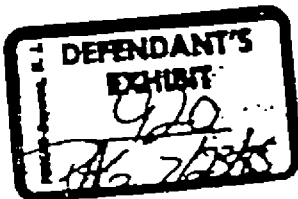


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CHLOROPHENOLS DEPARTMENT 237

INDUSTRIAL HYGIENE MANUAL

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### Health Hazards - Specific

Hazards for phenol, chlorine and specific chlorophenols are described in Appendix E. Chlorophenols may contain a minute quantity of impurities known as chlorinated dibenzo dioxins ("dioxins"). Special mention is made of these substances as there has been much concern by environmentalists and government officials over their potential health hazards.

To date, very little is known concerning the potential toxicity of dioxins although it is known that exposure to dioxins may result in a skin condition called chloracne. Some reversible liver effects have also been reported. Thus all operators are urged to follow good industrial hygiene practices as outlined in this manual.

Attached also are the results of the Nitro Plant mortality study related to dioxins.

- (1) References: Dow Finds Support, Doubt for Dioxin ideas, Rebecca L. Rawls, Feb. 12, 1979, C&E News.

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TABLE 8. REPORTED OCCUPATIONAL EXPOSURES IN CHLORINATED PHENOLS RESULTING IN HUMAN ILLNESS<sup>a</sup>

| Year, Place, and chemical(s)                                              | Type of exposure and no. of cases             | Effects on the skin                                                                                   | Neurological effects                                                                                                                                                                                                                                | Effects on the liver and serum lipids                                                                             | Other effects                                                                                                                                                                       | References                                                    |
|---------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| 1936 Michigan<br>Tetrachlorophenol<br>2-(2-chlorophenyl)<br>phenol        | Production<br>21                              | Chloracne,<br>hyperkeratosis                                                                          |                                                                                                                                                                                                                                                     |                                                                                                                   | Fatigue, weight<br>loss                                                                                                                                                             | Butler, 193                                                   |
| 1936 Mississippi<br>Tetrachlorophenol                                     | Wood treat-<br>ment<br>300-400                | Chloracne, facial<br>erythema, vesicula-<br>tion, ulceration,<br>hyperkeratosis,<br>hyperpigmentation |                                                                                                                                                                                                                                                     |                                                                                                                   | Fatigue, colored<br>urine, urinary<br>problems, venous<br>thrombosis                                                                                                                | Anonymous,<br>1936; Sting<br>1940                             |
| 1949 West Virginia<br>Trichlorophenol<br>2,4,5-T                          | Explosion<br>117<br>Production<br>111         | Chloracne, facial<br>erythema, hyper-<br>pigmentation,<br>melanosis                                   | Nervousness,<br>irritability,<br>insomnia,<br>personality<br>change, de-<br>pression,<br>headache,<br>vertigo, pain<br>and weakness<br>lower extrem-<br>ities, paresis,<br>peripheral neuro-<br>pathy, abnormal<br>nerve biopsy<br>(loss of myelin) | Hepatomegaly, ab-<br>normal liver<br>function, toxic<br>hepatitis, elevat-<br>ed triglycerides<br>and cholesterol | Fatigue, weight<br>loss, weakness,<br>decreased libido,<br>impotence, intol-<br>erance to cold,<br>increased sus-<br>ceptibility to<br>infection (es-<br>pecially respir-<br>atory) | Ashe and<br>Suakind, 19<br>1950; Suaki<br>1953; Suaki<br>1977 |
| 1949 Germany<br>Trichlorophenol<br>Tetrachlorophenol<br>Pentachlorophenol | Production,<br>Industrial<br>Laboratory<br>17 | Chloracne,<br>hyperpigment-<br>ation, scarring                                                        | Lower extremity<br>pain and weak-<br>ness, paresis<br>without atrophy,<br>paresthesia,<br>polyneuritis                                                                                                                                              | Abnormal liver<br>function,<br>cirrhosis                                                                          | Fatigue, severe<br>bronchitis, de-<br>creased libido,<br>impotence, bursi-<br>tis, myocardial<br>damage                                                                             | Brader and<br>Bauer, 1951                                     |

1952 Germany  
Trichlorophenol

Production  
31

Chloracne,  
hyperpigmen-  
tation

1953 Germany  
Trichlorophenol

Explosion  
55

Chloracne

1956 France  
Trichlorophenol  
1966 France  
Trichlorophenol

Production  
17  
Explosion  
21

Chloracne

1956 New Jersey  
Trichlorophenol

Production  
29

Chloracne,  
hyperpigmen-  
tation, hy-  
pertrichosis,  
acquired porphy-  
ria cutanea tarda

1963 Holland  
Trichlorophenol  
2,4,5-T

Explosion  
106

Chloracne,  
facial erythema

|                                                                                                                                                                                          |                                                                                                |                                                                                                                                                      |                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Lower extremity pain and weakness, paresthesia, memory and concentration deficits, sleep disturbances, hypersomnolence, abnormal psychological tests (apathy, dulled emotional response) | Toxic hepatitis, abnormal liver biopsy                                                         | Fatigue, chronic bronchitis, persistent blepharoconjunctivitis, myocardial damage, intolerance to alcohol                                            | Suskind, 1                        |
| Sensory impairment of smell, taste, hearing; tendency to orthostatic collapse, limited paresis, peripheral neuropathy, reading difficulties                                              | Toxic hepatitis                                                                                | Fatigue, drowsiness, bronchitis, laryngitis, blepharoconjunctivitis, hemorrhagic pleuritis, myocardial damage, increased susceptibility to infection | Coldman,                          |
| Peripheral neuropathy                                                                                                                                                                    | Toxic hepatitis, elevated triglycerides and cholesterol                                        |                                                                                                                                                      | Dugois et 1956; Dugois et al, 196 |
| Clinical examination normal                                                                                                                                                              | Abnormal liver function, abnormal liver biopsies (parenchymal cell degeneration, fluorescence) | Right upper quadrant pain                                                                                                                            | Bleiberg et 1964                  |
| No information                                                                                                                                                                           | Liver function normal                                                                          | Fatigue                                                                                                                                              | Vos et al,                        |

1964 USSR  
Trichlorophenol  
2,4,5-T

Production  
128

Chloracne

1968 England  
Trichlorophenol

Explosion  
79

Chloracne,  
facial  
erythema

1965-1968  
Czechoslovakia  
Trichlorophenol  
Pentachlorophenol  
2,4,5,-T

Production  
80

Chloracne,  
hyperpigmenta-  
tion, hyper-  
trichosis,  
scarring, ac-  
quired porphyria  
cutanea tarda

1969 New Jersey  
Trichlorophenol  
2,4,5-T  
2,4-D

Production  
73  
Followup of  
plant  
studied by  
Bleiberg  
(above)

Chloracne in 48,  
hypertrichosis  
in 16, hyperpig-  
mentation in 30,  
no overt por-  
phyria cutanea  
tarda

1978 England  
Trichlorophenol  
no longer in  
production

Followup of  
41 workers  
in 1968  
explosion  
(above)  
41

Chloracne

|                                                                                                                                                           |                                                                                                                                                                            |                                                                                                                                                       |                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Headache, loss of memory, somnolence, sleeplessness, increased sweating                                                                                   |                                                                                                                                                                            | Fatigue, joint pain, stomach pain                                                                                                                     | Telegina and Bikkulatov, 1970                                                    |
|                                                                                                                                                           | Abnormal liver function                                                                                                                                                    | Transient glycosuria, mild conjunctivitis                                                                                                             | May, 1973; Jensen and Walker, 1968; Jensen et al, 1972                           |
| Lower extremity weakness and pain, somnolence, headache, insomnia, emotional and psychiatric disorders, peripheral neuropathy (confirmed by abnormal EMG) | Hepatomegaly, abnormal liver function, abnormal liver biopsies (mild steatosis, periportal fibrosis, fluorescence). Elevated triglycerides, phospholipids, and cholesterol | Fatigue, weight loss, abnormal glucose tolerance, no evidence of myocardial or renal damage or of increased eye inflammation or respiratory infection | Jiraskek et al, 1964; Pazde Vejlupekova et al, 1980; Pazderova-Vejlupekova, 1981 |
| Lower extremity weakness, correlation between chloracne and hypomania scale on MMPI                                                                       | No significant abnormalities                                                                                                                                               | Eye irritation, mild uroporphyrinuria in one worker                                                                                                   | Poland et al, 1971 (see Bleiberg et al, 1964)                                    |
|                                                                                                                                                           | Elevated GGT, elevated triglycerides, elevated urinary D-glucuronic acid                                                                                                   |                                                                                                                                                       | May, 1982                                                                        |

1949 West  
Virginia  
Trichlorophenol  
2,3,5-T

226  
Followup of  
plant  
studied by  
Ashe and  
Suskind  
(above)

Chloracne  
70-residual  
47-by his-  
tory

Abnormal  
sensory  
findings in  
those with  
chloracne

1949 West  
Virginia  
Trichlorophenol  
2,4,5-T

204  
Followup of  
plant  
studied by  
Ashe and  
Suskind and  
Moses et al  
(above)

Chloracne in  
107  
Actinic Elastosis

1976 Seveso  
Trichlorophenol

No. not given  
ICMESA workers  
follow-up five  
years after  
explosion

a

Source: Moses et al, 1984

Elevated GGT  
in those with  
chloracne

Decreased libido,  
sexual dysfunction

Mosen et al  
1984

History of GI  
ulcer  
Lower pulmonary  
function in  
exposed smokers

Suskind and  
Hertzberg,  
1984

Elevated Alk.  
Phos.

Elevated urinary  
porphyrins

Chezzi et  
al, 1984

Table 10. Clinical Symptomology of Yusho Cases, 1969-1972.<sup>a</sup>

| Effects                                                                                                                                                       | Percent |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Skin                                                                                                                                                          |         |
| Acneform eruptions, distinctive hair follicles, red plaques on limbs, dark brown pigmentation of nail, skin and mucous membranes, itching, sweating of palms. | 82-87%  |
| Ocular manifestation                                                                                                                                          |         |
| Increased eye discharge, swelling of the upper eyelids, hyperemia of conjunctives, transient visual disturbance.                                              | 83-88   |
| Jaundice                                                                                                                                                      |         |
| No abnormalities of liver functions in the majority of cases.                                                                                                 | 10      |
| Numbness of the limbs, feeling of weakness, spasm of the muscles                                                                                              | 32-39   |
| Reduced sensory and motor nerve conduction velocity in few cases                                                                                              | 9       |
| Hearing difficulties                                                                                                                                          | 18      |
| Headaches, vomiting, diarrhea                                                                                                                                 | 17-39   |
| Chronic Bronchitis                                                                                                                                            |         |
| Lower serum Ig A and Ig M. PCB in the sputum                                                                                                                  | 40      |
| Irregular menstrual cycles                                                                                                                                    | 60      |
| Dark brown skin pigmentation of newborn, which gradually faded away, retarded growth and abnormal teeth number and shape.                                     |         |

<sup>a</sup>Source: Reggiani, 1980

Table 7. Toxic Effects of 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Man.<sup>a</sup>

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Effects

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DERMATOLOGICAL

Chloracne

Porphyria cutanea tarda

Hyperpigmentation and  
hirsutism

INTERNAL

Liver damage<sup>b</sup>

Elevated serum hepatic  
enzyme levels

Disorders of fat metabolism

Disorders of carbohydrate  
metabolism

Cardiovascular disorders

Urinary tract disorders

Respiratory disorders

Pancreatic disorders

NEUROLOGICAL

Polyneuropathies  
(peripheral neuritis)

Lower extremity weakness

Sensory impairments  
(sight, hearing, smell,  
taste)

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PSYCHIATRIC

Neurasthenic or depressive  
syndromes

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<sup>a</sup>Source: Huff, Moore, Saracci, and Tomatis, 1980

<sup>b</sup>Mild fibrosis, fatty changes, hemofuscin deposition and parenchymal-cell degeneration were observed in a few cases.