



the
Elephant Sanctuary[®]
in Tennessee

December 6, 2006

**Docket No. APHIS-2006-0044
Regulatory Analysis and Development
PPD APHIS,
Station 3A-03.8
4700 River Road Unit 118
Riverdale, MD 20737-1238**

Referencing Docket No. APHIS-2006-0044: Whether specific standards should be promulgated for elephants and what should be included in such standards. Include any studies or research.

Introduction

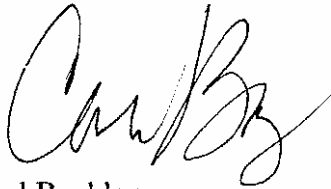
The Elephant Sanctuary in Tennessee manages elephants in a non-dominance natural habitat setting. In this document we cite exactly how the natural habitat setting contributes to the physical and mental health of an animal. The current trend is for increasing space for elephants, this is a good beginning, and whatever size this increase takes, careful consideration must be given to providing the most complex natural habitat outdoor environment that offers a variety of natural substrates, foliage and enrichment.

Elephants thrive in an environment where they have the freedom of choice about decisions that affect them. Choices such as who they spend time with and when, what to eat and where, and when and where they sleep are choices that each elephant should be allowed to make for themselves. When such decisions are made by the elephants, they form strong bonds with one another and their caregivers. Without the threat of being deprived or forced to do something against their will, they are cooperative and calm.

In a natural habitat environment elephants have access to a wide range of vegetation and topographical variations. Deciding on when and where to graze, when to submerge in a pond, where to enter the woods, and how long to remain there are all decisions that may seem simple but are vital to the well-being of the individual elephant. Contrary to what some might think, this system creates a harmonious situation in which a human can operate, not on the level of the

dominant or submissive individual, but as an accepted member of the herd, able to accomplish husbandry tasks and medical procedures safely.

Perhaps the most important and challenging component of this system is time. In this system the elephants operate in their own time, not ours. Although they are creatures of habit whose movements can be anticipated; their movements should not be dictated. They are not ruled by our time clocks or schedules; instead they have an internal guide, which they follow. Allowing elephants to determine when they will do everything throughout their day and night is the ultimate freedom these captive animals can experience. The results we have seen over the past eleven years speak volumes. We have experienced everything from solitary animals integrating into herd life, to formerly aggressive elephants becoming extremely passive and chronic health issues ending with very dramatic positive results in a short period of time.

A handwritten signature in black ink, appearing to read 'Carol Buckley', with a stylized, cursive script.

Carol Buckley
Founder, Executive Director

1) What are the causes of arthritis in elephants?

Arthritis means joint inflammation.

Joyce Poole has said that of the 2200 elephants observed in Amboseli (over a period of 34 years) in Kenya not one had foot disease or arthritis. Causes of arthritis in captive elephants are not simply injuries as has much been reported. An elephant can recover from an injury as long as she can exercise the area properly, (See case studies of Sanctuary residents below) and is living in an appropriate climate; as cold and damp will exacerbate an arthritic condition.

The following will cause joint inflammation and since these usually are combined with living in small spaces for the duration of the elephant's life they will result in osteoarthritis and osteomyelitis

- Being forced to repeat and hold an unnatural body position such as some poses used in circus performances
- Repetitive movement not consistent with natural behavior
- Long periods of chaining without opportunity to flex and move joints in the full range of motion
- Restricted movement
- Standing for long periods in restricted spaces on cement
- Standing without the relief of laying down to sleep

Case Study #1: Tarra, 32, Asian: Performed in circuses and zoos. Before coming to the Sanctuary, she suffered from periodic arthritis in her right wrist. Since coming to the Sanctuary she has been extremely active, walking miles each day, traversing steep hills and swimming in ponds and streams, and her arthritis has cleared up.

Case Study #2: Winkie, 40, lived in a zoo before coming to the Sanctuary. For over 30 years, she was kept indoors, on chains, six months of the year because of the cold weather. She underwent exploratory surgery for a problematic toe in which the vet, suspecting that a foreign object was embedded in the foot, cut her foot to the bone. (This surgery was documented on video by the veterinarian). The surgery was extensive but failed to produce any foreign objects. It was later determined that Winkie's problem was not an object in her foot but an infection in one of the bones of her foot. Due to an antiquated elephant exhibit, a lack of funds to rehabilitate the exhibit and a request by the USDA to improve the exhibit or relocate their elephants, the zoo sent Winkie to the Sanctuary. Upon arrival at the Sanctuary, it was determined that Winkie suffered from osteoarthritis and osteomyelitis (bone infections in her feet). After several months of foot soaks, the infection was no longer active. Winkie does experience occasional stiffness of her right front wrist in the winter months when her activity level is reduced and the ambient temperature drops.

2) What, if any, foot care practices have been used on captive elephants to maintain healthy feet?

THE ELEPHANT SANCTUARY PROTOCOL FOR FOOT CARE

Goal: maintain healthy, functional nails and foot pads.

Foot Pad

- surface of pad should have well defined tracks with no over lapping skin.
- thick enough to pad the foot and protect it from bruising (different with each individual)
- slightly convex in the center

Nails

- front edge slopped up from the bottom of the foot
- defined area between toes
- no sharp edges
- front of nail should never be shaved as it compromises nail integrity

Cuticles

- short and supple
- dry cuticles should be dressed with lubricant such as mineral oil

Trimming Techniques and Tools

Tools:

- hoof knife
- x-acto blade (triangle shape / z - rotter #163)
- wood rasp
- hoof nippers

Using the x-acto blade, bevel back overlapped skin on the pads. Bevel out decaying area without making the foot pad flat. It should be slightly convex in the center and retain some natural grooves essential to ensure tracking.

With the rasp, file down the edge (heel) of the foot to remove overgrown pad. File nails from the bottom of the foot upwards to the front edge of the nail. Unless addressing a slip nail or laminate over growth, never file the face of the nail as this will weaken the nail making it prone to splits.

With ex-acto blade remove all overgrown cuticle. Pay special attention to cuticle overgrowth between nails.

Nail Splits

Bevel out the split (lengthwise) and trim the bottom of the nail shorter than the pad. Never crosscut the top of the split.

After Trimming

Examine each foot with full weight applied. The foot should appear to be flat when the elephant is applying full weight on the foot. The front edge of the nail should not touch the ground.

Case Study #3 Sissy, 38, lived in several zoos over a 30-year period, most of that time alone. She came to the Sanctuary after being brutally beaten by her keepers at the El Paso Zoo. While at the zoo, Sissy had a chronic split nail, the result of improper foot trimming by the son of circus elephant trainer Murray Hill. After she arrived at the Sanctuary, her split nail was allowed to grow out. Within six months, with proper corrective trimming, her split nail healed and did not reoccur.

3) What substrates are best for captive elephants? Are there any substrate conditions that promote foot problems?

Asian elephants in the wild experience a wide variety of substrates; their ideal habitat being a classic forest substrate, dirt and leaves and small plants and grasses with plenty of shade trees. These forest substrates are a bit rocky as well, with a combination of dirt, roots, rocks, plants, plus some grasslands and marshes; but mainly the shaded areas of forests.

Best substrates for indoor enclosures: Elephants should not be allowed to spend extended periods of time on concrete. Indoor areas should be covered with a cushioned surface such as rubber matting, sand, wooden pallets or dirt.

Substrates that promote foot problems:

“In the wild, elephants walk on all types of substrates and all but the hardest surfaces “give” a little or a lot under their feet. This natural environment allows the elephant’s feet to wear normally, and allows them to distribute their massive weight, as they walk, in the way nature intended. Concrete, on the other hand, has no ‘give’ at all, and does not allow normal wear nor a natural walking motion that allows the elephant’s toes to dig in the sand or soil as they walk. Over the years and decades of an elephant’s life in the zoo... this unnatural surface takes its toll, forcing the feet into abnormal shape and wear patterns, ... and eventually creates enough damage that the elephants’ feet become chronically infected by opportunistic bacteria and fungi.**concrete flooring steadily injures, and eventually kills many of them.**” (Michael Schmidt, DVM) *Jumbo Ghosts*

In addition to an indoor enclosure which contains matting to cushion the concrete substrate, it is essential to provide elephants with a wide variety of substrates in the most

optimal size outdoor enclosure possible. In addition to the enrichment benefits, we cite many of the medical benefits for the elephants feet as cited below in “Captive Elephant Foot Care: Natural-Habitat Husbandry Techniques” by Carol Buckley included in the book *The Elephant’s Foot*.

1. Pastures: When grazing elephants use their feet, specifically their toes, to strike and sever the bamboo or coarse blades of grass, this wears the area between the toes, where nails and cuticles can overgrow. Routine grazing aids foot health by naturally manicuring cuticles and nails.
2. Trees and forests: An elephant will use one foot to secure a fallen tree while using the other to step on, smash and tear away at the tree bark and root system. Often the foot and toes are used in a repetitive dragging motion. Every part of the foot and nail are used in this activity which helps prevent nails and cuticles from becoming overgrown.
3. Working the soil: Elephants use their feet, specifically their toes, to tear away vegetation and uncover and loosen the soil. This digging activity stimulates blood flow, works the muscles, tendons and joints of the foot and wears the pads and nails.
4. Creek beds: There are other benefits in creek beds, with sand pits that acts like a sandpaper mittens, removing debris from nails and pad, as well as creek mud which condition the foot and protects it from becoming dry and brittle
5. Moisture: The idea that an elephant’s feet must be kept dry in order to remain healthy is a misconception. Non contaminated moisture benefits their feet and helps to maintain a healthy pad. The cuticles and foot pads do not dry out and become cracked. Instead they remain supple making natural wearing easier. When the foot is dried out it is more difficult for normal activity to wear the areas that are over grown.
6. Diet; Poor diet and/or poor assimilation of nutrients affects an elephant’s foot health. Slow growing nails and pads, nails prone to splits or cracks, excessively thin pads, and soft nails can all be the result of a poor diet or a diet that requires significant energy to digest.

Case Study #4 Current Elephant Sanctuary Resident Bunny, 54, lived alone in a zoo for 44 years. Follows an abstract in its entirety from the, Mesker Park Zoo and Botanic Garden in Indiana.

Preventive foot care for an Asian elephant at Mesker Park Zoo and Botanic

Garden. Hughes, Joan Albers; Southard, Madeline. *The Elephant’s Foot: Prevention and Care of Foot Conditions in Captive Asian and African Elephants*. Csuti, Blair; Sargent, Eva L.; Bechert, Ursula S. (Eds.). Iowa State

University Press, Ames. 2001. i-viii. 1-163 p. Chapter pagination: 73-77. ISBN: 0813828201.

Abstract

Mesker Park Zoo & Botanic Garden, Evansville, Indiana has a forty-six year old female Asian elephant (*Elephas maximus*) who is left unchained in a stall with a concrete floor at night. She has daily access to a yard with a substrate of large rock (#53 limestone) covered with crushed limestone (#10 with fines) and an area of sand. We have an aggressive free-contact regimen to prevent serious foot problems. The preventive regimen includes, interior exhibit and yard maintenance, general husbandry, daily hands-on inspections, twice daily foot scrubs and weekly pedicures for all four feet. To make more efficient use of time, pedicures are done with power tools (planer, sander) in addition to the usual hand tools. If the beginning of a problem is found treatment is aggressive. Treatment usually consists of medical soaks, topical antimicrobials and removal of all necrotic tissue. In this manner we have been able to contain relatively minor problems, preventing major problems from occurring.

Introduction

Mesker Park Zoo & Botanic Garden has instituted a free contact preventive foot care program for our forty-six year old Asian elephant (*Elephas maximus*). Incorporated into this program are general husbandry practices, inside and outside exhibit maintenance, daily foot inspections, weekly pedicures and two-way communication between keepers and veterinary staff. The program is updated as new problems arise and old treatments cease to work. This preventive program allows minor problems to be identified and treated early, preventing major consequences.

General Background Information

Bunny, our female Asian elephant, was wild born in 1952 and came to MPZ&BG in 1954. She has been housed by herself except for a short time in the early 1950's and approximately five years in the 1980's when she was housed with younger African elephants (*Loxodonta africana*). She has always been handled with a free contact system defined as "direct human handling of an elephant when the elephant and keeper share the same work space. The safety of the keeper is dependent upon the reliability and responsiveness of the elephant to all commands given" (Mikota, Sargent, Ranglack. 1994). Her temperament is basically mild mannered with intermittent fits of moodiness. Bunny has had several different keepers over the years. She generally has a good relationship with her keepers, but like all elephants she is relatively easily spooked and doesn't react well to change of any kind. The present keeper has worked with her continuously for the last twelve years.

In the past Bunny was chained nightly in the inside exhibit but this was discontinued several years ago due to persistent foot problems on her rear feet, caused by constant contact with urine and feces. Her diet consists of elephant chow (Mazuri – Purina Mills) three to four flakes (partial bales) alfalfa, two to three bales timothy hay and various

produce. She also receives supplemental Vitamin E and rock salt. Bunny is weighed approximately every six months because her weight can have a major effect on the condition of her feet and nails. The more overweight she becomes the more the stone in the yard embeds itself into her feet and the harder it is to keep the pressure off the nails when split.

Elephant exhibit and yard

The condition of Bunny's yard is a major consideration when dealing with her foot problems. Her yard has been the same the entire time she has been here but has gone through many changes. It is a large circular yard with a deep pool at the bottom of a slight hill. The pool was filled all the time during warm weather but her foot problems have caused that to change because the bacterial content of the pool promotes abscesses. Now the pool is usually filled only once a week. However, when the pool is not filled the water is left on as a trickle so Bunny has constant access to water. The pool is two thirds encircled by railroad ties set up on end allowing for behavioral enrichment and rubbing of her feet and body. Years ago the substrate began as grass, then became dirt and mud wallows. During this time period Bunny seemed to have had many more cuticle problems and foot abscesses. A rock substrate was added to cover the mud, causing problems with holes in the soles and nails of her feet. Now the yard has small crushed limestone (#10 with limestone fines) over ninety percent of the total area. Ten percent of the yard is a sand pit which she utilizes a majority of her time outside. There is a large tractor tire in the yard for rubbing on as well as logs and tires of varying sizes. A large ball is available for her use and she takes it with her wherever she goes. Minimal shade is available in the yard, so during the summer she is allowed access to her inside exhibit. Bunny stays inside a majority of the time during hot weather, this has provided behavioral enrichment by allowing her to make the choice of where she wants to stay.

During the colder weather she stays inside. Her inside exhibit consists of two stalls with concrete flooring. There are hanging tires to rub on. Browse and/or logs with bark remaining on them, are provided when available, so she can either eat or rub the bark off with her feet.

Foot health history

There has been a variety of foot problems caused by improper wear of the feet and nails encountered over the years attributed to exhibit conditions and lack of adequate exercise. As she ages there have been more frequent foot problems as well as general health problems. In the past twelve years the condition of her feet and her foot care has changed in many ways.

Here in the Midwest we have varying weather conditions which contribute to foot problems. Hot, humid weather during the summer can encourage abscesses to develop in the cuticles and nails to split. Moist conditions soften the nail, and inadequate wear or trimming can put unusual pressure on the softened nail, causing it to split (Schmidt 1986). In the winter a different set of problems arise. Since the elephant is kept inside

most of the time, necrotic pododermatitis (commonly known and listed here as “foot rot”) above the cuticles becomes more prevalent. This is because she urinates on the inside of her rear legs and is unable to throw dirt back to dry them. The urine keeps the area moist longer, which allows the bacteria a starting point to create this condition. It was more of a problem when she was chained at night. Leaving her unchained at night has also helped with the abscess problem by letting her move to a feces free area. A small pool holds water (not her drinking supply) that can also become contaminated with fecal material leading to abscesses in the cuticles above the nails. A major cause of these problems are chronically wet and dirty conditions and inadequate exercise (Schmidt 1986). The crushed limestone can become a problem during warmer weather because of the access to the yard. Pieces can become lodged in the pads and nails of the feet which, if not removed immediately, can cause the nail to rot or an abscess to form in the sole. Since lime acts as a drying agent, it can cause very small cracks in the nail. There is also a variety of items in the yard for her to rub on helping to prevent cuticle overgrowth. Keeping her feet trimmed is important since she is unable to walk as much as she would in the wild. This lack of exercise can cause overgrowth of the sole and nails leading to major problems. We have become more vigilant in inspecting for the beginning of specific problems depending on the time of year. Here at Mesker Park Zoo & Botanic Garden the keepers do a daily inspection and trimming as necessary. Actual pedicures are rotated doing all four feet once per week. Veterinary examinations are done on a weekly or biweekly basis and more frequently if there is a problem present.

Many foot problems lead to abscesses owing to the thickness of the skin, causing the abscesses to go undetected for long periods of time, to the point that they either have become quite large or have spread and undermined a significant area of skin (Schmidt 1986). “Because abscesses tend to spread beneath the skin rather than come to a head and rupture externally, serious sequelae can occur” (Schmidt 1986).

Bunny’s foot problems did not become persistent until around 1980 at the age of twenty-eight years of age. Before that time she had occasional minor problems. When she started having persistently cracked feet (at the cuticles) a more regular foot care protocol was introduced. This protocol included use of povidone/iodine solution soaks followed by application of ninety percent dimethyl sulfoxide (DMSO) and nitrofurazone solution. By mid 1981 the trimming of excess growth was added to the routine. The actual problem continued into late 1981. From 1982 to late 1985 the routine consisted of povidone/iodine solution soaks and scrubs along with trimming of excess growth of cuticles. In late 1985 her rear feet started cracking. Nitrofurazone applications were added to the routine. By early 1986 the cracks were still a problem. Povidone/iodine solution soaks were still being done, but now povidone/iodine solution was to be flushed into the foot cracks and Kopertox (Fort Dodge Animal Health, Fort Dodge, Iowa) was applied. Throughout the rest of 1986 the feet had no new problems. Then in 1987 a hole developed in the right rear pad. This hole was approximately half an inch deep. Treatment consisted of normal routine, plus flushing the hole with water and keeping it clean. For the next five months more holes appeared. Each new one was pared out to improve drainage. At this time more frequent foot trimming was instituted. By mid 1987 it was decided that the pool being filled with water all the time may be contributing to Bunny’s foot condition. The

pool was then drained until the holes and cuticles healed. A DMSO/nitrofurazone mixture was once again started for use on the cuticles after scrubbing. Three percent hydrogen peroxide solution was used as a flush. The holes in the sole healed well but the cuticles continued to be a problem through 1988 and 1989.

Early 1990 saw a new problem with the discovery of a deep nail crack in the lateral nail of the right front foot. This nail had been previously treated for nail rot. In January 1990, surgical glue was used to try to prevent any further cracking. By February 1990, the surgical glue was switched to an acrylic patch. This filled in the entire crack. Regular foot trimming was to continue as normal with a little more attention to any lameness or heat over the nail and/or cuticle. Two months later the acrylic patch was reapplied after it fell out. Cuticles were still a constant problem and now foot rot had set in just above the cuticles of the rear feet. In July 1990, the acrylic was once again applied with wire woven through both sides of the crack in the nail to help the material remain in the severe crack longer. This was the last application done. When this came out in approximately three months the nail was sufficiently healed and did not require another application.

During the summer of 1991, we had an outbreak of abscesses and realized this was going to be a seasonal problem. The pool was once again drained and left empty to keep Bunny's feet dry. Keeping Bunny's feet as dry as possible was the newest addition to the routine. By the end of three months and the onset of autumn, her feet began improving.

January 1992 started with the addition of using the power sander to sand the cuticles. This improved our ability to keep the cuticles from overgrowing and entrapping debris. Between this time and late 1994 abscesses were identified early and dealt with before they could undermine large areas.

In September of 1994 a fistulous tract of infection was discovered on the left front foot. It appeared to have originated on the sole and broke out a few inches proximal to the place of origin. This area was pared out for drainage and cleaning. Flushing was done with a three percent hydrogen peroxide solution and a mixture of one-third nitrofurazone solution/one-third chlorohexidine solution/one-third three percent hydrogen peroxide solution three to four times daily. The abscess was then packed with a gauze sponge soaked in povidone/iodine solution. A bandage was used to hold the packing in place. The first bandage was a piece of disposable diaper covered with duct tape. Since the bandage was on the front foot and easily accessible, it was removed by the elephant within the hour. The final version of the bandage was a small waterproof pad to hold packing covered with duct tape that was molded to exactly cover only the nail area. This seemed to be acceptable to Bunny and she left it alone. The key to this seemed to be not getting the duct tape on her cuticles. This tract took only two months to heal using this treatment. In mid 1995 another fistulous tract was found on the sole. Treatment consisted of the normal cleaning routine and paring out the necrotic tissues until fresh blood was reached. Then the area was flushed with a mixture of the aforementioned nitrofurazone solution/chlorohexidine solution/hydrogen peroxide solution. This procedure was done at least twice daily until healed. This tract healed within the month it was discovered.

Since mid 1995 we have had no major foot or cuticle problems. Small beginning abscesses are opened immediately upon discovery. These heal quickly.

In August 1998 a fairly large split appeared in the lateral nail of the left front foot. This has been treated by paring out necrotic tissue as necessary to allow for drainage and keeping the nail clean and dry. As of this writing the nail is starting to improve and heal.

With each additional incident we have gathered more information to improve the preventive program. Various aspects of Bunny's life have been looked into, including yard condition, condition of her feet, trimming protocol, general husbandry and weather. Cultures were taken during a couple of particularly persistent problems, they showed that enteric bacteria were the causative agents of the abscesses. This led to changes in the pool schedule and exhibit management. Large fans have been placed outside the inside stalls to hasten the drying of the floors after cleaning.

Equipment for Foot Care

There is a myriad of tools required in the care of an elephant's feet. For this institution the ankus is the most important tool used to train and control an elephant. This is especially crucial when working on an elephant's feet in a free contact system. Because of the free-contact system we require a minimum of two trained elephant keepers each equipped with an ankus to be present while working with the elephant. This becomes even more imperative when giving a pedicure and using power tools. One person controls and distracts the animal; the other works on the feet.

Elephant tubs are used to place the elephant's feet in an appropriate position for foot work. The tubs allow the feet to be placed in a position for improved visibility and prevents the keeper from having to stand on his/her head to see the condition of the sole of the foot.

A power sander with a flexible head adapter is used to shape nails and cuticles. This grooms any ragged and overgrown tissue, removing areas in which debris and moisture can become trapped, preventing abscesses associated with bacterial growth from a mixture of trapped debris and moisture.

A power planer is used to take very thin layers off the bottom of her sole and nails allowing better visualization of possible problems. It also prevents an overgrown sole which can allow an abscess to start beneath it. Since these abscesses can become very severe before being found, early detection is critical.

These power tools allow the necessary work to be done in a shorter amount of time, which in turn results in it being done on a more frequent schedule. The ability to give more time to foot care allows the feet to be maintained in better condition and can help catch problems earlier. There are some drawbacks to the use of the power tools. Cutting too much off at once with the planer can be a serious problem. This can lead to pain or inadvertent access to the circulatory system with resulting contamination. Some of the

problems associated with over planing are folding of the sole and bruising of the tissue underlying the sole. Both of these can lead to more serious abscesses and sloughing of the sole. Planing should always be done a little bit at a time to prevent this. Usually, the planer is set on the lowest setting to cut the thinnest amount of sole. So the rule of thumb when planing is to cut off only the smallest amount possible at one time. Misshaping of the pad is another problem with power tools. The pads should be planed flat and not follow the curve up to the back of the foot. If done improperly the elephant's weight is shifted and other lameness can occur.

Hand files of various sizes are used for smoothing out rough areas left by trimming to prevent debris from being trapped causing an abscess. Hand clippers (like those used to trim goat feet) are used to trim excess growth around cuticles and to open up abscesses in the cuticle. Hoof knives are used to pare open problem areas in the sole and nails. A hand held scrub brush is used for scrubbing her cuticles, nails and soles, on a daily basis keeping feet as clean as possible. Cotton swabs come in handy for checking the depths of draining tracts and holes found in nails and cuticles. Syringes only (no needles) are used to flush disinfectant and medications into the draining tracts caused by abscesses.

Training Bunny to deal with the power tools

Although Bunny has always been trained to be handled in the free contact system, there is specific training that needs to be done to do foot work, especially with power tools. The process starts with allowing the elephant to become accustomed to the sounds made by the power tools (planer, sander) and allowing her to see them. Once this is accomplished then she is trained to allow the power tools to be run over her feet without them being turned on. She is given many treats when she allows this to be done without moving. Then the power tools are turned on her feet. Treats are very important during this training as positive reinforcement and distraction.

Even though Bunny has been trained to allow use of the electric tools, caution must still be used at all times. Foot work should only be done as long as the elephant will tolerate it. Once the elephant's patience is spent foot work should be suspended until the next day. This prevents the elephant from associating foot care with unpleasantness and fear.

Foot care throughout the years

Foot care has gone from basic maintenance of abscesses and dealing with a problem only after its appearance, to aggressively looking for abscesses and nail rot before they become severe. This includes getting her up on a tub twice a week and removing loose flaps and scraping rough areas of the nail to see if there is a larger problem underneath. Then medicating, flushing, cutting away necrotic tissue daily until the problem is completely healed.

Bunny has been through many changes in foot care over the last nine years. We used to use hoof knives to cut pads. Now we have switched to using an electric planer leaving a smoother surface. She is medicated in the morning, fed and locked out in the yard. After the inside exhibit is cleaned she is given access to one inside stall. She receives hay all day long. In the evening she is bathed with a chlorohexidine scrub; her feet are checked for rocks. All skin sores are medicated with povidone/iodine scrub, rinsed, dried and nitrofurazone ointment applied. Feet are dried and Vaseline TM Intensive Care Antibacterial Cream is applied to the cuticles.

General Daily Care

Each morning a visual check of all four feet is done. This is accomplished through lifting of her feet and looking at them. Any debris must be brushed off and most importantly, any rocks embedded in the sole or nails must be immediately removed. Embedded limestone invites nail rot and abscesses if not removed. Twice weekly, each foot is put up on the tub and carefully checked over. This is when the foot can be visualized best and most of the problems are found. A general foot beauty treatment including, cleaning of nails and cuticles, clipping excess flaps off the cuticles and palpating around cuticles for abscesses. Early abscesses feel a bit more fluid and springy than the rest of the cuticle but “owing to the thickness and toughness of normal or overgrown sole, many abscesses of the foot are not readily observable externally as a fluctuant swelling” (Schmidt 1986). The pads are cleaned and at this time the bottom of the nails are checked for any problems (darkened or soft spots). At least once every two weeks the planer is used. The planer is set at the lowest setting and just the outer layer of the pad and nail is removed. This removes the darkened layer and allows problems to become more visible. Any crushed limestone is cleaned out from under this top layer. Then the back of the foot is checked along the side of the pad. Any cracks in this area which appear moist or deep are widened along the sides and the rough edges of the cut sides are filed smooth. After this, the cracks are filed following the contour of the foot from side to side not from top to bottom. This leaves no areas to entrap debris. If no problems are found, the elephant is then put on exhibit (outside in the summer, inside in the winter).

In the afternoon the elephant is bathed and the feet checked once more. Special attention is given to the presence of any new rocks, they are removed if found. The feet are then scrubbed with a brush and chlorohexidine scrub. Once the entire foot is clean and dry a thin layer of Vaseline TM Antibacterial Intensive Care Cream is applied to the cuticle areas and the medial side of the rear feet directly above the cuticles. This cream serves two purposes: 1) it softens the skin and allows the elephant to rub off excess growth herself; 2) it gives some protection to these areas from the effects of urine and feces.

Additional Foot Care To Treat Problems

When a problem occurs the general foot care routine is done with additional treatment for the specific problem. The most commonly found problem are abscesses. It is best to find abscesses as early as possible. Since they are not generally visible until they are quite severe, palpating the cuticles is necessary. The cuticles around and between each nail are palpated. If a suspected abscess is found then a small triangular clip is made over the area

to verify there is serous fluid or pus underneath. An abscess can be filled with either serous fluid or pus depending on the bacteria involved. Many are filled with a serous fluid. If fluid or pus is found, a cotton swab is used to determine the direction the abscess goes (horizontal or vertical). If it is a horizontal abscess then a small triangular hole is made at either end. If the abscess is vertical then a small triangular hole is made at the very bottom of the abscess. The skin on top of the abscess is left in place until the new growth underneath has caused the old skin to slough. This protects the new skin until it has healed enough. The abscess is flushed with a three percent hydrogen peroxide solution or a mixture of one half chlorohexidine solution/ one half three percent hydrogen peroxide solution twice daily. This area is observed daily and kept open until it is well on its way to healing (no more fluid or pus forms under the skin).

Hairline fractures of the nail are a new and ongoing problem. Presently the split is opened into an upside-down V and rounded at the top. The cut sides are filed down so there are no rough edges. The nails are trimmed along the bottom to make sure weight is not affecting the nail. The exhibit is kept as dry as possible to lessen the effects of constant moisture. We presently are basically maintaining this problem and have not found any better preventive measures necessary at this time.

Nail rot is mainly caused by rocks and crushed limestone embedding into the nails. Treatment consists of finding the rocks and paring out that area a little deeper than the rock. If there is a blackened, rotten looking area – that is nail rot. This area must then be cut back drastically and opened up to the front of the nail. An aggressive approach with removal of all necrotic tissue is the key to preventing the spread of nail rot. Sometimes it takes several attempts to finally eliminate all the necrotic tissue. The nails must be trimmed shorter to keep all pressure off of the weakened nail, all the edges are filed smooth. To check this we have the elephant stand on the foot and make sure that nail does not touch the ground. A cotton swab is used to check depth. Draining tracts can be followed to reach the pulp of the nail causing bleeding when the rot is removed. Necrotic tissue can be found to be recurring for several days. The scraped areas are kept clean and dry as much as possible. There is always a little ridge where pulp and nail meet – this area needs to be carefully cleaned out with a cotton swab. As the area is healing some filing is needed to ensure it heals from the inside out. It must be kept opened at all times! Flushing is done several times a day, if the hole in the nail is very large then a gauze sponge soaked in povidone/iodine solution is wedged in place and left there until it falls out, while the elephant is outside. Healing can take several weeks or longer.

Keeping pads planed smooth helps prevent foot problems. By removing the darkened exterior layer it makes any problems below the surface visible. This makes early detection of abnormal conditions and prevention of more serious consequences possible.

Necrotic pododermatitis or “foot rot” on the medial side of rear feet directly above cuticles is generally a seasonal problem and presents itself most often during the winter months. When the elephant urinates the urine runs down the inside of the rear legs. During the summer this is not a problem because the elephant throws dirt and sand to dry her legs. However, in the winter when she is inside at all times there is no dirt or sand to

use and thus the damp urine remaining on her skin promotes the growth of bacteria associated with foot rot. This presents itself as a blackened area where the tissue has a very soft, rotten feeling and is easy to peel off. The first step in treatment is to remove any easily removable necrotic tissue – usually by filing. Doing this allows medications to reach healthy tissue. This is followed by soaking each foot for three or four minutes in a tub with povidone/iodine solution. The feet are scrubbed with a brush, rinsed and dried completely. Then every other day a thin layer of Vaseline™ Antibacterial Intensive Care Cream is applied to the affected area. On the opposite days Kopertox (Fort Dodge Animal Health, Fort Dodge, Iowa) is used instead of the cream. The Kopertox helps dry up the rot. The drier the exhibit, the better the condition of the elephant's feet.

Conclusion

Consistency in the foot care routine is very important. New keepers are trained by experienced keepers in the proper procedures. Keeper vigilance is also very important to the success of this routine. This vigilance includes anticipating what problems might be most likely to occur during a particular season. When a problem is found keepers must be aggressive in starting the proper treatment. Any break in this routine can have negative effects on the health of the feet.

Another very important part of proper foot care is open communication between the elephant keepers and the veterinary staff. This includes a willingness to try new techniques and medications and discard ones that are nonproductive.

Other important factors not related to the actual care and treatment of the feet are the condition of the yard, the weather and general husbandry of the elephant. The substrate in the yard has a great impact on foot condition. If the yard is muddy and damp then abscesses can occur more frequently. Improper rock size can cause problems from nail rot and stone bruises to abscesses in the sole. Standing water such as is found in a deep pool can cause enteric bacteria from feces to start abscesses in the cuticle area.

Bunny's feet have gone through many changes through the years with problems increasing in frequency as she gets older. As the problems increase so does the frequency of preventive and general care required to maintain healthy feet. Prevention, accomplished by correcting any conditions likely to cause foot problems, routine foot care and immediately aggressive treatment when a foot problem occurs are the most critical techniques required to maintain healthy elephant feet here at Mesker Park Zoo & Botanic Garden.

Glossary

fistula – any abnormal, tube-like passage within body tissue

fistulous – pertaining to or of the nature of a fistula.

necrotic pododermatitis – an inflammation of the skin of the foot leading to cell damage caused by enzymatic degradation.

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Bunny since her arrival at The Elephant Sanctuary-When she arrived at the Sanctuary, her foot pads and nails had been over-trimmed, causing the pads to be dangerously thin and the nails weak. The first goal was to allow her pads and nails to grow out. She was given twice-daily foot soaks – with apple cider vinegar, and homeopathic remedies. Within six months, the foot infections that had plagued her for 20 years finally healed. Moving her from concrete and hard-packed dirt to more yielding natural surfaces not only allowed her feet to recover, it prevented the problems from recurring – problems that could have eventually claimed her life. Bunny recovered from her debilitating foot disease within 6 months of her arrival in 1999 and has not experienced any foot problems since.

Case study #5 Delhi, 60 performed in the circus for more than 50 years. For 30 of those years, she was trained and leased to circuses by the Hawthorn Corporation. In 2003, Delhi became the first elephant ever to be confiscated by the USDA after her feet were soaked in full-strength formaldehyde, causing severe chemical burns. Delhi arrived at the Sanctuary crippled, her life expectancy questionable, and classified by her veterinarian to be under hospice care.

November 24, 2003-Delhi arrives at The Elephant Sanctuary

Delhi's feet are severely damaged by infection and chemical burns. She has areas of overgrown skin over much of her body, especially covering her back legs. Her front feet are swollen; she walks awkwardly slow and stands gingerly as if she is experiencing pain in her front feet. Both elbows are infected. Her trunk is not completely functional. The condition is referred to as a "partially paralyzed trunk". She has learned to live with this handicap and never misses a drop of water when taking a drink.

December 1, 2003

Radiographs were taken of Delhi's feet today. These x-rays are an important part of Delhi's medical evaluation. It is our understanding that her feet have not been x-rayed in the past which is unfortunate. The lack of x-rays means we cannot accurately determine

at what stage the infection was one year ago, two years ago and so on. Elephant foot infections are insidious; not only do they eat away at the flesh of the foot but when chronic, the infection actually migrates through the flesh to the bones in the elephant's feet and legs. This condition is excruciatingly painful and life threatening.

Once the infection reaches the bone there are two options, surgery or antibiotic therapy. If the infection is diagnosed early, the infected digit of the foot can be surgically removed. There has been marginal success with this approach. If the infection has spread past the first digit the chance of recovery is greatly reduced. Surgery to remove an infected third digit has never proven successful. In that situation drug therapy is usually the option of choice but it is not a cure.

January 14, 2004

Delhi's x-rays were read today. Delhi suffers from severe osteomyelitis in both front feet. The good news is that the infections have not gotten worse since her last x-rays. It is hard to judge how much better the condition is at this early stage. Our goal is to see steady progress which we believe the x-rays suggest. This will be a slow process, but if we succeed the infection will be stopped.

February 2, 2004

Delhi continues to recover daily. We are seeing a marked improvement in the pads of her front feet which are callusing, regenerating into a thick pad. The daily foot soaks, along with a healthy diet and exercise have been beneficial. Delhi is walking less gingerly, applying pressure to her feet freely and engaging in activities in which she uses her feet to dig and collect grasses.. She no longer has the sprawled stance she had when she first arrived and now spends much of her time playing and actually running around. Today it was raining, so mud became her focus. She spent the afternoon playing in the mud outside the front door of her barn. At one point something caught her fancy and she did the "granny dash" down the lane out into her yard disappearing around the hill. Without hesitation she did a full body slam into a soft mountain of hay created by a "round bale" that she had demolished earlier. She must feel good because she is playful, active and in good spirits

April 27, 2004

Delhi's x-rays indicate that her condition is stable. It is hard to determine if there is improvement at this early stage but judging from her attitude, weight gain and improvement in the condition of her feet, we continue to be optimistic

November 23, 2005 - Delhi's 2nd anniversary

Delhi showed us that even a 60-year-old elephant can scale a fence. She gingerly lifted each of her limber legs, slowly and carefully, over the temporary cable which had been

erected to contain her for quarantine, she slowly but effectively managed to climb over the fence to munch on the tasty grass growing on the other side. These past two years have taught us what an incredible recovery an infirmed elephant can make.

December 2006

Delhi continues her daily foot soaks and enjoying life in the expanded Asian elephant habitat of over 2200 acres. She now also enjoys the constant companionship of Misty, another rescued Hawthorn Corporation elephant.

Case Study #6 Jenny was a female Asian elephant born in 1970 in Southeast Asia. She was trained for the circus where she performed for 26 years. In 1996 Jenny arrived at The Elephant Sanctuary. She was in poor physical condition including; low body weight, overgrown, infected, decaying and split nails and pads. She was alert and attentive and appeared to be in a stable mental condition. On arrival Jenny's pads and nails were severely overgrown. Her pads were spongy and had numerous infected tracts, 1 inch wide and several inches deep. Her cuticles were 1 inch long, dry and cracked. Several nails were 2 to 4 inches overgrown; five nails were severely infected and appeared to be sloughing. The heels of her pads were dry and split with deep vertical cracks. The deteriorated and infected condition of Jenny's feet appeared to be causing her extreme pain. Her behavior pattern after arrival was to lie down every 20 to 25 minutes to avoid the pain she experienced while standing. At every opportunity, Jenny would submerge in one of the ponds or creek. The cool water appeared to help relieve her pain, and because she was buoyant, she was not putting weight on her feet. As days passed, Jenny showed marked improvement; greater activity, less time reclining and the improved condition of her pads and nails. Jenny was conditioned to place her infected feet into tubs of lukewarm, diluted apple cider vinegar twice a day. After the initial soaking, necrotic tissue was trimmed to expose the infected areas. During a series of three trimmings over a 6-week period, more than 2 inches of foot pad was removed. Immediately following treatments, Jenny was released into a 40-acre natural-habitat yard. Her daily activity included mud bath excavation, spring water swims, digging, dusting, napping, grazing, foraging, and tree felling. Over the course of each day, Jenny walked many miles, repeatedly submerged herself in fresh water, and moved several hundred pounds of earth and vegetation. Pad trimming was discontinued after three sessions (6 weeks) Apple cider vinegar soaks continued for 1 year. Jenny's pads required no further trimming; her pads and nails remained at optimum length and condition. Jenny died on October 16, 2006, necropsy results are pending.

African Elephant Feet-Anatomical analysis showing sensitivity in elephants foot cushions. The structure of the cushions in the feet of African elephants (*Loxodonta africana*). (GE Weissengruber, GF Egger, JR Hutchinson, HB Groenewald, L Elsasser, D Famini, and G Forstenpointner *Journal of Anatomy*, December 1, 2006; 209(6): 781-92.)

The uniquely designed limbs of the African elephant, *Loxodonta africana*, support the weight of the largest terrestrial animal. Besides other morphological peculiarities, the feet

are equipped with large subcutaneous cushions which play an important role in distributing forces during weight bearing and in storing or absorbing mechanical forces. Although the cushions have been discussed in the literature and captive elephants, in particular, are frequently affected by foot disorders, precise morphological data are sparse. The cushions in the feet of African elephants were examined by means of standard anatomical and histological techniques, computed tomography (CT) and magnetic resonance imaging (MRI). In both the forelimb and the hind limb a 6th ray, the prepollex or prehallux, is present. These cartilaginous rods support the metacarpal or metatarsal compartment of the cushions. None of the rays touches the ground directly. The cushions consist of sheets or strands of fibrous connective tissue forming larger metacarpal/metatarsal and digital compartments and smaller chambers which were filled with adipose tissue. The compartments are situated between tarsal, metatarsal, metacarpal bones, proximal phalanges or other structures of the locomotors apparatus covering the bones palmarly/plantarly and the thick sole skin. Within the cushions, collagen, reticulin and elastic fibres are found. In the main parts, vascular supply is good and numerous nerves course within the entire cushion. Vater-Pacinian corpuscles are embedded within the collagenous tissue of the cushions and within the dermis. Meissner corpuscles are found in the dermal papillae of the foot skin. The micromorphology of elephant foot cushions resembles that of digital cushions in cattle or of the foot pads in humans but not that of digital cushions in horses. Besides their important mechanical properties, foot cushions in elephants seem to be very sensitive structures

4) Do captive elephants require a certain amount of exercise (i.e. walking) to maintain healthy feet?

Elephants in the wild:

Elephants are physically vigorous, non-territorial animals that move almost continuously for 20 out of every 24 hours (Moss, 1988).

Elephants range 10 to 20 km (7 to 13 miles) per day without regard to species type (Sukumar 2003).

In Amboseli, elephants inhabit what is regarded as a relatively small area for wild elephants. Members of this elephant population range over approximately 5,000km². **(3,100 miles)** Each elephant and its family have a core area of use encompassing at least 194km² **(120 miles)**. Elephants travel 8 **(5 miles)** to 20 **(12 miles)** kilometers a day, frequently walking further in areas of lower resource availability, or when a male is searching for females. Figures for Asian elephants are similar with home ranges averaging 350 km² **(217 miles)** for males and 100 **((62 miles)** to 115km² **(71 miles)** for females and daily movements ranging between 8 **(5 miles)** to 22 km **(14 miles)**. [Joyce Poole, 2005]

Asian elephant needs anywhere from 25000 Ha to 60000 Ha (61,750 to 148,200 acres OR 96.5 square miles to 231 square miles) and for a male up to 75,000 Ha (185,250 acres or 290 square miles).

The elephants move quite a distance in a single day, from 1.5 to over 50 Km/day (.9 to over 30 miles per day). [A. Christy Williams, 2005]

Most zoo elephants, over 60%, die of illness rather than old age (Clubb & Mason, 2002). Captive elephants are often unable to travel the long distances (and therefore receive appropriate levels of physical exercise) covered by their wild counterparts. According to studies, zoo elephants may be 31-72% heavier than wild elephants (Kurt and Schmid, 1996). Overweight elephants tend to develop disorders of the feet, joints, ligaments and skin causing discomfort and suffering. Arthritis is also common and is thought to be caused by the cold and by prolonged contact with damp concrete floors, a common feature in elephant enclosures.

Here are three case studies of the oldest Sanctuary resident Asian elephants and one young African elephant who have shown clear benefits from exercise after many years in captivity.

Case Study #7 Delhi, 60, When Delhi moved from her quarantine area into the Asian habitat in 2004, she wasted no time in moving out into the habitat and straight up a steep hill. Delhi climbed the hill like she had done it a million times. Although she continues to suffer from osteomyelitis, the disease process has slowed dramatically and she is extremely active, walking miles each day exploring the habitat. When the weather is good, she spends all day and night outside. Due to her environment and diet, her health is good and the advancement of her osteomyelitis has slowed considerably. Delhi's continual activity includes climbing, walking, and the occasional run which exercises a full range of motion for all of her joints.

Case Study #8 Shirley, 58, performed for 30 years with the circus. Her leg was broken when she was attacked by another elephant. Despite her injury, she had to continue performing with the circus for almost two more years. When she arrived, her permanent leg injury caused her to limp and wear her nails and foot pads unevenly. Her skin was dry, with layers of dead skin built up on her head and back. Today, Shirley is one of the Sanctuary's oldest elephants yet she is very active. Last year Shirley was observed in full play behavior using her full range of motion. She has no problem lying down, scaling hillsides, traversing a steep hill up and down, swimming, and running, walking miles each day. while moving about the habitat with the members of the herd. As a direct result of her activity, her nails and foot pads wear evenly and no longer require corrective trimming. Additionally Shirley appears to have no discomfort in her crippled leg.

Case Study #9 Zula, 31, African elephant Historically, African elephants do not suffer from the same type of foot problems as their Asian cousins because their species is designed to live on naturally hard surfaces, such as the packed earth of an open savannah.

Zula lived in a wild animal park and was moved to the Sanctuary with her companion Tange because the director felt that the park facilities were inadequate for them. Zula arrived at the Sanctuary with a history of hip problems. After several months of increased activity, Zula's range of motion improved and she is now navigating terrain that she was incapable of navigating upon her arrival.

Response to the so-called benefits of Elephant Rides

It has been suggested that elephant rides are a good form of exercise for captive elephants. Certainly if an elephant is chained for hours each day, or living in an extremely small zoo enclosure, there is benefit to almost any activity that allows them to move, but the ride alternative is not to be considered an acceptable alternative to proper husbandry. Elephants must engage in forms of exercise that will exercise their full range of motion to insure a healthy body and mind. As much of this exercise as possible must be free choice and not dictated exercise.

Why elephant rides are detrimental to the physical health of elephants:

- 1) The repetition movement in small circles is unnatural movement for elephants. This repetitive movement can actually have an accumulated negative effects on the joints and muscles of the elephant that does rides for any length of time. In addition to the impacting joints and muscles, this unnatural repetitive circular movement, which is dictated by the trainer can have an accumulative mental impact as well; this activity is seriously boring for elephants.
- 2) The extra weight of the rider is an unnatural weight burden which puts a strain on all joints and muscles
- 3) Circular motion is not natural nor beneficial, repetitive circular movement causes a burden to the elephants muscle structure
- 4) This circular walking can also wear foot pads and nails in an unnatural way,
- 5) The substrate is almost always an unnaturally hard surface (asphalt, concrete or hard packed dirt) which further negatively impacts the health of the elephant's joints, nails and feet.

5) What industry/professional standards are available for elephant care and husbandry?

THE ELEPHANT SANCTUARY IN TENNESSEE
Guidelines for Captive Elephants

A) Outside Enclosures:

- 1) Should include a variety of natural substrates
- 2) A pool of fresh circulating water, large enough for several elephants to completely submerge
- 3) Separate source of water for drinking
- 4) Shade structure
- 5) Rocks, boulders and tree trunks for scratching and conditioning the skin and feet
- 6) Ample room for the elephants to run and exercise unrestricted. Minimum acreage has not yet been established for captive elephants but by studying their wild cousins we know that families of elephants utilize thousands of acres in order to sustain a healthy life style. We have learned from hands on experience that less than a few hundred acres is insufficient if the goal is to rehabilitate captive elephants who have suffered the traumas of traditional captive life.
- 7) Must be fenced in a manner suitable to contain the species:
 - a) Thick wall steel pipe (minimum 4-1/2" thick) concreted into the ground
 - b) If horizontals are used they should be made of steel cable, thick wall steel pipe, or steel square tubing, sufficient to withstand the potential harsh treatment of a 10,000 intelligent athlete.
 - c) If steel cable is used the design must be "slack wire" to deter the elephant from climbing out
 - d) Hot wire fencing is highly effective if installed properly. However hot wire fencing should never be used as primary fencing
 - e) The enclosure should be a minimum of 5 feet high
- 8) No elephant should have direct access to moats that create a safety hazard. If a moat is utilized to contain an elephant it must be designed so that the enclosure side of the moat has a gradual slope enabling the elephant to safely walk in and out of the moat unassisted. Additionally the enclosure side of the moat and bottom should be constructed of dirt, grass or other natural substrate. The enclosure side and bottom of the moat should not be constructed of any hard, unyielding material such as rock or concrete. The moat must be designed to drain so that water and debris does not collect at the bottom. The containment side of the moat (the wall) can be made of any nontoxic material that is proven non-hazardous in the event that the

elephant touches, rubs on or ingests the material. Smooth finish concrete or smooth rock is suggested. Machined wood posts and planks can splinter when an elephant rubs on them and creosote used to preserve utility poles and railroad ties is toxic. The containment side of the moat should be high enough to prevent the elephant from placing his/her chin above the wall.

B) Shelters:

- 1) Elephants must have shelter from inclement weather
- 2) Any area of the structure that elephants have direct access must be constructed of materials capable of withstanding an elephant's force.
 - a) Walls can be made of concrete filled block, or solid concrete slabs, wood plank covered concrete, or any other material that will withstand an elephant's force.
 - b) Alternative materials can be used for the exterior walls if the elephants are not permitted direct access to the walls
- 3) Each elephant should have a minimum of 1000 square feet of personal indoor space.
 - a) Floors should be constructed of poured concrete, at least 6 inches thick, pitched to the back, with ample drainage
 - b) Concrete floors should be covered with solid wood platforms or rubber matting
- 4) The shelter should be designed to provide individual spaces, as well as a common space for socialization
- 5) Elephant and caregiver areas should be divided. Steel pipe set on two-foot centers provide a safe caregiver/elephant barrier. The caregiver areas should be a minimum of 15 feet wide.
- 6) Ceiling height should be a minimum of 16 feet
- 7) All light fixtures should be recessed or designed to prevent elephants from reaching them.
- 8) No electrical or plumbing fixtures should be within the immediate elephant area or an elephant's reach
- 9) No electrical or plumbing shall be routed through an elephant's area or through an area within an elephant's reach
- 10) Chains should never be used to restrain an elephant
- 11) The shelter should be equipped with a restraint chute, scale and hoist
- 12) The shelter should have ample ventilation to maintain good air quality
- 13) Windows and skylights are recommended to allow sunlight into the shelter during inclement weather
- 14) The shelter must be equipped with a heat source capable of maintaining the shelter at 65 degrees
- 15) Automatic watering devices should be available for the elephant's free choice access to fresh drinking water
- 16) Elephants must have free choice access to the outdoors during suitable weather (temperatures over 32')
- 17) No female elephant should be kept in solitary isolation except in the case of contagious disease, and then only for the duration of her treatment.

Whenever possible a quarantine facility should be designed to give elephants visual and auditory access to non quarantined elephants provided a minimum of 75 feet division separates the two. Any elephant infected with a contagious disease must be maintained in a quarantine facility with a separate air supply from other elephants to prevent the spread of disease. Waste from the infected animal, barn waste, soiled hay or bedding, feed, and gray water from washing the barn must not be allowed to contaminate any air supply or area occupied by other elephants. The quarantine facility must be equipped with auxiliary inside shift stall and outside shift yards for separation and temporary confinement for medical and treatment purposes. The auxiliary stall and yard should be used only when necessary to ensure caregiver and elephant safety, to monitor dietary intake, and as required for medical purposes.

- 18) Enclosures must be maintained free of feces and waste, washed daily, and disinfected weekly. If elephants are confined indoors they must have ample space to ensure that they do not stand or sleep in their own waste.

C) Nutrition:

- 1) Elephants are constant eaters and must have free choice access to clean, nutritious hay or live vegetation (adult=150 pounds per day). Protein level of hay should range from 12% to 17% and be dust and mold free.
- 2) Whole grains, vitamins, minerals, salt, and pro-biotics should be supplemented on a daily basis. The amount depends on the condition of the individual elephant.
- 3) Each elephant should receive 10-20 pounds of fresh fruits and vegetables per day.
- 4) Trace mineral salt should be offered free choice.
- 5) Elephants should be tested for vitamin E levels. If levels are low they must be supplemented on a daily basis with a liquid form of Vitamin E.
- 6) Fresh browse should be made available whenever elephants are confined indoors.

D) Enrichment:

- 1) Elephants should never be housed alone
- 2) Any herd of less than five individuals is not considered a viable social group. Every effort should be made to house elephants in groups no smaller than five.
- 3) Any object that is elephant-proof can and should be considered for elephant enrichment.
- 4) Nothing takes the place of freedom to roam and live vegetation to eat, but enrichment can alleviate boredom and development of neurotic behavior.
- 5) The key to successful enrichment is to change the enrichment objects regularly.
- 6) Logs, boulders, piles of sand, gravel, clay and substrate are enriching.

- 7) New sights, sounds, and smells are enriching.
- 8) Keeper-directed activities and public exhibition should not be considered viable enrichment.

E) Veterinary Care:

- 1) A veterinarian familiar with elephants must be accessible. The more often a veterinarian visits the barn, the more comfortable he/she will become with the elephants. Even if the facility is protected contact, it still is important that the veterinarian and elephant are comfortable with each other.
- 2) Baths should be given daily.
- 3) Foot trimming should be done as needed.
- 4) Fecal examinations should be done twice a year.
- 5) Tuberculosis and general blood tests should be done once a year

F) Management:

- 1) Free contact non-dominance and protected contact are considered viable forms of elephant management.
- 2) Any form of punishment is unacceptable.
- 3) No elephant should ever be struck, poked, prodded or hooked with any object or weapon.
- 4) Electricity does not prevent aggression in elephants and cannot be used for any purpose.
- 5) Chaining can be detrimental to an elephant's joints and therefore is considered an unacceptable husbandry and management tool
- 6) Food, water and companionship are essential for an elephant's well-being. Deprivation of any or all is considered abusive
- 7) If an elephant continues to display aggressive behavior, alternative positive management approaches must be explored.
- 8) Bonded individuals must not be separated.
- 9) Bonded herds must not be separated.
- 10) Species must be conspecific.
- 11) Captive breeding does not enhance nor conserve the wild population and is considered exploitive as the offspring are held in captivity for their entire life, many times separated from their maternal family, spending their life in a restricted environment entertaining the public..
- 12) Elephant rides and shows are not considered to be an appropriate activity for captive elephants. The elephants are dominated by their trainers, in many cases separated from their herd members, and forced to travel under conditions that are unnatural for elephants.

6) Are there any other health or care issues related to elephants that should be specifically addressed in the AWA standards?

Yes, these issues detailed below include space, unrelated bond herds, climate, temperature, transport, and tuberculosis protocol.

Space

Elephants are a highly intelligent, social species, motivated by food and relationships. It is our observation that a diverse vast space and compatible others have the greatest positive influence on an elephant's behavior and health. Space helps to reduce tension and relieve boredom. With room to roam elephants can maintain healthy feet and a toned body. Subordinate elephants do not feel trapped or hunted by an intimidating elephant; with room the subordinate elephant can flee. She has an opportunity to develop the self-confidence necessary to overcome her fear, and over time she can develop the skills to relate to other elephants and become a viable, integral member of the herd. Space provides the opportunity to avoid confrontation, thereby reducing stress. Reducing the pressures that can cause an elephant to become fearful and/or agitated decreases the probability of aggression toward other elephants and caregivers.

With space, elephants spend less time in proximity to caregivers and more time relating to one another. They learn to get their social and psychological needs met from one another, and they become a healthy, self-governing herd. The caregiver's role is not to dominate or dictate the elephants' lives but to provide a place where the elephants feel safe.

Space and unrelated bond herds

Elephant herds in the wild:

In addition to encountering the local males that live on the fringes of one or more groups, (wikipedia.org) the female's life also involves interaction with other families, clans, and subpopulations. Most immediate family groups range from five to fifteen adults, as well as a number of immature males and females. When a group gets too big, a few of the elder daughters will break off and form their own small group. They remain very aware of which local herds are relatives and which are not. When undisturbed, the herd pursues a regular and orderly routine of drinking, bathing and feeding in accustomed places and resting in a favorite retreat area.

Cow herds typically number 9 to 11 elephants. (www.nature-wildlife.com) Larger herds tend to split in two but continue occupying the same home range and associating at least half the time. These "bond groups," averaging 28 related elephants in 2 to 3 family units, usually stay under a mile apart, staying in touch through rumbling calls too low for

people to hear. Different bond groups may share a home range; they may all belong to the same clan. Depending on primary plant productivity and resource distribution, home ranges can be as small as 5.4 mi square (14 km square) in a groundwater forest (e.g., Manyara NP, Tanzania) to over 1350 mi square (3500 km square) in arid savanna. Persecuted elephants aggregate in herds numbering up to 200 animals including many young elephants. Animals from the same clan may often be involved, reunited in adversity and their common need for leadership. Aggregations of up to 1000 elephants used to form during rainy seasons and were often migratory.

Unrelated bond herds at The Elephant Sanctuary

The original seven elephants at the Sanctuary who range in age from 32 to 60 have formed a functional herd of unrelated individuals with 58 year old Shirley as the matriarch. This is a very healthy group, which has had ample time and more than ample space to allow each elephant to make the choices about the relationships she is comfortable with. An entry from our log in 2005 states:

Today was a reminder of what we are striving for; a healthy environment which allows for natural behavior between caring members of a close-knit family group of elephants. What a joy it is to observe these elephants as they demonstrate how important choice is in their lives. We observed a banquet of displays of affection; first Shirley and Tarra, then Jenny and Sissy and then Sissy and Shirley, all in a 20 minute span of time.

We observed this herd greet each new arrival in turn, which was not the case with our second herd, the former Hawthorn elephants.

Early in 2006, the Sanctuary received eight circus elephants previously owned by the Hawthorn Corporation. They were chained and, for the two years before coming to the Sanctuary, confined in a barn. Denied the opportunity to interact naturally, they built up resentments toward their keepers and each other. Their first weeks at the Sanctuary, in an environment of freedom and free choice, allowed long-simmering conflicts to come to the surface. This is part of their recovery and another reason why space is so important. With space, they can work through their unresolved issues with the ability to avoid each other or engage, without fear of being cornered in a small yard or barn. They are now able to form sincere loving relationships with each other. The habitat for both these herds was several hundred acres; the founding herd is now in a 2200 acre habitat with lots of room to introduce new arrivals.

The Riverbanks Zoo

It is vital that elephants have space and freedom of choice when integrating elephants into larger groups. When elephants feel they have no choice when presented with a new relationship it is very stressful and they react in kind. Small space was an issue for the Riverbanks Zoo (The new exhibit built in 2002 is 1 acre, with a 300,000 gallon pool. The barn is approximately 5,000 square). They have previously tried to integrate unrelated females as documented in the following fact sheet. (c. In Defense of Animals)

TIMELINE

1985 – Dec. 2001: Belle and Belinda live at Columbus Zoo
2000: Penny arrives at Columbus Zoo from Henry Vilas Zoo in Madison, WI
2000-2001: Belle, Belinda, Penny live at Columbus Zoo
Dec. 2001: Belle, Belinda and Penny are shipped to Riverbanks Zoo in Columbia, South Carolina and placed in the new 1-acre exhibit.
April 2002: Belinda first goes out into exhibit with Belle and Penny.
Sept. 2002: Tumpe arrives at Riverbanks
Sept - Nov. 2002: Belinda's behavior "regresses" and she starts refusing to come out of the barn.
Nov. 2002: Belinda dies
Nov. 2002 – Feb. 2005: Belle and Penny fight with each other. Both gang up on and fight with Tumpe, pushing her into pool, trapping her in stall, etc.
Nov. 2003: Star arrives at Riverbanks from Hollywild Animal Park.
April 2004: Star let out into exhibit with other 3 elephants
Oct. 3 – 4, 2004: Star climbing over log at back corner of exhibit.
Dec. 17, 2004: Star sent to Montgomery Zoo

Climate and Temperature

Elephants in the Wild

Elephants are found mainly in warm climates: forests and open grasslands alike make a good home. Asian elephants live in tropical forest regions throughout the continent while African elephants are often seen in the open plains and savannahs of Central Africa. Both kinds need to be near water (animalexploration.tripod.com)

Sri Lanka weather

Sri Lanka's position between 5 and 10 north latitude endows the country with a warm climate, moderated by ocean winds and considerable moisture. The mean temperature ranges from a low of 15.8° C (60 degrees F) in Nuwara Eliya in the Central Highlands (where frost may occur for several days in the winter) to a high of 29° C (84.2 degrees F) in Trincomalee on the northeast coast (where temperatures may reach 37° C (98.6 F)). The average yearly temperature for the country as a whole ranges from 26° C to 28° C. (79-82 degrees Fahrenheit) Day and night temperatures may vary by 4 to 7 . 7. January is the coolest month, causing people, especially those in the highlands, to wear coats and sweaters. May, the hottest period, precedes the summer monsoon rains.

Indonesia climate

Indonesia has a tropical climate with high humidity. There are two seasons: the dry season from May to September and the wet season from October to April. Monsoons are frequent during the wet season, and even during the dry season there is some rainfall.

Thailand's Climate

Thailand's climate is tropical, high both in temperature and humidity, and dominated by monsoons. April and May are the hottest months of the year, when even the locals are moved to complain about the heat. June sees the beginning of the South West Monsoon, and brings with it the rainy season, which continues intermittently until the end of October.

From November to the end of February the climate is much less trying with a cooling North East breeze and a reduction in the humidity level. (<http://en.wikipedia.org/wiki/>)

US Zoos

The temperature range in natural areas where elephants live is around 30 degrees to 110 degrees. The climate for many US zoos averages prohibitively cold temperatures in the coldest winter months. Syracuse New York which houses six Asian elephants at the Rosamond Gifford Zoo averages 16 F degrees in the December-February months. The Buffalo Zoo also with Asians averages 20F degrees, while the National Zoo further south in Washington D.C. averaged 29F degrees in the same time frame.

The Elephant Sanctuary in Tennessee Climate

The weather in Hohenwald, TN is quite similar to the weather in natural areas where elephants live, with comparable temperatures that range from 30 degrees to 110 degrees. Both Southeast Asia and Hohenwald, TN are classified as sub-tropical, sharing similar climate, weather conditions, terrain, vegetation and growing season; both provide suitable conditions for elephants to thrive. Only in the month of January are there some days that temperatures cause the elephants to seek the shelter of their heated barn. Even on a day considered cold by human standards, the elephants spend extended periods outside.

Weather in Hohenwald, Tennessee

Hohenwald, Tennessee was chosen as the location for The Elephant Sanctuary because of its similarity to natural habitats of wild elephants. The charts below demonstrate just how mild Hohenwald's weather and climate conditions are. Both Hohenwald, Tennessee and elephant ranges in Southeast Asia are subtropical, experiencing similar climate, weather conditions, terrain, vegetation and growing season; both provide suitable conditions for elephants to thrive.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ave. temp. (F)	36.8	41.1	49.8	58.2	66.3	74.0	77.8	76.5	70.2	58.7	48.8	40.2
High temp. (F)	48.2	54.2	63.8	73.3	79.7	86.4	89.7	89.1	83.4	73.4	61.7	51.6
Low temp. (F)	25.4	27.9	35.7	43.1	52.8	61.4	65.9	63.9	56.8	43.9	35.9	28.8
Precipitation (in.)	4.7	4.5	5.9	4.8	5.9	4.6	4.8	3.2	4.0	3.4	5.2	5.7

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Days with precip.	11	10	12	11	11	10	9	8	7	9	11
Wind speed (mph)	9.0	9.3	9.8	9.1	7.6	6.9	6.3	6.0	6.5	6.9	8.8
Morning humidity (%)	80	79	78	80	85	87	89	90	89	86	81
Afternoon humidity (%)	67	63	58	57	60	61	62	62	62	59	67
Sunshine (%)	42	48	53	60	61	66	64	64	63	62	42
Days clear of clouds	6	7	8	8	8	8	8	10	11	13	7
Partly cloudy days	6	6	7	8	10	12	13	12	9	8	7
Cloudy days	18	15	16	13	13	10	10	9	10	11	17
Snowfall (in.)	2.9	2.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0

Transport

At some time in their life a captive elephant will be transported; many travel on a regular basis to performance venues across North America. If elephants are allowed to travel, guidelines that address travel accommodations must be developed to insure a traveling elephant's safety, health and welfare.

For all modes of transportation the duration of confinement, and a range of acceptable temperature within the confined area must be established; currently no such requirements exist. Currently five modes of transportation are available for elephants; crate on a flatbed trailer, crate in a cargo plane and crate on a cargo ship, railroad car and semi trailer.

Each mode of transportation has its challenges but transporting by crate is possibly the most undesirable due to the challenge of meeting the elephant's safety, health and welfare needs. Cargo plane and cargo ship transport is regulated. Although the regulations address the safe containment of the cargo, these regulations do not address the safety, health or welfare of the elephant.

A crate transported on the back of a flatbed trailer can create safety, health and welfare problem for elephants, including little protection from the elements. Tarping a crate does not provide sufficient protection from the elements nor provide an opportunity to control and maintain temperature. Additionally, when a semi-solid crate is used for transport as opposed to a cage style crate, veterinarians and caregivers do not have full access to the elephant for feeding, cleaning and medical emergencies. Unavoidably, the crate, with the elephant inside, must be lifted by heavy equipment to be loaded onto the flatbed trailer, causing the elephant undue stress.

Transport by railroad car limits the ability to make unscheduled stops, caregivers are limited as to when they can service the elephants, the height of a railroad car is lower than a semi trailer cramping an elephant's already minimal space, and many elephants are chained inside the congested space adding to safety and health issues. Unavoidably, the constant vibration caused by rolling over the railroad tracks adds to the fatigue an

elephant experiences as they work to stay upright, balancing their huge bulk in a moving railroad car, hour after hour.

A semi trailer can be designed to provide a variety of features that address an elephant's safety, health and welfare during transport. Such a semi must be constructed with an interior cage to hold an elephant chain-free. This cage must be designed to give a caregiver safe access to the entire elephant. The trailer must have several closable air vents along both sides and on the back doors. These vents must be accessible during transport from the outside of the trailer. The trailer should also be equipped with two sets of double elephant access doors; one on the back and another on the side. A storage area accessible by caregivers from the passenger side must be designed to store tools, feed and other equipment required for transport. A tank for palatable water should be installed inside the storage room or under the belly of the trailer to carry fresh drinking water. A refrigerator unit (standard semi component) must be a permanent feature of the trailer to insure that a controlled temperature (air conditioning and heat) can be maintained inside the trailer at all times; not only during transport but during layovers as well. A video camera should be mounted inside the trailer, out of the elephants reach, with a monitor in the cab of the truck for continual surveillance of the elephant.

Tuberculosis

Tuberculosis is an emerging disease in the captive elephant population. The Elephant Sanctuary in Tennessee developed a detailed protocol for its quarantine facility which has housed eleven of the former Hawthorn elephants all elephants who have been TB exposed or TB positive.

THE ELEPHANT SANCTUARY RESPIRATORY PROTECTION AND INFECTION CONTROL PLAN

The following is the Elephant Sanctuary's respiratory protection and infection control plan which it will implement when a MTB culture positive elephant is in residence.

- The Sanctuary will adopt all aspects of the use and care of the N-95 mask as outlined by the Tennessee State Department of Health. The Sanctuary will utilize resources made available by reliable sources including the Tennessee State Department of Health to train staff, visitors and volunteers on the hazards, symptoms, and mode of transmission of *M. tuberculosis*. The Sanctuary will work with the Department of Health to track the MTB status of all personnel and will respond to recommendations made as result of any conversion by Sanctuary personnel.
- The Sanctuary will follow the MTB treatment protocol as established in the Guidelines for the Control of Tuberculosis in Elephants developed by the National Tuberculosis Working Group for Zoo and Wildlife Species.
- The care and treatment of all resident elephants, including MTB culture positive elephants, will be performed under the authority of Dr. Steven Scott, the vet of record. The Sanctuary will continue to consult with Dr. Susan Mikota, member of the National Tuberculosis Working Group for Zoo and Wildlife Species. Dr. Mikota has first hand experience with MTB culture positive elephants. She is intimately familiar with the medical history of the two elephants currently scheduled to be moved to the Sanctuary. Dr. Mikota has agreed to consult with the Sanctuary regarding the care and treatment of MTB elephants in residence. Dr. Freeland Dunker is the head veterinarian at the San Francisco Zoo. He developed and implemented successfully MTB treatment for an Asian elephant with a history of aggression towards people. Dr. Dunker has agreed to be available for consultation regarding the ongoing treatment of any MTB elephant in residence at the Sanctuary.

- When a MTB culture positive elephant is in residence at the Sanctuary, a sign notifying staff, visitors and volunteers will be posted. Additionally, when an elephant is identified as MTB culture positive, all persons entering the compound where the quarantine barn is located will be informed of the hazard with a verbal warning and written handout informing them of TB situation and precautionary measures required by everyone who enters.
- The Sanctuary will control access to the area housing MTB culture positive elephants by administratively limiting access to essential personnel. No non-essential visitor will be allowed on grounds.
- When a MTB culture positive elephant is in residence at the Sanctuary, the Sanctuary will take the following precautionary measures in the barn to reduce the risk of spreading the disease.
 - Staff will be assigned so as to limit the risk of cross contamination. Two senior caregivers will supervise the care and treatment of any MTB culture positive elephant. Their access to both populations of elephants, MTB culture positive and non exposed, will be severely limited. An additional two caregivers will be assigned to the direct care and treatment of any MTB culture positive elephant. These two caregivers will have NO access to any other elephant until such time as the elephants in their care have had two consecutive negative trunk washes, 30 days apart following demonstration of achieving therapeutic drug levels as defined by the working group.
 - No pressure washer or leaf blower will be used to clean the barn.
 - Radiant heaters will be used as opposed to the blower-style forced air heaters.
 - When the barn is closed, cupola style exhaust fans equipped with HEPA filters will be used to draw air from the barn and dilute and disperse it into the atmosphere, in a direction not occupied by personnel or elephants.
 - Manure will be collected in a container separate from the other elephants' waste. It will be stored away from creeks, streams and elephants.
 - Mycobacteriocidal disinfectants will be utilized to clean the quarantine facility.
 - A fence barrier will be used to prevent dogs and other animals from entering the quarantine barn and yard.

- All tools will be kept separate from the other barn and elephants.
 - All doors and windows on the east facing wall of the main elephant barn (the wall adjacent to the quarantine barn) will remain closed for the duration of time that any MTB culture positive elephant is inside the quarantine barn.
 - The existing elephant population will be restricted open air access of no closer than 75 feet to the quarantine barn and yard.
- All personnel will be provided with N-95 masks that have been appropriately fit-tested by a trained health care worker.
- All staff having contact with MTB culture positive elephants will be provided with protective equipment, including N-95 masks that have been appropriately fit-tested by a trained health care worker. Additionally, gowns, gloves, boots and any other gear deemed appropriate by the attending veterinarian will be provided for and worn by staff when collecting trunk wash samples, treating and caring for MTB culture positive elephants. The attending veterinarian will be familiar with, and adhere to, the requirements and recommendations of “THE NATIONAL TUBERCULOSIS WORKING GROUP FOR ZOO AND WILDLIFE SPECIES”.
- Any staff, visitor or volunteer that enters the compound when a MTB culture positive elephant is present will be required to put on their N-95 mask at the front gate, prior to entering Sanctuary property.
- An N-95 mask will be required to be worn by all office personnel from the time they enter the property until they are inside the office space. The only time the office personnel will be allowed to not wear their mask will be while they are inside the office.
- The air intake to the office will be equipped with a HEPA air filter when a MTB culture positive elephant is in residence.
- All personnel, including maintenance and caregivers, will be required to wear their mask while in proximity of the quarantine barn and yard whenever a MTB culture positive elephant is outside.
- All personnel with access to the compound where the quarantine barn is located are required to have the 2-step TB test prior to being allowed on grounds. When there is a MTB culture positive elephant in residence, personnel will be given TB skin tests every three months.