Chemicals in the Workplace

OSH Training Workshop: Chemicals as Work Hazards
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Session Outcome

At the end of the session, participants should be able to describe how to protect themselves from chemicals in their respective workplaces.
Learning Outcomes

At the end of the session, participants should be able to:
1. Describe how chemicals interact with the body and vice versa.
2. Identify good practices on chemical safety.
Chemical Agents and Hazardous Materials or Substances

**Chemical Agents** – any chemical element or compound, on its own or admixed, as it occurs in the natural state or as produced, used or released, including release as waste, by any work activity, whether or not produced intentionally and whether or not placed on the market.
Chemical Agents and Hazardous Materials or Substances

**Hazardous materials or substances** – substances in solid, liquid, or gaseous forms known to constitute poison, fire, explosion or adverse health outcomes.
What makes a chemical hazardous?

“All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy”

– Paracelsus, Father of Modern Toxicology
Classifying Chemical Agents

- State of matter (solid, liquid or gas)
- General chemical structure (organic or inorganic compounds)
- Chemical reactivity (explosive, flammable, oxidizer)
- Target organ/s affected
Airborne Chemical Agents

• Gases
• Vapors
• Aerosols
  • Dust (solids in gas)
  • Fume (from molten metal)
  • Smoke (from incomplete combustion of carbon-based materials)
  • Mists (liquids in gas)
Types of Chemical Agents According to Health Effects

1. Asphyxiant
2. Irritant
3. Narcotic
4. Mutagen
5. Carcinogen
6. Sensitizers
7. Reproductive toxicants
8. Teratogens
Routes of Exposure
Acute vs. Chronic Effects

**Acute Effects**
- Occur very rapidly during or immediately after exposure
- Usually in response to a relatively high dose or high exposure concentration
- Symptoms vary from sudden death to minor irritation of the skin, eyes, nose and throat

**Chronic Effects**
- Tend to occur after long-term, repeated exposure to lower levels of a certain agent
- Usually long lasting and develop gradually over long periods of exposure
- Recovery extremely slow and often incomplete
- Includes cancer, bronchitis and dermatitis
Stochastic vs. Non-stochastic Effects

**Stochastic Effects**
- Occurs randomly
- Once a stochastic effect occurs, the consequence is independent of the initiating dose
- Lacks a threshold dose
- Includes cancer

**Non-Stochastic Effects**
- Characterized by a threshold dose below which these do not occur.
- Beyond the threshold dose, non-stochastic effects have a clear relationship between the dose and the extent of effects
- Includes inflammatory and degenerative diseases
Principles of Industrial Hygiene

1. Anticipation
2. Recognition
3. Evaluation
4. Control
Globally Harmonized System of Classification and Labelling Chemicals

• Aims to:
  • Provide improved, consistent hazard information
  • Encourage the safe transport, handling and use of chemicals
  • Promote better emergency response to chemical incidents
  • Ease compliance
Globally Harmonized System of Classification and Labelling Chemicals

- Has two major elements:
  - Classification of the hazards of chemicals according to the GHS rules
  - Communication of the hazards and precautionary information using Safety Data Sheets and Labels
GHS Pictograms

<table>
<thead>
<tr>
<th>Flame</th>
<th>Flame over circle</th>
<th>Exploding bomb</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Flame" /></td>
<td><img src="image" alt="Flame over circle" /></td>
<td><img src="image" alt="Exploding bomb" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corrosion</th>
<th>Gas cylinder</th>
<th>Skull and crossbones</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Corrosion" /></td>
<td><img src="image" alt="Gas cylinder" /></td>
<td><img src="image" alt="Skull and crossbones" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exclamation mark</th>
<th>Environment</th>
<th>Health Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Exclamation mark" /></td>
<td><img src="image" alt="Environment" /></td>
<td><img src="image" alt="Health Hazard" /></td>
</tr>
</tbody>
</table>

Figure 2. Pictograms under the Globally Harmonized System of Classification and Labelling of Chemicals (United Nations, 2015).
Sections of the Safety Data Sheet

DOLE D.O.136-14 (Guidelines for the Implementation of GHS in Chemical Safety Program in the Workplace)

1. Identification of the substance or mixture and of the supplier
2. Hazard identification
3. Composition/information on ingredients
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
Sections of the Safety Data Sheet
DOLE D.O.136-14 (Guidelines for the Implementation of GHS in Chemical Safety Program in the Workplace)

9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information including information on preparation and revision of the SDS
Figure 4. Methods of Control. (Plog & Quinlan, 2002)
Chemical Safety Program Elements
DOLE D.O.136-14 (Guidelines for the Implementation of GHS in Chemical Safety Program in the Workplace)

A. Facilities
B. Control Measures
C. Workers’ Right to Know
D. Storage Requirements and Inventory
E. Waste Management (DENR AO 92-26)
F. Information and Training
G. Personal Protective Equipment (POSHS Rule 1080)
H. Work Environment Monitoring (POSHS Rule 1070)
I. Occupational Health and Medical Surveillance (POSHS Rule 1060)
# Lead metal

## Classification:

<table>
<thead>
<tr>
<th>Health</th>
<th>Physical</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Toxicity (Oral, Inhalation)</td>
<td>Does not meet criteria for any Physical Hazard</td>
<td>Aquatic Toxicity – Short Term (Acute) Category 3</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>Does not meet criteria</td>
<td></td>
</tr>
<tr>
<td>Eye Damage/Eye Irritation</td>
<td>Does not meet criteria</td>
<td></td>
</tr>
<tr>
<td>Respiratory or Skin Sensitization</td>
<td>Does not meet criteria</td>
<td></td>
</tr>
<tr>
<td>Mutagenicity</td>
<td>Does not meet criteria</td>
<td></td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 2</td>
<td></td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>Category 1A</td>
<td></td>
</tr>
<tr>
<td>Specific Target Organ Toxicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Exposure</td>
<td>Category 1</td>
<td></td>
</tr>
</tbody>
</table>

## Label:

### Symbols:

![Symbol](image)

### Signal Word:

**DANGER**

### Hazard Statements:

**DANGER!**

- Causes damage to kidneys, blood-forming systems, central nervous system and digestive tract through prolonged or repeated exposure.
- May damage the unborn child. May cause harm to breast-fed children. Suspected of damaging fertility.
- Suspected of causing cancer.
- Harmful to aquatic life.

### Precautionary Statements:

- Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.
- Wear protective gloves/protective clothing/eye protection.
- Do not breathe dust or fumes.
- Wash hands thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- If exposed or concerned or you feel unwell: Get medical advice/attention.
- Avoid release to the environment.

[https://www.teck.com/media/2015-Products-Lead_Metal_SDS-T2.5.pdf](https://www.teck.com/media/2015-Products-Lead_Metal_SDS-T2.5.pdf)
 SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Eye irritation (Category 2), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal word Warning Skin irritation
Hazard statement(s)
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove
Nickel metal powder

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Flammable solids</th>
<th>Category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Sensitization</td>
<td>Category 1</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 1B</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 1</td>
</tr>
<tr>
<td>Target Organs - Kidney, Blood.</td>
<td></td>
</tr>
</tbody>
</table>

Label Elements

Signal Word
Danger

Hazard Statements
Flammable solid
May cause an allergic skin reaction
May cause cancer
Causes damage to organs through prolonged or repeated exposure

https://www.fishersci.com/shop/msdsproxy?productName=AC193610250&productDescription=NICKEL+POWDER+99.9%25+-+25GR&catNo=AC19361-0250&vendorId=VN00032119&storeId=10652
Cadmium oxide

http://www.dcfinechemicals.com/files2/Hojas%20de%20seguridad%20(EN)/102670-SDS-EN.pdf
Lead oxide

2. HAZARD(S) IDENTIFICATION

HAZARDOUS CHEMICAL DANGEROUS GOODS. According to the Model WHS Regulations and the ADG Code.

**Poisons Schedule**
- S6 Classified as S6: Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)

**Signal Word**
- DANGER

**GHS Classification**
- Acute Toxicity (Oral) Category 4, Acute Toxicity (Inhalation) Category 4, Reproductive Toxicity Category 1B, STOT - RE Category 2, Acute Aquatic Hazard Category 1, Chronic Aquatic Hazard Category 1

**GHS Label Elements**

<table>
<thead>
<tr>
<th>Hazard Statements</th>
<th>Prevention</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>H302</td>
<td>Harmful if swallowed</td>
<td>H373 May cause damage to organs through prolonged or repeated exposure</td>
</tr>
<tr>
<td>H332</td>
<td>Harmful if inhaled</td>
<td>H400 Very toxic to aquatic life</td>
</tr>
<tr>
<td>H360</td>
<td>May damage fertility or the unborn child</td>
<td>H410 Very toxic to aquatic life with long lasting effects</td>
</tr>
<tr>
<td><strong>Precautionary Statements</strong></td>
<td><strong>Prevention</strong></td>
<td><strong>Response</strong></td>
</tr>
<tr>
<td></td>
<td>P101 If medical advice is needed, have product container or label at hand.</td>
<td>P308+P313 IF EXPOSED: or concerned: Get medical advice / attention.</td>
</tr>
</tbody>
</table>

Sulfuric acid, 3M

Carbon black

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance

Carbon Black is not classified according to the Regulation (EC) No 1272/2008

<table>
<thead>
<tr>
<th>Human Health effects</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhalation</strong></td>
<td>Mechanical irritation of upper respiratory tract. Short-term effects after exposure of dust of carbon black at high concentrations of dust may cause temporary discomfort in the upper respiratory tract, accompanied by coughing and wheezing.</td>
</tr>
<tr>
<td><strong>Eyes</strong></td>
<td>High concentrations of dust may cause mechanical eye irritation.</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>Prolonged or repeated contact with product may cause mechanical irritation, dry skin.</td>
</tr>
<tr>
<td><strong>Swallowing</strong></td>
<td>No effect</td>
</tr>
</tbody>
</table>

n-Hexane

Toluene, reagent grade

Ethanol, 95%

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification
- Flam. Liq. 3  H226
- Skin Irrit. 2  H315
- Eye Irrit. 2A  H319
- Carc. 1A  H350
- Repr. 2  H361
- STOT SE 1  H370

Full text of H statements: see section 16

2.2. Label elements

GHS-US labeling
- Hazard pictograms (GHS-US):
  - GHS02
  - GHS07
  - GHS08

Signal word (GHS-US): Danger
Hazard statements (GHS-US):
- H226 - Flammable liquid and vapor
- H315 - Causes skin irritation
- H319 - Causes serious eye irritation
- H350 - May cause cancer (Ingestion)
- H361 - Suspected of damaging the unborn child (Ingestion)
- H370 - Causes damage to organs (central nervous system, optic nerve) (oral, Dermal)

Isopropyl alcohol, 99%

Section 2: HAZARDS IDENTIFICATION

OSHA Hazards: Flammable Liquid, Target organ effect, Irritant
Target Organs: Cardiovascular system, gastrointestinal tract, kidney, liver, nerves

GHS label elements (including precautionary statements)

Signal Word: DANGER!
Hazard Statement(s):
H225 Highly flammable liquid and vapor
H319 Causes serious eye irritation
H336 May cause drowsiness or dizziness

http://websites.retailcatalog.us/1424/mm/isopropyl-alcohol.pdf
Methanol, lab grade

Methyl ethyl ketone

# Xylene

<table>
<thead>
<tr>
<th>Xylene</th>
<th>Page 2 of 9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal word</strong></td>
<td>Danger</td>
</tr>
<tr>
<td><strong>Hazard statements</strong></td>
<td>H226 Flammable liquid and vapour.</td>
</tr>
<tr>
<td></td>
<td>H312 Harmful in contact with skin.</td>
</tr>
<tr>
<td></td>
<td>H315 Causes skin irritation.</td>
</tr>
<tr>
<td></td>
<td>H332 Harmful if inhaled.</td>
</tr>
<tr>
<td><strong>Precautionary statements</strong></td>
<td>P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.</td>
</tr>
<tr>
<td></td>
<td>P233 Keep container tightly closed.</td>
</tr>
<tr>
<td></td>
<td>P243 Take precautionary measures against static discharge.</td>
</tr>
<tr>
<td></td>
<td>P280 Wear protective gloves/protective clothing/eye protection/face protection.</td>
</tr>
<tr>
<td></td>
<td>P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.</td>
</tr>
<tr>
<td></td>
<td>P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.</td>
</tr>
<tr>
<td></td>
<td>P331 Do NOT induce vomiting.</td>
</tr>
<tr>
<td></td>
<td>P403 + P235 Store in a well-ventilated place. Keep cool.</td>
</tr>
</tbody>
</table>

### 2.3. Other hazards

| **Other hazards** | Not known. |

Ethyl benzene

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Flammable liquids (Category 2), H225
Acute toxicity, Inhalation (Category 4), H332
Specific target organ toxicity - repeated exposure (Category 2), hearing organs, H373
Aspiration hazard (Category 1), H304
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

Classification according to EU Directives 67/548/EEC or 1999/45/EC
F Highly flammable
Xn Harmful
R11 R20, R48/20, R65

For the full text of the R-phrases mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal word Danger

https://www.cdhfinechemical.com/images/product/msds/37_446411061_EthylBenzene-CASNO-100-41-4-MSDS.pdf
Formaldehyde, 37%

<table>
<thead>
<tr>
<th>Classification</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable liquids</td>
<td>Category 3</td>
</tr>
<tr>
<td>Acute oral toxicity</td>
<td>Category 3</td>
</tr>
<tr>
<td>Acute dermal toxicity</td>
<td>Category 3</td>
</tr>
<tr>
<td>Acute Inhalation Toxicity - Vapors</td>
<td>Category 3</td>
</tr>
<tr>
<td>Skin Corrosion/irritation</td>
<td>Category 1B</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 1</td>
</tr>
<tr>
<td>Skin Sensitization</td>
<td>Category 1</td>
</tr>
<tr>
<td>Germ Cell Mutagenicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 1A</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 1</td>
</tr>
<tr>
<td>Target Organs - Respiratory system, Central nervous system (CNS), Optic nerve.</td>
<td></td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 1</td>
</tr>
<tr>
<td>Target Organs - Kidney, Liver, Heart, spleen, Blood.</td>
<td></td>
</tr>
</tbody>
</table>

Label Elements

<table>
<thead>
<tr>
<th>Signal Word</th>
<th>Danger</th>
</tr>
</thead>
</table>

Trichloroethylene

### 2. Hazard(s) identification

**Classification**
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Corrosion/irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Skin Sensitization</td>
<td>Category 1</td>
</tr>
<tr>
<td>Germ Cell Mutagenicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 1A</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 2</td>
</tr>
<tr>
<td>Target Organs - Central nervous system (CNS).</td>
<td>Category 3</td>
</tr>
<tr>
<td>Specific target organ toxicity - (repeated exposure)</td>
<td>Category 2</td>
</tr>
<tr>
<td>Target Organs - Kidney, Liver, Heart, spleen, Blood.</td>
<td></td>
</tr>
</tbody>
</table>

**Label Elements**

**Signal Word**
Danger

**Hazard Statements**
- Causes skin irritation
- Causes serious eye irritation
- May cause an allergic skin reaction
- May cause drowsiness or dizziness
- Suspected of causing genetic defects
- May cause cancer
- May cause damage to organs through prolonged or repeated exposure

Clear protective lacquer aerosol

<table>
<thead>
<tr>
<th>2 HAZARDS IDENTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RISK PHRASES</strong></td>
</tr>
<tr>
<td>R12</td>
</tr>
<tr>
<td>R36</td>
</tr>
<tr>
<td>R67</td>
</tr>
<tr>
<td><strong>SAFETY PHRASES</strong></td>
</tr>
<tr>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>S2</td>
</tr>
<tr>
<td>S16</td>
</tr>
<tr>
<td>S23</td>
</tr>
<tr>
<td>S25</td>
</tr>
<tr>
<td>S38</td>
</tr>
<tr>
<td>S51</td>
</tr>
</tbody>
</table>

The above phrases are the risks associated with the product.

**PHYSICAL AND CHEMICAL HAZARDS**
Aerosol containers can explode when heated, due to excessive pressure build-up. When sprayed on a naked flame or any incandescent material the aerosol vapours can be ignited.

**STATEMENT OF HAZARDOUS NATURE**
HAZARDOUS SUBSTANCE (According to criteria of NOHSC). DANGEROUS GOODS (According to ADG Code).

**DG CLASS**
Class 2: Gases

Vinyl chloride (monomer)

<table>
<thead>
<tr>
<th>GHS CLASSIFICATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHS: PHYSICAL HAZARDS:</td>
</tr>
<tr>
<td>Category 1 - Causes damage to liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system through prolonged or repeated exposure</td>
</tr>
<tr>
<td>GHS: CONTACT HAZARD - SKIN:</td>
</tr>
<tr>
<td>Category 2 - Causes skin irritation.</td>
</tr>
<tr>
<td>GHS: CONTACT HAZARD - EYE:</td>
</tr>
<tr>
<td>Category 2B - Causes eye irritation</td>
</tr>
<tr>
<td>GHS: TARGET ORGAN TOXICITY (SINGLE EXPOSURE):</td>
</tr>
<tr>
<td>Category 3 - May cause respiratory tract irritation</td>
</tr>
<tr>
<td>Category 3 - May cause drowsiness or dizziness</td>
</tr>
<tr>
<td>GHS: TARGET ORGAN TOXICITY (REPEATED EXPOSURE):</td>
</tr>
<tr>
<td>Category 1A - May cause cancer.</td>
</tr>
<tr>
<td>GHS: CARCINOGENICITY:</td>
</tr>
<tr>
<td>Category 2 - Suspected of causing genetic defects</td>
</tr>
<tr>
<td>GHS: GERM CELL MUTAGENICITY:</td>
</tr>
<tr>
<td>Category 2 - Suspected of damaging fertility or the unborn child</td>
</tr>
<tr>
<td>GHS: REPRODUCTION TOXIN:</td>
</tr>
<tr>
<td>Category 2 - Suspected of causing genetic defects</td>
</tr>
<tr>
<td>GHS - OSHA Hazard(s)</td>
</tr>
<tr>
<td>Simple Asphyxiant: May displace oxygen and cause rapid suffocation</td>
</tr>
</tbody>
</table>

Unknown Acute Dermal Toxicity:
100% of this product consists of ingredient(s) of unknown acute dermal toxicity.

Chlorpyrifos

Section 2. Hazards Identification

2.1 Classification of the Substance or Mixture:
   Acute Toxicity: Oral, Category 3
   Aquatic Toxicity (Acute), Category 1
   Aquatic Toxicity (Chronic), Category 1

2.2 Label Elements:

GHS Signal Word: Danger

GHS Hazard Phrases:
   H301: Toxic if swallowed.
   H400: Very toxic to aquatic life.
   H410: Very toxic to aquatic life with long lasting effects.

GHS Precaution Phrases:
   P264: Wash (hands) thoroughly after handling.
   P273: Avoid release to the environment.

GHS Response Phrases:
   P301+310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
   P330: Rinse mouth.
   P391: Collect spillage.

GHS Storage and Disposal Phrases:
   Please refer to Section 7 for Storage and Section 13 for Disposal information.

https://www.caymanchem.com/msdss/21412m.pdf
TRUE or FALSE

1. All chemicals are hazardous to workers.
2. Cancer is a stochastic effect.
3. An SDS aids in hazard identification.
4. The GHS differentiates chemicals that cause acute and chronic effects.
5. The identity of the chemicals used in the process can be kept confidential to the worker/s exposed to it.
What did you learn today?
How will you apply this in your occupation?
THREE (3) KEY MESSAGES

1. Chemical toxicity depends on the dose.
2. The Safety Data Sheet is an important document for chemical safety.
3. The GHS System streamlines important activities on chemical safety.
Bibliography


Bibliography


Thank you for participating.

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