COMPOUNDS IDENTIFIED IN THE COMMUNITY AS IDENTIFIED BY ATSDR IN THE FOLLOWING DOCUMENT

Petitioned Public Health Assessment Addendum Southern Wood Piedmont Company

Augusta, Richmond County, Georgia

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"Compounds Found at Elevated Levels Both On site and Off site (Wood-Treatment Facility)"

The following compounds were found at elevated levels both on and off site, and are commonly used at wood-treating facilities. It is possible that the elevated amounts of these compounds are related to activities at SWP.

Arsenic contamination was widespread off site, appearing at levels above comparison values in groundwater; surface water; soil, and ditch, swamp, and creek sediment. Because remediation has not yet taken place in some of these areas, continued arsenic exposure is possible. Arsenic exposure for children in contact with ditch sediments is sufficient to cause concern. Chronic exposure to maximum levels of arsenic detected in some off-site residential soils might pose a health threat to children as well.

Groundwater was sufficiently contaminated with arsenic that chronic ingestion would present an increased risk for skin cancer.

Arsenic is used (or generated) in smelting and as a pesticide. Burning of fossil fuels can also release arsenic. Low levels of arsenic are also present in nature. The average naturally occurring arsenic soil level in the Eastern United States is 4.8 mg/kg. About 95% of the background samples taken had arsenic levels below 8 mg/kg.

Various effects of arsenic have been noted at high doses not relevant to the levels seen at this site. Effects of the low-level, long-term exposures that are likely to be seen at the site include the development of skin irritation. Concentrations of arsenic in soil are not sufficient to cause an increased cancer risk; however, chronic ingestion of arsenic-contaminated groundwater at levels found off site increases the risk for skin cancer [39].

Prior (i.e., before EPA's 1993 sampling) chromium levels in groundwater; ditch, swamp, and creek sediments; and off-site surface soil exceeded comparison values (RMEGs). They also exceeded health guideline reference doses in all these media. Chromium was a past health concern in the above media; however, it is only a current problem in groundwater. Since residents in the area consuming municipal water for potable and nonpotable uses, elevated chromium levels in the groundwater is currently not of public health concern (refer to Appendix

3 for more information). Chromium is used in plating and making special steels, while chromium salts are used as dye mordants, tanning agents, pigments, wood preservatives, and anti-corrosive and cleaning agents. Major environmental sources include industrial emissions from the combustion of fossil fuels. Chromium can irritate the stomach, nasal passages, and lungs and can be toxic to the liver and kidneys. Prior to 1993, it was possible to expect that chronic exposure to residential soils at the levels of chromium found off site might cause such adverse health effects [40].

Benzene occurs in off-site groundwater and air at levels exceeding comparison values; the levels in off-site groundwater are of potential health concern. Ideally, benzene exposure should be zero. The health concern is that children drinking this water for long time might be at an increased risk for the development of leukemia. Off-site groundwater is listed as a completed exposure pathway because of the high probability that this water was consumed by private well users in the past.

Air is another possible exposure route; however, we lack data on past air concentrations. Current air levels of benzene are similar to levels in many urban areas. Benzene was one of the most common industrial solvents in the past but is rarely used now. The primary reason for this reduction has been concern over its ability to cause leukemia after long-term, low-level exposures. Benzene affects the blood, the central nervous system, skin, bone marrow and its ability to generate new white blood cells, eyes, and the respiratory system. Skin contact with benzene may result in reddening and swelling of the skin at the point of contact. Benzene levels off site, typical of levels found in urban air, were above comparison values,; however, these levels would not be expected to result in adverse health effects.

Cresol, which may actually be a mixture of three closely related compounds, is a commonly used wood preservative. The compounds occur naturally in wood, coal, oil, tar, smoke, and some foods. Cresol was found in on-site groundwater at levels that might cause health effects in children drinking this water for long periods of time. (See page 2-8 in Appendix 2). This on-site groundwater has reportedly never been used as a drinking water source. The effects that might be seen at chronic, low doses are primarily neurological: twitches, decreased activity, and lethargy. We do not know whether off-site private wells are contaminated with cresol and whether residents are still drinking water from private wells [45].

Carbazole (diphenylene amine) is a common component of creosote. The concentrations found are a health concern for children ingesting creek or swamp sediments. Acute health effects, such as respiratory and eye irritation, are possible but unlikely. Carbazole is also an intermediate in the production of dyes and is used in color photographic processes.

PCP (Pentachlorophenol) was detected at levels exceeding health guidelines in on-site groundwater. A commonly used wood preservative PCP has been released into soils, air, and water at numerous wood treatment sites. It can cause both cancer and noncancerous health effects (birth defects and damage to liver, kidney, skin, blood, lungs, and the nervous system) in laboratory animals. Effects in humans are not as well studied [44]. Exposure to low levels of PCP in on-site groundwater that would ever be used as a drinking water source is a potential health concern. This concern includes the potential for development of increased cancer risk.

Off-site exposure to PCP in groundwater has not been verified by environmental monitoring [42].

Polycyclic Aromatic Hydrocarbons (PARs). In general, PAHs form as products of ordinary combustion and thus are everywhere. They are in smoke, tobacco smoke, soot, and coal. They are generally natural products with no known use. They biodegrade slowly. We do not have health guidelines for all P AHs in all media, and it is difficult to predict potential health effects from mixtures of these compounds. Carcinogenic P AHs tend to be metabolized into more reactive forms. There is little known noncancer toxicity, although some P AHs are fetotoxic and reproductively toxic. Some cardinogenic forms are immunosuppressive and/or genotoxic in invitro tests. P AHs generally have low water solubility and strong absorption to soil and thus do not migrate well in the environment. They may interact with each other, enhancing or reducing cardinogenic potential (reduction is the more common experimental results), but these interactions are ill defined for most PAHs [43].

Certain P AHs are not known to cause cancer. These include the following: acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, methylated naphthalenes, naphthalene, phenanthrene, and pyrene. Sufficient evidence exists to accept that the following P AHs are also carcinogenic: benzo[a] anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[I,2,3-c,d]pyrene.

P AH levels found in groundwater (on and off site), soil, and sediments (off site) are sufficient to result in exposures that exceed health guidelines. There is a risk of the development of adverse health effects, especially to children, from P AHs in these environments. These risks include acute effects and an increased risk of the development of cancer. Individual P AHs, which may also exceed exposure limits, include acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene.

Dioxins and furans in ditch sediments were at concentrations above health guidelines. Dioxins and furans are related classes of compounds formed in the manufacture of various chlorinated products, including herbicides like 2,4,5-T (a component of Agent Orange) and other chlorinated cyclic hydrocarbons, in paper bleaching, and as a contaminant in PCP. They can also result from combustion of various chemicals, industrial wastes, and municipal wastes. They form naturally in most combustion processes. Forest fires have generated low background levels throughout the world. Dioxins and furans include compounds with various levels of chlorination. Isomers with 4 chlorine molecules include the most toxic forms, and congeners with chlorines in the 2,3,7 and 8 positions are the most toxic within each isomer group. The most toxic congener is 2,3,7,8TCDD, while the related furan is only slightly less toxic. Other dioxins and furans can range from slightly less toxic to 1,000 times less toxic. Scientists dealing with mixtures of dioxins and furans have developed a system to weigh concentrations of congeners and isomers by factorsthat relate their toxicity to that of 2,3,7,8-TCDD, generating "TCDD equivalency factors." These factors are then used to assess the health risks from a dioxin/furan mixture.

In animals, 2,3,7,8-TCDD causes reproductive failure, birth defects, immunosuppression, thymic atrophy, liver damage and enzyme induction, "wasting" (severe loss of weight and body fat over

several weeks), changes in iron in the blood, thickening of the skin (a rapid response), and hormonal changes. We do not yet know the actual cause of animal death, but it may involve alterations in the hormonal systems. Development of intoxication signs may be delayed, and death can require several weeks [36].

While we see many of these effects in animals, there are wide species differences in effect and levels needed to cause particular effects. Undefined factors also cause a great many individual differences in susceptibility. The only proven effect of2,3,7,8-TCDD in humans is development of chloracne, a severe skin condition that may be disfiguring and long lasting. A number of chlorinated hydrocarbons can cause chloracne, and there is a wide range of susceptibility to this disease. It has been associated most often with massive doses of chlorinated compounds found during industrial and/or occupational exposures.

Chloracne from the low levels seen in the environment has been very rare, and the levels found at the site would be unlikely to have this effect.

Dioxins were present in ditch sediment in sufficient concentration to pose a risk for increased incidence of cancer in children ingesting the material. Acute effects (chloracne) were also possible; however, these ditches have been remediated and no longer pose a threat.

Dibenzofuran was found in swamp and ditch sediment. Available data do not clarify whether this analysis represents the unchlorinated compound or one or more of the chlorinated forms. The EP A analysis method for these compounds is specific for the unchlorinated compound, so we assume that the data report on the unchlorinated compound. The unchlorinated form would be less toxic than the chlorinated and unlikely to cause significant health effects.

Compounds Found Off site Not Associated with Wood-Treating

Other substances found off site at levels that may be of health concern had no clear relation to activities at SWP. These are discussed below.

Beryllium levels exceeded comparison values in off-site sediments from the ditch and swamp, in ditch water, and in surface soil. Exposure estimates exceeded health guidelines in these media as well, except in ditch water. However, the threat from beryllium is due to the potential for increased cancer rates in the area because of inhalation of contaminated dusts derived from beryllium-contaminated soils. Generation of a large amount of dust from ditch and swamp sediments is very unlikely. Therefore, beryllium's presence in offsite media does not present a health threat.

Beryllium is used in strengthening alloys, primarily of copper, but also of aluminum and nickel. The major environmental source is combustion of coal [52]. Thus, SWP is probably not the source of beryllium.

Cadmium exceeds comparison values in off-site surface water and surface soil. Predicted exposures to off-site soil are sufficient to be a health concern for children, especially pica children. Cadmium is commonly ingested with food and is also present in combustion ash from

incinerators or fossil fuels and in tobacco smoke. The source of cadmium contamination is unlikely to be from SWP. Chronic, low-level exposures to surface soil contaminated with cadmium might increase the risk of kidney and liver damage. Cancer does not normally result from cadmium ingestion [46].

Lead is sometimes found at wood treatment sites; however, the highest levels of lead were found near the recycling facilities, not near SWP. It occurred there in off-site groundwater; surface water; soils; and ditch, swamp, and creek sediments at concentrations exceeding health guidelines. Exposure doses would be of concern only to children and pica children ingesting residential or ditch soil near the recycling facilities. The primary effects of lead are on the peripheral and central nervous systems, blood cells, and calcium metabolism. Nervous system effects include neuropathy, decreased nerve conduction velocity, slowed speech and language processing, shortened attention span, decreased IQ, decreased motor skills and coordination, and lessened concentration. Lead has effects on the fetus and newborn child, but these would not occur in a pica child ingesting contaminated soil or sediment [47].

Nickel occurs above comparison values in groundwater; surface water; soil; and ditch, creek, and swamp sediments, but exposure estimates indicate that it is not sufficiently concentrated to pose a health problem. Nickel is used in electroplating and in the manufacture of steel, alloys, and batteries. It is also found in tobacco smoke and byproduct from the combustion of fossil fuels. Small amounts of nickel are essential nutrients [48].

Thallium is metal utilized in electrical devices and glass. It concentrates in plants and is high in cigarette smoke. Thallium was found in ditch sediment. Although acute exposures to thallium in high doses may have harmful effects, humans or animals have shown almost no effects as the result of long-term exposure to small amounts. However, there are limited numbers of studies. Thallium has not been classified for its ability to cause cancer [49]. The maximum level of thallium in ditch sediments does exceed health guidelines for children; however, the validity of this concentration level is questioned and may not exist because of the following:

Åit was the only sample out of 40 that showed a level above the detection limit,

- the sample was acquired in an isolated location, showing no direct relationship with an identifiable source, and
- QA/QC protocols are suspect (i.e., both lead and thallium levels in the sample are exactly the same, 42 mg/kg).

Even if the level is a true concentration for the specified location, the area may not pose a health risk to children since they must inadvertently ingest sediment there on a daily basis for many years to produce chronic adverse health effects.

BCIE (bis-2-chloroisopropyl ether) was found in off-site soil at levels sufficient to pose slight increase in the rate of cancer for children ingesting the soil over a long period of time. Bern is a waste contaminant from manufacturing processes for chemicals, rubber, and insecticides. In higher concentrations, it can irritate eyes and the respiratory system.

3,3-dichlorobenzididne was found in off-site soil at levels sufficient to cause an increased risk of cancer in a child ingesting soil daily over a long period oftime (greater than 365 days); however, no acute (short term exposure usually of 14 or fewer days) health effects would be expected at this level of exposure. 3,3-dichlorobenzidine is used in dyes and pigments, and most information on its toxicity comes from studies of workers exposed to high levels. Some persons exposed to low levels over long time periods have experienced liver damage. The compound is a carcinogen in animal assays and can cause leukemia in animals.

N-nitrosodimethylamine (NDMA) was found in surface water in the ditch. Once used as a rocket fuel, it now appears most often as an unwanted contaminant of alkylamines. NDMA breaks down quickly in the environment. Long-term, low-level ingestion exposure can lead to liver damage and both liver and lung cancer. However, these types of exposures to ditch water are not likely.

PCBs occurred in surface water and off-site soil at levels exceeding comparison values. PCBs are a group of 209 related compounds once used widely in industry because they are excellent insulators for electrical devices or equipment. Therefore, they were used as coolants, lubricants, hydraulic fluids, and plasticizers, especially in electric capacitors and transformers. They were manufactured from 1929 until 1977, when production and sale of PCBs was banned in the United States. However, equipment containing PCBs remains in use, and they have been found at numerous waste sites, former electrical equipment repair sites, and a variety of other manufacturing sites. PCBs are persistent in environment and can bioaccumulate in the body.

PCBs were generally made in a crude fashion, resulting in complex, inconsistent, and poorly characterized mixtures of the various possible forms. Thus, PCBs are usually found at contaminated sites as complex mixtures. Some PCBs have been studied more thoroughly than others. In general, acute effects are slight and require high doses to develop. These effects in humans might include development of a skin rash called chloracne (also caused by a variety of chlorinated organic materials) and nausea (perhaps leading to a vomiting reflex). Other effects, involving liver, reproductive functions, and the immune system have been observed at high doses in animals but not in humans [51].

With long-term, low-level exposures that occur around contaminated sites, there is little known effect from PCB exposure. Some PCBs are thought to cause cancer, primarily liver cancer, in humans, but the evidence is not definitive. To be safe, A TSDR considers all PCBs potentially

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PCBs are present in sufficient concentration in off-site soils and ditch sediments to pose a small, probably unmeasurable, increase in the risk of cancer."