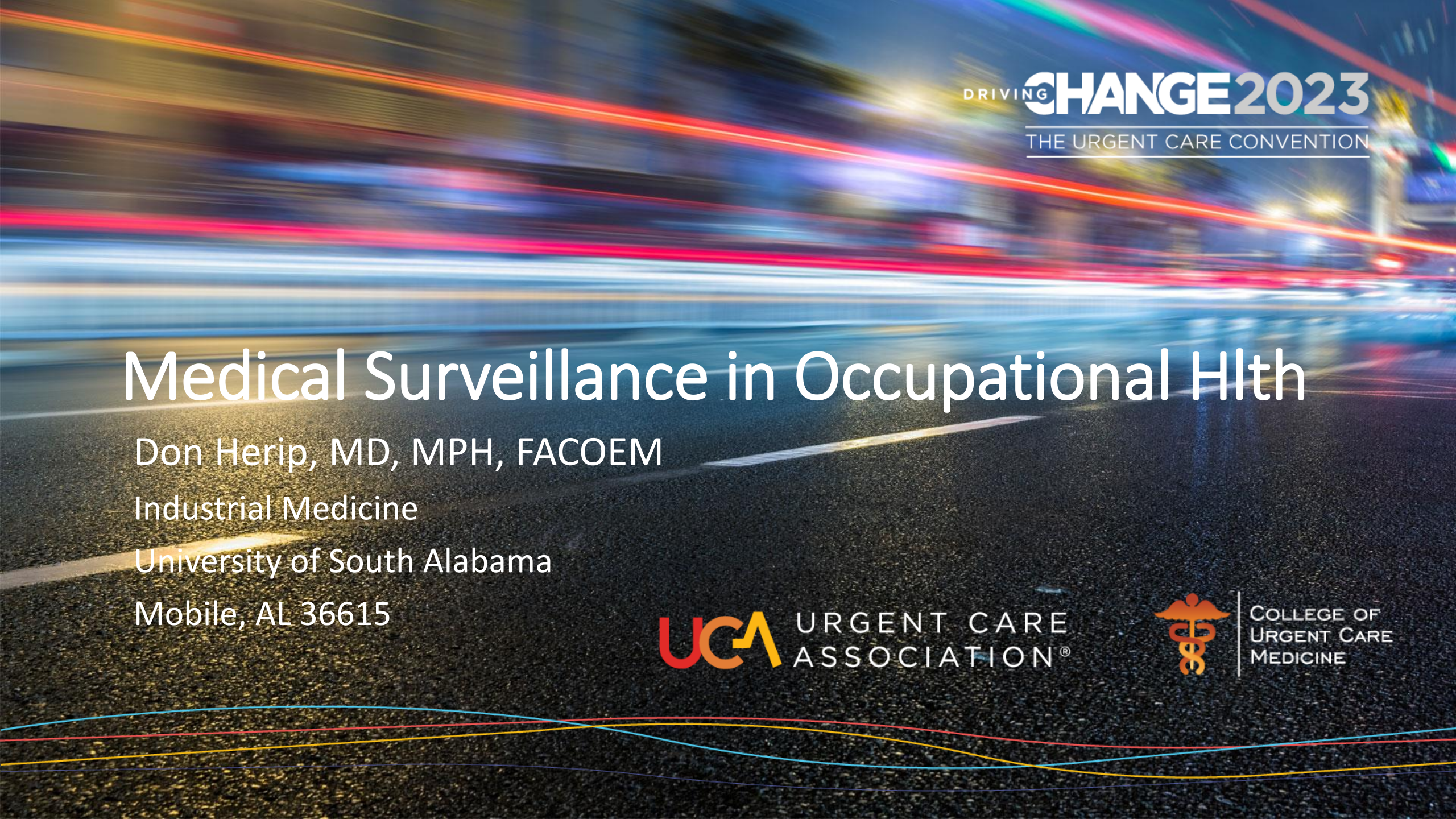

Medical Surveillance in Occupational Hlth

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URGENT CARE ASSOCIATION®

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Faculty Disclosures

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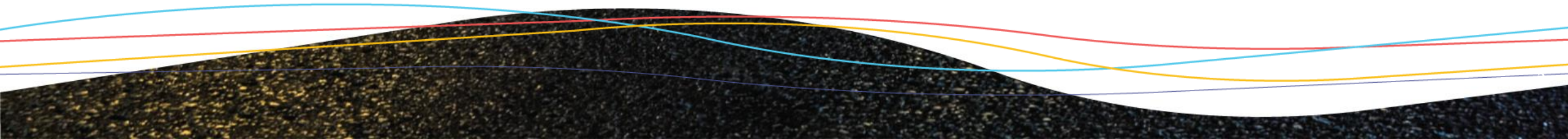
- None



Learning Objectives

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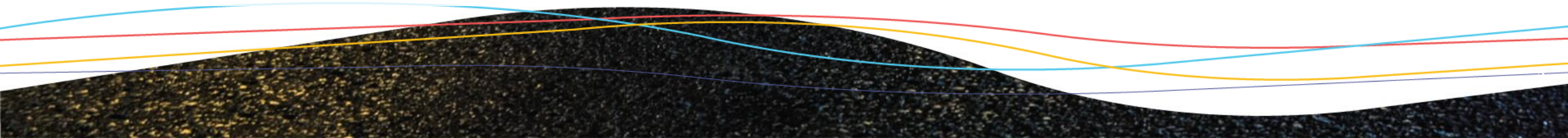
1. Explain how at-risk workers are identified for medical surveillance programs.
2. Describe how medical surveillance programs protect workers health.
3. Explain the importance of pre-placement, periodic, and termination exams.
4. Illustrate specific medical surveillance protocols for:
   - Asbestos
   - Pesticides
   - Hazardous noise
   - Lead (Pb)



Medical Surveillance- Definition

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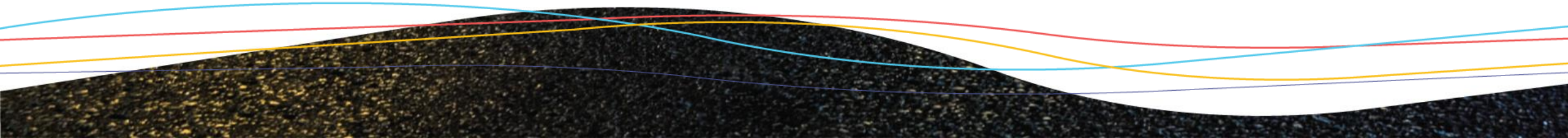
- Periodic assessment of individual workers in terms of occupational history, medical history, and symptoms and signs related to hazardous substances/conditions exposure.

Hans J. Van der Merwe. In Occupational Medicine Principles and Practical Applications. Carl Zenz. 1988 by Year Book Medical Publishers. p. 57.



Medical Surveillance- Purpose

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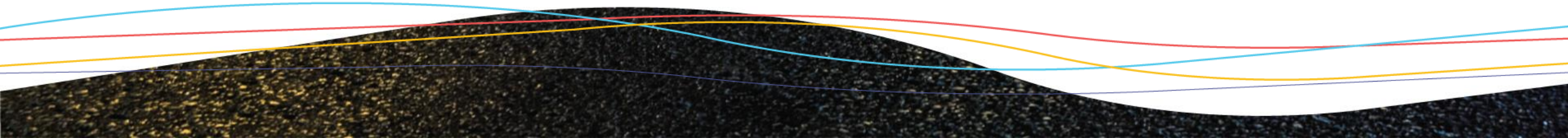
THE URGENT CARE CONVENTION

- Prevent occupational disease
- Serve as a check on engineering controls because symptoms of exposure may indicate a failure that must be corrected.
- The extent of medical surveillance depends on the hazards and seriousness of exposures as determined by industrial hygienists.

Hans J. Van der Merwe. In Occupational Medicine Principles and Practical Applications. Carl Zenz editor. 1988 by Year Book Medical Publishers. p. 57.



Occupational Hazards

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- **Chemical:** Gases, fumes, vapors
- **Biological:** Bacteria, viruses, molds
- **Physical:** Noise, heat, cold, radiation
- **Ergonomic:** Cumulative trauma

Industrial Hygiene

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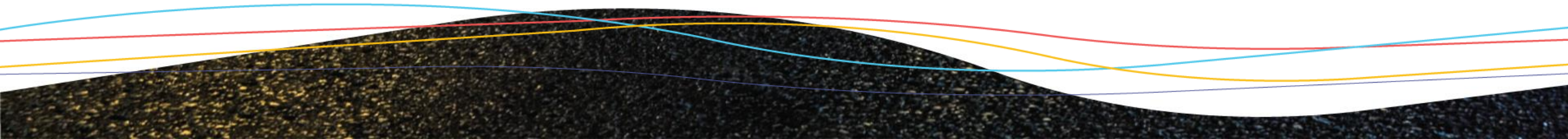
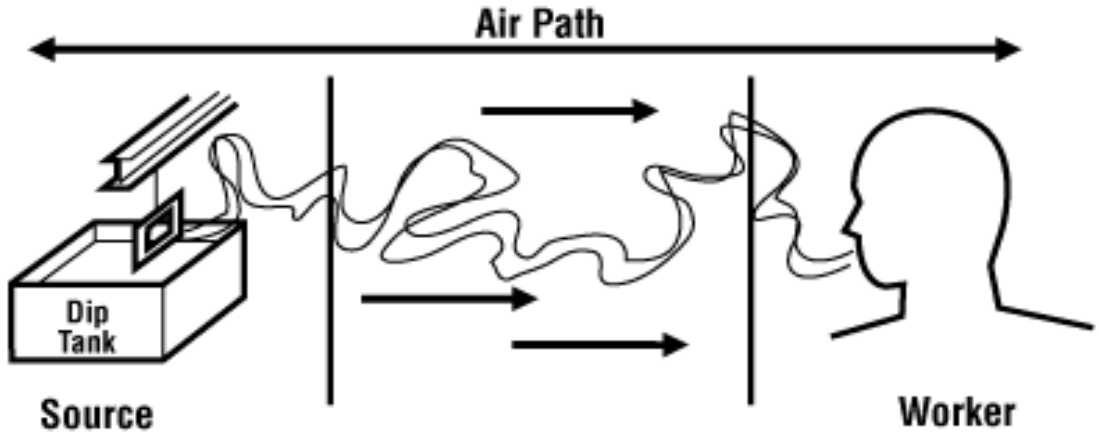
- Recognition, evaluation, and control of workplace hazards
- Perform workplace sampling
- Determine need for medical surveillance (action levels)



Control Measures

- Substitute a less hazardous chemical
- Isolate the worker or process
- Administrative controls
- Personal protective equipment

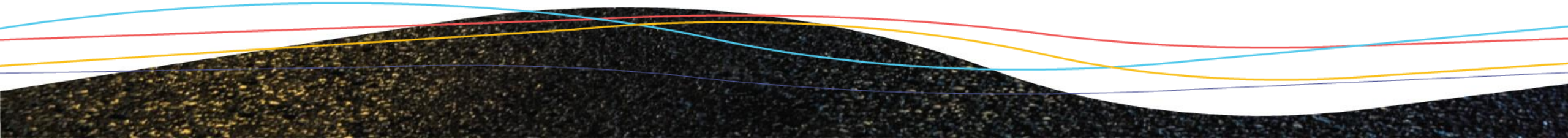


Hierarchy of Controls

https://www.cdc.gov/niosh/topics/hierarchy/

PEL vs. AL

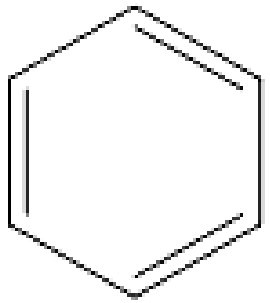
- **PEL:** Permissible Exposure Level
- **AL:** Action level
- **AL:** Exposure level where **surveillance** becomes advisable
  - Usually it is 50% of the permissible exposure limit (PEL).



Substitution

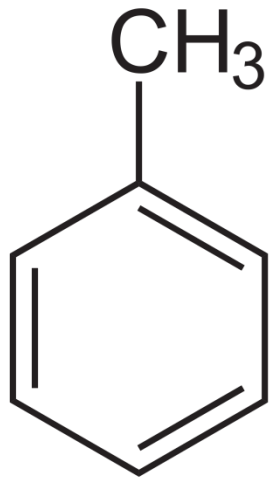
Benzene

- PEL 1ppm
- Carcinogen: AML, etc.



Toluene

- PEL 200ppm
- Noncarcinogen



Medical Surveillance

Analysis of health information to detect problems that may occur in the workplace that require targeted prevention.

Exposure	**Effect**	**Surveillance**
Asbestos	Lung CA	CXR, PFTs
Pesticides	Cholinesterase inhibition	Cholinesterase Levels
Noise	Hearing loss	Audiogram
Lead (Pb)	Multisystem	Blood lead levels

Chemical	OSHA Standard
Asbestos	1910.1001
Benzene	1910.1028
Cadmium	1910.1027
Ethylene oxide	1910.1047
Formaldehyde	1910.1048
Lead	1910.1025
Methylene Chloride	1910.1052
Vinyl chloride	1910.1017

http://www.osha.gov/SLTC/medicalsurveillance/index.html

Medical Surveillance- Components

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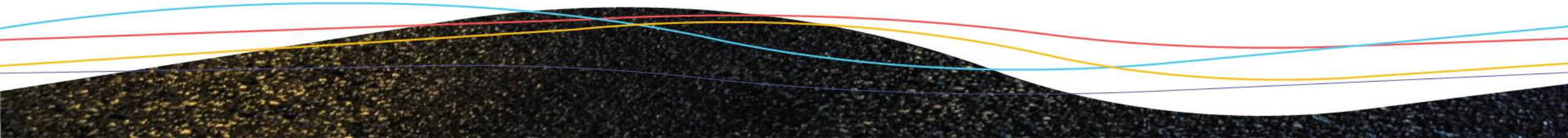
- Medical history (vulnerable to occupational exposures?)
- Occupational history (present and past exposures)
- Determination of fitness for duty
- Determination of fitness to use PPE such as respirators.
- Ancillary testing required for certain exposures such as: laboratory tests, pulmonary function tests, CXR, audiograms, etc.



Medical Surveillance Exams

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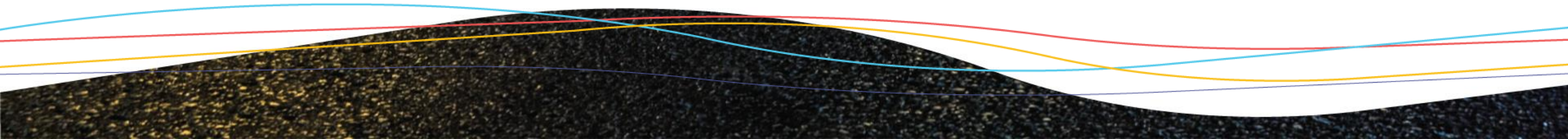
- Pre-placement screening exams
- Periodic screening exams
- Termination screening exams



Screening Exams

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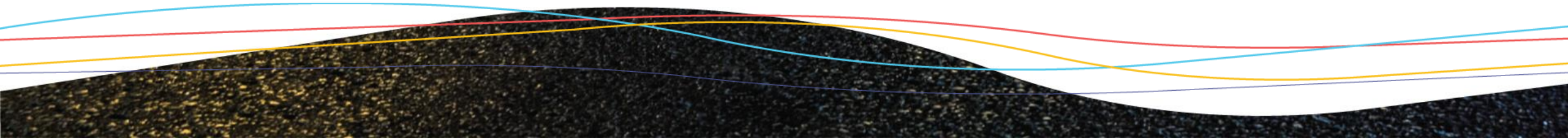
- Screening exams are target-organ specific
- Screening exams are substance-specific - focused
- Abnormal findings requires further investigation
  - Change in the work process?
  - Change in the PPE?
  - Non-occupational causes?
  - Group trends?



Physical Exams

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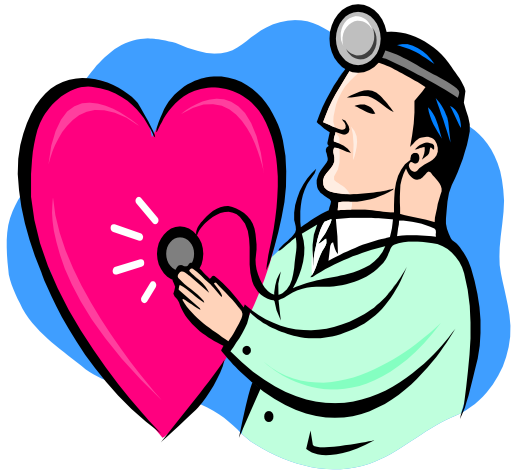
- Focused exam based on work exposures
- Exam components delineated by OSHA requirements
- Not a substitute for primary care exam
  - Investigation of abnl results (not work-related) performed by PCP



US Adults by Age **Without a PCP** (%)

2015 Data

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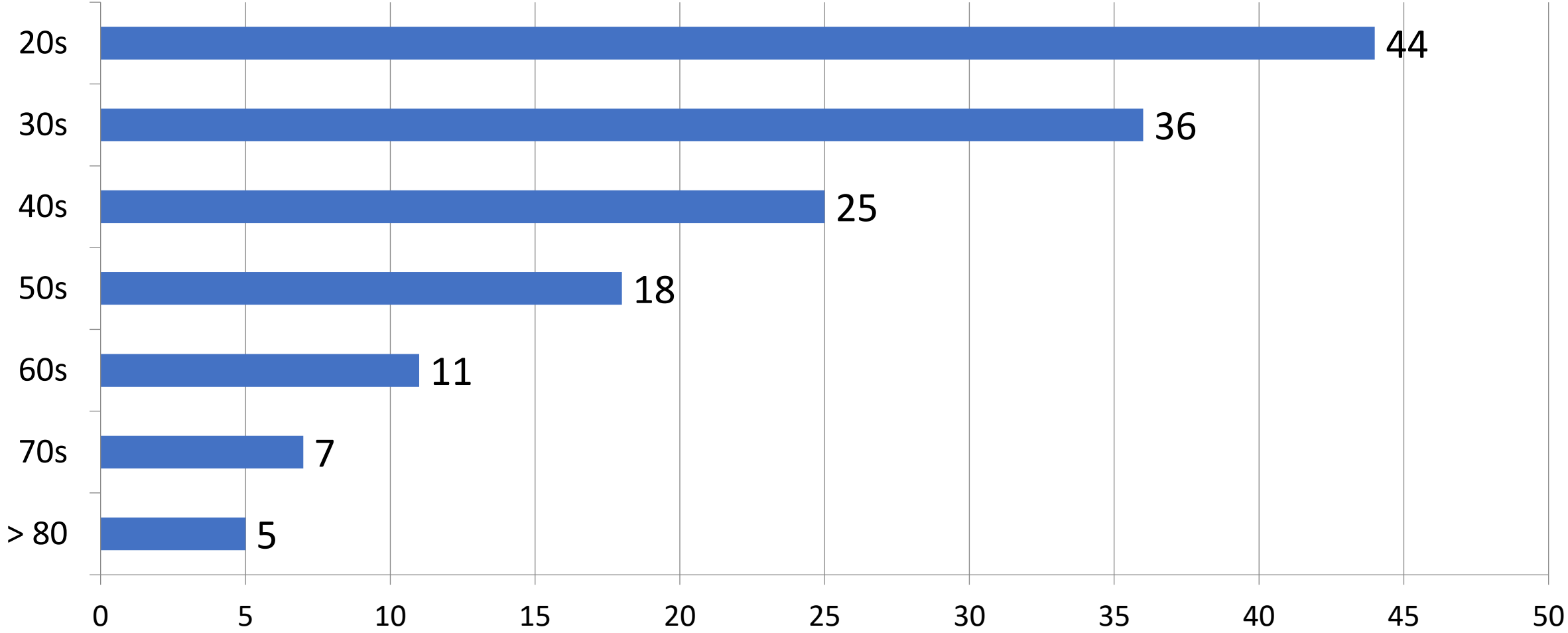

Levine DM, et al. JAMA Int Med, 2020 Vol. 180, No.3. pp. 463-466.

Specific Examples

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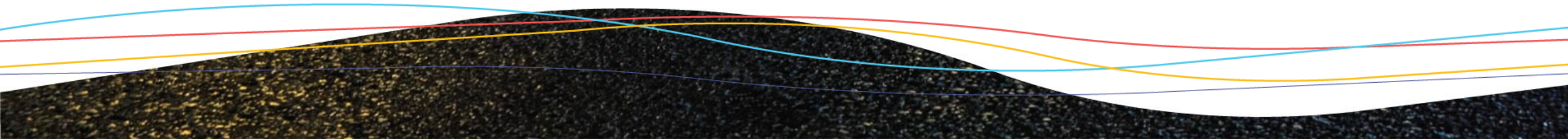
- Asbestos
- Pesticides
- Noise
- Lead (Pb)




Danger
Asbestos hazard

Asbestos Use in the US

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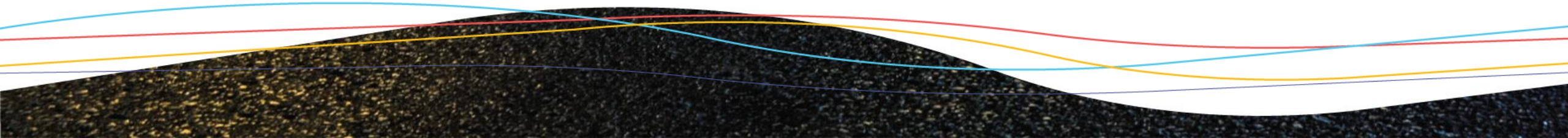
- Asbestos is a fibrous material that is resistant to fire, resulting in its use as insulation and in fire safety products.
- Used in a wide variety of products: brake linings, roofing products, floor tiles, and cement.
- Production and use peaked in the US during the 1930s-1960s and slowly tapered off during the 1970s.
- Most use of asbestos in the US stopped after 1989.



Prior to 1981- Asbestos Sources

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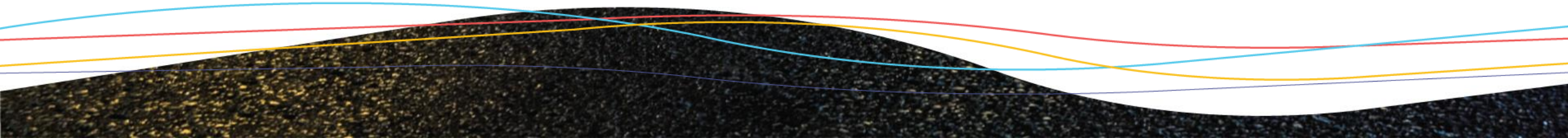
- Roofing, shingles and siding
- Block insulation
- Heating and cooling systems
- Floor tiles and vinyl flooring
- Adhesives
- Electrical insulation and panels
- Plaster, cement, putties, taping compounds and caulk
- Textured paints
- Appliance components
- Ceiling tiles and spray-on coatings
- Popcorn ceiling materials
- Attic insulation (vermiculite)
- Gardening products (vermiculite)
- Pipe, boiler, and duct insulation
- Wallboard
- Fireplace decorations
- Heat-resistant textiles



Pneumoconiosis

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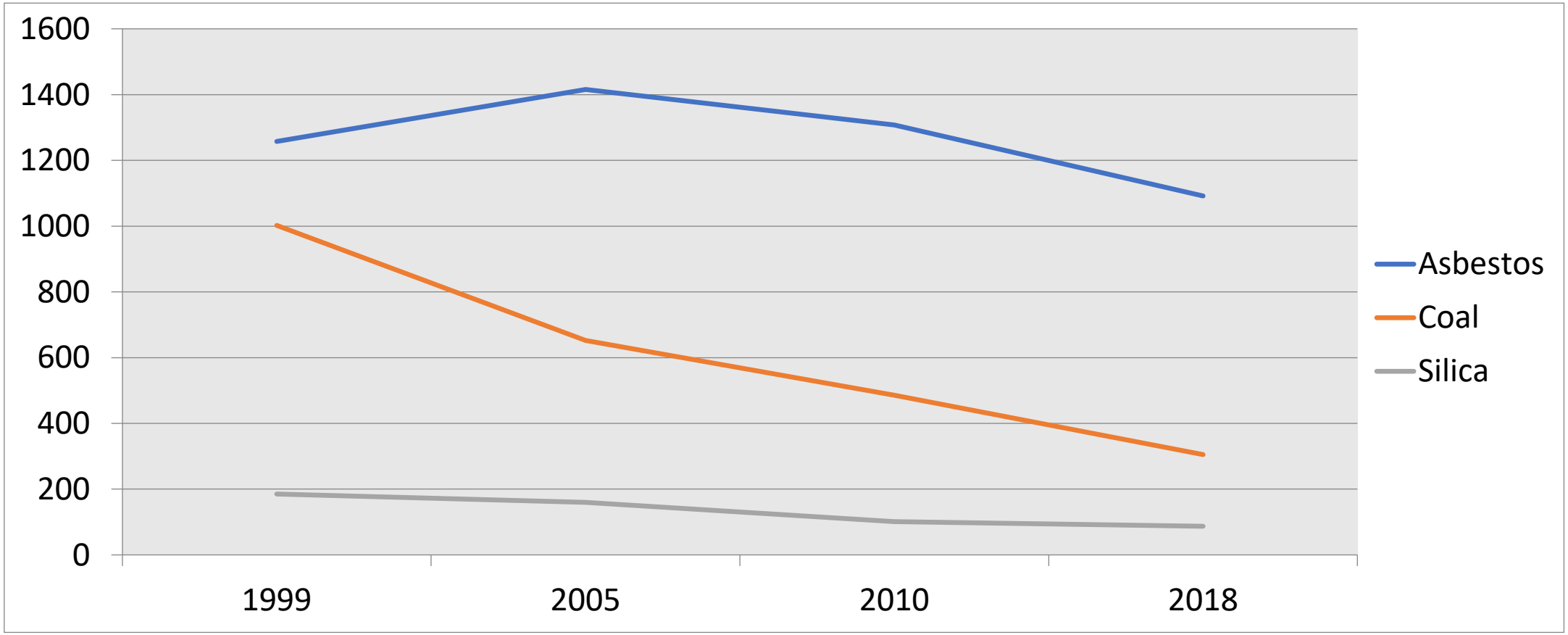
- Preventable occupational lung diseases caused by inhaling dust:
  - Asbestos
  - Coal dust
  - Silica
  - Other inorganic dusts: aluminum, bauxite, beryllium, iron, and tin oxide

MMWR June 12, 2020. Vol. 69, No. 23. p.693-698.

Pneumoconiosis Deaths
US 1999-2018

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION



Data from CDC. MMWR June 12, 2020. Vol. 69, No. 23. p.693-698.

Asbestos Regulation History- US

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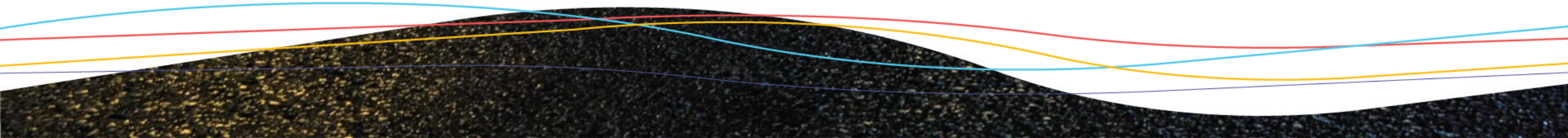
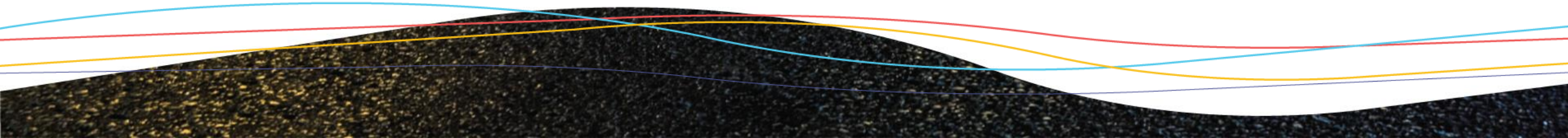
Date	**PEL** (fibers/cc)
1971	12
1972	5
1975	0.5
1986	0.2
1994	0.1

PEL: Permissible exposure level



Asbestos Medical Surveillance

- Must institute medical surveillance for all employees who are or will be exposed to airborne asbestos at or above the PEL and/or EL.
- Medical examinations and procedures must be performed by or under the supervision of a licensed physician.
- Exams must occur at a reasonable time and place and shall be provided at no cost to the employee.



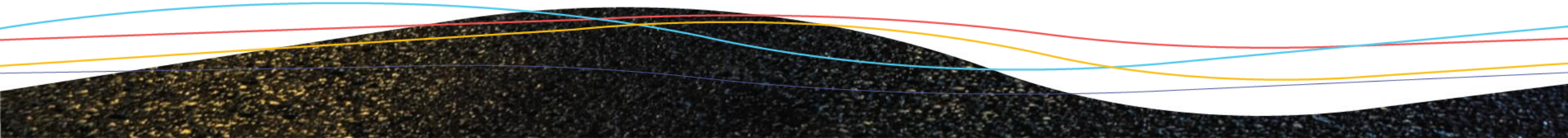
Asbestos Medical Surveillance- Exams

- Medical history
- Work history
- Respiratory disease standardized questionnaire
- Complete physical examination with emphasis on the respiratory system, the cardiovascular system, and the digestive tract.
- Chest X-ray with “B” reader interpretation
- Pulmonary function tests
- Any additional tests deemed appropriate by the examining physician

29 CFR 1910.1001 Appendix D, Part 1 of the standard

Restrictive Lung Disease

- Loss of functioning alveoli with parenchymal lung disease
- Etiology:
  - Sarcoidosis: Idiopathic multisystem disease.
  - Pulmonary fibrosis: Pneumonias, TB, gastric aspiration, uremia, pancreatitis, pulmonary amylodosis.
  - **Work exposures: Asbestos,** Silica, coal, beryllium, welders, talc.



Restrictive Lung Disease- Spirometry

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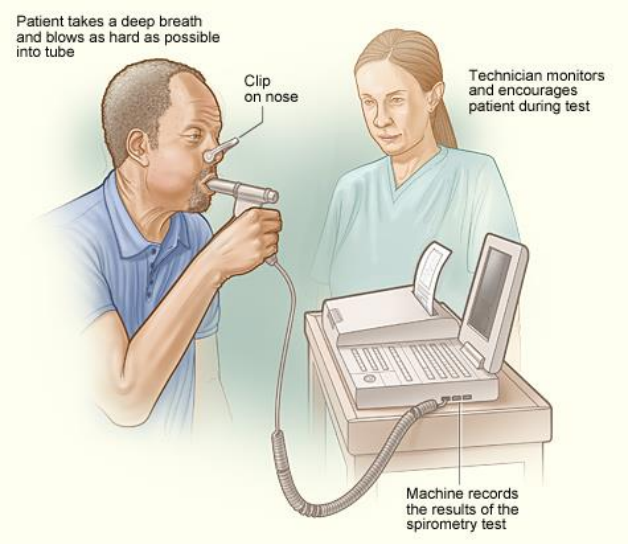
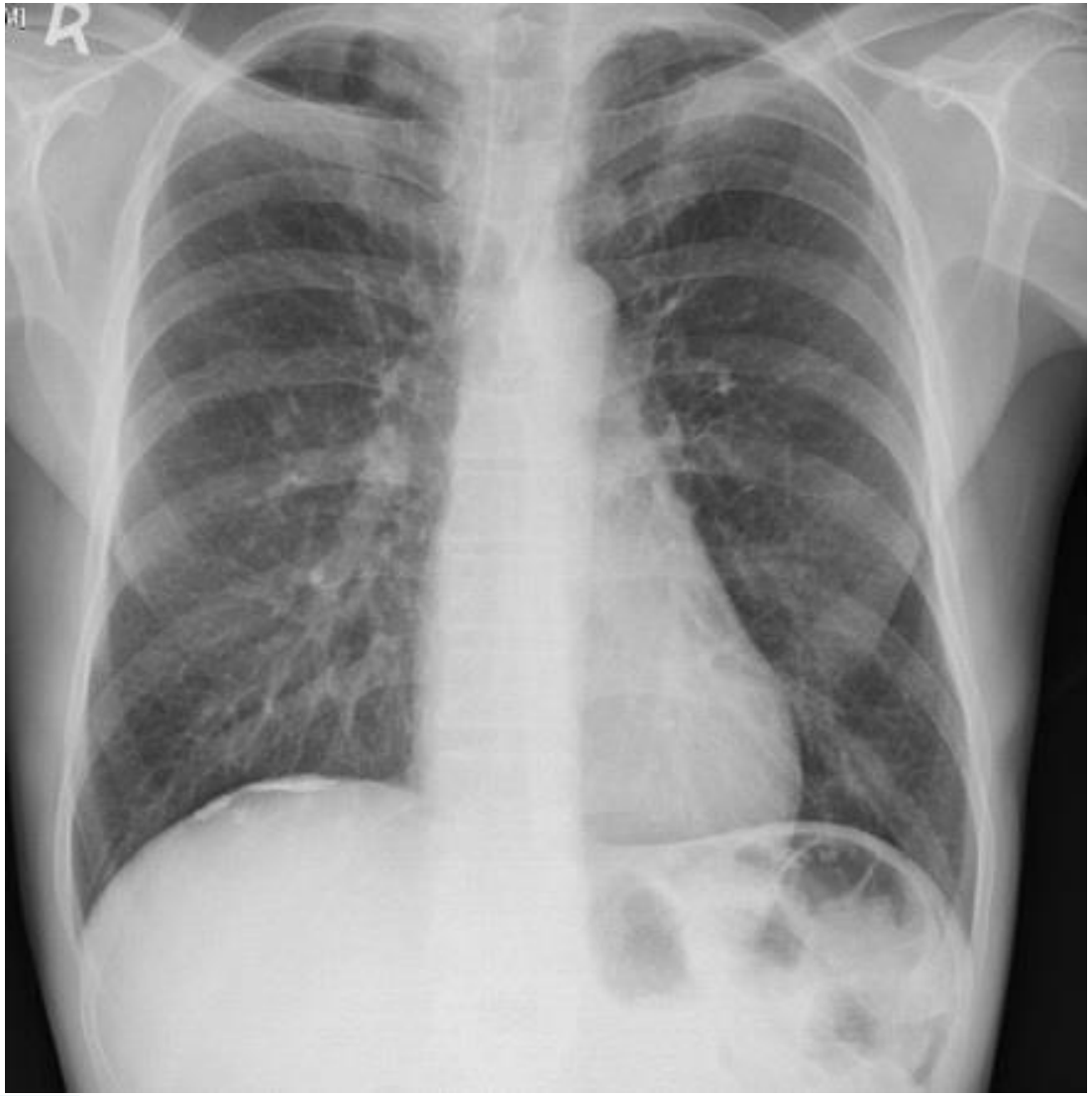
- Severity of disease:
  - FVC and TLC < 80% = Restrictive disease
  - 70-80 % predicted: mild restrictive disease
  - 60-70% predicted: moderate restrictive disease
  - 50-60% predicted: moderately severe restrictive disease
  - < 50% predicted: severe restrictive disease
- The ratio of FEV_1 to FVC is usually preserved or increased.
- Lung function changes may precede radiographic changes.



- Agarwal AN, et al. Respirology. 2007 Sep;12(5):759-62.
- Hariri LP, et al. Ann Am Thorac Soc. 2020 May;17(5):550-554.
- https://www.osha.gov/sites/default/files/publications/OSHA3637.pdf

Chest X ray

- Mild asbestosis is not easily diagnosed on CXR
- First changes: Irregular linear densities initially seen at the lung bases which increase in number and coarseness as the disease progresses.
- "B" reader interpretation required.
  - https://www.cdc.gov/niosh/topics/chestradiography/breader.html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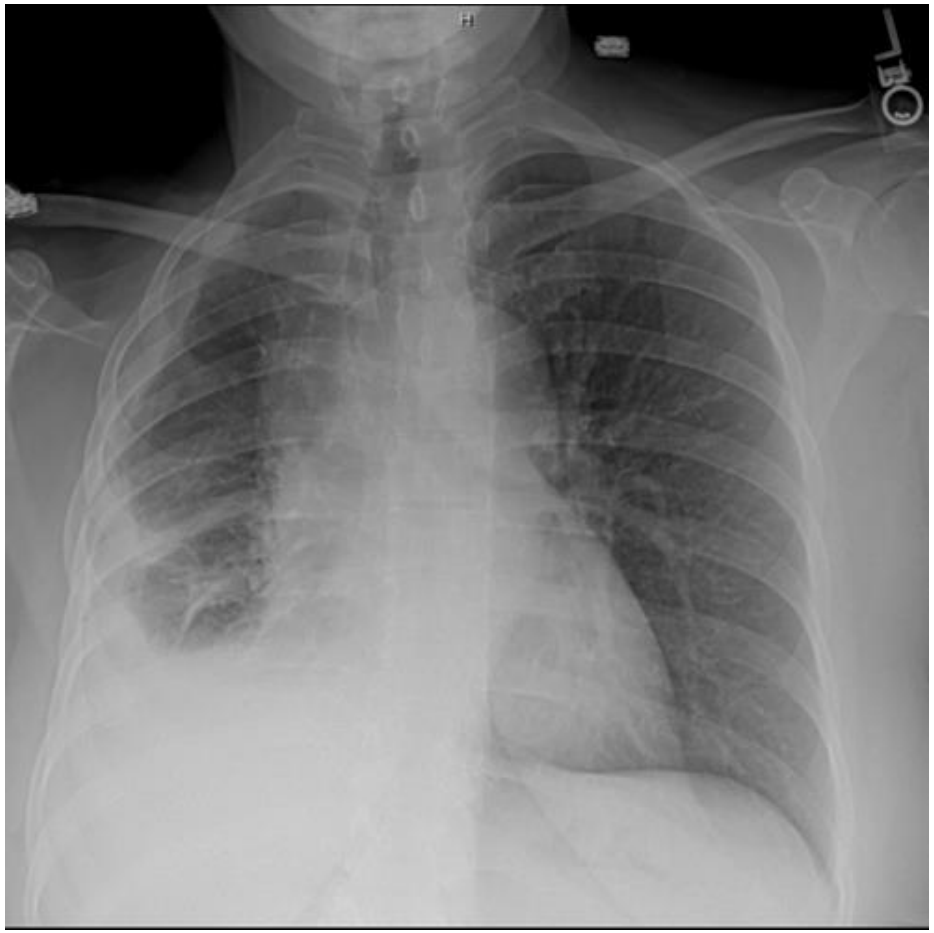
Mesothelioma

- Approximately 80% of affected individuals have a significant history of asbestos exposure making it the major associated risk factor for mesothelioma.



Asbestos Medical Surveillance

CXR Frequency

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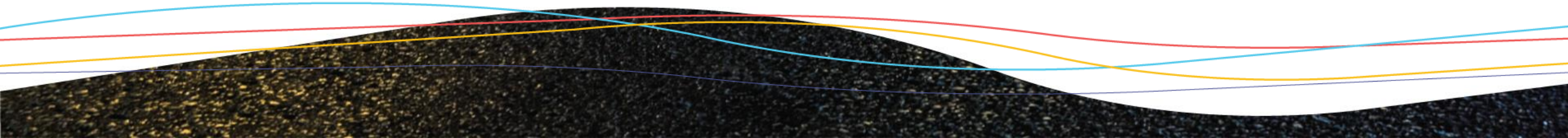
Years since first exposure	Age of employee		
	15 to 35	**35+ to 45**	**45+**
0 to 10	Every 5 yrs	Every 5 yrs	Every 5 yrs
10+	Every 5 yrs	Every 2 yrs	Every 1 yr



Lung Cancer Risks

Synergism with smoking

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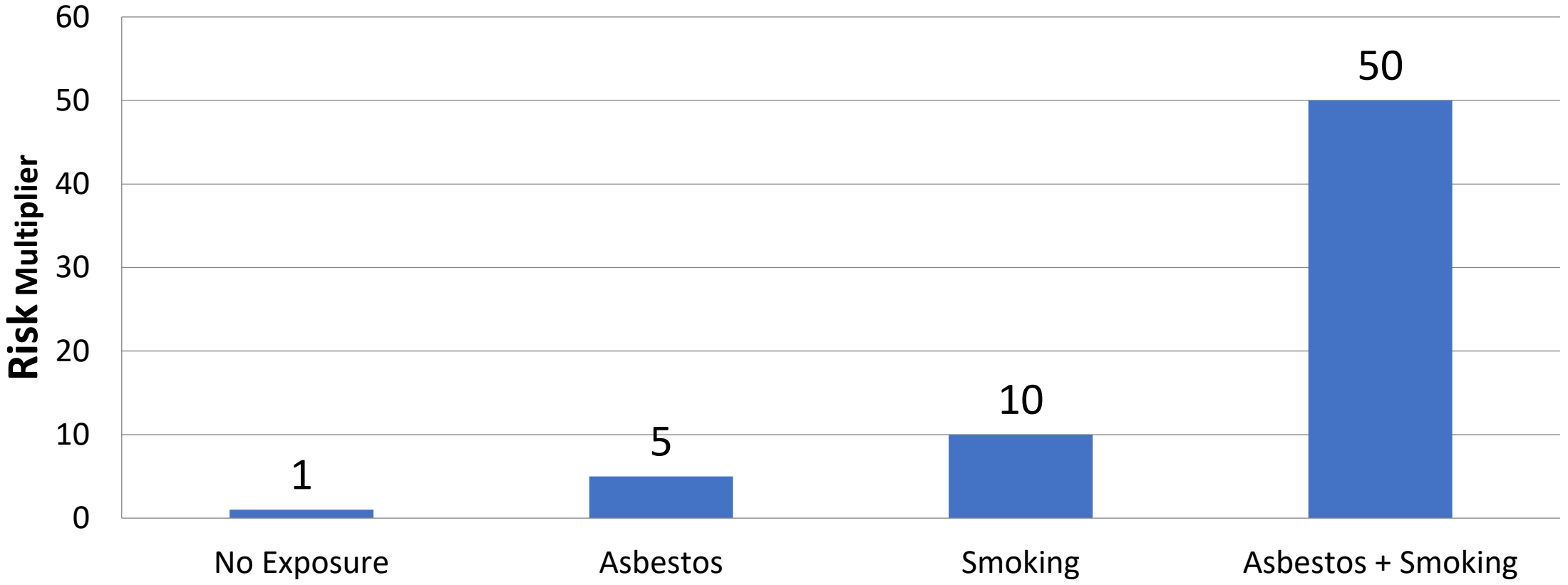

Asbestos Medical Surveillance
Recordkeeping

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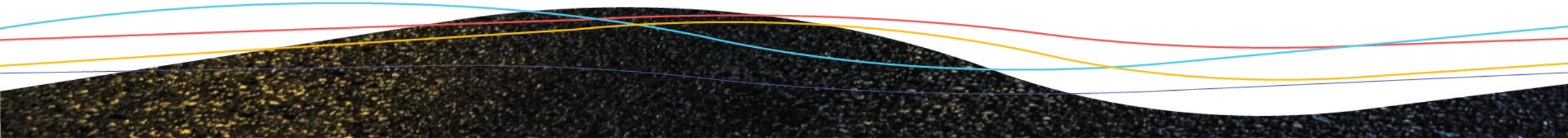
- **Exposure records:** Employer must keep an accurate record of all exposure measurements taken to monitor employee exposure to asbestos. This record must be kept for 30 years.
- **Medical surveillance records**: Employer also must maintain an accurate record for each employee subject to medical surveillance. Record must be maintained for the duration of employment plus 30 years.



Physician’s Written Opinion

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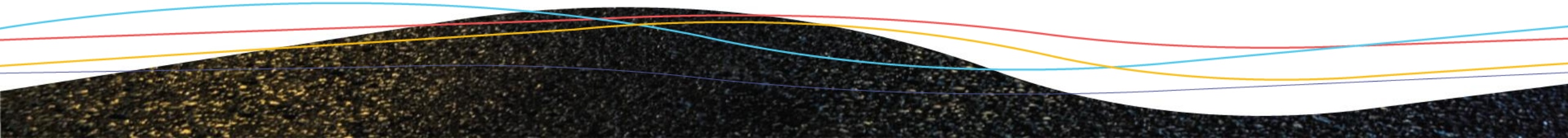
- Employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.
- Physician's opinion: Exam results in writing, as well as information on any medical conditions that may make the employee more susceptible to asbestos, recommended limitations on the employee or safety equipment, and statements that the employee has been informed of the exam's results, and that lung cancer risk increases when combining smoking and asbestos exposure.
- Clinical statement: “No work-related disease identified”



Pesticides

Pesticides- Cholinesterase Inhibitors

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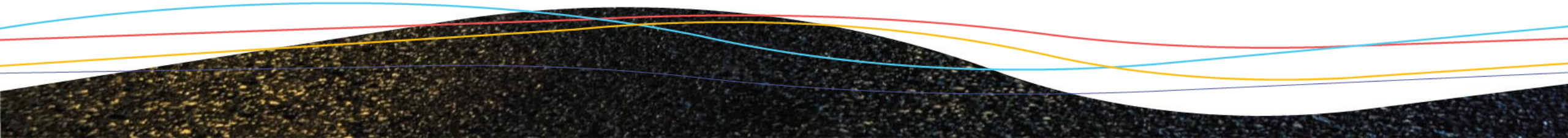
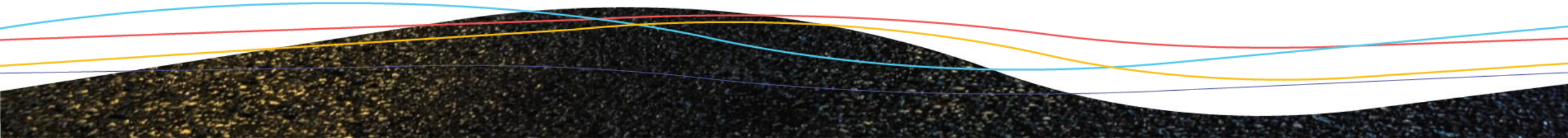
- Pesticides that inhibit acetylcholinesterase
  - Organophosphates
  - Carbamates
- Cholinesterase levels
  - Levels vary greatly btw individuals
  - Pre-exposure baseline level required to detect any significant changes
  - A biomarker that reflects the activity of acetylcholinestrase



Cholinesterase Inhibitors- Sx

- Acetylcholine excess causes stimulation of cholinergic systems
- **Early symptoms:** Headache, nausea, dizziness, and increased secretions, such as sweating, salivation, tearing and respiratory secretions (*SLUDGEBBB and DUMBELS).*
- **Progressive symptoms:** Muscle twitching, weakness, tremor, incoordination, vomiting, abdominal cramps and diarrhea.



Removal From Work Criteria

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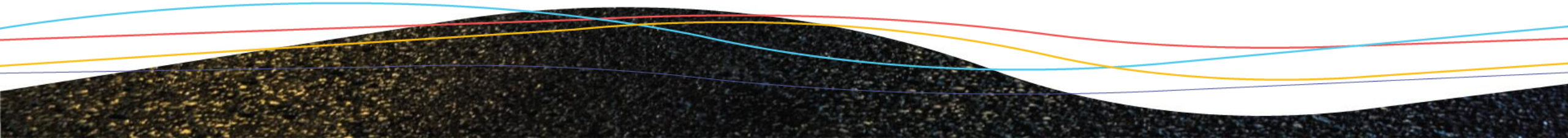
Percent of Baseline	RBC ChE	Plasma ChE
< 80 %	Prompt retesting of worker and investigation of work practices by employer	
≤ 70%	Immediate removal of worker from further exposure	
≤ 60%		Immediate removal of worker from further exposure

Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase Inhibiting Pesticides Edition 6.0 .

Published: Dec 2017.

https://oehha.ca.gov/media/downloads/pesticides/document-pesticides/physicianguidelines.pdf



Investigate Work Practices

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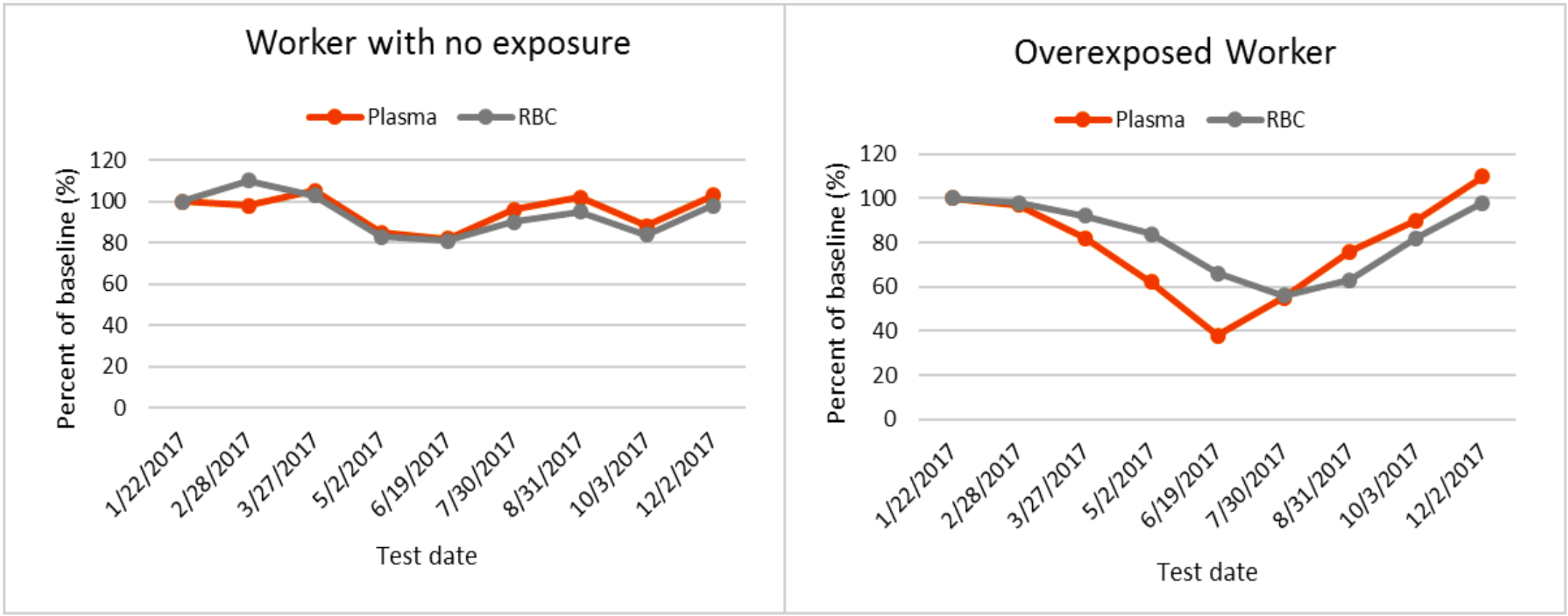
- 80% decrease of either rbc or plasma cholinesterase requires:
  - Further investigation of work practices
  - Prompt re-testing

Cholinesterase Monitoring



https://oehha.ca.gov/media/downloads/pesticides/document-pesticides/physicianguidelines.pdf

Pesticide applicator

Chemical Resistance Chart- **Gloves**

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Chemical	**Neoprene**	**Latex/rubber**	**Butyl**	**Nitrile**
Acetaldehyde	VG	G	VG	G
Acetone	G	VG	VG	P
Diesel fuel	G	P	P	VG
Hexane	F	P	P	G
Propyl alcohol	VG	VG	VG	VG
Sodium hydroxide	VG	VG	VG	VG
Toluene diisocyanate	F	G	G	F
Trichloroethylene	F	F	P	G
Xylene	P	P	P	F

OSHA 3151-12R 2004. Personal Protective Equipment. https://www.osha.gov/Publications/osha3151.pdf

Hazardous Noise

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Hazardous Noise

- > 84 dBA
- Impulse or impact noise > 140 dB

Noise Dosimeter

- Sound level meters evaluate three time-averaging characteristics: fast, slow, and peak
- The slow setting should be used when measuring sound intensity for purposes of assessing occupational noise

Noise Control Measures- Engineering

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- Enclose noisy machines and/or operators
- Sound absorbent surroundings
- Improve machine maintenance
- Mufflers

Hearing Protection

Employers shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees.

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735

Why Hearing Protection is **Not** Used

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THE URGENT CARE CONVENTION

Causes headaches	24%
Causes head pressure	37%
Causes itching	43%
Interferes with job performance	46%
Interferes with communication	70%

Only 20% of workers wear HPD at all times while in hazardous noise areas.

http://www.cdc.gov/niosh/topics/noise/pubs/presentations/MorataASA2003-1.pdf

Permissible Exposure Levels- OSHA

Sound intensity in dBA	Duration in hours
85 (Action level)	16
90 (PEL)	8
92	6
95	4
97	3
100	2
102	1.5
105	1.0
110	0.5 (30 mins)
115	0.25 (15 mins)

Noise Source	Loudness in dB
Gun shot	140-170
Jet engine	140
Pain threshold	125
Rock concert/chain saw	110-120
Diesel locomotive/stereo	110-120
Loader/backhoe- no cab	103
Jack hammer	96
Motor cycle/lawnmower	90
Loader/backhoe- insulated cab	90
OSHA- Hearing program AL	85
Conversation	60
Whisper	30-40

Types of Hearing Loss

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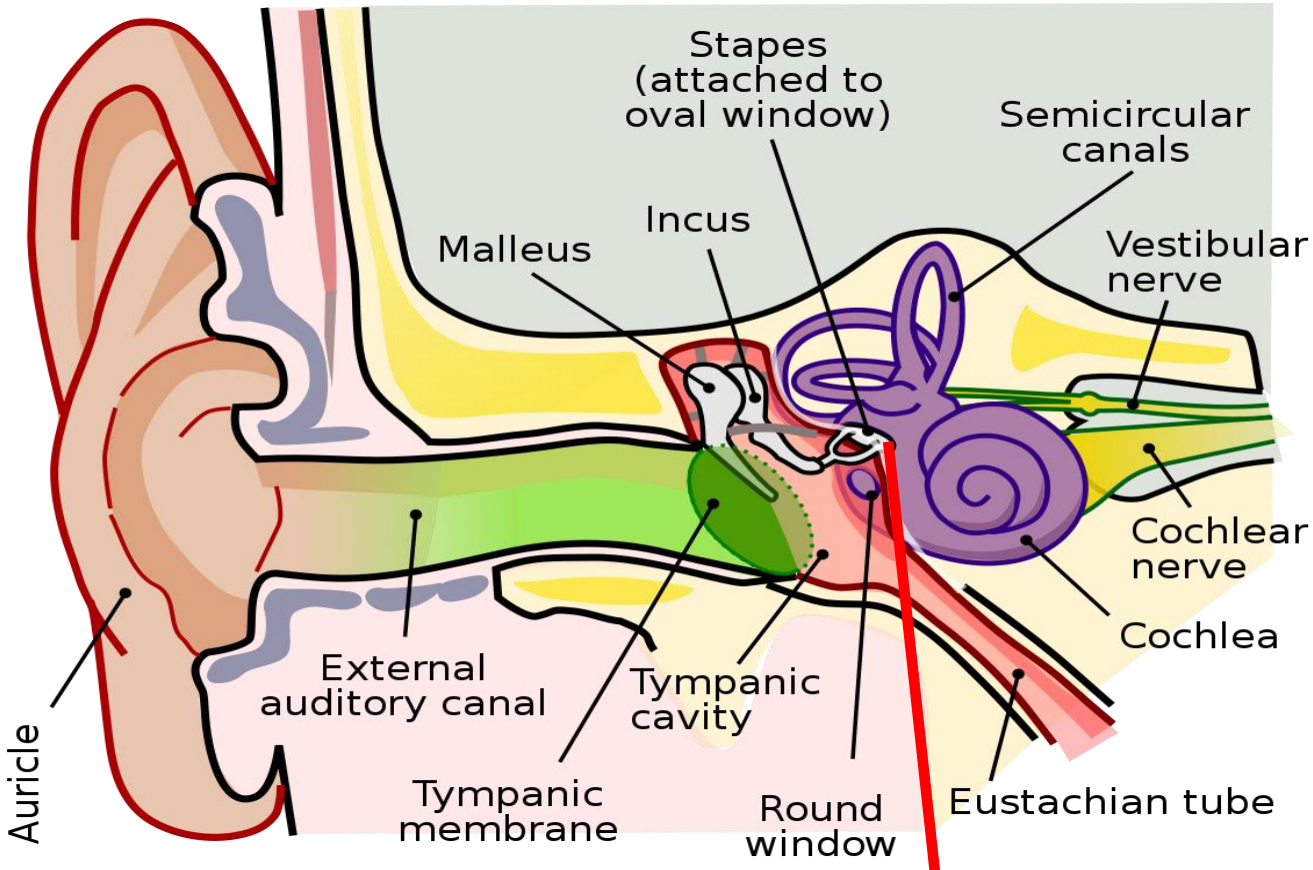
THE URGENT CARE CONVENTION

- **Sensori-neural: Hazardous noise exposure**
- Conductive
- Mixed
- Non-organic



Conductive loss

Sensori-neural loss

Hearing Loss US Adults Age 20-69 yrs

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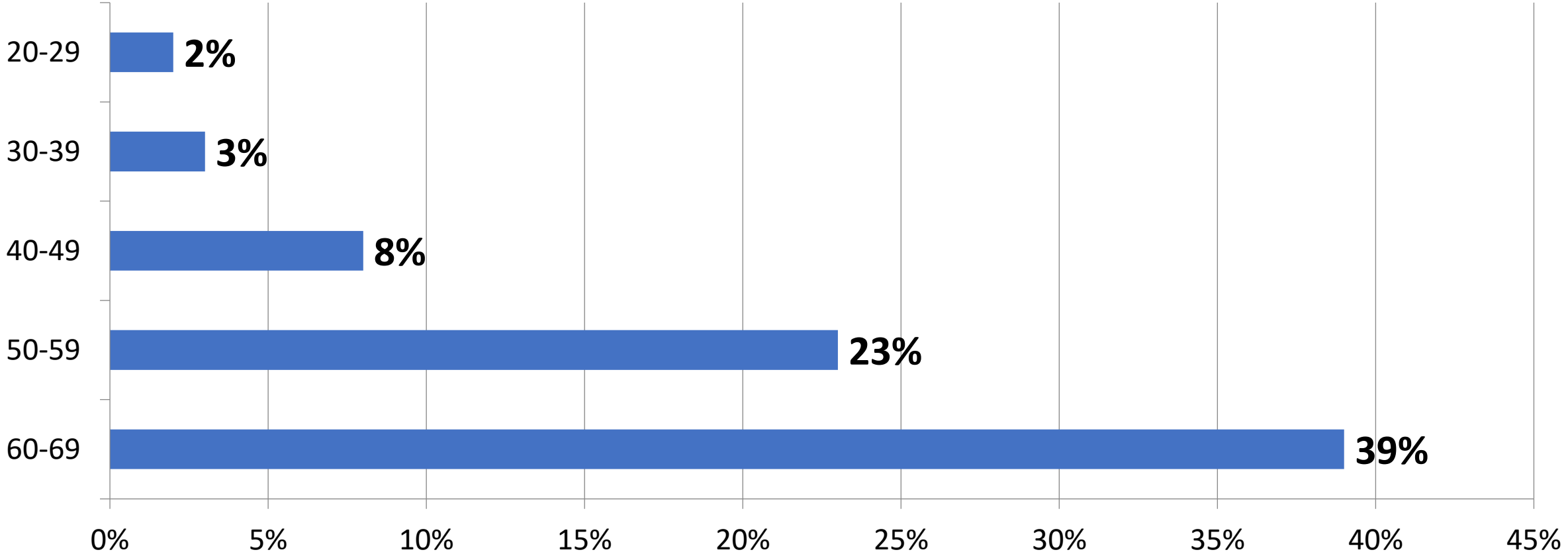
THE URGENT CARE CONVENTION



Hoffman HJ, et al. JAMA Otolaryngol Head Neck Surg. 2017;143(3):274-285.

Hazardous Noise Prevalence

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THE URGENT CARE CONVENTION

- 25% of all workers have been exposed to hazardous noise
- 53% of noise-exposed workers report not wearing hearing protection.

- Kerns E, et al. Cardiovascular conditions, hearing difficulty and occupational noise exposure within U.S. industries and occupations. Amer Journal of Indust Med, 2018:61, 477-491.
- Green DR, et al. Prevalence of hearing protection device non-use among noise-exposed US workers in 2007 and 2014. Amer Journal of Indust Med. Vol 64, Issue12. Dec 2021. Pages 1002-1017.

Noise-Induced Hearing Loss

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THE URGENT CARE CONVENTION

- Painless
- Progressive
- Preventable
- Permanent

Sensori-Neural Hearing Loss- Causes

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THE URGENT CARE CONVENTION

- Genetics/Congenital
- Disease: Mumps, Meningitis
- Ototoxic drugs
- Head trauma
- Presbycusis
- Meniere's disease
- Acoustic neuroma

Noise Exposure

Prolonged exposure to hazardous noise causes hearing loss by the physical destruction of the hair cells of the cochlea

Audiograms

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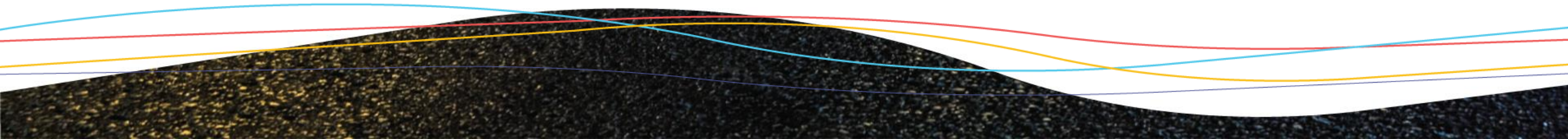
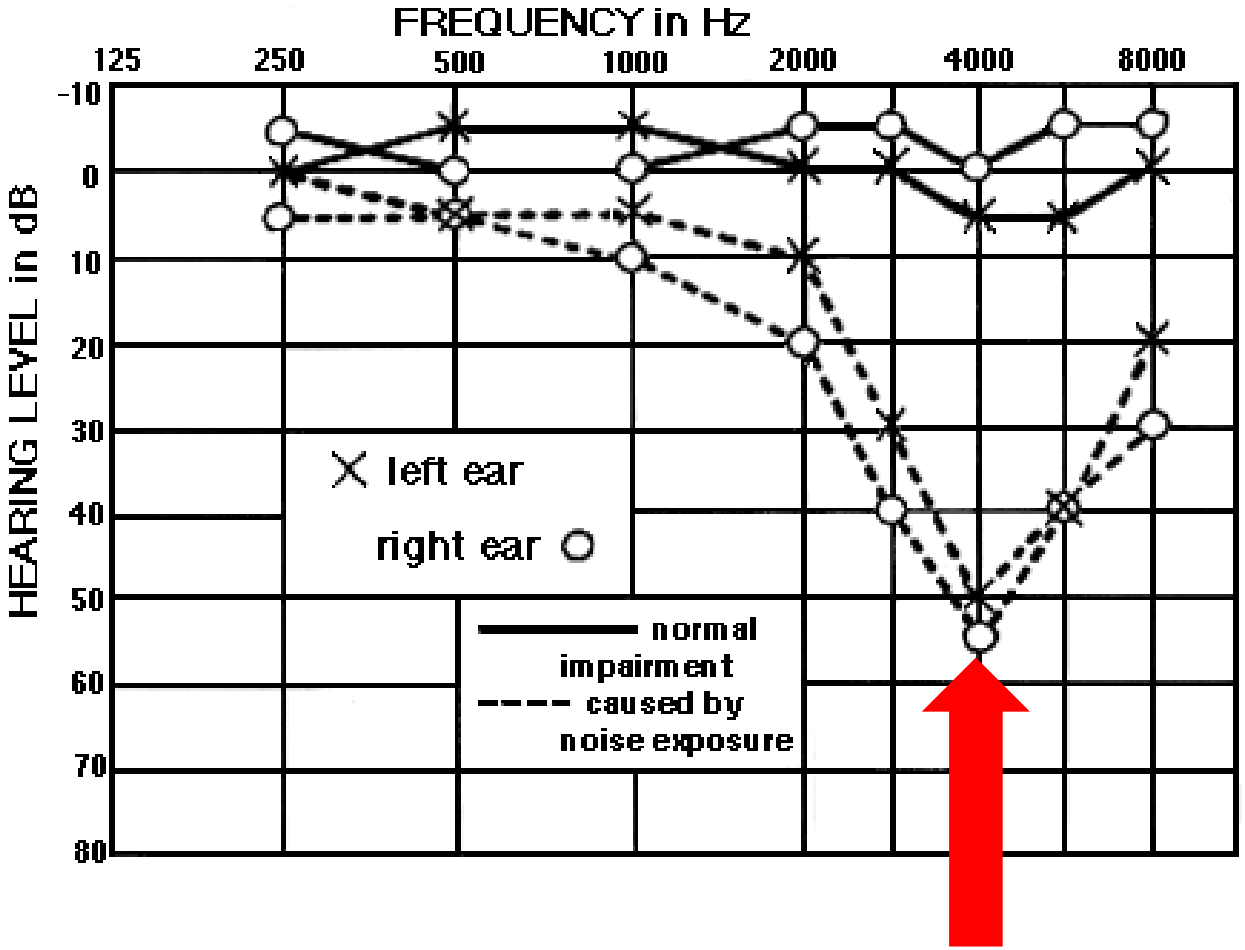
THE URGENT CARE CONVENTION

- Baseline: Within 30 days
- Monitoring i.e. annually
- Exit



Audiogram Pattern: NIHL



OSHA Recordability- **2 Criteria**

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- 10 dB average loss or greater from baseline for 2000, 3000, 4000 kHz in either ear

and

- Hearing level at the same frequencies is 25 dB or greater regardless of employee's age

Hearing Conservation Amendment 29 CFR 1910.95: New record keeping rule for hearing loss issued July 1, 2002 with an effective date of Jan 1, 2003

Audiogram Interpretation

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THE URGENT CARE CONVENTION

	Date	500	1000	2000	3000	4000	6000	8000
Left ear	1 Jan 2022	5	10	20	20	15	15	20
	1 Feb 2023	5	10	30	30	30	20	20
		0	0	+10	+10	+15	+5	0
Right ear	1 Jan 2022	10	10	20	20	15	15	20
	1 Feb 2023	15	10	20	25	25	20	25
		+5	0	0	+5	+10	+5	+5

Audiogram Interpretation

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION

	Date	500	1000	2000	3000	4000	6000	8000
Left ear	1 Jan 2022	5	10	20	20	15	15	20
	1 Feb 2023	5	10	30	30	30	20	20
		0	0	+10	+10	+15	+5	0
10 + 10 +15 = 35 35/3 = 11.7								
Right ear	1 Jan 2022	10	10	20	20	15	15	20
	1 Feb 2023	15	10	20	25	25	20	25
		+5	0	0	+5	+10	+5	+5

TTS vs. STS

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THE URGENT CARE CONVENTION

TTS -Temporary threshold shift

STS - Standard threshold shift

Temporary Threshold Shift (TTS)
Confirm Shift

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THE URGENT CARE CONVENTION

- Retest after auditory rest (noise-free) ≥ **14 hours**
  - Hearing protection vs. noise avoidance during “quite time”
- Retest within 30 days
  - If STS does not confirm- not recorded
  - If the retest confirms the STS= Recordable hearing loss case
  - Must record the hearing loss illness within 7 calendar days of the retest

Audiogram Screening Frequencies

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THE URGENT CARE CONVENTION

- **OSHA frequencies:** 2000, 3000, 4000
- **DOT frequencies:** 500, 1000, 2000
  - < 40 dB loss at 500, 1000, and 2000 kHz in better ear

Hearing Conservation Amendment 29 CFR 1910.95: New record keeping rule for hearing loss issued July 1, 2002 with an effective date of Jan 1, 2003

Hearing Loss Severity

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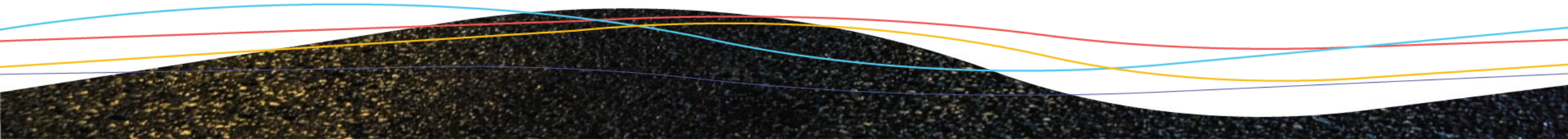
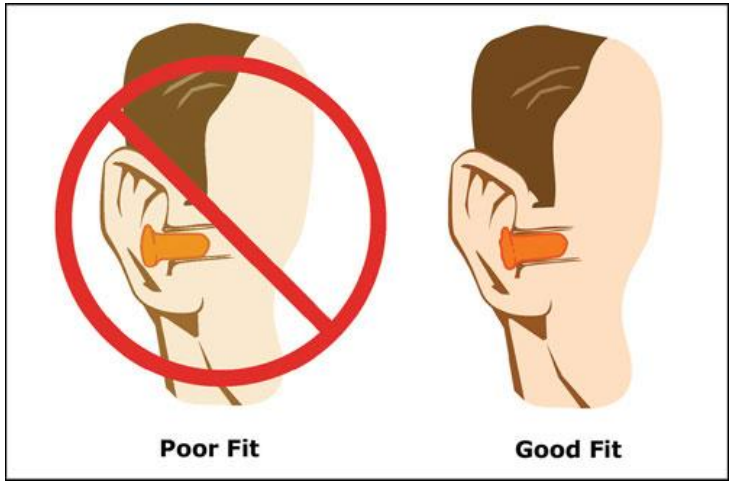
- **Mild** hearing loss: 25 to 40 dB
- **Moderate** hearing loss: 40 to 55 dB
- **Moderate-to-severe** hearing loss: 55 to 70 dB
- **Severe** hearing loss: 70 to 90 dB
- **Profound** hearing loss: 90 dB or more

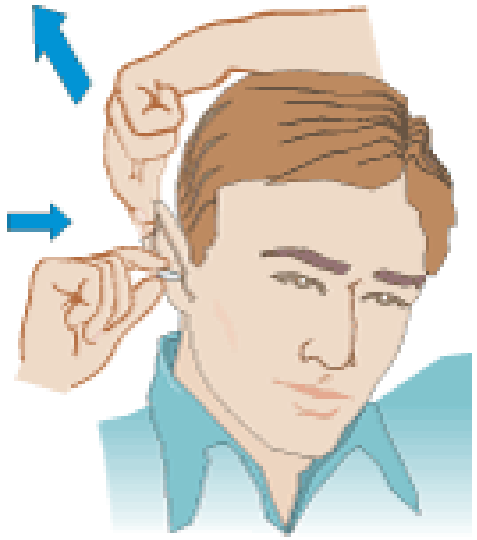


STS Follow-up

- Notify worker within 21 days (unless not work related)
- Fit or refit for hearing protection device



http://www.hearingreview.com/2008/05/fit-testing-of-hearing-protection/



Work-Relatedness of Hearing Loss

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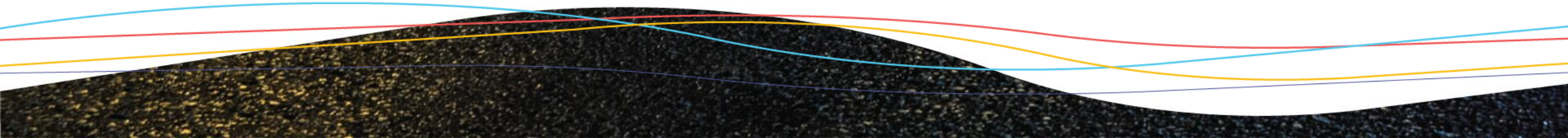
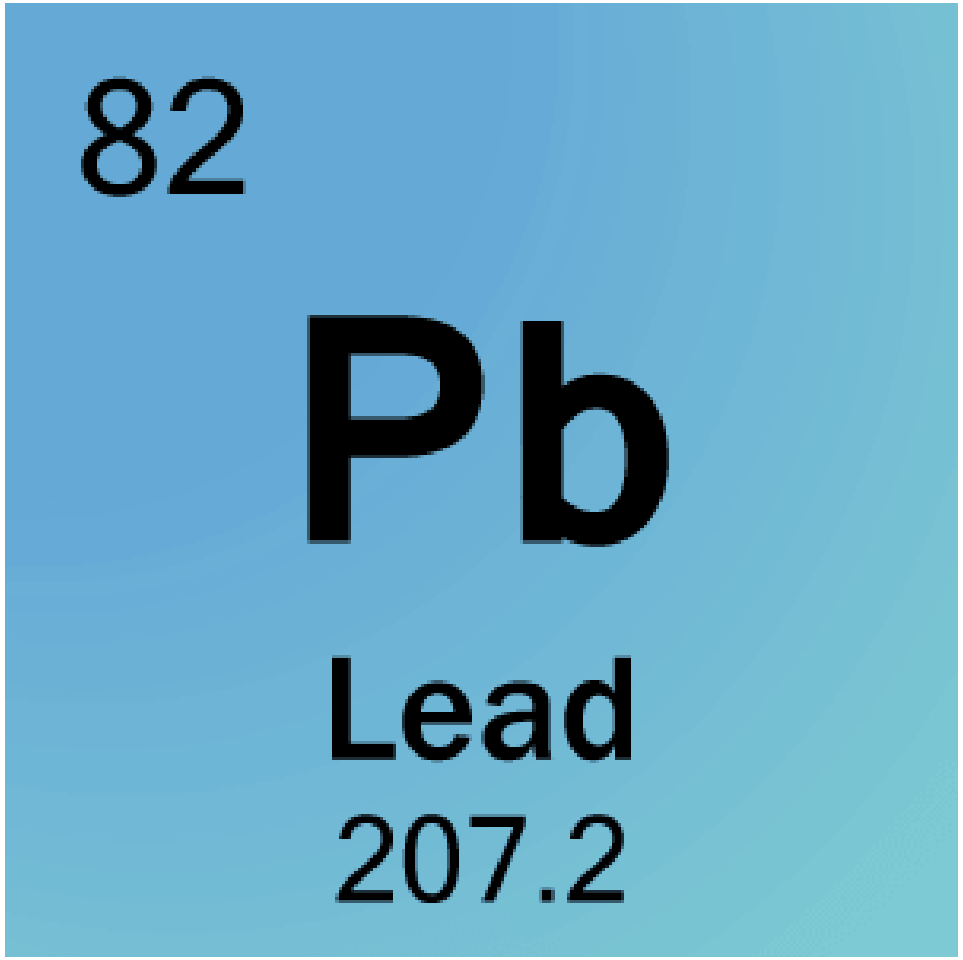
THE URGENT CARE CONVENTION

1. Is the audiogram valid?
2. Is the employee exposed to hazardous noise or ototoxic chemicals at work?
3. Hearing loss consistent with NIHL or is there a medical condition that can explain the loss?
4. Did a work exposure either cause or contribute to the hearing loss or significantly aggravate a pre-existing hearing loss?




82
Pb
Lead
207.2

Lead (Pb) – Occupational Exposure

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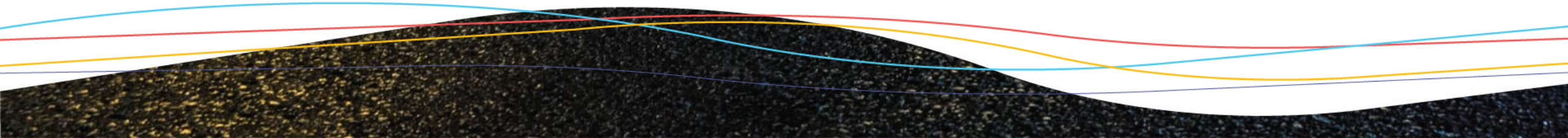
THE URGENT CARE CONVENTION

- Automotive repair
- Battery manufacturing or recycling
- Construction of bridges, tunnels, or elevated highways
- House painting or wallpapering
- Home renovation
- Firearms instruction
- Furniture refinishing
- Lead smelting or mining



Lead (Pb) Surveillance

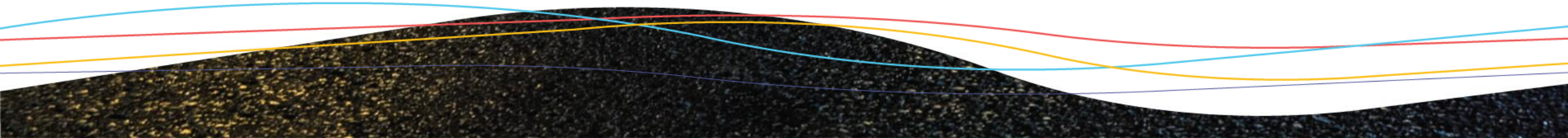
- Biological monitoring and medical surveillance is to be made available to all employees exposed to lead above the action level of 30 ug/m(3) TWA for more than 30 days/year.
- Blood sampling and medical evaluation performed on a schedule which is defined by:
  - Previous laboratory results (lead levels)
  - Worker complaints or concerns
  - Clinical assessment of the examining physician

Ref: 1910. Subpart Z: Toxic and Hazardous Substances. Std 1910.1025 App C

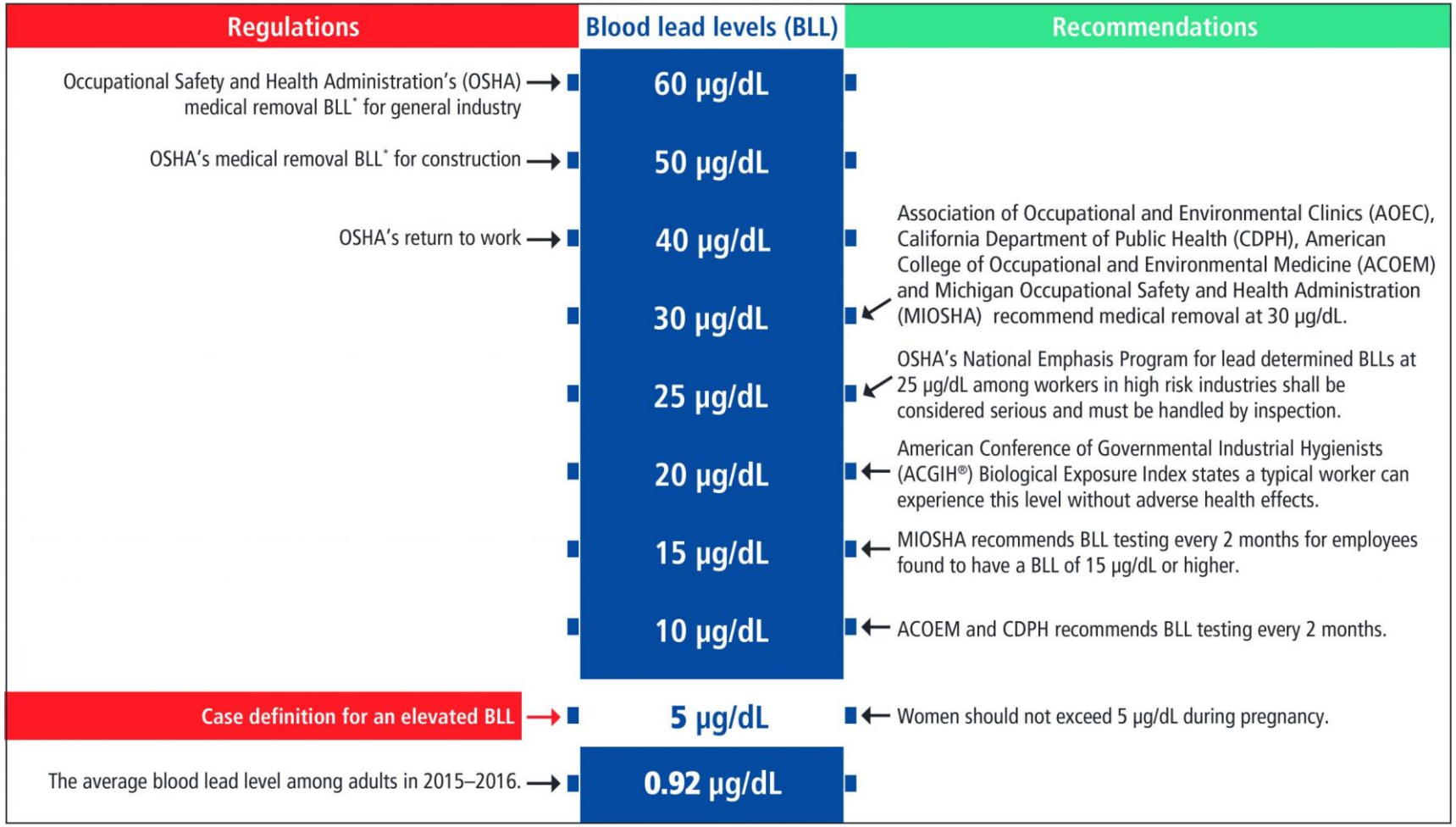
Lead (Pb) Surveillance

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION

- **Every six months:** Blood lead level (BLL) of all employees who are exposed to lead above the action level of 30 ug/m(3).
- **Every two months:** BLL every two months for employees whose last blood lead level was ≥ 40 ug/100 g whole blood.
- **Monthly:** For employees who are removed from exposure to lead due to an elevated blood lead
- A zinc protoporphyrin (ZPP) is required on each occasion that a blood lead level measurement is made.



Regulations Versus Recommendations Related to Adult Lead Exposure in the Workplace



*The OSHA Lead Standards state that the examining physician has broad flexibility to tailor protections to the worker's needs.

https://www.cdc.gov/niosh/topics/ables/ReferenceBloodLevelsforAdults.html

Pb Poisoning: Signs and Symptoms

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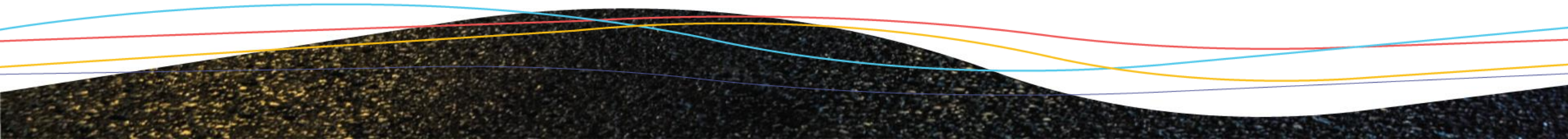
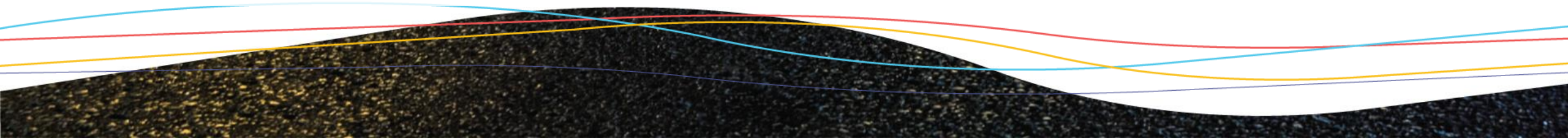
THE URGENT CARE CONVENTION

- High blood pressure
- Numbness and/or tingling in the hands and feet
- Memory loss, mood disorders
- Weakness
- Abdominal pain
- Headache



Zinc protoporphyrin (ZPP)

- ZPP formed with:
  - Iron deficiency
  - Pb poisoning (insertion of iron is inhibited)
- Protoporphyrin combines with Zn instead of Fe to form ZPP.
- ZPP not useful in the body since it cannot bind to oxygen.
- ZPP will not reflect recent/acute lead exposure because it does not change quickly when a person's source of Pb exposure is removed.
- ZPP detects a person's average exposure to Pb over the last 3-4 mths.



Lead Exposure

https://natecintl.com/blog/lead-exposure-continues-to-impact-lives-especially-in-construction/

https://www.thetrace.org/2016/04/gun-range-toxic-lead-pollution/

http://www.okinternational.org/Projects

Summary comments

Medical Surveillance Programs
Large Amount of Data Generated

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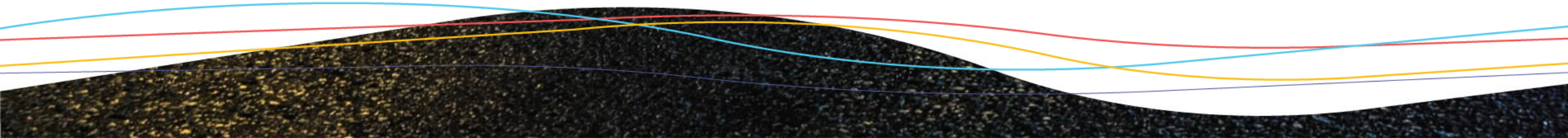
THE URGENT CARE CONVENTION

- Blood tests: CBC, metabolic panel, etc.
- Urinalysis
- Audiogram
- PFTs
- CXRs
- Specific exposure testing i.e. Pb, cholinesterase, etc.



Medical Surveillance Programs

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THE URGENT CARE CONVENTION

- Document appropriate follow up of all abnormal results.
  - Non-work-related abnormalities f/u with PCP.

Physician’s Written Opinion

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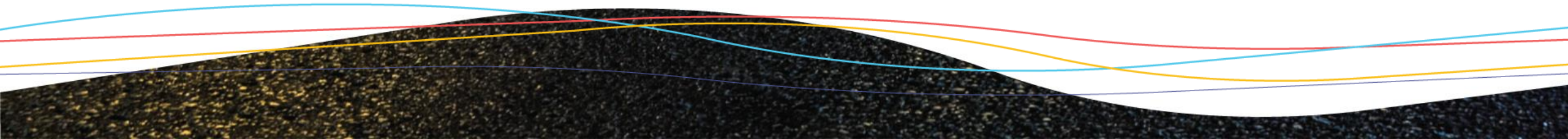
THE URGENT CARE CONVENTION

- Written opinion generated after review of all the data.
- The employer shall provide a copy of the physician's written opinion to the affected employee within 30 days from its receipt.
- “No work-related disease identified”

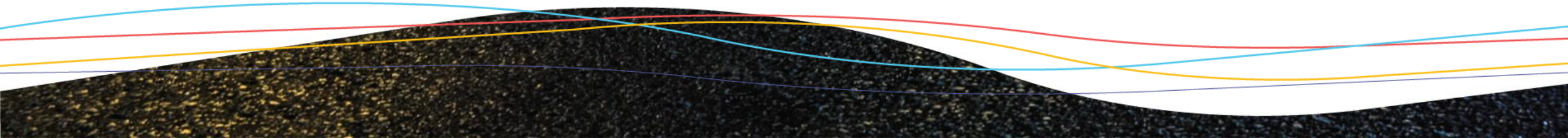


Take Away Points

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION

Occupational Medical Surveillance Programs:

1. Preventive focus
2. Identifies workers that need surveillance.
3. Identifies potential hazards of work exposure.
4. Perform tests and examinations based on exposures.
5. Serves as a check on engineering controls since symptoms of exposure may indicate a failure that must be corrected.



The End

DRIVING CHANGE 2023
THE URGENT CARE CONVENTION