FACT SHEET

Prussian blue

Facts About Prussian blue
Prussian blue can remove certain radioactive materials from people’s bodies, but must be taken under the guidance of a doctor.

People may become internally contaminated (inside their bodies) with radioactive materials by accidentally ingesting (eating or drinking) or inhaling (breathing) them, or through direct contact (open wounds). The sooner these materials are removed from the body, the fewer and less severe the health effects of the contamination will be. Prussian blue is a substance that can help remove certain radioactive materials from people’s bodies. However, small amounts of contamination may not require treatment. Doctors can prescribe Prussian blue if they determine that a person who is internally contaminated would benefit from treatment.

What Prussian blue is
Prussian blue was first produced as a blue dye in 1704 and has been used by artists and manufacturers ever since. It got its name from its use as a dye for Prussian military uniforms. Prussian blue dye and paint are still available today from art supply stores.

People SHOULD NOT take Prussian blue artist’s dye in an attempt to treat themselves. This type of Prussian blue is not designed to treat radioactive contamination and is not made for that purpose. People who are concerned about the possibility of being contaminated with radioactive materials should go to their doctors for advice and treatment.

Use of Prussian blue to treat radioactive contamination
Since the 1960s, Prussian blue has been used to treat people who have been internally contaminated with radioactive cesium (mainly Cs-137) and nonradioactive thallium (once an ingredient in rat poisons). Doctors can prescribe Prussian blue at any point after they have determined that a person who is internally contaminated would benefit from treatment. Prussian blue will help speed up the removal of cesium and thallium from the body.

How Prussian blue works
Prussian blue traps radioactive cesium and thallium (mainly Tl-201) in the intestines and keeps them from being re-absorbed by the body. The radioactive materials then move through the intestines and are excreted (passed) in bowel movements. Prussian blue reduces the biological half-life\(^1\) of cesium from about 110 days to about 30 days. Prussian blue reduces the biological half-life of thallium from about 8 days to about 3 days. Because Prussian blue reduces the time that radioactive cesium and thallium stay in the body, it helps limit the amount of time the body is exposed to radiation.

\(^1\)Biological half-life is the time that it takes a substance in the body to be reduced by \(\frac{1}{2}\).
**Who can take Prussian blue**
The drug is safe for most adults, including pregnant women, and children (2-12 years). Dosing for infants (ages 0-2 years) has not been determined yet. Women who are breast feeding their babies should stop breast feeding if they think they are contaminated with radioactive materials and consult with their doctors. People who have had constipation, blockages in the intestines, or certain stomach problems should be sure to tell their doctors before taking Prussian blue. Before taking Prussian blue, people also should be sure to tell their doctors about any other medicine they are taking.

**How Prussian blue is given**
Prussian blue is given in 500-milligram capsules that can be swallowed whole. People who cannot swallow pills can take Prussian blue by breaking the capsules and mixing the contents in food or liquid. Breaking open the capsules will cause people’s mouths and teeth to be blue during the time of treatment.

The dose of Prussian blue depends on the person’s age and the amount of contamination in the body. Prussian blue usually is given 3 times a day for a minimum of 30 days, depending on the extent of the contamination.

**Side effects of Prussian blue**
The most common side effects of Prussian blue are upset stomach and constipation. These side effects can easily be treated with other medications. People may have blue feces (stool) during the time that they are taking Prussian blue.

**Where you can get Prussian blue**
Prussian blue is available only by prescription. The CDC has included Prussian blue in the Strategic National Stockpile (SNS), a special collection of drugs and medical supplies that CDC keeps to treat people in an emergency.

**Where you can get more information**
More detailed information on Prussian blue can be found at the U.S. Food and Drug Administration Web site. ([http://www.fda.gov/cder/drug/infopage/prussian_blue/Q&A.htm#2](http://www.fda.gov/cder/drug/infopage/prussian_blue/Q&A.htm#2))

You may also call the CDC Public Response line at 1-800-311-3435 or visit [http://www.cdc.gov/netinfo.htm](http://www.cdc.gov/netinfo.htm) to request more information.

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The Centers for Disease Control and Prevention (CDC) protects people’s health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.

For more information, visit [www.bt.cdc.gov/radiation](http://www.bt.cdc.gov/radiation), or call the CDC public response hotline at (888) 246-2675 (English), (888) 246-2857 (Español), or (866) 874-2646 (TTY).
Facts About Neupogen®

When a person has received a very high dose of radiation, destruction of the bone marrow, potentially resulting in uncontrolled bleeding and infection, is a major concern. To help the recovery of the bone marrow, growth factors that stimulate the blood cells to multiply can be used. Filgrastim (trade name Neupogen®), is a drug that was approved for use by the FDA in 1991 for cancer patients with bone marrow damage due to chemotherapy or radiotherapy. Treated patients have had fewer infections, less need for intravenous antibiotics, and shortened hospital stays than those who did not receive the drug. Neupogen may also be useful for patients who have bone marrow damage from accidental exposures to high doses of radiation and it is expected to provide similar benefits.

What Neupogen Is

Filgrastim (trade name Neupogen®) is a human granulocyte colony stimulating factor (G-CSF) produced by recombinant DNA technology. It is a specific type of cytokine that stimulates the growth of white blood cells.

What Cytokines Are

Cytokines are hormone-like proteins that act as communicators between cells. They can relay messages between cells, telling them to grow, stop growing, move to a trouble spot, or otherwise change the cell’s function. Neupogen® is a specific type of cytokine that stimulates the growth of white blood cells.

Use of Neupogen® to Treat Persons Accidentally Exposed to High Doses of Radiation

Just like a cancer patient who has received chemotherapy or radiation therapy, a person who has received a high dose of radiation may experience bone marrow destruction, possibly resulting in uncontrolled bleeding and infection. Since Neupogen® has been used successfully for cancer patients to stimulate the growth of the white blood cells, making them less vulnerable to infections, it is expected to help patients who have bone marrow damage from very high doses of radiation in much the same way.

How Neupogen® Works

Patients who receive very high doses of radiation often are left with very few white blood cells. The patients’ own bone marrow will eventually create new blood cells, but this is a slow process. And until the white blood cell counts rise sufficiently, the patients are at a high risk of death from infection. Neupogen® can speed up the process of white blood cell creation, reducing the time that the patient is vulnerable to infection.

Who Can Take Neupogen

People may be prescribed Neupogen® following chemotherapy or radiation therapy to assist in their recovery. Also, people may be prescribed Neupogen® following a high dose of radiation from a radiation emergency. Neupogen® is safe for most adults, but should not be taken by people who have known hypersensitivity to E. coli-derived proteins, filgrastim, or any component of filgrastim. Children and pregnant women should take Neupogen® with caution. It is not known if Neupogen® is excreted in human milk, so breastfeeding women should take Neupogen® with caution as well.
Facts About Neupogen®  
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**Side Effects of Neupogen®**
The possible side effects of Neupogen® include fever, diarrhea, skin rash and weakness. The most common side effect is mild to moderate bone pain.

**How Neupogen® Is Given**
Neupogen® is given by injection under the skin or through intravenous infusion.

**What the Treatment Plan Is**
The treatment plan is to give 5 micrograms per kilogram of patient weight (mcg/kg) of G-CSF filgrastim (Neupogen®) daily for up to 2 weeks, either by injection or intravenous infusion.

**Where You Can Get More Information**
More detailed information on cytokines can be found at the FDA web site, at:  
[http://www.fda.gov/bbs/topics/CONSUMER/CON0291f.html](http://www.fda.gov/bbs/topics/CONSUMER/CON0291f.html)

More detailed information on Neupogen® can be found at:  

You can also call the CDC Public Response line at 1-800-311-3435 or visit the web site at [http://www.cdc.gov/netinfo.htm](http://www.cdc.gov/netinfo.htm) to request more information.

For more information, visit [www.bt.cdc.gov/radiation](http://www.bt.cdc.gov/radiation), or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).

March 1, 2005
Potassium Iodide (KI)

What is Potassium Iodide (KI)?
Potassium iodide (also called KI) is a salt of stable (not radioactive) iodine. Stable iodine is an important chemical needed by the body to make thyroid hormones. Most of the stable iodine in our bodies comes from the food we eat. KI is stable iodine in a medicine form. This fact sheet from the Centers for Disease Control and Prevention (CDC) gives you some basic information about KI. It explains what you should think about before you or a family member takes KI.

What does KI do?
Radioactive iodine may be released into the air—and then breathed into the lungs—as part of a radiological or nuclear event. In most cases, once radioactive iodine has entered the body, the thyroid gland quickly absorbs it. After it has been absorbed into the thyroid gland, radioactive iodine can then cause thyroid gland injury. Because KI acts to block radioactive iodine from being taken into the thyroid gland, it can help protect this gland from injury.

It is also important to know what KI cannot do. KI cannot protect parts of the body other than the thyroid from radioactive iodine. KI cannot protect the body from any radioactive elements other than iodine. If radioactive iodine is not present, then taking KI is not protective.

How does KI work?
The thyroid gland cannot tell the difference between stable and radioactive iodine and will absorb both. KI works by blocking radioactive iodine from entering the thyroid. When a person takes KI, the stable iodine in the medicine gets absorbed by the thyroid. There is so much stable iodine in the KI that the thyroid gland becomes “full” and cannot absorb any more iodine—either stable or radioactive—for the next 24 hours.

Iodized table salt also contains iodine; there is enough iodine in iodized table salt to keep most people healthy under normal conditions. However, there is not enough iodine in table salt to block radioactive iodine from getting into your thyroid gland. You should not use table salt as a substitute for KI.

How well does KI work?
It is important to know that KI may not give a person 100% protection against radioactive iodine. How well KI blocks radioactive iodine depends on

- how much time passes between contamination with radioactive iodine and taking KI (the sooner a person takes KI, the better),
- how fast KI is absorbed into the blood, and
- the total amount of radioactive iodine to which a person is exposed.

Who should take KI?
The thyroid glands of a fetus and of an infant are most at risk of injury from radioactive iodine exposure. Young children and people with low stores of iodine in their thyroid are also at risk of thyroid injury.

Infants (including breast-fed infants): Infants need to be given the recommended dosage of KI for babies (see How much KI should I take?). Even though some KI gets into breast milk, it is not enough to...
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protect breast-fed infants from radioactive iodine exposure. The proper dose of KI given to a nursing infant will help to protect them from radioactive iodine that they breathe in or drink in breast milk.

Children: The United States Food and Drug Administration (FDA) recommends that all children exposed to radioactive iodine take KI, unless they have a known allergy to iodine. Children from newborn to 18 years of age are the most sensitive to the potentially harmful effects of radioactive iodine.

Young Adults: The FDA recommends that young adults (those between the ages of 18 and 40 years) who are exposed to radioactive iodine take the recommended dose of KI. Young adults are less sensitive to the effects of radioactive iodine than are children.

Pregnant Women: Because all forms of iodine cross the placenta, pregnant women should take KI to protect the growing fetus. However, pregnant women should take only one dose of KI following exposure to radioactive iodine.

Breastfeeding Mothers: Women who are breastfeeding should take only one dose of KI if they have been exposed to radioactive iodine. Because radioactive iodine quickly gets into breast milk, CDC recommends that women exposed to radioactive iodine stop breastfeeding and feed their child baby formula or other food if it is available. If breast milk is the only food available for an infant, nursing should continue.

Adults: Adults older than 40 years should not take KI unless public health or emergency management officials say that contamination with a very large dose of radioactive iodine is expected. Adults older than 40 years have the lowest chance of developing thyroid cancer or thyroid injury after contamination with radioactive iodine. They also have a greater chance of having an allergic reaction to KI.

When should I take KI?
After a radiological or nuclear event, local public health or emergency management officials will tell the public if there is a need to take KI or other protective actions. You may be told to shelter-in-place or evacuate. Follow the instructions given to you by these authorities.

How much KI should I take?
The FDA has approved two different forms of KI—tablets and liquid—that people can take by mouth after a nuclear radiation emergency. Tablets come in two strengths, 130 milligram (mg) and 65 mg. The tablets are scored so they may be cut into smaller pieces to give lower doses. Each milliliter (mL) of the oral liquid solution contains 65 mg of KI.

According to the FDA, you should take (or give) the following doses after exposure to radioactive iodine:

- Adults should take 130 mg (one 130 mg tablet OR two 65 mg tablets OR two mL of solution).
- Women who are breastfeeding should take the adult dose of 130 mg.
- Children between 3 and 18 years of age should take 65 mg (one 65 mg tablet OR 1 mL of solution). Children who are adult size (greater than or equal to 150 pounds) should take the full adult dose, regardless of their age.
- Infants and children between 1 month and 3 years of age should take 32 mg (½ of a 65 mg tablet OR ½ mL of solution). This dose is for both nursing and non-nursing infants and children.
- Newborns from birth to 1 month of age should be given 16 mg (¼ of a 65 mg tablet or ¼ mL of solution). This dose is for both nursing and non-nursing newborn infants.
How often should I take KI?
A single dose of KI protects the thyroid gland for 24 hours. A one-time dose at the levels recommended in this fact sheet is usually all that is needed to give full protection to the thyroid gland. In some cases, radioactive iodine might be in the environment for more than 24 hours. If that happens, local emergency management or public health officials may tell you to take one dose of KI every 24 hours for a few days. You should do this only on the advice of emergency management officials, public health officials, or your doctor. Avoid repeat dosing with KI of pregnant and breastfeeding women and newborn infants. Those individuals may need to be evacuated until levels of radioactive iodine in the environment fall.

Taking a higher dose of KI, or taking KI more often than recommended, does not offer more protection and can cause severe illness or death.

Medical conditions that may make it harmful to take KI
It may be harmful for some people to take KI because of the high levels of iodine in this medicine. You should not take KI if:
- you know you are allergic to iodine (If you are unsure about this, consult your doctor. A seafood or shellfish allergy does not necessarily mean that you are allergic to iodine.) or
- you have certain skin disorders (such as dermatitis herpetiformis or urticaria vasculitis).

People with thyroid disease (for example, multinodular goiter, Graves’ disease, or autoimmune thyroiditis) may be treated with KI. This should happen under careful supervision of their doctor, especially if dosing lasts for more than a few days.

In all cases, talk to your doctor if you are not sure whether or not to take KI.

What are the possible risks and side effects of KI?
When public health or emergency management officials tell the public to take KI following a radiological or nuclear event, the benefits of taking this drug outweigh the risks. This is true for all age groups. Some general side effects caused by KI may include intestinal upset, allergic reactions (possibly severe), rashes, and inflammation of the salivary glands.

When taken as recommended, KI causes only rare adverse health effects that specifically involve the thyroid gland. In general, you are more likely to have an adverse health effect involving the thyroid gland if you
- take a higher than recommended dose of KI,
- take the drug for several days, or
- have pre-existing thyroid disease.

Newborn infants (less than 1 month old) who receive more than one dose of KI are at particular risk for developing a condition known as hypothyroidism (thyroid hormone levels that are too low). If not treated, hypothyroidism can cause brain damage. Infants who receive KI should have their thyroid hormone levels checked and monitored by a doctor. Avoid repeat dosing of KI to newborns.

Where can I get KI?
KI is available without a prescription. You should talk to your pharmacist to get KI and to get the directions about how to take it correctly. Your pharmacist can sell you KI brands that have been approved by the FDA.
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Other Sources of Information
- The FDA recommendations on KI can be reviewed on the Internet at www.fda.gov/cder/drugprepare/default.htm#Radiation.


For more information, visit www.bt.cdc.gov/radiation, or call CDC at 800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).
Diethylenetriaminepentaacetate (DTPA) can remove certain radioactive materials from people's bodies, but it must be taken under the guidance of a doctor.

People may become internally contaminated (inside their bodies; see www.bt.cdc.gov/radiation/contamination.asp) with radioactive materials by accidentally ingesting (eating or drinking) or inhaling (breathing) them. The sooner that these materials are removed from the body, the fewer and less severe the health effects of the contamination will be. Small amounts of contamination may not require treatment, but doctors can give DTPA if they determine that a person who is internally contaminated would benefit from treatment.

What DTPA Is
DTPA is a calcium or zinc salt that has been used since the 1960s to treat people who have been internally contaminated with certain radioactive materials, such as americium (www.bt.cdc.gov/radiation/isotopes/americium.asp), plutonium (www.bt.cdc.gov/radiation/isotopes/plutonium.asp), Californium, curium, and berkelium. Currently, DTPA is approved only for treatment of internal contamination with plutonium, americium, and curium.

How DTPA Works
DTPA comes in two forms: calcium (Ca-DTPA) and zinc (Zn-DTPA). Both forms are capable of binding to certain radioactive materials (refer to previous section) and speeding up the release of these materials in the urine, thus reducing the amount of internal contamination.

DTPA is most effective if given within the first 24 hours after internal contamination. However, DTPA is still effective several days or weeks after a person has been internally contaminated.

Who Can Take DTPA
Ca-DTPA is safe for most adults, but it should not be taken by people who have kidney disease or bone marrow depression. Also, Ca-DTPA should not be taken by children younger than 18 years of age, by pregnant women, or by people who have bone marrow problems. Ca-DTPA should be used with caution in patients suffering from a severe form of a disease called hemochromatosis. Children and pregnant women who are under a doctor's care can take small doses of Zn-DTPA. Ca-DTPA and Zn-DTPA should not be used to treat people who are internally contaminated with the radioactive materials uranium (www.bt.cdc.gov/radiation/isotopes/uranium.asp) or neptunium.

Side Effects of DTPA
Most DTPA is excreted (released) in the urine within 12 hours after it is given, so it does not build up in the body or cause long-term health effects. Side effects of treatment with DTPA can include headache, lightheadedness, chest pain, metallic taste in the mouth, nausea, diarrhea, and itching skin, but these symptoms decrease between treatments. Also, DTPA increases the loss of certain minerals (zinc, magnesium, and manganese) from the body, but supplements can be taken to offset this loss.
**How DTPA Is Given**

DTPA can be injected into a vein in the arm by using a syringe or a slow drip of liquid from a bag. DTPA can be given to people whose lungs have been contaminated with radioactive materials by having them inhale DTPA in a mist or spray. Inhaling DTPA may cause some people, especially those with asthma, to cough or wheeze.

DTPA may need to be administered daily for an extended period. However, **many people may need only one dose of DTPA** for treatment. The duration of treatment depends on the amount of internal contamination and the person’s response to treatment. DTPA should be given only as long as a doctor has determined you need it.

During treatment, doctors may collect blood, urine, and feces samples from the people who are undergoing treatment. These samples provide information about levels of radioactive materials in the body.

**Where You Can Get DTPA**

DTPA is available only from a doctor. CDC has included both Zn- and Ca-DTPA in the Strategic National Stockpile (SNS), a special collection of drugs and medical supplies that CDC keeps to treat people in an emergency.

**Where You Can Get More Information**

More detailed information on DTPA can be found at the U.S. Food and Drug Administration (FDA) Web site at [www.fda.gov/cder/drug/infopage/dtpa](http://www.fda.gov/cder/drug/infopage/dtpa).

Additionally, you can call the CDC Public Response line at 1-800-311-3435 or visit the Web site at [www.cdc.gov/netinfo.htm](http://www.cdc.gov/netinfo.htm) to request more information.