark of a living shagbark hickory tree. The total foraging range of the colony consisted of a linear strip along approximately 0.5 mi. of creek. Foraging habitat was confined to air space from 6 ft to ca. 95 ft high near the foliage of streamside and floodplain trees.

Two additional colonies were discovered during subsequent summers, also in east-central Indiana. These had estimated populations of 100 and 91 respectively, including females and pups. Habitat and foraging area were similar to the first colony discovered. Additional evidence gathered during recent years indicates that, during summer, Indiana bats are widely dispersed in suitable habitat throughout a large portion of their range.

Through the use of radio telemetry techniques, several additional maternity colonies have recently been discovered and studied at several locations. These studies reinforced the belief that floodplain forest is important habitat for Indiana bat summer populations. However, maternity colonies were also located in more upland habitats. It was also discovered that Indiana bats exhibited fidelity to specific roosting and foraging areas to which they returned annually.

Between early August and mid September, Indiana bats arrive near their hibernation caves and engage in swarming and mating activity. Swarming at cave entrances continues into mid or late October. During this time, fat reserves are built for hibernation. It is thought that Indiana bats feed primarily on moths. A longevity record of 13 yr 10 mo has been recorded for this species.

Hibernating bats leave little evidence of their past numbers; thus, it is difficult to calculate a realistic estimate of the overall population decline for this species. However, population estimates at major hibernacula indicated a 34% decline in the total Indiana bat population from 1983 to 1989.

The only record of Indiana bats on the ORR is from a single specimen in the 1950s (Webb 2000). No maternity roosts have been located on the ORR (FWS 1999a). In general, limited information suggests that the bats roost primarily north of their hibernacula and more often in the northerly parts of their range. During mist netting on lower East Fork Poplar Creek and its tributaries, described above for gray bats and in Harvey (1997), no Indiana bats were captured out of six species recorded.

A large percentage of the known population of the Indiana bat hibernates in two caves in Kentucky and a cave and a mine in Missouri. Nursery roosts are found under loose bark of dead trees. Open riparian corridors along streams are required for foraging habitat. No confirmed sightings in Anderson or Roane counties are on record with TDEC. Mitchell *et al.* (1996) did not report any sightings during their investigations, nor did they report any records of previous sightings on the ORR. The ORR Biosolids Land Application Sites were selected to avoid streams and riparian areas. In addition, the vast majority of trees present on the application sites form the border of each site and are of the mature hardwood variety and do not typically produce loose bark or exfoliate. For the most part, trees are allowed to grow undisturbed. Trees that die are allowed to remain in place or where they fall and are only removed if they happen to fall over an site access roadway. Accordingly, DOE staff concludes that the activity would be unlikely to adversely affect the endangered Indiana bat. The reasons for our conclusion are:

- the rarity of the Indiana bat species on the ORR;
- the land application sites are not located in designated floodplains;
- the absence of streams present on the application sites, reducing the likelihood of foraging habitat;
- the absence or rarity of exfoliating tree stands that are present or serve as the borders to application sites, reducing the likelihood of roosting habitat;
- the non-disturbance of existing tree stands by the current operations (e.g., lack of tree removal operations), reducing the likelihood of roosting disturbance if the Indiana bat is present;

- the established buffer zone of 500 feet around existing bodies of water on the application sites prohibiting the application of biosolids, reducing the likelihood of direct or indirect contact with biosolids being applied if the Indiana bat is present; and
- the rigorous radionuclide monitoring program in place and the extremely low to non-detectable levels of radionuclides found in application site soils (***Table 1.3***) and vegetation (***Table 1.4***), reducing the likelihood of accumulation of radionuclides within insects that consume vegetation that represent a food source for the Indiana bat.

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