Appendix A

Hazards of Compounds Demonstrating
The Highest Concentration In The
Lipari Landfill Leachate

The following organic compounds have been identified, sampled, and analyzed in the Lipari leachate. Public health hazards and toxicological information is provided for the ten compounds found to have the highest concentrations in the Lipari leachate.

**BENZENE** Syns: benzol, phenyl hydride, coal naphtha. Clear colorless liquid. $C_6H_6$, mw: 78.11, mp: 5.51°, bp: 80.093°-80.094°, flash p: 12°F (CC), d: 0.8794 @ 20°, autoign. temp.: 1044°F, lel: 1.3%, uel: 7.1%, vap. press: 100 mm @ 26.1°, vap. d: 2.77, ulc: 95-100.

THR = Poisoning occurs most commonly through inhal of the vapor, though benzene can penetrate the skin, and poison in that way. Locally, benzene has a comparatively strong irritant effect, producing erythema and burning, and, in more severe cases, edema and even blistering. Exposure to high conc of the vapor (3000 ppm or higher) may result from failure of equipment or spillage. Such exposure, while rare in industry, may result in acute poisoning, characterized by the anesthetic action of benzene on the CNS. The anesthetic action of benzene is similar to that of other anesthetic gases, consisting of a preliminary stage of excitation followed by depression and, if exposure is continued, death through respiratory failure. The chronic, rather than the acute form, of benzene poisoning is important in industry. It is a recognized leukemogen. [14, 3, 1, 102] There is no specific blood...
picture occurring in cases of chronic benzol poisoning. The bone marrow may be hypoplastic, normal, or hyperplastic, the changes reflected in the peripheral blood. Anemia, leucopenia, macrocytosis, reticulocytosis, thromocytopenia, high color index, and prolonged bleeding time may be present. Cases of myeloid leukemia have been reported. For the supervision of the worker, repeated blood examinations are necessary, including hemoglobin determinations, white and red cell counts and differential smears. Where a worker shows a progressive drop in either red or white cells, or where the white count remains below 5,000 per cu mm or the red count below 4.0 million per cu mm, on two successive monthly examinations, he should be immediately removed from exposure. Following absorption of benzene, elimination is chiefly through the lungs, when fresh air is breathed. The portion that is absorbed is oxidized, and the oxidation products are combined with sulfuric and glycuronic acids and eliminated in the urine. This may be used as a diagnostic sign. Benzene has a definite cumulative action, and exposure to relatively high conc is not serious from the point of view of causing damage to the blood-forming system, provided the exposure is not repeated. On the other hand, daily exposure to conc of 100 ppm or less will usually cause damage if continued over a protracted period of time. In acute poisoning, the worker becomes confused and dizzy, complains of tightening of the leg muscles and of pressure over the forehead, then passes into a stage of excitement. If allowed to remain in exposure, he
quickly becomes stupefied and lapses into coma. In non-fatal cases, recovery is usually complete and no permanent disability occurs. In chronic poisoning the onset is slow, with the symptoms vague: fatigue, headache, dizziness, nausea and loss of appetite, loss of weight and weakness are common complaints in early cases. Later, pallor, nosebleeds, bleeding gums, menorrhagia, petechiae and purpura may develop. There is great individual variation in the signs and symptoms of chronic benzene poisoning. Benzene is a common air contaminant.

Fire Hazard: Dangerous, when exposed to heat or flame; can react vigorously with oxidizing materials, such as BrF₅, Cl₂, CrO₃, O₂, ClO₄⁻, O₃, perchlorates, (AlCl₃ + FC₁₀₄), H₂SO₄ + permanganates), K₂O₂, (AgClO₄ + acetic acid), Na₂O₂ [19].

Spont Heating: No.

Explosion Hazard: Mod, when its vapors are exposed to flame. Use with adequate ventilation.

Disaster Hazard: Dangerous, highly flam.

To Fight Fire: Foam, CO₂, dry chemical.

\[ \text{ClCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{Cl}, \text{ mw: 143.0, bp: 178.5°, fp: -51.9°, flash p: 131°F (CC), d: 1.2220} \]
\[ \text{bp: 20°/20°, autoign. temp: 696°F, vap. press: 0.7 mm} \]
\[ \text{at 20°, vap. d: 4.93.} \]

Acute tox data: Oral LD\textsubscript{50} (rat) = 75 mg/kg; inhal LC\textsubscript{LO} (rat) = 1000 ppm for 45 min; dermal LD\textsubscript{50} (rabbit) = 720 mg/kg. [3]

THR = HIGH via oral and inhal; MOD via dermal routes. The vapor is irr to the mu mem of the eyes and nose. It affects the kidneys and liver in varying degrees, and is a mild narcotic. Guinea pigs cannot be killed immediately by exposure to conc which can be attained at ordinary room temp, but exposure to 1,000 ppm for 30 to 60 min may produce death after several days. Autopsy shows congestion of the lungs and upper respiratory tract, pulmonary edema, and congestion of the liver, brain and kidneys. The pulmonary edema apparently develops after a latent period of several hours, similar to the action of "nitrous fumes." In humans, exposure to 500 to 1,000 ppm causes severe irr of the eyes and nose after brief exposure, and deep inhal is nauseating and intolerable. A conc of 100 ppm produces slight nausea and irr; conc of 35 ppm are practically free from irr, though the odor is easily detectable. An exper(+) carc. [3, 8]

Fire Hazard: Mod, when exposed to heat, flame or oxidants.
Explosion Hazard: see also ethers. Reacts vigorously with oleum, chlorosulfonic acid. [19]

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes; reacts with water or steam to evolve toxic and corrosive fumes; can react vigorously with oxidizing materials.

To Fight Fire: Water, foam, mist, fog, spray, dry chemical.

ETHYLENE DICHLORIDE. Syns: ethylene chloride, 1,2-dichlorehthane. Colorless liquid, pleasant odor, sweet taste. CH₂ClCH₂Cl, mw: 99.0, bp: 83.5°, ulc: 60-70, lel = 6.2%, uel = 15.9%, fp: -35.7°, flash p: 56°F, d: 1.257 @ 20°/4°, autoign. temp.: 775°F, vap. press: 100 mm @ 29.4°, vap. d: 3.35.

Acute tox data: Oral LD₅₀ (rat) = 770 mg/kg. [3]

THR = HIGH - MOD via oral and dermal routes. Causes a pulmonary edema upon inhal. [79] An eper transplacental carc. [23, 3], mutagen [111] and teratogen. Ethylene dichloride has a distinctive odor and strong local irr effects, which give warning of its presence in relatively safe conc. There Ethylene dichloride has a specific effect on the cornea. Exposure to the vapor, or, in animals, injection under the skin, produces a clouding which may progress to
endothelial necrosis and infiltration of the corean by lymphocytes and connective tissue cells. The narcotic action of the compound is strong.

**METHYLENE CHLORIDE.** Syn: dichloromethane. Colorless volatile liquid. CH₂Cl₂, mw: 84.94, bp: 39.8°, lel = 15.5% in O₂, uel = 66.4% in O₂, fp: -96.7°, d: 1.326 @ 20°/4°, autoign. temp.: 1139°F, vap. press: 380 mm @ 22°, vap. d: 2.93.

Acute tox data: Oral LD₅₀ (rat) = 2136 mg/kg; ipLD₅₀ (mouse) = 1500 mg/kg; scLD₅₀ (mouse) = 6440 mg/kg; inhal LC₅₀ (guinea pig) = 5000 ppm for 2 hrs; inhal TC₅₀ (humans) = 500 ppm for 8 hrs blood problems. Prolonged inhal of 500 ppm CNS problems.

THR = MOD via oral, ip, sc and inhal routes. An exper carc. [23] This material is very dangerous to the eyes. Except for its property of inducing narcosis, it has very few other acute toxicity effects. Its narcotic powers are quite strong, and in view of its great volatility, care should be taken in its use. It will not form explosive mixtures with air at ordinary temp. However, it can be decomp by contact with hot surfaces and open flame, and it can then yield toxic fumes, which are ir and will thus give warning of their presence. It has been used as an anesthetic in Europe and is still used there for local anesthesia. Exper have shown that 25,000 ppm conc for
2 hr exposures were not lethal. Conc of 7,200 ppm after 8 min caused paresthesia of the extremities; after 16 min, acceleration of the pulse to 100; during the first 20 min, congestion in the head, a sense of heat and slight irri of the eyes. At a level of 2,300 ppm, there was no feeling of dizziness during 1-hr exposures, but nausea did occur after 30 min of exposure. The limit of perception by smell is set at 25-50 ppm conc. Can cause a dermatitis upon prolonged skin contact. A respirator for organic vapors and fumes should be worn to avoid excessive inhal. Used as a food additive permitted in food for human consumption.

Fire Hazard: Reacts violently with Li, NaK, potassium-tert-butoxide, (KOH + n-methyl-n-nitrosourea). [19]

Explosion Hazard: None under ordinary conditions, but will form explosive mixtures in atmosphere having high oxygen content, in liquid O₂, N₂, O₄, K, Na, NaK. [19]

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of phosgene.

PHENOL. Syns: carboxylic acid, phenic acid, phenylic acid. White, crystalline mass which turns pink or red if not perfectly pure, burning taste, distinctive odor. C₆H₅OH, mw: 94.11, mp: 40.6°, bp: 181.9°, flash p: 175°F (CC), d:
Acute tox data: Oral LD$_{50}$ (rat) = 414 mg/kg; dermal LD$_{50}$ (rat) = 669 mg/kg; ip LD$_{50}$ (rat) = 250 mg/kg; sc LD$_{50}$ (mice) = 344 mg/kg. [3]

THR = HIGH via oral, ip, sc and dermal routes. A co-carc [23] and an exper carc [3, 23] via dermal route. In acute phenol poisoning, the main effect is on the CNS. Absorption from spilling phenolic solutions on the skin may be very rapid, and death results from collapse within 30 min to several hrs. Death has resulted from absorption of phenol through a skin area of 64 in.$^2$ Where death is delayed, damage to the kidneys, liver, pancreas and spleen and edema of the lungs may result. Absorbed phenol is partly excreted by the kidneys, partly oxidized. Part of the excreted portion is combined with sulfuric and glycuronic acids; the remainder is excreted unchanged. The symptoms develop rapidly, frequently within 15-20 min following spilling of phenol on the skin. Headache, dizziness, muscular weakness, dimness of vision, ringing in the ears, irregular and rapid breathing, weak pulse, and dyspnea may all develop, and may be followed by loss of consciousness, collapse and death. When taken internally, there is also nausea, with or without vomiting, severe abdominal pain, and corrosion of the lips, mouth, throat, esophagus and stomach. There may be perforation. On the skin,
the affected area is white, wrinkled and softened, and there is usually no immediate complaint of pain; later, intense burning is felt, followed by local anestesia and still later, by gangrene. [75, 76, 77, 20] Chronic poisoning, following prolonged exposures to low concs of the vapor or mist, results in digestive disturbances (vomiting, difficulty in swallowing, excessive salivation, diarrhea, loss of appetite), nervous disorders (headache, fainting, dizziness, mental disturbances) and skin eruptions. Chronic poisoning may terminate fatally in cases where there has been extensive damage to the kidneys or liver. Dermatitis resulting from contact with phenol or phenol-containing products is fairly common in industry. A common air contaminant. As little as 1.5 g (oral) has killed.

Fire Hazard: Mod, when exposed to heat, flame or oxidizers and reacts violently with (AlCl$_3$ + nitro-benzene), butadiene. [19]

Spont Heating: No.

Disaster Hazard: Dangerous; when heated, emits toxic fumes; can react with oxidizing materials.

To Fight Fire: Alcohol foam, CO$_2$, dry chemical.

TOLUENE. Syns: methylbenzene, phenylmethane, toluol.

Colorless liquid, benzol-like odor. $C_6H_5CH_3$, mw: 92.13, mp:
Acute tox data: Inhal $T_{LO}^{CNS}$ (human) = 200 ppm  
Inhal $T_{LO}^{psychotropic}$ (man) = 100 ppm  
oral $LD_{50}^{rat}$ = 5000 mg/kg; inhal $LC_{LO}^{rat}$ = 4000 ppm for 4 hrs; ip $LD_{50}^{rat}$ = 1640 mg/kg; inhal $LC_{50}^{mice}$ = 5300 ppm; dermal $LD_{50}^{rabbit}$ = 14000 mg/kg. [3]

THR = MOD via oral, inhal and ip routes; LOW via dermal route.

Toluene is derived from coal tar, and commercial grades usually contain small amounts of benzene as an impurity. Acute poisoning, resulting from exposures to high conc of the vapors, are rare with toluene. Inhal of 200 ppm of toluene for 8 hrs may cause impairment of coordination and reaction time; with higher conc (up to 800 ppm) these effects are increased and are observed in a shorter time. In the few cases of acute toluene poisoning reported, the effect has been that of a narcotic, the workman passing through a stage of intoxication into one of coma. Recovery following removal from exposure has been the rule. An occasional report of chronic poisoning describes an anemia and leucopenia, with biopsy showing a bone marrow hypoplasia. These effects, however, are less common in people working with toluene, and they are not as severe.
Exposure to conc up to 200 ppm produces few symptoms. At 200-500 ppm, headache, nausea, loss of appetite, a bad taste, lassitude, impairment of coordination and reaction time are reported, but are usually accompanied by any laboratory or physical findings of significance. With higher conc, the above complaints are increased and in addition, anemia, leucompenia and enlarged liver may be found in rare cases.

A common air contaminant.

Fire Hazard: Slight, when exposed to heat, flame or oxidizers.

Explosion Hazard: Mod, when exposed to flame or reacted with \((H_2SO_4 + HNO_3), N_2O_4, AgClO_4\). [19]

Disaster Hazard: Mod dangerous; when heated, emits toxic fumes can react vigorously with oxidizing materials.

To Fight Fire: Foam, CO\(_2\), dry chemical.

**ETHYLIDENE CHLORIDE.** Syns: ethylidene dichloride, chlorinated hydrochloric ether, 1,1-dichlorethane. Colorless liquid, aromatic, ethereal odor, hot saccharine taste.

\(CH_3CHCl_2\), mw: 99.0, mp: -97.7°, lel = 5.6%, bp: 57.3°, flash p: 22°F (TOC), d: 1.174 @ 20°4°, vap. press: 230 mm @ 25°, vap. d: 3.44, autoign. temp.: 856°F.
Acute tox data: Oral LD₅₀ (rat) = 725 mg/kg. [3]

THR = MOD via oral route. An exper teratogen. [3] Liver injury has been reported in exper animals.

Fire Hazard: Dangerous, when exposed to heat or flame.

Explosion Hazard: Mod, when exposed to heat or flame.

Disaster Hazard: Dangerous; when heated to decomp, emits highly toxic fumes of phosgene; can react vigorously with oxidizing materials.

To Fight Fire: Alcohol foam, water, foam, CO₂, dry chemical.

VINYL CHLORIDE. Syns: chloroethylene, chloroethene.
Colorless liquid or gas (when inhibited), faintly sweet odor.
CH₂CHCl, mw: 62.50, bp: -13.4°, lel = 3.6%, uel = 33%; flash p: -108°F (COC), fp: -159.7°, d(liquid): 0.9195 @ 15°/4°,
vap. press: 2600 mm @ 25°, vap d: 2.15, autoign. temp.: 882°F.

Acute tox data: Inhal TCLO (human) = 20 ppm cardiovascular effects. [3] Inhal TCLO (human) = 500 ppm intermitt carc; oral LD₅₀ (rat) = 500 mg/kg; inhal TCLO (rat) = 6000 ppm for 4 hrs/day for 12-18 days neo; inhal
$T_{CL0}$ (rat) = 250 ppm, intermitt for 4 hrs/day over 130 wks carcin. [3]

THR = HIGH irr via inhal route and to skin, eyes and mu mem. In high conc, it acts as an anesthetic. Causes skin burns by rapid evaporation and consequent freezing. Chronic exposure has shown liver injury in rats and rabbits. Circulatory and bone changes in the fingertips reported in workers handling unpolymerized materials. A recog human carc. [3, 1, 23] via inhal route. [102] May cause local irr.

Fire Hazard: Dangerous, when exposed to heat, flame or oxidizers. Large fires of this material are practically inextinguishable.

Spont Heating: No.

Explosion Hazard: Severe, in the form of vapor, when exposed to heat or flame. Also, on standing, forms perioxides in air and can then explode. [19]

Disaster Hazard: Very dangerous; when heated to decomp, emits highly toxic fumes of phosgene; can react vigorously with oxidizing materials. Before storing or hauling this material, instructions for its use should be obtained from the supplier.

To Fight Fire: Stop flow of gas.
ETHYL BENZENE. Syns: ethyl benzol, phenylethane. Colorless liquid, aromatic odor. C₆H₅C₂H₅, mw: 106.16, bp: 136.2°, fp: -94.9°, flash p: 59°F, d: 0.8669 @ 20°/4°, autoign. temp.: 810°F, vap. press: 10 mm @ 25.9°, vap. d: 3.66, lel = 1.0%, uel = 6.7%.

Acute tox data: Oral LD₅₀ (rat) = 3500 mg/kg; dermal LD₅₀ (rabbit) = 5000 mg/kg; inhal TCₐ₍O (human) = 100 ppm for 4 hrs. [3]

THR = MOD via irr to skin, eyes, mu mem and via oral and inhal routes. The liquid is an irr to the skin and mu mem. A conc of 0.1% of the vapor in air is an irr to the eyes of humans, and a conc of 0.2% is extremely irr at first, then causes dizziness, irr of the nose and throat and a sense of constriction of the chest. Exposure of guinea pigs to 1% conc has been reported as causing ataxia, loss consciousness, tremor of the extremities and finally death through respiratory failure. The pathological findings were congestion of the brain and lungs, with edema. No data are available regarding the effect of chronic exposure.

Erythema and inflammation of the skin may result from contact of the skin with the liquid (Section 9). Exposure to the vapor causes lachrymation and irr of the nose and throat, dizziness, and a sense of constriction of the chest. The irr
properties are sufficient to cause workers to leave an atmosphere containing 0.5% of the vapor.

Fire Hazard: Dangerous, when exposed to heat or flame; can react vigorously with oxidizing materials.

Spont Heating: No.

Disaster Hazard: Dangerous; keep away from heat and open flame.

To Fight Fire: Foam, CO$_2$, dry chemical.

**NAPHTHALENE.** Syns: moth flakes, white tar, tar camphor. Aromatic odor, white, crystalline, volatile flakes. C$_{10}$H$_8$, mw: 128.16, mp: 80.1°, bp: 217.9°, flash p: 174°F (CC), d: 1.162, llel = 0.9%, uel = 5.9%, autoign. temp.: 979°F, vap. press: 1 mm @ 52.6°, vap. d: 4.42.

Acute tox data: Oral LD$_{50}$ (child) = 100 mg/kg; oral LD$_{50}$ (rat) = 1780 mg/kg; ip LD$_{50}$ (mouse) = 150 mg/kg. [3]

THR = MOD via oral and HIGH via ip routes. An exper neo [3] via sc route. May be used as an insecticide. Systemic reactions include nausea, headache, diaphoresis, hematuria, fever, anemia, liver damage, convulsions and coma.
Fire Hazard: Mod, when exposed to heat or flame; reacts with oxidizing materials. Reacts violently with CrO₃. [19]

Spont Heating: No.

Explosion Hazard: Mod, in the form of dust, when exposed to heat or flame.

To Fight Fire: Water, CO₂, dry chemical.

PH.069/09