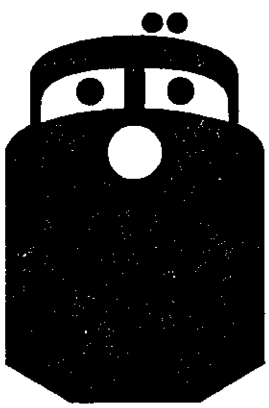
The CANALERT Guide

for Locomotive Engineers and their Families

Living in a 24-Hour World



Cover Photo, "Space Sun Eclipse," courtesy NASA. From the CD-ROM *Mediaclips Worldview.*

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Introduction

CANALERT

To the CANALERT Volunteer

Welcome to the CANALERT Project. Together we have the opportunity to bring improvements to railway policies that have seen little change over the past hundred years.

You have the opportunity, through your participation in the CANALERT Project, to bring ground-breaking change to your life and the lives of your family as well. The CANALERT countermeasures, designed to enhance your alertness and stabilize your work and sleep schedules, cut to the heart of railway lifestyle issues and concerns that many locomotive engineers have battled with throughout their railway careers.

This training session and guide book are the first countermeasure. The discussions that we will have here about alertness, sleep, health, and family and social issues are designed to help you understand the other countermeasures and integrate them effectively into your life.

As with anything, the personal results you achieve from your involvement in this project are largely dependent on the effort you put into it. We sincerely hope that you will seize this opportunity and make the most of the countermeasures, thereby reaping the full benefits of volunteering for the CANALERT Project.

About Circadian Technologies, Inc.

Circadian Technologies, Inc. (CTI), with the cooperation of the Brotherhood of Locomotive Engineers, CN Rail, CP Rail and VIA Rail, has developed the CANALERT project.

CTI was established in 1983 by Dr. Martin Moore-Ede, a professor at Harvard Medical School in Boston. Dr. Moore-Ede pioneered the scientific development of biocompatible work schedules for around-the-clock operations and has developed a number of techniques for enabling employees to remain awake, alert and vigilant while working outside of traditional daytime hours.

CTI consults to all types of businesses which operate 24 hours a day, including oil refineries, nuclear power plants, manufacturing facilities and all modes of transportation (road, rail, sea and air).

Our mission is to improve safety, health and performance in around-the-clock operations by developing solutions based on our expertise in circadian physiology, ergonomics and human alertness technologies.

Benefits of a Locomotive Engineer's Lifestyle

- Freedom from rush hour traffic
- The use of public sports and recreational facilities when everyone else is working
- The ability to participate in school and daytime events
- The opportunity to coach a sport
- The convenience of running errands that can only be accomplished on weekdays, and doing so at times when stores aren't crowded
- Good salary
- The opportunity to enjoy daytime hours outside.

More Benefits:

The CANALERT Countermeasures
An Overview

The CANALERT countermeasures are designed to work together as a program that increases alertness and safety in the railway industry while promoting healthier, more balanced lives for locomotive engineers.

- Lifestyle Training
- Headsets with Music
- Napping
- Bunkhouse Upgrade
- Individualized Counseling
- Time Pools.

Biological Clocks

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Design Specs for the Human Body

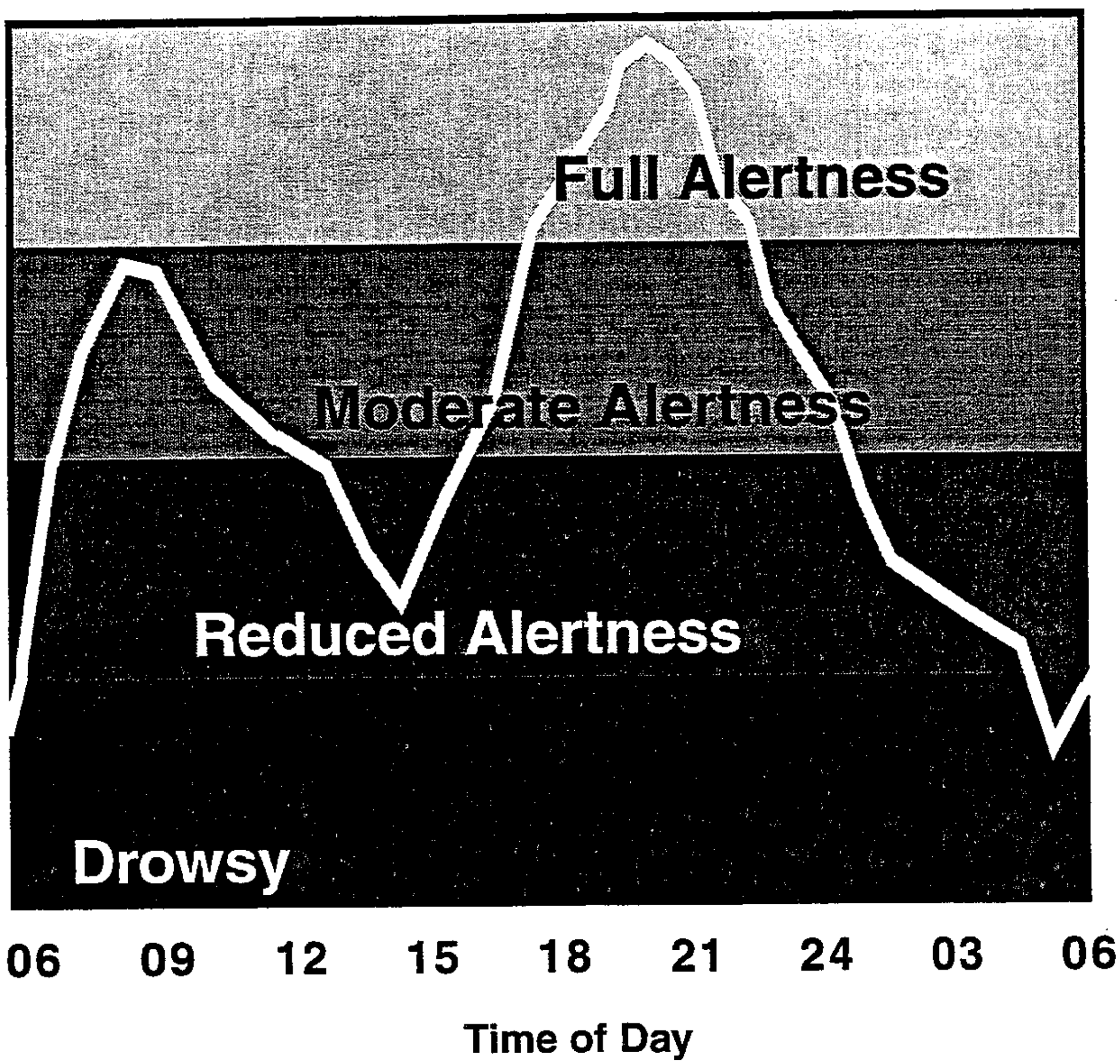
Humans were not designed for peak performance at night.

We were designed to be awake during the day and asleep at night. Since prehistoric times, nature has set our biological clocks (or circadian rhythms) to operate on a 24-hour cycle. Because of that, our body functions and energy levels are automatically higher after sunrise and lower after sunset.

Since Mother Nature provided us with relatively poor night vision, poor sense of smell, and poor hearing, we were not competitive in the primitive forest at night. Thus, our circadian rhythms force us to retreat to the safety of our "caves" by virtually "shutting down" our systems and putting us to sleep at night, and then recharging them to get us up and running the next day.

Biological clocks in both plants and animals regulate the daily cycle of activity and inactivity. The timing of sleep and wakefulness by these internal clocks runs on a cycle, or rhythm, of about (*circa*) a day (*dia*), hence, "circadian rhythm."

The Human Circadian Cycle



Biological Clocks

- This chart shows the basic circadian cycle of alertness and sleepiness for humans.
- The rhythm isn't exactly the same for everybody. The main peak of alertness can occur earlier or later in the day. We call the early-alert people "larks" and the late-alert people "owls."
- Although individual rhythms vary, everybody's cycle has two distinct peaks and dips. The big dip is at night, but another one occurs in the mid-afternoon. The mid-afternoon dip is often presumed to be a lull in energy caused by a big lunch. However, while the type and amount of food we eat can certainly affect our level of alertness, the afternoon dip is part of the circadian cycle and isn't caused by what we eat.
- Most body functions follow similar circadian cycles. The digestive system, for example, is more active during regular daytime meals and less active during the night. This is why stomach upsets commonly occur when meals are eaten at irregular times.
- The time of our lowest alertness comes in the hours just before dawn.

Ideas & Thoughts:

More on Biological Clocks

Virtually every function in the body is timed according to a day-night cycle. You not only have circadian (approximately 24 hour) rhythms in the obvious things (such as activity, sleep, and eating) but also in the internal states of your body (such as body temperature, digestion, kidney function, and the hormones in your blood).

Medical research in recent years has shown that these circadian rhythms are not driven solely by external cues (primarily sunrise and sunset). In fact they are maintained by "biological clocks" inside our brains which would keep on working even if someone were underground in a cave and did not know the time of day.

Actually that was how the first experiments were done. A Frenchman agreed to live underground in a cave for several months where he could not tell whether it was day or night outside. Despite this, his biological clocks kept on ticking, and he continued to stay awake and then go to sleep on a regular basis.

The length of his day-night rhythm, however, was not exactly 24 hours. In fact he went to bed a little later every night and got up a little later than the previous day. This has been true of other people who have since been studied in this way. Nowadays we do the experiment in modern laboratories which have an apartment where volunteers live for several weeks or even months with no windows, no TV or radio, and no clocks or watches to tell them the time of day.

Typically people have a 25-hour day when they are prevented from knowing what time of day it is. That is the natural rhythm of our biological clocks. In long experiments, without realizing it, a person in a time-free environment might go to bed at 11 PM on the first night, 12 midnight on the next night, 1 a.m. on the 3rd, 2 a.m. on the 4th, and so on around-the-clock until he or she was going to bed at 8 a.m. and sleeping until 4 in the afternoon. What is amazing is that the person does not realize what has happened to them because they have no way of telling what time it actually is in the outside world.

If we have a 25-hour clock how do we normally manage to keep on a 24-hour schedule? Why are we not going to bed on New York time on Monday, Chicago time on Tuesday, Denver time on Wednesday, San Francisco time on Thursday, and Honolulu time by the time Sunday comes around?

The answer is our biological clocks are reset an hour each day by time cues in the world around us. Light (either natural sunlight or artificial electric light) falling on our eyes in the morning sends a message to the clocks in the brain and causes them to reset so that we get back in synch with the outside world. In addition, meals may give our bodies a time cue. The trouble with electric light is that we can trick our biological clocks into thinking it is morning at any time of day or night. But as we will see, it is not nice to fool Mother Nature.

Is there anything that might give you a hint of your natural 25-hour rhythm? Well, if you think about it, on weekends or days off when you do not have to get up at a specific time, most people like to stay up a little later in the evening and sleep in a little longer in the morning. If you do so you are giving in to the demands of your own biological clock. If you give in too much, you will find it hard to get up on the first day back to work—in fact, people on straight day jobs who sleep in too much on the weekends will tend to suffer from "Monday morning blues." The alarm clock may say 6 a.m., but their body clock says it's only 4 a.m., and as a consequence they feel lousy.

The problems of straight-day workers are nothing when compared to those of the locomotive engineer. Although our body clocks can adjust by an hour or two a day, they cannot immediately shift 8 or 12 hours the way the locomotive engineer's schedule sometimes requires. It takes several days or even a week or more for the body to readjust to that kind of change. During that adjustment period, your body is out of synch with the world around you.

We cannot survive the lack of sleep for nearly as long as we can survive the lack of food. If you keep someone awake, the ill effects will soon occur. The loss of a single night's sleep leads to fatigue and a significant decline in the performance of the individual on the subsequent day. If someone is deprived of sleep for several days and nights, major problems are seen. They start hallucinating and become quite unable to function.

Just being tired is not enough to ensure a good sleep. If it is at the wrong time of day according to your body clock, it is hard to sleep properly. You toss and turn in bed and keep waking up and then falling off to sleep again. That is what happens if you work an irregular schedule. On the night runs, you get really sleepy, especially at 4 or 5 in the morning, but when you get off work and try to get some sleep at 9 a.m., you cannot sleep properly. Your body clocks are waking you up, and they do not want to let you sleep.

It takes several days for your body to adjust to a new schedule. Unfortunately, the ever-changing schedule of a locomotive engineer does not allow time for this adjustment. On the job, you often have the combined effects of sleep deprivation and working during your low point of 4-5 a.m. Together these problems make it especially hard to get through the run without falling asleep.

Alertness/Fatigue

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Alertness/Fatigue

Our survey of locomotive engineers showed that alertness levels are a major concern. We are going to give you the actual percentages from the survey to write into the blank spaces below, but before we do, write in your own best guess of the percentage of engineers who had difficulty in the following areas:

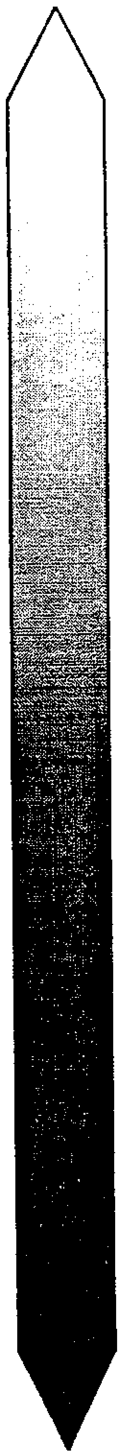
Survey Findings

Your Guess	Actual Proportion	
______%	______%	feel the need for increased alertness on the job
______%	______%	say the schedule is making them fatigued
______%	______%	have had 3 or more auto accidents in the past year
______%	______%	report they have been awakened by the RSC device
______%	______%	have thought that they missed an advance signal but had not
______%	______%	have booked unfit due to fatigue in the past year
______%	______%	consider the job "highly" or "very highly" fatiguing

Ideas & Thoughts:

Human Alertness Scale

Peak Mental Alertness



Emergency "Fight or Flight" Response
Total focus on a crisis

Alert and Fully Vigilant
Able to think clearly about complex situations

Moderate Alertness
Able to perform routine tasks satisfactorily

Reduced Alertness
Vigilance and performance somewhat diminished

Drowsy
Awareness of sleepiness. Performance degrades

Fighting Sleep
A conscious effort is required to stay awake

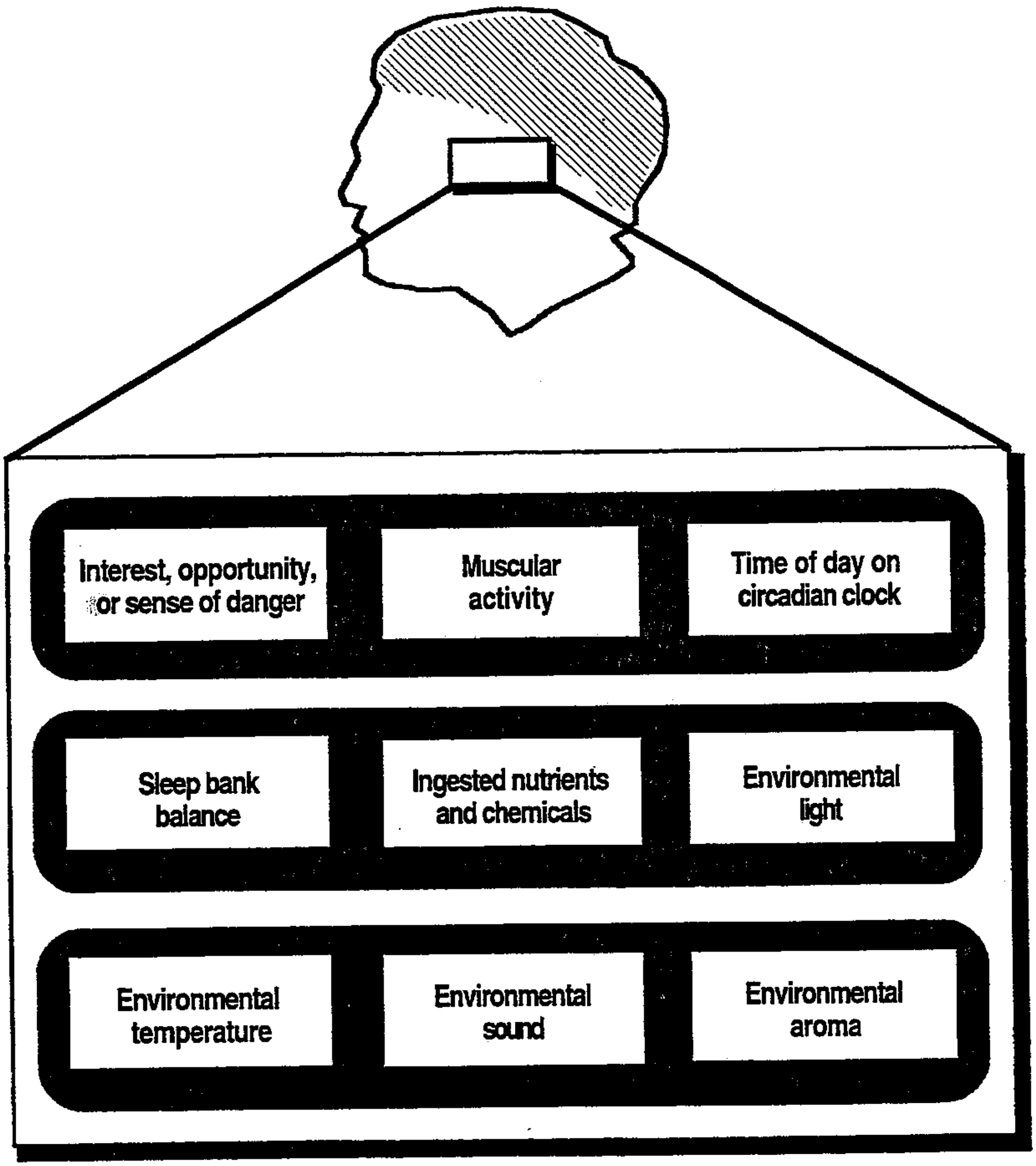
Microsleeps
Brief lapses into Stage 1 sleep

Asleep

Alertness and Fatigue

- It is helpful to view alertness and fatigue as a continuum with peak mental alertness on one end and sleep on the other.
- Your level of alertness determines how well you can perform your job. To be attentive, vigilant and able to think clearly, alertness is a must.
- Peak alertness is the adrenaline-pumped "fight or flight" response, and while it is not the necessary or desired state for most situations, it can be handy if the circumstance calls for it.

The Nine Controls of Human Alertness



The Nine Controls of Human Alertness

Interest, Opportunity or Sense of Danger

Nothing pulls us faster from a drowsy state than the imminent threat of danger, or just surviving a near miss. An interesting challenge or a promising opportunity can also keep us awake.

Muscular Activity

Any type of activity helps us to keep alert. You do not have to be running or lifting weights; stretching, doing isometric exercises or even chewing gum can stimulate your level of alertness.

Time of Day on Circadian Clock

Our biological (circadian) clock makes us sleepy or alert on a regular schedule whether we are working or not.

Sleep Bank Balance

Sound and restful sleep makes deposits in our "sleep bank" and sustained wakefulness makes withdrawals. When the bank balance is too low, the pressure to sleep has a severe dampening effect on our alertness.

Ingested Nutrients and Chemicals

Alertness may be enhanced by the chemicals and nutrients we ingest or inhale. For example, caffeine is the most common among locomotive engineers. Its benefits cannot be denied, but it has its drawbacks too.

Environmental Light

Bright lights can have dramatic effects on suppressing sleepiness and resetting the biological clock.

Environmental Temperature

It is common experience that cool, dry air, especially on the face, alerts one out of sleepy state and that sultry heat brings on the desire for sleep.

Environmental Sound

Music and other irregular sounds can help keep us alert. Soothing sounds can lull us to sleep.

Environmental aroma

Although less scientific work has been done on aroma than on the other eight switches, recent studies have shown that some aromas, such as peppermint, seem to make people more alert.

Automatic Behavior Syndrome (ABS)

ABS is a state of fatigue in which we are essentially sleeping with our eyes open. While able to perform simple or familiar tasks, we are unable to respond quickly. Participants in sleep lab studies experiencing ABS show brain waves characteristic of sleep. Many of us have experienced that startling moment upon pulling into our driveway after driving home while severely fatigued, that we have no recollection of the last mile or so.

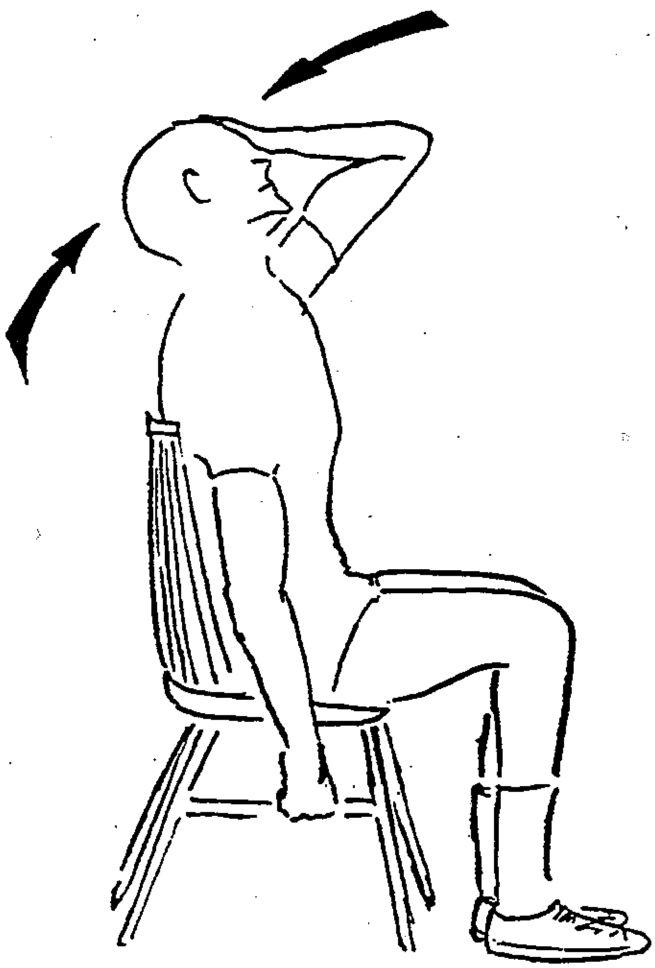
The danger for locomotive engineers is greatest on long slow runs. You can be sitting at the controls staring out the window with your eyes open and your brain asleep. You will be able to perform routine tasks, such as hitting the RSC switch, but you may be unable to respond to critical signals and situations.

Avoiding ABS

The following isometric exercises are easy to do while running a train, and they are quite effective in reducing the fatigue that can lead to automatic behavior syndrome.

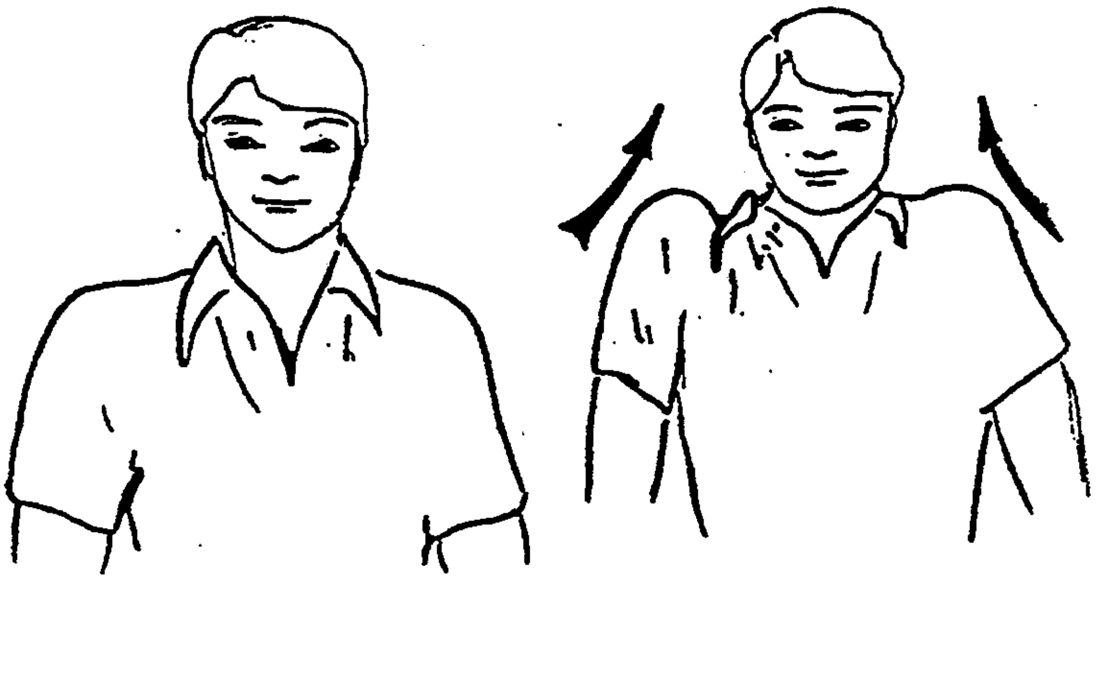
Isometic Exercise for the Neck

- Place the palm of your hand on your forehead so your fingers point towards the back of your head.
- Using only your neck muscles, try to push your head forward. Resist with your hand.
- Hold for three seconds, then relax.



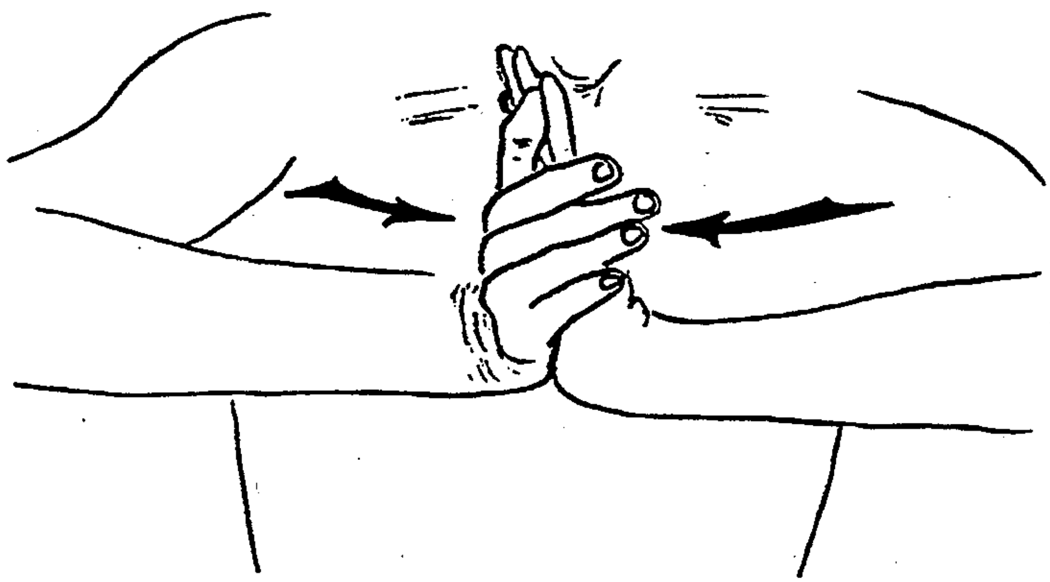
Isometric Exercise for the Shoulders

- While inhaling, slowly lift your left shoulder upwards to the ear.
- Then drop your shoulder and at the same time breathe out and relax.
- Once again, while breathing in, lift your right shoulder to the ear.
- Drop the shoulder and breathe out. Feel the muscles lengthen and relax.
- Now lift both shoulders. Drop, relax.



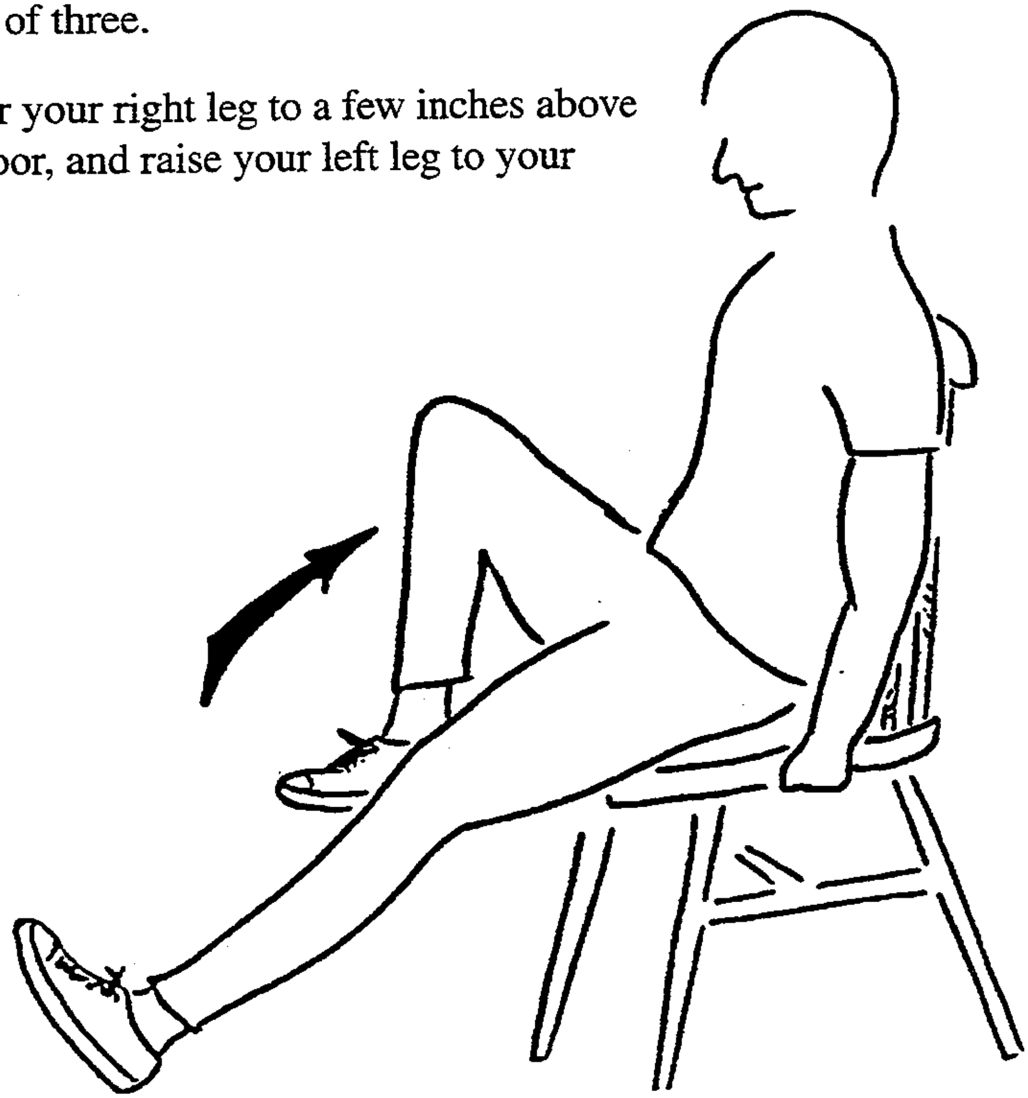
Isometric Exercises for the Hands

- Clasp your hands right in front of your chest.
- As you inhale, press them together as hard as you can for a count of three seconds.
- Relax, and exhale.
- Without separating your hands, try to pull them apart. Pull for three seconds, then relax.
- You can also do this exercise above or behind your head.



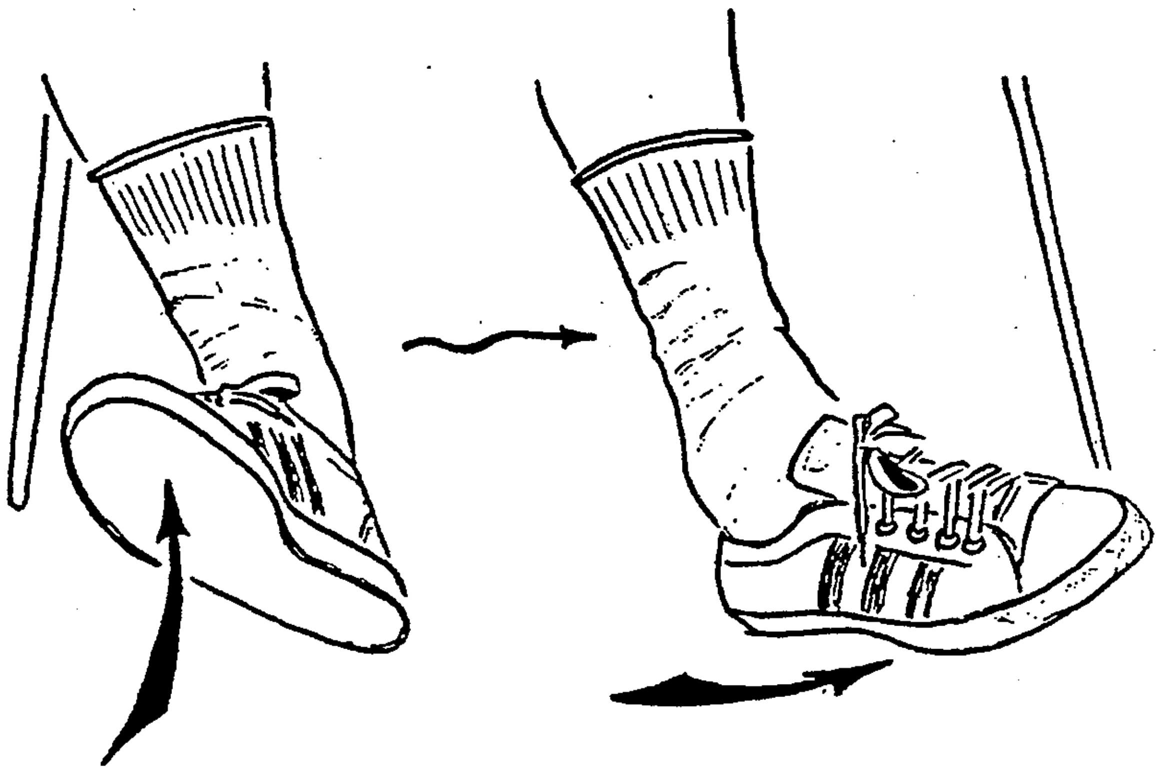
Isometric Exercises for the Legs

- Hold onto the seat of your chair.
- Raise your left leg a few inches off the floor.
- Then pull your right leg toward your chest as far as you can. Hold for a count of three.
- Lower your right leg to a few inches above the floor, and raise your left leg to your chest.



Isometric Exercises for the Ankles

- While keeping your heel firmly on the ground, point your toes up towards your nose.
- Pull for three seconds, then relax.
- Keep your heel down and your toes up. Then pull your toes to the left, then to the right.
- Make slow circling movements five times in each direction.



Tips to Enhance Alertness

- Anticipate points of low alertness and plan the use of countermeasures.
- Get out, stretch and walk around at sidings.
- Talk to the conductor or make a phone call.
- Use caffeine effectively.
- Do isometric exercises.
- Keep the cab cool by opening a window.
- Play mental games.
- Chew gum.
- Develop healthier eating habits in terms of type of food, quantity of food and timing of meals. Eat small, easily digested meals that provide needed nutrition. Large meals cause sleepiness, but eating before bedtime can disrupt sleep quality.
- Use the new headsets to play music or other stimulating tapes.
- Learn to use the new napping countermeasure effectively.

More Tips:

Headset Countermeasure

The CANALERT headset countermeasure capitalizes on two of the controls of alertness:

- **Interest, opportunity or sense of danger.** The CANALERT headset contains a high-fidelity cassette player. You are encouraged to play music or other tapes that interest you.
- **Environmental sound.** The headset significantly reduces the fatiguing monotonous noise of the locomotive.

Each volunteer is provided with his own headset for the duration of the project. Developed specifically for CANALERT by David Clark Co., makers of headsets for pilots and astronauts, the headsets are lightweight, comfortable and operated hands-free by the use of a foot pedal.

Conductors on runs with CANALERT volunteers may use headsets from a pool made available for them. The intercom feature allows you to communicate with each other in normal speaking tones. If there is a radio message while you are listening to a tape, the tape cuts out, just like the music system on a commercial airplane.

Ideas & Thoughts:

Sleep

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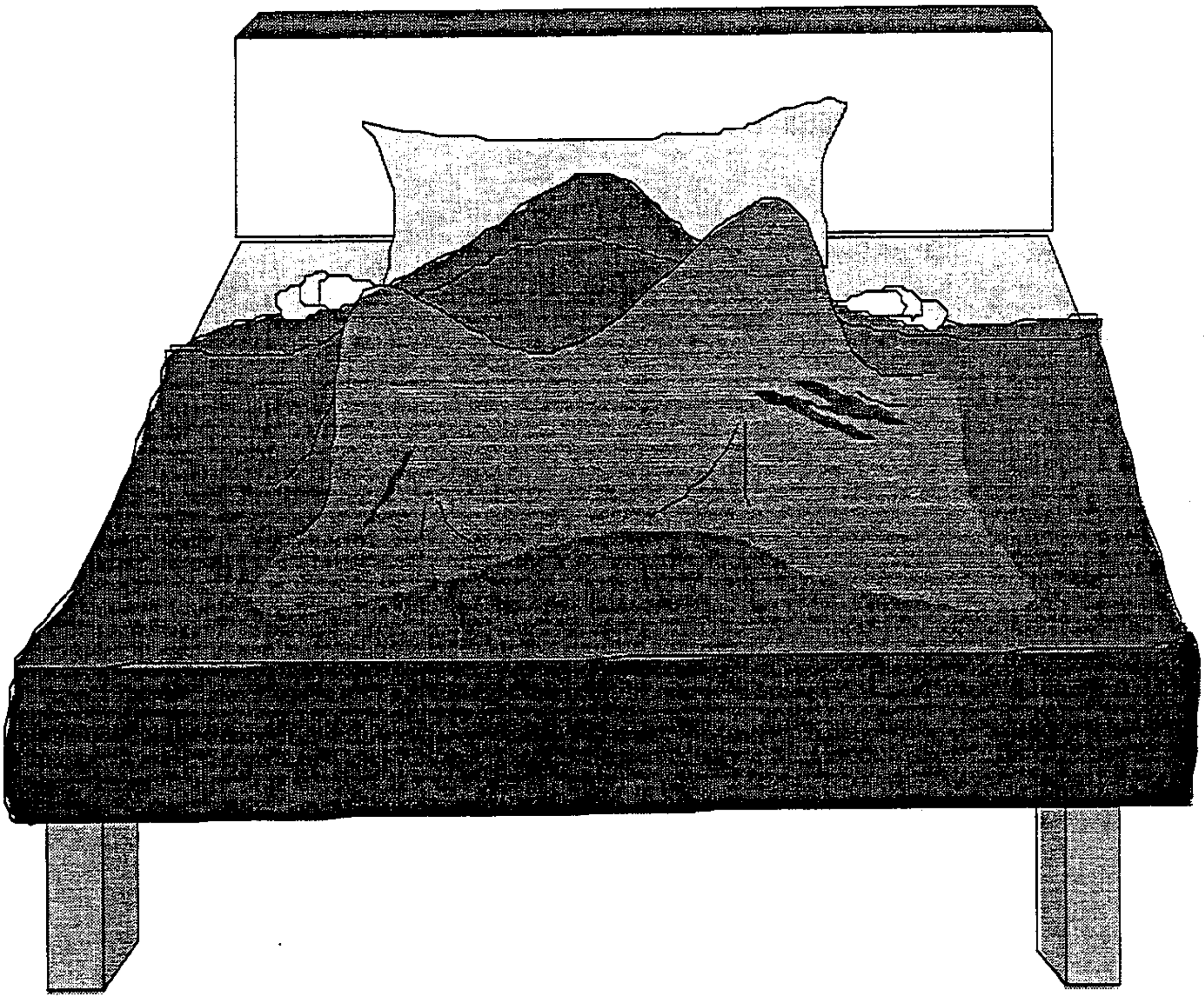
Sleep

Our survey of locomotive engineers showed how difficult it is for railroaders to get a good night's sleep. We are going to give you the actual percentages from the survey to write into the blank spaces below, but before we do, write in your own best guess of the percentage of engineers who had difficulty in the following areas:

Survey Findings

Your Guess	Actual Proportion	
______%	______%	have problems with insomnia or sleep disorders
______%	______%	get fewer than five hours' sleep on work days
______%	______%	find it difficult to get good daytime sleep
______%	______%	had gone more than 24 hours without sleep in the 2 weeks prior to the survey

Ideas & Thoughts:



Sleep

Although we spend approximately one third of our lives asleep, and despite the thousands of studies conducted in hundreds of sleep labs around the world, fundamental mysteries about sleep remain unsolved.

- What specific function does sleep serve?
- Why do we dream?
- Do we sleep because we get tired or do we get tired so that we will sleep?

These and many other questions about why we sleep are unanswered but we do know quite a lot about how we sleep and the role sleep plays in alertness:

- Sleep is an active process. Our minds do not shut off when we are asleep.
- There are clearly defined stages of sleep characterized by distinct brain wave patterns.
- When we are getting quality sleep, we move through the sleep stages in specific cycles, each of which last about 90 minutes.
- Alertness and performance are directly related to quality and quantity of sleep.

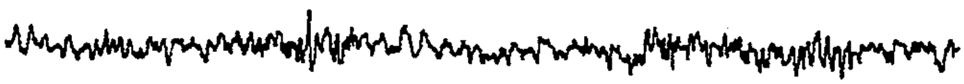
Ideas & Thoughts:

Stages of Sleep

Awake

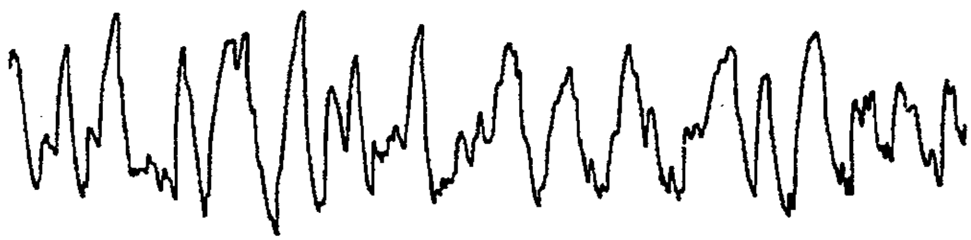
Drowsy

Stage 1



Stage 2

Delta Sleep (Stages 3 and 4)



REM Sleep

Stages of Sleep

With the use of a device called an Electroencephalogram (EEG), which measures electrical activity in the brain, sleep researchers have identified 5 stages of sleep characterized by distinct brain wave patterns.

Awake. When we are awake, our brain produces a fast, irregular pattern of brain waves.

Drowsy. As we become sleepy, the brain develops a pattern known as alpha waves with about 10 regular waves each second.

Stage 1. When we fall asleep, the brain waves change to a low voltage, high frequency pattern which indicates we have entered Stage 1 sleep. If someone were to wake us at this point, we would probably not say we had been asleep. Research has shown us, however, that if during this stage a person is required to perform a task, such as pressing a button when a light goes on, they cannot respond to the task. Therefore, we can be asleep without really knowing it. Very brief dips, of up to 20 or 30 seconds into Stage 1 sleep are known as ***micro sleeps,*** which are often not remembered. Micro sleeps and ABS are the two conditions, other than fully asleep, in which you are most likely to miss a signal or think you have missed one.

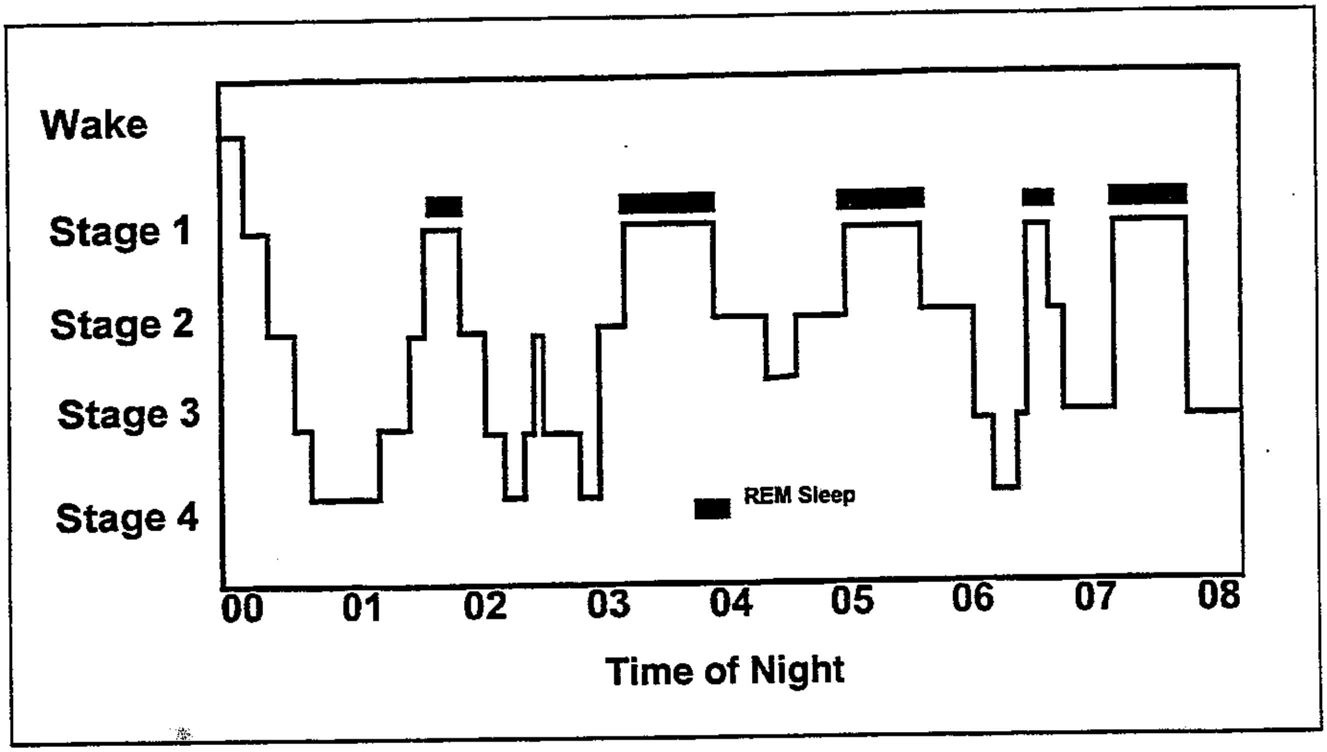
Stage 2. After five minutes or so in Stage 1 sleep, two new types of brain waves emerge. The presence of a distinct wave called a K Complex, with burst of high frequency activity, indicates that we have reached Stage 2. This level of sleep is still light enough that if awakened during it we are likely to feel alert and refreshed.

Stage 3. As the sleep period continues, the brain waves slow down in frequency but increase in amplitude. When the waves slow to two cycles per second, we have entered Stage 3 sleep. This is also called delta sleep because these slow waves are known as delta waves.

Stage 4. As the brain begins to produce mostly delta waves, we are considered to be in Stage 4 sleep. If awakened from the deepest stages of delta sleep, we will likely feel groggy and disoriented and suffer what is known as ***sleep inertia***, a condition of impaired functioning, which can last for 15 minutes or more. This is why the most effective length time for a nap is approximately 20 minutes , which does not allow us to reach a level of sleep from which we emerge impaired.

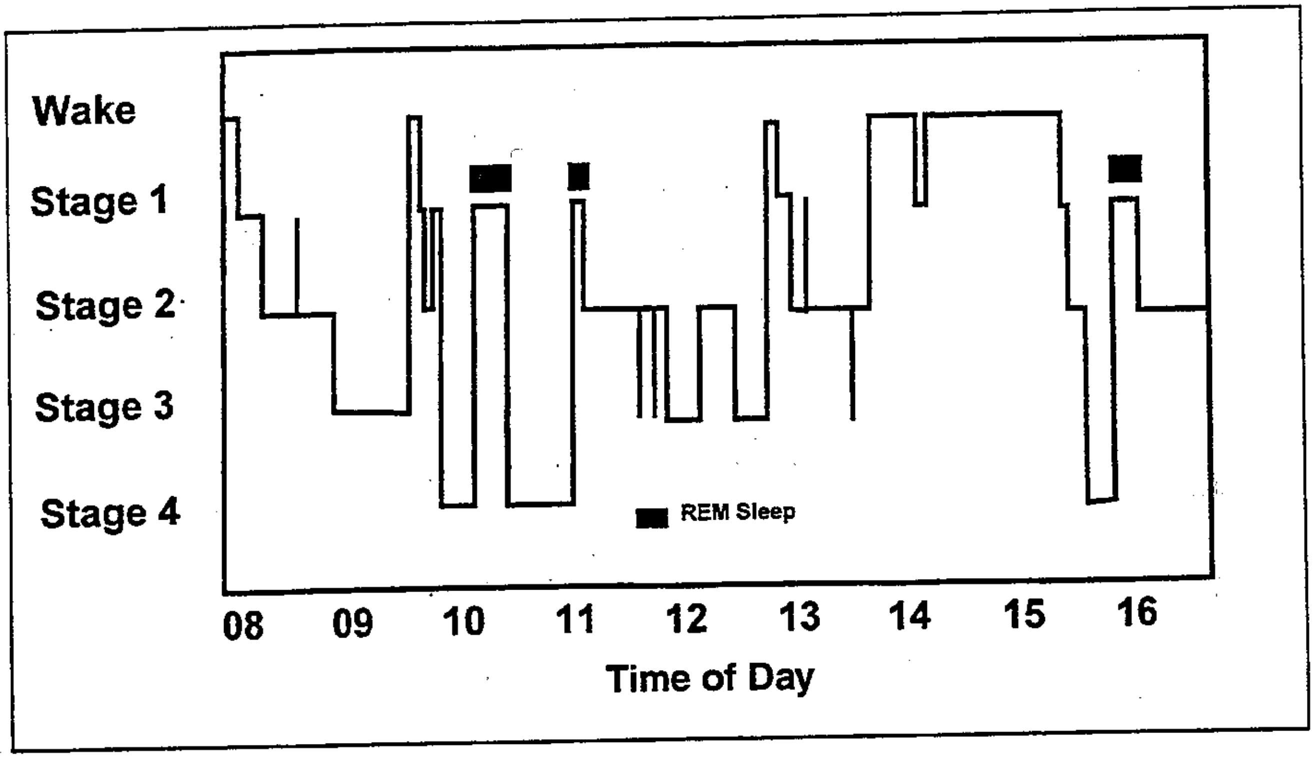
REM Sleep. After about 70 or 80 minutes of sleep, the delta waves begin to subside and we return to Stage 2 and enter the first REM (Rapid Eye Movement) Stage. This is where most dreaming occurs.

Normal Sleep Pattern



- Normal sleep occurs in cycles which move through the sleep stages in the specific sequence shown in this graph. Each cycle lasts about 90 minutes.
- Quality, recuperative sleep requires 4-5 uninterrupted sleep cycles.

Daytime Disrupted Sleep Pattern



- All sleep is not of the same quality and does not provide the same fully recuperative benefits.
- When you attempt to sleep outside your regular bedtime hours, your sleep is much more disrupted.
- Cumulative sleep debt occurs when insufficient quantity or quality of sleep continues over several consecutive days.

Sleep and Irregular Schedules

In order for an individual to feel well rested and alert, the various stages of sleep have to occur in their proper proportions. Sleep specialists who treat people with sleep disorders know that underlying virtually every complaint is a disruption of the normal patterns of sleep.

In a technical sense, all people who work irregular schedules have a sleep disorder. In 1979 the Association of Sleep Disorders published the first comprehensive diagnostic classification of sleep and arousal disorders. Under the section "Disorders of Sleep-Wake Schedule," they included the diagnosis "Persistent Frequently Changing Sleep-Wake Schedule." This condition can be the consequence of several situations including irregular work schedules.

Studies of the sleep of people who work irregular schedules indicate a number of problems including shortened sleep and frequent awakenings. This is most common when the schedule requires the worker to sleep during the day.

EEG readings of this type of daytime sleeping reveal the underlying cause of the problem. The sleep pattern of daytime sleep for someone working an irregular schedule is not normal. Generally the deeper stages of sleep (Stages 3 and 4, or Delta Sleep) are shortened and REM sleep time is also curtailed. Accordingly, this type of daytime sleep has a greater proportion of Stages 1 and 2 than normal. Generally, sleep researchers consider Delta and REM sleep to be the deeper and more restorative types of sleep. Reduction of time spent in these stages means that the individual will still feel fatigued despite having spent 6 or 8 hours asleep.

Another problem is that when a person is in Stage 1 and 2 sleep, he or she is more easily aroused. A noise that would not disturb someone in Stage 4 would awaken them during Stage 2. The fact that there is more noise during the day tends to compound this problem.

How Does Your Bedroom Rate?

Use these guidelines to rate your room and its ability to help you get to sleep and stay asleep. Respond to the following questions by circling the number that best mastches your bedroom, with 5 being high and 1 being low.

1. **Quiet:** My room is quiet, without loud or sudden noises	1	2	3	4	5
2. **Dark:** My room is dark for the entire sleep period	1	2	3	4	5
3. **Temperature:** My room is warm or cool enough to help me sleep	1	2	3	4	5
4. **Comfortable Bed:** My bed is comfortable—mattress, blankets, pillows, etc.	1	2	3	4	5
5. **Air Flow:** My room has adequate fresh air to help me sleep.	1	2	3	4	5
6. **Interruptions:** I am able to prevent interruptions of my sleep.	1	2	3	4	5
Total Score:	______				

Results:

25-30	Well-designed
20-25	Good, but not great
20 or less	Needs work

Tips on Better Sleep

- Establish a relaxing bedtime routine that signals your body it is time for sleep. Experiment to discover what works best for you. Some ideas:
  - Take a warm (not hot) shower or bath.
  - Do light stretches.
  - Drink a warm, non-caffeinated beverage.
  - Dim the lights as you prepare for bed.
  - Read.
- Avoid caffeine and alcohol at least three hours before going to bed.
- Manage your environment:
  - Make your room as dark as possible. Even a sliver of light entering your room can keep you awake.
  - Wear a sleep mask and/or ear plugs.
  - Put a Do-Not-Disturb sign on your bedroom door.
  - Install a doorbell kill switch.
  - Turn off the phone in the bedroom.
  - Make sure the whole family knows your sleep schedule.
- Wear dark sunglasses when you are driving home in the morning after a night run.
- As much as possible, maintain your schedule on your days off.

More Tips:

Napping Countermeasure

The introduction of napping for locomotive engineers represents a significant departure from previous railway policy. Short naps have an extraordinary recuperative effect and their benefits should not be underestimated. Numerous studies have shown that in demanding situations, such as solo around-the-world sailing, humans can function quite well for extended periods of time on a sleep schedule consisting exclusively of 20-minute naps taken every four hours. This is not the ideal sleep schedule, but it illustrates the power of the 20-minute nap.

Naps for locomotive engineers will fall into two categories:

- Naps that you take when the opportunity arises, such as when in sidings or awaiting the arrival of power at the terminal
- Naps to which you are entitled when your run extends into your "Protected Zone" or "Special Protected Zone" established under the new time pool system

In all cases, remember: cooperation and communication between you and the RTC is essential to the success of this program.

Ideas & Thoughts:

Rules for Napping

- Frequency Change
  - Advise the RTC that you are changing frequencies.
  - Change to quiet frequency.
  - Verify frequency change.
- Leaving the cab to perform train inspections (Rule 110) will not be required.
- The nap window is 35 minutes, with 20 minutes of sleep time.
- Use the wake-up timer, which will be provided.
- Napping blindfolds will also be provided.
- Secure the train before you nap.
- Napping is OK on the mainline with the RTC concurrence.
- Some areas are restricted for napping, such as areas where the train cannot be secured due to track grade.
- The RTC will call you if you do not depart after receiving a clear signal or if stopped on the mainline with no signal.
- There will be napping facilities at the home terminal.

Getting the Most from Naps

There are several factors to consider when scheduling naps, such as time of day, length of nap, and individual differences in sleep patterns.

In a study done by a group of researchers in Detroit, different subjects were deprived of sleep, and then allowed to take naps of varying length. One of the surprising results of this study was that naps 30 and 60 minutes long did not provide the subjects with substantially more restorative sleep than naps 15 minutes long. A nap of two hours, however, allowed subjects more than double the restorative sleep of a single hour nap. This means that a worker will be better rested and better able to perform his job by scheduling a straight two hour stretch of sleep before he comes to work.

Time of day is important to consider when scheduling naps. Regardless of how long someone has gone without sleep, his body continues to follow a circadian rhythm in ability to sleep. A nap taken when a person is more relaxed and ready for sleep will be deeper and more restorative. At some times of day, it is very difficult to sleep no matter how tired a person feels, especially if they have had coffee or ingested other stimulants within the previous several hours.

The length of time it takes to fall asleep is also related to time of day. People on a normal daytime awake/nighttime asleep schedule fall asleep more quickly in the early morning, early afternoon, and shortly before the usual bedtime. The worst time to try to nap if an individual is accustomed to the day shift is from about 6 PM to just prior to customary bedtime, due to peak circadian alertness that occurs in the early evening. During this time it will take considerably longer to get to sleep. These differences do become less significant, however, if an individual has been sleep deprived or working night shifts for an extended period of time.

Another factor to consider is sleep inertia, the time it takes to return to full alertness after a nap. At certain times of day, a prolonged nap can be detrimental to performance because of the long recovery time.Brief naps have minimal sleep inertia, and a person typically returns to full alertness within minutes. Similarly, awakening in the middle of the deep stages of sleep increases inertia. That is why 1-hour naps are less desirable than those of 20 minutes (short enough to keep you from going into deep sleep) or 2 hours (long enough for you to come out of deep sleep).

Bunkhouse Upgrade Countermeasure

Several rooms in the Blue River bunkhouse will be upgraded for use by CN CANALERT volunteers. The upgrade countermeasure is based on a standard developed by Circadian Technologies, Inc. to minimize noise and disturbance in hotel rooms for business travelers. It includes the use of soundproofing, black-out curtains and devices to generate a low level of relaxing background noise.

The bunkhouse upgrade is being made in only one location so that it can be tested against another location that has the benefits of the other countermeasures without the upgraded bunkhouse.

Ideas & Thoughts:

Health

CANALERT

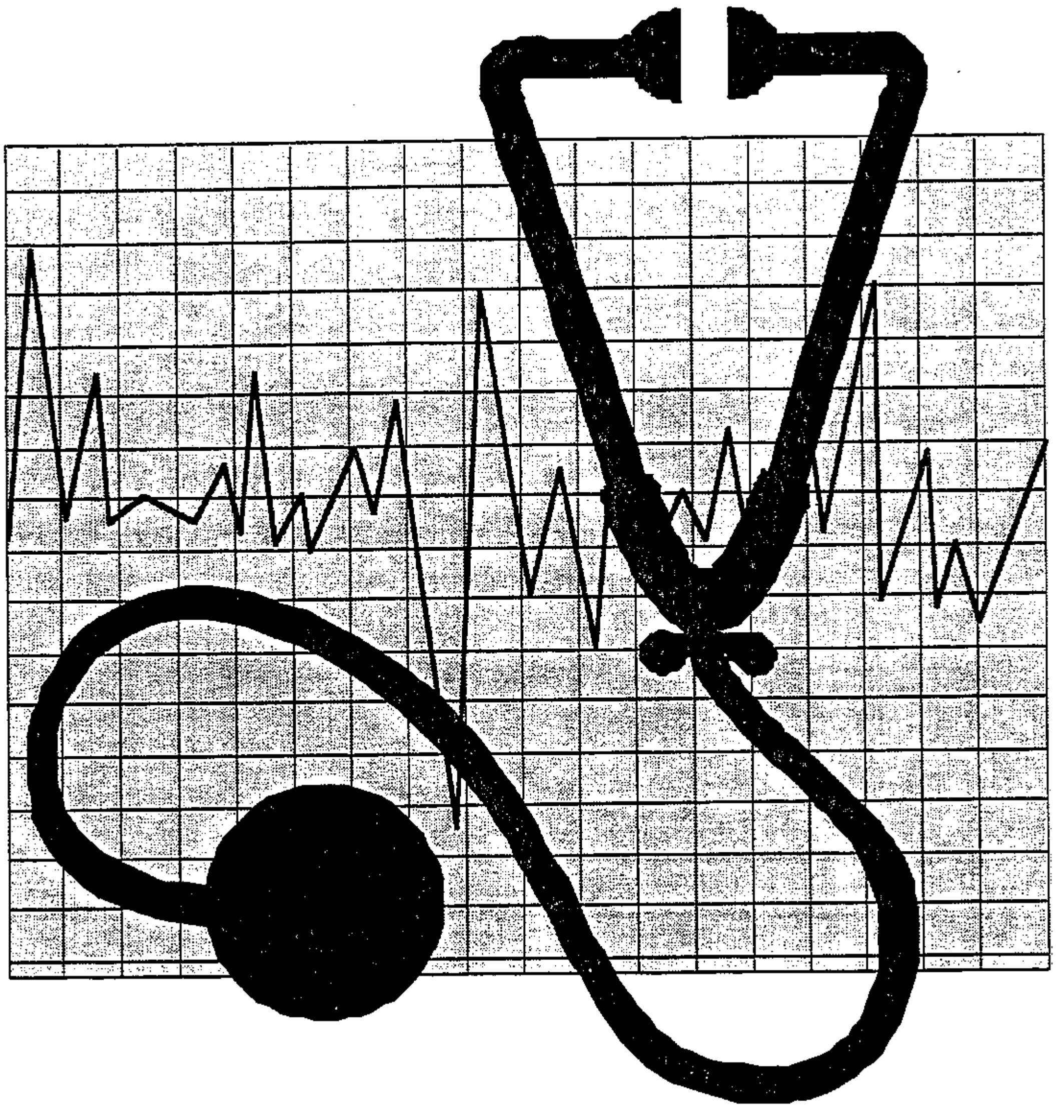
Health

Our survey of locomotive engineers showed the railway lifestyle takes its toll on health. We are going to give you the actual percentages from the survey to write into the blank spaces below, but before we do, write in your own best guess of the percentage of engineers who had difficulty in the following areas:

Survey Findings

Your Guess	Actual Proportion	
______%	______%	think a more regular schedule could decrease sick time
______%	______%	feel their health could be improved by a more regular schedule
______%	______%	have gained more than 20 pounds since running trains
______%	______%	have booked sick due to fatigue in the past year

Ideas & Thoughts:



Health Disorders Associated with Working Irregular Schedules

- Sleep disorders
- Digestive disorders
- Coronary artery disease
- Mood disorders
- Worsening of underlying illnesses
  - Epilepsy
  - Diabetes
  - Manic-depressive illness

While working an irregular schedule can present greater exposure to health risks, it is how you deal with the exposure over the long term that determines whether or not it develops into health problems. People who work irregular schedules *do not* have to suffer from more health problems than those with straight day jobs. Most of these health problems can be prevented through better education, good health management and personal discipline.

Ideas & Thoughts:

Sleep Disorders

More than 5% of the population suffers from sleep disorders, and many of them don't know it. The most common sleep disorders are:

Sleep Apnea

This is a repeated cessation of breathing during sleep. A person who suffers from it can wake up many, many times during sleep, often without realizing it. They just wonder why they are so tired when they get up. Sometimes the first person aware of a case of sleep apnea is the person who sleeps near the sufferer.

Sleep apnea can be due to an obstruction in the airway or to damage in the part of the brain that controls respiration. It is often associated with obesity. There are several successful treatments available.

Narcolepsy

A disease of uncontrollable sleep attacks that occur sometimes several times a day. The cause is unknown, although it may be genetic. Other disorders (such as encephalitis) can have similar symptoms; however, this can be distinguished with a brain scan.

Insomnia

This general term covers a host of problems that prevent sleep. It is probably more properly viewed as a sleep disturbance than a sleep disorder. While about 12% of the general population suffer from it, two-thirds of workers with irregular schedules report problems with insomnia. It can also be caused by overactive thyroid gland, diabetes, muscle-twitching, or caffeine.

Many cases of insomnia are made worse by psychological factors, including worry about inadequate sleep, causing more insomnia. Sleeping pills sometimes seem to provide temporary relief from it, but the relief is always short-lived and ultimately, they usually make it worse.

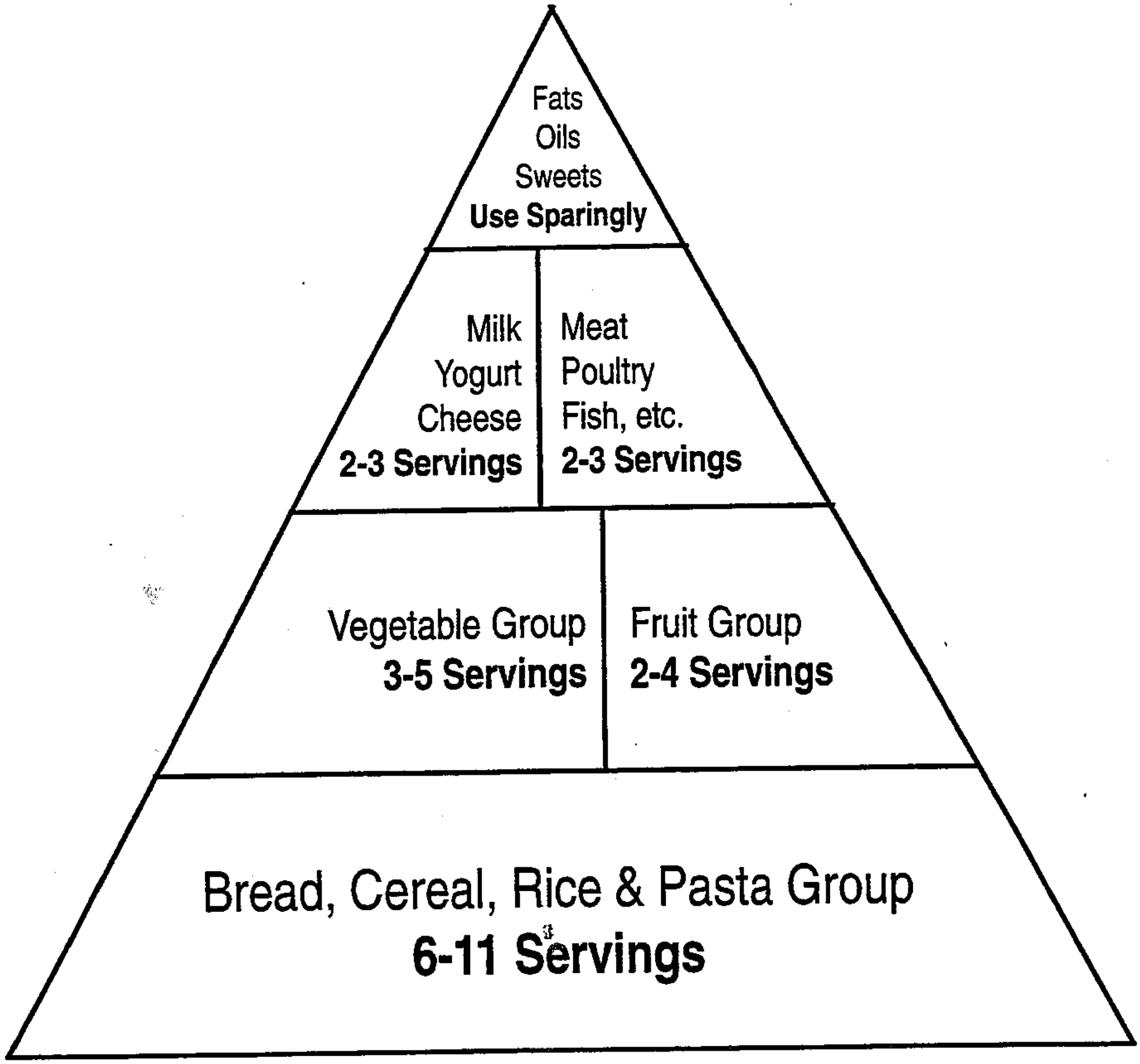
Nutrition-Related Disorders Associated with Working Irregular Schedules

- Gastrointestinal disorders (constipation, diarrhea)
- Cardiovascular disease
- Weight gain
- Heartburn
- Loss of appetite
- Peptic Ulcer

The stomach's circadian cycle is influenced by the anticipation of eating and the stomach's clock. Enzyme secretion occurs in a cyclical pattern that corresponds to habitual meal times. The stomach's circadian clock "shuts down" at night, and the secretion of digestive enzymes slows. Therefore, our digestive systems are ill-prepared for large meals or hard-to-digest foods that are eaten at night.

Ideas & Thoughts:

The Food Guide Pyramid
The Guide to Daily Food Choices



Basics of a Healthy Diet

A balanced, healthy diet is important for everyone, but the demands of the railway lifestyle make it even more important for locomotive engineers to eat right. The Food Guide Pyramid shows the approximate proportions of the basic food groups that are needed for a healthy diet.

Fiber

Fiber is an essential part of a healthy diet. It helps prevent constipation and has been linked to the prevention of colon cancer. High fiber foods include fruits, vegetables and whole grain cereals and breads. Give your body time to adjust to a higher fiber diet. Increase fiber consumption slowly.

Salt

Excessive salt has been linked to high blood pressure, heart attacks, kidney disorders and strokes. Our bodies need 250 mgs. of salt per day. The average Canadian consume 4,000-6,000 mg. per day. Try cooking with other spices and less salt and cut down on processed foods, which are loaded with salt. Allow several months for your taste buds to adjust to a lower salt diet.

Cholesterol

Low-density lipoprotein (LDL) Cholesterol is linked directly to cardiovascular disease, specifically heart attack and stroke. The reason is that it forms plaque desposits in the blood vessels, which restricts the flow of blood. It is not clear that eating cholesterol raises the level of LDL cholesterol in your blood, but it is clear that eating fat does so. A lower fat diet (less than one third of the calories coming from fat) and regular exercise can usually reduce LDL levels (or raise high-density lipoprotein—HDL—levels, which is almost as good) in most people.

Sugar

Locomotive engineers often consume food and beverages containing large amounts of sugar to increase alertness and energy or just to combat boredom. The energizing effects of sugar, however are short-lived, with a quick decline back to the previous low level of energy or, often, an even lower level. A better way of maintaining energy and alertness is to eat a well-balanced combination of low-fat protein, complex carbohydrates and sugar.

Recommended Nighttime Foods

High complex carbohydrates

- Fresh and cooked fruits and vegetables
- Juice
- Whole grain breads, cereals and crackers
- Potatoes, rice and pasta

Low fat proteins

- Lean meats
- Skinless chicken and turkey
- Fish and shellfish
- Soybeans, tofu and legumes
- Homemade pizza with lowfat cheese
- Skim or low fat milk and cheese

Ideas & Thoughts:

Foods to Avoid at Night

High Fat Foods

- Fatty meats
- Fried foods
- Pastries
- French fries, potato and corn chips
- Subs and pizza
- Chicken and turkey skin
- Whole milk dairy products

Foods that promote gastric secretion and stomach irritation

- Highly spiced foods
- Excessive coffee or tea (including decaffeinated)
- Tomato juice

Ideas & Thoughts:

Caffeine

Caffeine has long been the most popular alertness enhancer among locomotive engineers. Although not without its health risks and sleep disruptive characteristics, caffeine has some benefits that cannot be denied. These include:

- Increased alertness
- Greater capacity for muscular work
- Better performance on mental tasks
- Decreased fatigue
- Faster reaction time
- Improve simple motor coordination
- Enhanced clarity of thought
- Starts working in 15-45 minutes

There was a time when coffee and other caffeinated drinks were generally considered to be harmless, but in recent years the negative aspects of caffeine have begun to be publicized. *Caffeine is a drug.* When heavy users attempt to stop using it, symptoms of withdrawal become evident. They include severe headaches, nausea, vomiting and depression.

As a stimulant caffeine has a disruptive effect on sleep. It reduces the amount of Stage 3, Stage 4, and REM sleep, depriving the user of the restorative benefits of the deeper sleep stages.

Timing and moderation are the keys to effective use of caffeine. The stimulating effects of coffee last for a long time in the body, so try to stop your consumption 3-4 hours before going to bed.

Alcohol

Alcohol is often used for relaxation and in moderation, it can be fine for this purpose. Although it can make you drowsy, it should not be used to help you fall asleep. Alcohol, like caffeine, reduces the amount of Stage 3, Stage 4, and REM sleep. It is also a diuretic, so drinking alcohol beverages before bedtime increases the chance that you will be awakened after a few hours to go to the bathroom.

Nicotine

The health problems associated with smoking are well documented. Nicotine contributes to lung cancer, heart disease, and respiratory disorders.

What is less widely recognized is that nicotine is also a stimulant. As such, it has a similar effect on the body as does caffeine, although it is much more highly addictive. As a result, smokers should avoid cigarettes or nicotine tablets for at least 2-4 hours before bedtime.

Since the benefits of nicotine as a stimulant are negligible, while the negative aspects of smoking can be life-threatening, making a serious personal commitment to stop smoking is highly advisable.

Sleeping Pills

Sleeping pills may initially alleviate sleep problems but they are not a long-term solution to the sleeping difficulties associated with an irregular work schedule. Continued use leads to tolerance. This means that the pills become less and less effective, and that you need to take more to get the same effect. Like alcohol, sleeping pills can disturb the normal structure of sleep. In the long run, they probably won't help you sleep. After prolonged use of sleeping pills, some people sleep poorly when they stop taking them. They then feel they need the pills to sleep, so the end result may be a drug dependency problem.

Tips for Better Diet and Nutrition

- On night runs avoid greasy/starchy food. Your body is not able to digest food properly in the middle of the night. Eat light snacks only, such as soup, fruit, or toast.
- Avoid a heavy meal just before bed.
- Keep your main meals on a regular schedule. Your body responds best when each meal occurs at a regular interval.
- Limit soda, caffeine and sugar consumption.
- Make mealtimes pleasant:
  - Don't eat directly from the refrigerator, put food on plates.
  - Sit down for all meals and snacks.
  - Chew food thoughtfully.
- "Brown-bag" it—bring food from home.
- Use the locomotive refrigerator to increase "brown-bagging" options.
- Use the terminal kitchen facilities to prepare your own meals.

More Tips:

Counseling Countermeasure

The counseling countermeasure is designed as an individualized extension of the lifestyle training. It is intended to help you get the most out of the other countermeasures and integrate them effectively into your life.

Counseling will be conducted after you have had the opportunity to experience the other countermeasures. We know that, as a CANALERT volunteer, you will be working hard to make big changes in your life. Since change never comes easy, our circadian health specialists will be contacting you to schedule a confidential session in which you can discuss any concerns or difficulties that you may be having.

Family/Social Issues

CANALERT

Family/Social Issues

Our survey of locomotive engineers showed the railroading lifestyle is tough on their family and social lives. We are going to give you the actual percentages from the survey to write into the blank spaces below, but before we do, write in your own best guess of the percentage of engineers who had difficulty in the following areas:

Survey Findings

Your Guess	Actual Proportion	
______%	______%	become irritable more than several times per week on the job
______%	______%	are concerned about being too tired to do anything
______%	______%	are concerned about lack of time for planning
______%	______%	are concerned about lack of quality time for family

Ideas & Thoughts:

Evaluate Your Family and Social Situation

Use these guidelines to evaluate the impact that your railway lifestyle has on your family and social situation. Respond to the following questions by circling the appropriate number, with 2 being high and zero being low.

• Difficulty in planning ahead	0	1	2
• Not enough "quality" time with the family	0	1	2
• Locomotive Engineer "irritable"	0	1	2
• Spouse feels s/he is rearing children alone	0	1	2
• Communication problems	0	1	2
• Spouse lonely or nervous when locomotive engineer on night runs	0	1	2
• Meal planning	0	1	2
• Interference with household routines	0	1	2
• Keeping kids quiet	0	1	2
• Family/friends don't understand schedule	0	1	2
• Having enough time for romance	0	1	2
• Having enough time for recreational activities	0	1	2
• Being "too tired" all the time	0	1	2
• Matching your schedule with friends' schedules	0	1	2
Your total	______		

Results

0-10	Things are going great
11-19	You might want to pick a couple of things to work on with your family
20-28	You need to find some better ways to deal with your irregular schedule

Family and Social Issues

- Second to sleeping problems, the most common complaint of locomotive engineers is the disruption of their family and social life and the difficulty of planning social events with family and friends.
- Among married locomotive engineers, especially those with school-aged children, child care and time spent with family are complicated by working irregular schedules. Divorce rates are 50% higher for people who work irregular schedules.
- For locomotive engineers who are single and dating, the ability to sustain long-term relationships can be difficult.
- One of the hardest things about managing relationships with family and friends is making sure that everyone has the same thing in mind when they are communicating. To the family, a day off can look like the locomotive engineer is available to play or do errands. To the locomotive engineer just returning from a night run, that day looks like a good time to sleep.

Ideas & Thoughts:

Tips for Improving Your Family and Social Life

- Communicate with your family. All family members must make their needs and expectations known to each other. Be committed to developing good communication skills. Be willing to compromise.
- Set a family schedule. In many cases, the family should go ahead with planned activities if the spouse can't make it.
- Set aside a time each week to talk to your spouse or significant other.
- Deal with family or relationship problems before they get too big.
- Make a "date" with spouse or child to share a special activity.
- Plan a Family Day once a month.
- Set up a Family Bulletin Board where you can leave special notes, and where the kids can leave schoolwork, pictures or messages for you.
- Have a friend of family member tape a favorite TV show and then watch tapes together when you aren't at work.
- Rent or purchase a home video camera and have the family videotape an activity that was missed because you had to work (e.g., birthday party, Little League game).

More Tips:

Time Pools Countermeasure

The CANALERT time pools are the most significant countermeasure and are at the heart of the CANALERT Project. They provide more regular schedules for locomotive engineers, which represents a tremendous step forward for the railway industry.

The time pools are designed to improve railway safety by reducing fatigue, thereby increasing the levels of alertness and vigilance of locomotive engineers while they are running trains.

No matter which time pool you are in, your schedule will usually call for you to work one day and have the next day off. In general, you will be able to get some sleep at the same time every day. For those times when your schedule disrupts your routine, the time pool has a "protected zone" and a "special protected zone" to help safeguard your alertness.

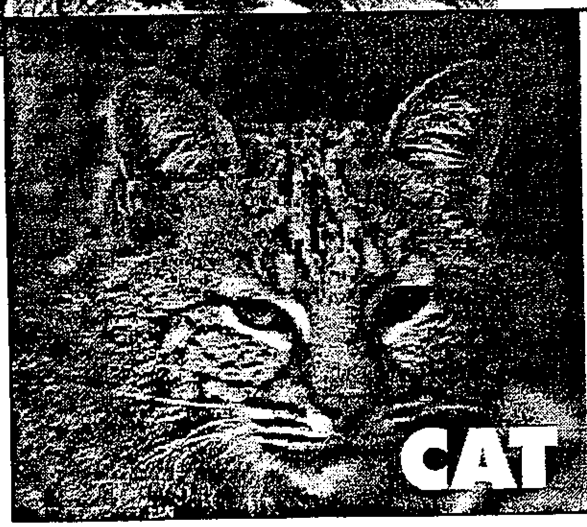
Time pools are assigned on the basis of seniority. You may not be in the pool you like the best, but it will still provide you with a regular, predictable life while working in a 24-hour operation. As with all of the countermeasures, the time pools are subject to change through the course of the project.

Ideas & Thoughts:

Time Pools

Duty Start Window:	**0500 - 1500**
Recuperative Zone:	**2100 - 0600**
Protected Zone:	**0300 - 0700**
Special Protected Zone:	**0100 - 0300**

Duty Start Window:	**1300 - 2300**
Recuperative Zone:	**0000 - 1000**
Protected Zone:	**0700 - 1100**
Special Protected Zone:	**0400 - 0700**



Duty Start Window:	**2100 - 0700**
Recuperative Zone:	**1200 - 2100**
Protected Zone:	**1800 - 2200**
Special Protected Zone:	**0400 - 0800**

Time Pool Terminology

The three CANALERT Time Pools each contain the following components, which create a routine schedule by establishing approximate time frames for work and sleep:

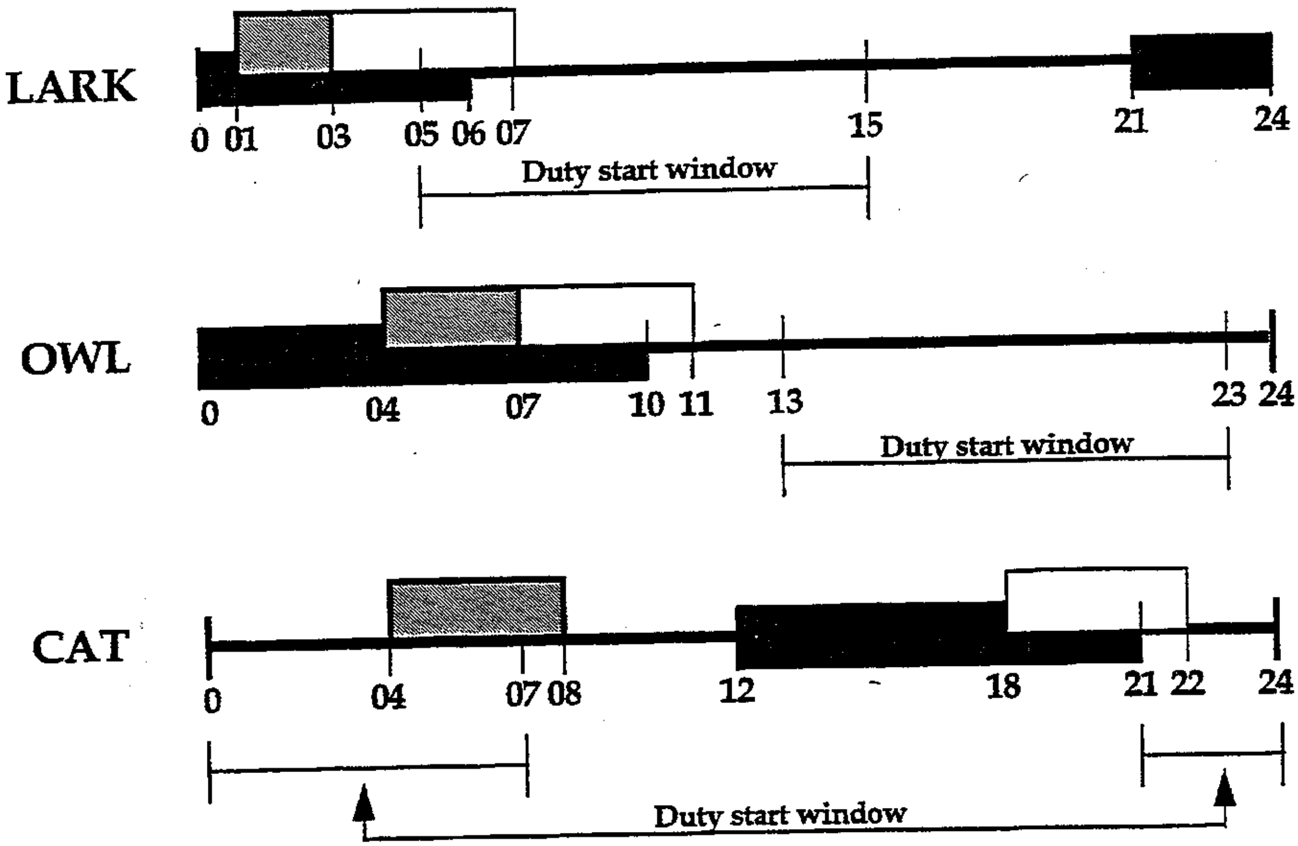
Duty Start Window
This is the time period in which you can begin work at your home terminal. In order for you to take a train, its crew supply time must fall within your duty start window.

Recuperative Zone
This is when you will get your most recuperative sleep, known as *circadian rest*. Try to maintain your schedule by continuing to get most of your sleep in your recuperative zone, even on your days off.

Protected Zone
This is the time period in which your alertness is likely to be at its lowest and running trains is the most hazardous. If your return train is scheduled to arrive home during or after your protected zone, you must have had three hours of circadian rest during your recuperative zone at the away-from-home terminal before starting your return run.

Special Protected Zone
The risk of severe fatigue during this time period is not as great as it is during the protected zone, but it is great enough that a nap somewhere during your run may be necessary for you to proceed safely. If your return train is scheduled to run into your special protected zone, you are entitled to a nap if you feel you need one.

Time Pools



Recuperative Zone

Protected Zone

Special Protected Zone

The Life of a Lark

- Just because it's the most nearly "normal" schedule doesn't mean it requires any less management
- It's important to sleep at night
- If you think you'll be called early, go to bed early
- Your internal clock generally allows you to make adjustments up to an hour earlier or two hours later without too much trouble for those times when you get in late or feel you may have to start early
- Try to manage your time in a way that you will be getting sleepy as your regular bedtime approaches
- When you're on your way home at night, watch what you eat and drink
- Lark's "worst case"
  - Called to start work at 1500, which takes you into your recuperative zone by end of shift
  - Unlikely you can get a train back before protected zone
  - Get three hours' rest at away-from-home terminal

Ideas & Thoughts:

How to Live Like an Owl

- Go to bed well after midnight and sleep into mid-morning
- You may want to nap outbound as well as on the way back
- It is important to try to sleep at the same time every day
- The owl is often tempted to go without sleep on some days with the idea of making it up later. You'll be far better off if you get nearly the same amount of sleep every day
- Try to manage your time in a way that you will be getting sleepy as your regular bedtime approaches
- Owl's "worst case"
  - Called to start work at 2300, which takes you into your special protected zone
  - Request a nap if you need it
  - Plan on getting at least three hours' rest at away-from-home terminal

Ideas & Thoughts:

The Split-Sleeping Cat

- There are three possible patterns of sleeping. You should experiment and find the one that works best for your biological clock:

  - Main sleep in the mornings
  - Main sleep in the afternoons
  - Split sleep into two sleep periods each day

- It's unlikely you'll be able to get your family to operate on the same schedule, so work with them and consider making breakfast the main family event of the day

- Cat's "worst case"
  - Called to start work at 0700, which takes you into you recuperative zone
  - Arrive at away-from-home in recuperative zone; you must take circadian rest
  - Nap on return if you need to

Ideas & Thoughts:

Summary of Time Pool Benefits and Drawbacks

Benefits

- Your time pool provides for "anchor sleep" (i.e., sleep in the Recuperative Zone), and it keeps your internal clock in the same time zone
- You'll get the most out of your time pool if you sleep at the same time every day
  - it will get you out of "perpetual jet lag"
  - it will get all your physiological systems on the same schedule
- improve digestion, help weight control
- increase alertness during working hours
- make sleep deeper and more pleasant
- Your time pool allows you and your family to predict your availability for personal and social activities
- Your time pool gives you a regular schedule, a regular life

Drawbacks

- This is a major change to your life, and such changes *never* happen easily
- Family and friends may be used to your old lifestyle and will have to be trained to an understanding of the new one
- The recuperative zone reduces the flexibility of when you can sleep (although this may help you maintain a regular sleep schedule and ensure that you are sleepy during your recuperative zone)

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