IMPROVEMENT IN BEHAVIOUR BASED SAFETY THROUGH SAFETY ACT INDEX


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ABSTRACT

Problem definition: In more than 95% of the cases, the incidents happening in India & abroad, the root cause is unsafe behavior of the workers. The issue is how to correct the unsafe behavior of the workers at workplace?

A new tool known as safety Act Index was developed for the first time in our country for observing unsafe acts/unsafe behavior of workers. Workers' behavior was observed from a distance without imposing any punitive action. Efforts are made to establish the root cause of unsafe behavior. A formula has been developed to arrive at weighted average of unsafe behavior. From weighted average of unsafe behavior, Safety Act Index is calculated. The safety Act Index score is plotted on a graph to observe the trend of unsafe behavior. This provides input for training needs of workers & also to address the bad habits of the workers. This tool demonstrates that we really care about improving safety.

It is a method to keep track of how people are working. It is a powerful tool to address unsafe behavior of workers in a non-threatening manner. Positive behavior is to be reinforced by rewarding safe behavior of workers instantly. This way we can show & demonstrate that we really care about improving safety.

MAJOR CHALLENGES IN SAFETY CULTURE IMPROVEMENT / NEED OF THIS SAI CONCEPT:

1. Safety culture matures over a period of time.
2. Inadequate understanding of Behavior based safety.
3. Non recognition of small achievements of success. Going for negative reinforcement.
4. Time constraints/targets set by supervisors.
5. Overconfidence, familiarity with the job & hence low risk perception.
6. Invincible attitude that nothing will happen to me.
7. Insufficient worker involvement.
8. Very few champions to propagate safe behavior.
9. Bypassing safe operating procedures.

CONCEPT OF SAFETY ACT INDEX

Safety Act Index (SAI) is a tool for capturing the unsafe act / behavior of workers & plotting the trend accordingly.

The Safety Act index (SAI), which quantitatively represents the plotting of unsafe practices/acts, which is further used to identify and monitor the trend of unsafe behavior to increase the effectiveness of safety management.

SAI shows the opportunity to improve and area of concern with respect to unsafe behavior.

Management thinks that why accidents are happening, despite us ensuring:

- Established safety rules
- Displaying visual cautions and SOPs
- Providing PPEs
- Providing training
- Providing proper supervision etc.

In spite of all the above being followed, why accidents are happening, in most of cases the reason is...

Unsafe behavior act

Figure 1

What was done:

The Safety Act Index (SAI) concept was rolled out in station X. It helps to understand and find out the unsafe act / behavior of workers and measurement is done according to a mathematical formula.

SAI calculation provides us with the input of a particular aspect of behavior in which more training/ counselling is required.

Once the unsafe act / behavior is noticed, it is important to know why the person is adopting that behavior through discussion with him in positive manner.

Methodology:

A two-member cross-functional team, preferably heads of sections, carries out a site visit of a particular area not related to their function. They need to observe the behavior of workers from a distance. Seeing the senior employees from a distance, the workers might put on the chin strips of their helmets, put on their face masks if working in a dusty environment, put on their hand gloves or may be put on their helmets. **Care is to be observed that this is not a tool to be used for imposing any kind of penalty. We need to practice the concept of positive reinforcement. If any worker is found working with all safety PPE's, he or she is to be instantly rewarded.** The concept of positive reinforcement will send the message among workers that safe behavior is rewarded. In the event of a major unsafe behavior being observed, the concerned worker is to be counselled & the root cause of this behavior is to be established as per the **ABC Model of Behavior Based Safety. ABC stands for Antecedent, Behavior & Consequences. If safe behavior is rewarded instantly, it gets reinforced.**

QUANTITATIVE CALCULATION OF SAFETY ACT INDEX (SAI):

Equation 1:

- **Weightage average of unsafe and safe acts / behaviors = ((number of workers involved in unsafe act 1) X (severity of unsafe act 1) + (number of workers involved in unsafe act 2) X (severity of** unsafe act 2).....+(number of workers involved in unsa**fe act n) X (severity of unsafe act n) + (number of workers doing work safely) X (1)) / (Total number of workers working there involved in unsafe & safe behavior)**
- **Severity ranking on scale from 1 to 10 (1 = Safe Behavior, 2 to 10 = Severity ranking for different unsafe behaviors) as shown in table 1.**

Equation 2:

- **Safety Act Index = 1 / weightage average of unsafe act/ unsafe behavior.**
- Safety Act Index (SAI) value is between 0 to 1.
- **The desired level for ensuring safe work culture is 1.**
- If the SAI graph trends downwards it indicates the increasing risk due to unsafe act / behavior.
- Management audit team requires a shared sense of judgement regarding severity rating of unsafe acts.
- SAI is not to be used as a disciplinary tool. This tool primarily focusses on positive reinforcement.
- Audit Team members need to be replaced preferably at an interval of 6 months so that more members can be brought onboard.

Table 1

Severity Matrix		
Sr No	**Unsafe Behavior/Unsafe Act**	**Severity Rating**
01.	Safety belt not anchored while working at height	10
02.	Talking on mobile phone while working at Height	10
03.	Secondary fall protection not used while working at height	9
04.	Tag line not used with tool at height	8
05.	Talking on mobile phone while driving	7
06.	Face shield not worn during welding	7
07.	Nose mask not worn	7
08.	Working on single plank instead of two planks	7
09.	Shifting cylinder through pallet trolley instead of cylinder trolley	7

Sr No	Unsafe Behavior/Unsafe Act	Severity Rating
10.	Safety helmet not worn	6
11.	Not worn safety shoes	6
12.	Welding apron not worn	5
13.	Hand gloves not worn	5
14.	Not wearing chin strip of helmet at ground level	4
15.	Reflective jacket not worn	4
16.	Worn damaged safety shoes	4
17.	Safety goggles not worn in CHP, AHP area	4
18.	Gum boot not worn while working in water, muddy conditions	3
19.	Workers taking rest at job site instead of labor shed	3
20.	Not wearing PPE's while entering plant	2

Remarks:

1. For safe behaviors rating to be taken as '1' for calculating SAI. In weighted average equation in the numerator no of workers displaying safe behavior are to be multiplied with rating 1 and added to the no of workers with unsafe behavior multiplied by the severity rating of that unsafe behavior as per the above table.
2. The list of unsafe behavior provided above is not exhaustive and other categories may be added by the stations based on their own judgement.

Sample Calculations and Illustration:

	One worker observed with required PPEs during spray painting work. Weighted average = (1x1) /1 = 1 Safety Act Index = 1 /1 = 1
	3 Workers wearing all required PPE's during alum shifting work. Weighted average= (3x1) /3 = 1 Safety Act Index = 1 /1 = 1
	Out of 3 workers 1 is not using hand gloves during pipeline fit up work. And other 2 were using hand gloves. Weighted average= (1x5 + 2x1) /3= 2.33 Safety Act Index = 1 /2.33 = 0.43
	Three workers were engaged in housekeeping work; they were not wearing hand gloves and two of them were also not using face masks. Weighted average= (3x5+2x7)/3= 9.67 Safety Index = 1/9.67=0.10

	Two workers were not wearing safety helmets & reflective jackets. Weighted average: (2x6+2x4)/2 = 10 Safety Index: 1/10=0.10
	Three workers were wearing safety harnesses, but anchoring was not done by them. Weighted average: (3x10)/3 =10 Safety Index: 1/10=0.10
	Worker was wearing one hand gloves instead of both hand gloves. Weighted average: (1x5)/1 = 5 Safety Index: 1/5=0.2
	Worker was doing grinding work without face shield. Weighted average: (1x7)/1 = 7 Safety Index: 1/7=0.14
	Worker safety helmet's chin strip found in damaged condition. Weighted average: (1x4)/1 = 4 Safety Index: 1/4=0.25
Average Safety Act Index for a particular date = Average: (1+1+0.43+0.1+0.1+0.1+0.2+0.14+0.25) =3.32/9 =0.37 0.37 (Means 37% Safe behaviour and 63% Unsafe behaviour)	

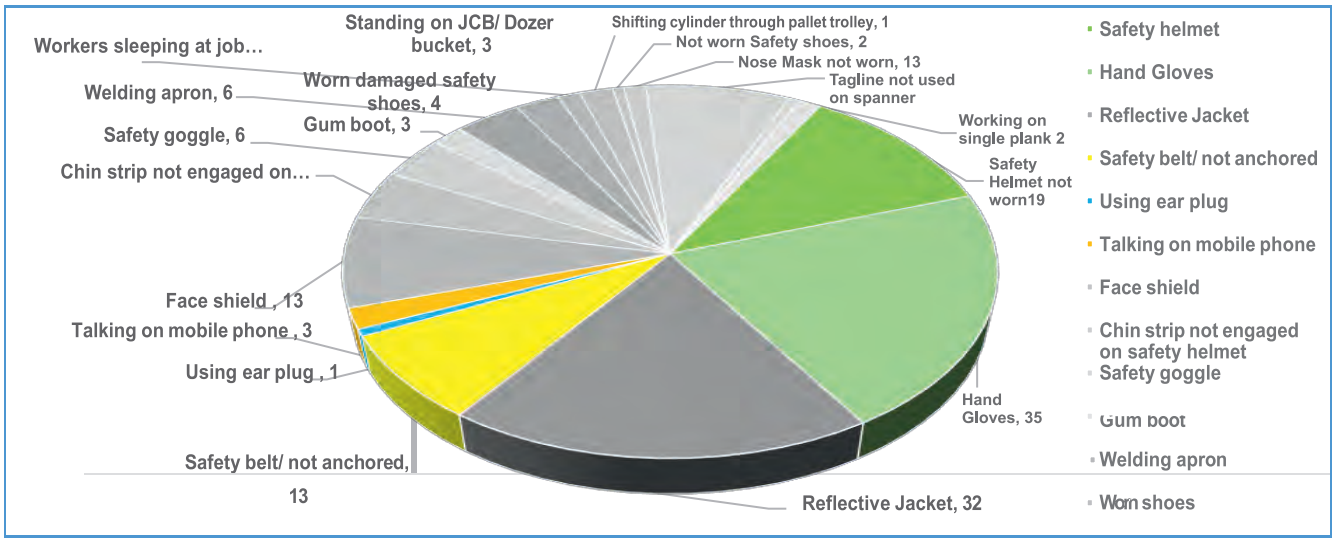
Table 2

Unsafe Behavior of workers: Analysis (May'23 – April'24) for station X

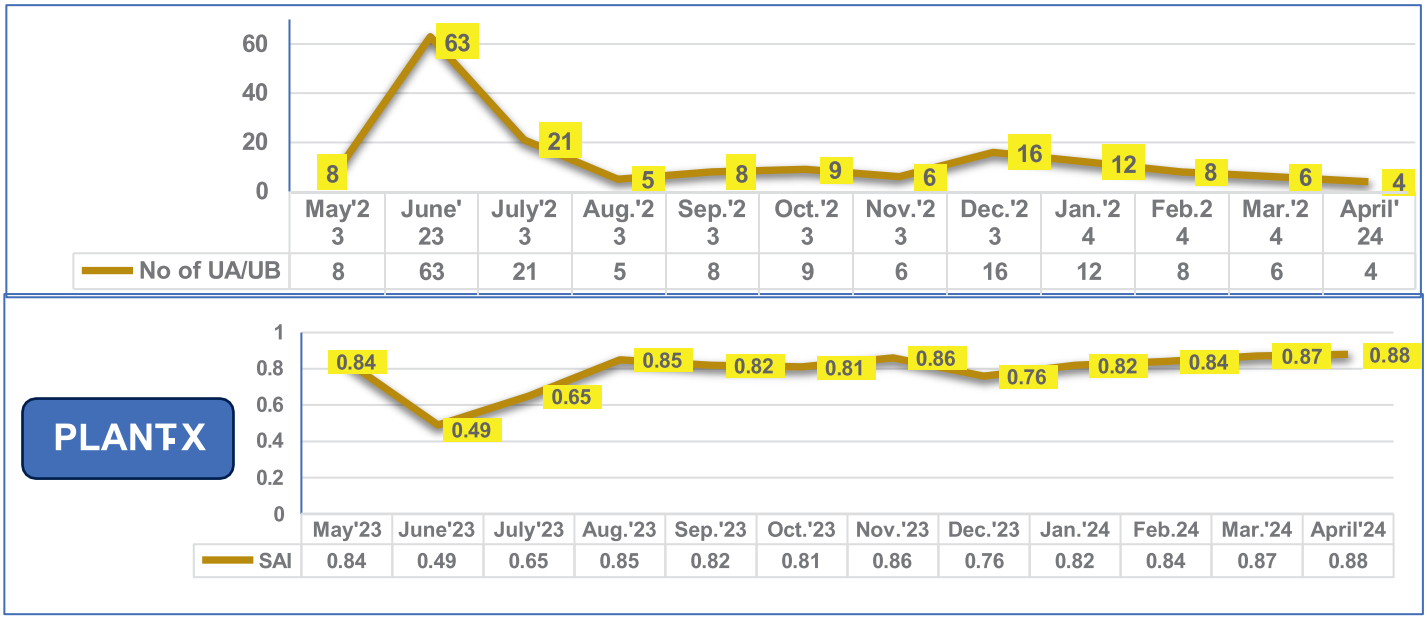
Sr. No.	Type of Unsafe Act/ Unsafe Behavior	Number of Unsafe Act/ Unsafe Behavior
01	Safety helmet not worn (Majority observations during overhauling)	19
02	Hand gloves not worn	35
03	Reflective jacket not worn	32
04	Safety belt not worn/ anchored	13
05	Using earphones at job site	1
06	Talking on mobile phone during two-wheeler driving	3
07	Face shield not worn	13
08	Chin strip not engaged on safety helmet	7
09	Safety goggles not worn	6

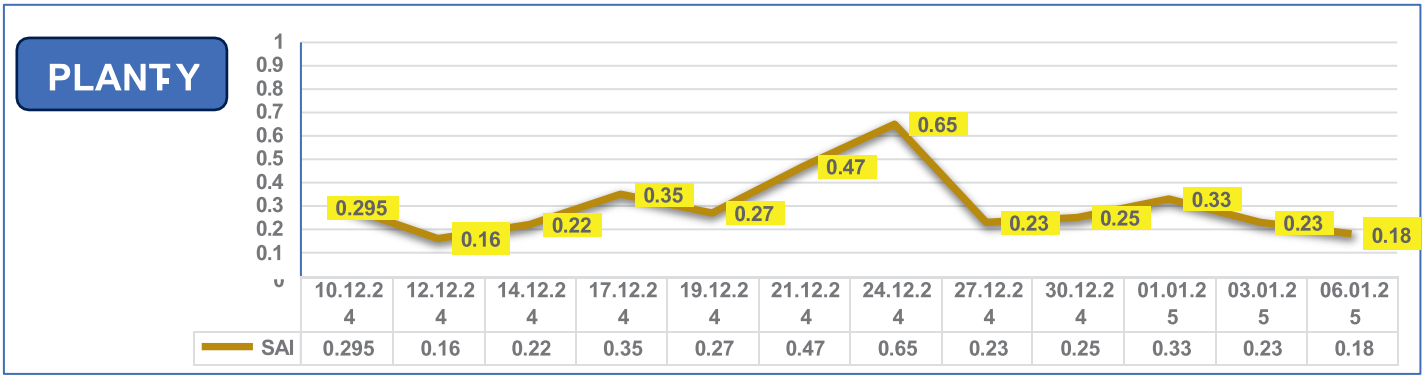
Sr. No.	Type of Unsafe Act/ Unsafe Behavior	Number of Unsafe Act/ Unsafe Behavior
10	Gum boot not worn	3
11	Welding apron not worn	6
12	Worn damaged safety shoes	4
13	Workers taking rest at job site instead of labor shed	2
14	Standing on JCB/ Dozer bucket	3
15	Shifting cylinder through pallet trolley instead of cylinder trolley	1
16	Not worn safety shoes	2
17	Nose mask not worn	13
18	Tag line not used on spanner	1
19	Working on single plank instead of two planks	2
Total		166

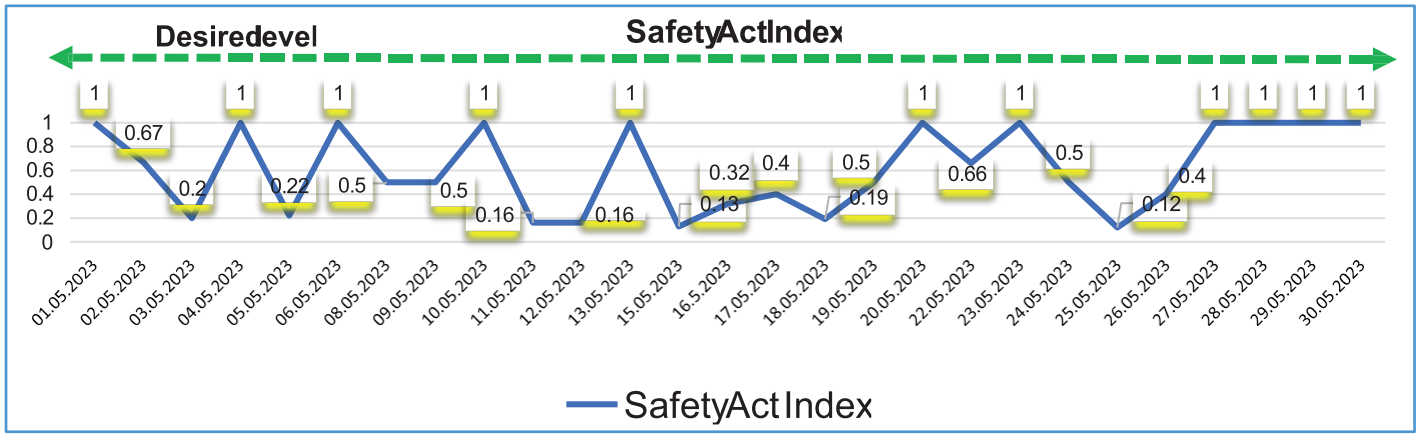
Graphic 2: Unsafe Behavior of workers: Trend Analysis (May'23 – April'24)



Graphic 3: Safety Act Index: Month wise unsafe behaviors & SAI: (May'23 –April'24)





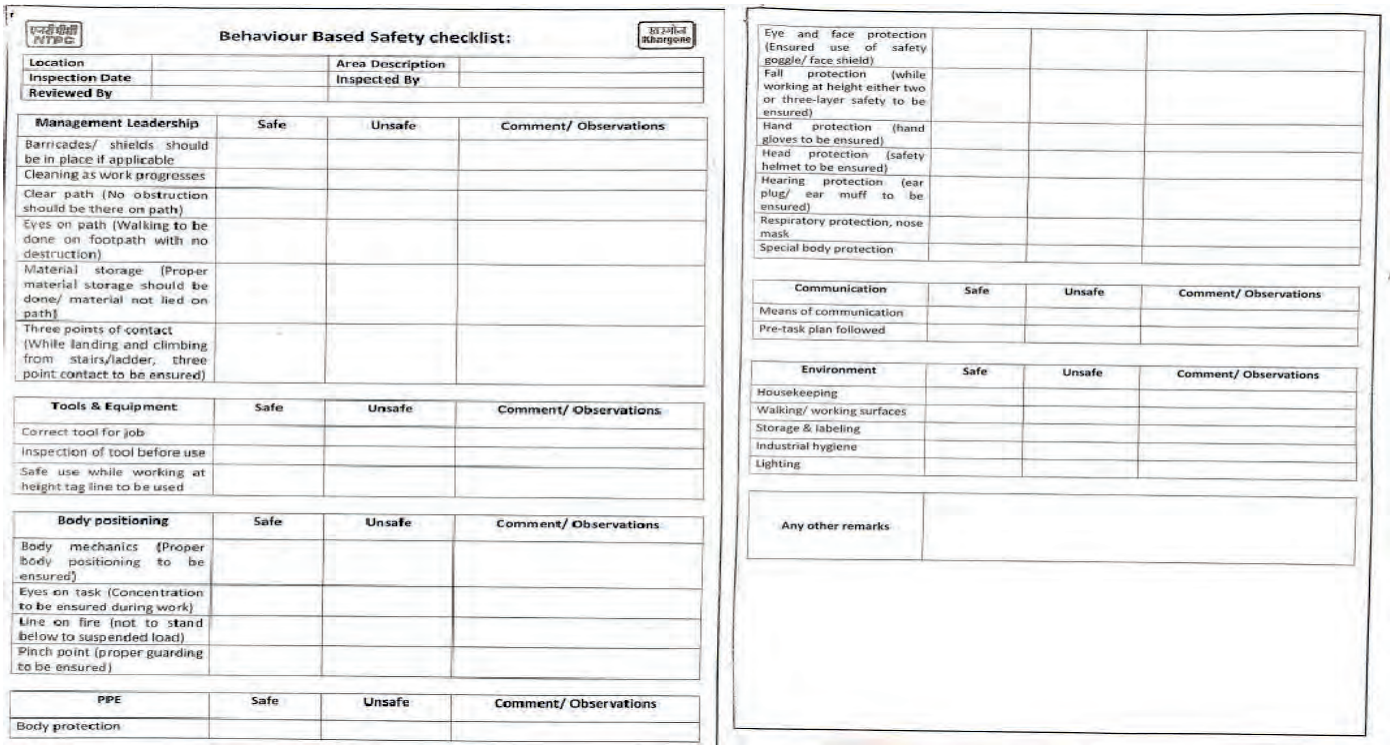


Inference of trend analysis:

1. Initially the Safety Act index value will be less in the first two to three months indicating many cases of unsafe behavior. This is evident in graphic 3.
2. Number of unsafe behaviors will peak during the overhauling period as outside agencies are deployed.
3. During the first couple of months, safety acts audit needs to be done on daily basis. Once the behaviour of workers improves, it needs to be done on a weekly basis. Safety Act Index generally stabilises after 3-4 months.
4. Patterns of behavior that are seen indicate areas of strength & weakness which needs to be addressed.

COMPLEMENTARY TOOLS TO BE USED IN ADDITION TO SAFETY ACT INDEX:

01. Behavior Based Safety checklist: illustration 2



Behaviour Based Safety checklist:

Location		Area Description	
Inspection Date		Inspected By	
Reviewed By			

Management Leadership	Safe	Unsafe	Comment/ Observations
Barricades/ shields should be in place if applicable			
Cleaning as work progresses			
Clear path (No obstruction should be there on path)			
Eyes on path (Walking to be done on footpath with no destruction)			
Material storage (Proper material storage should be done/ material not lied on path)			
Three points of contact (While landing and climbing from stairs/ladder, three point contact to be ensured)			

Tools & Equipment	Safe	Unsafe	Comment/ Observations
Correct tool for job			
Inspection of tool before use			
Safe use while working at height tag line to be used			

Body positioning	Safe	Unsafe	Comment/ Observations
Body mechanics (Proper body positioning to be ensured)			
Eyes on task (Concentration to be ensured during work)			
Line on fire (not to stand below to suspended load)			
Pinch point (proper guarding to be ensured)			

PPE	Safe	Unsafe	Comment/ Observations
Body protection			
Eye and face protection (Ensured use of safety goggle/ face shield)			
Fall protection (while working at height either two or three-layer safety to be ensured)			
Hand protection (hand gloves to be ensured)			
Head protection (safety helmet to be ensured)			
Hearing protection (ear plug/ ear muff to be ensured)			
Respiratory protection, nose mask			
Special body protection			

Communication	Safe	Unsafe	Comment/ Observations
Means of communication			
Pre-task plan followed			

Environment	Safe	Unsafe	Comment/ Observations
Housekeeping			
Walking/ working surfaces			
Storage & labeling			
Industrial hygiene			
Lighting			

Any other remarks	

02. Talk on Behaviour Based Safety in every mass pep talk: illustration 3

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Behavioural Aspects:

दुर्घटनाओं के मूल कारण हमेशा स्पष्ट नहीं होते हैं, लेकिन वे अक्सर किसी न किसी हिस्से में एक या अधिक असुरक्षित व्यवहार के कारण होते हैं। व्यवहार-आधारित सुरक्षा, या बीबीएस, कार्यस्थल में असुरक्षित व्यवहार को बदलने में मदद करती है।

- BBS का अर्थ है सभी असुरक्षित व्यवहार को हटाना/सुधारना।
- कोई भी कार्य शुरू करने से पहले की आपकी मनःस्थिति सकारात्मक होनी चाहिए।
- अगर आप का स्वास्थ्य ठीक नहीं नहीं है तो आपको कार्य नहीं करना चाहिए।
- आपकी मनःस्थिति हमेशा इस प्रकार होनी चाहिए की आपके द्वारा किये जाने कार्य के दौरान या कार्य समाप्त होने के बाद किसी को हानि न पहुंचे।
- हर काम को पूर्ण रूप से समझने के बाद उस कार्य को करना चाहिए तथा कोई भी कार्य दबाव में आके या जल्दबाजी में न करे।
- कार्यस्थल पर हमेशा अपने साथियों और कामगारों को सुरक्षा के प्रति जागरूक करना चाहिए।

Personnel Hygiene:

- स्वच्छता सभी स्वास्थ्य सम्बन्धी बीमारियों से हमारा बचाव करती है।
- खाद्य वस्तु खाने से पहले हमेशा सुनिश्चित करें की आपके हाथ साफ हो तथा खाने की जगह कार्यस्तेत्र से दूर (कैंटीन) होनी चाहिए।
- किसी भी कट को बहते पानी से तुरंत धो लेना चाहिए।
- किसी भी प्रकार के चोट या कट को खुला नहीं रखना चाहिए उसका सही तरिके से ड्रेसिंग होना चाहिए।
- जब आप किसी केमिकल के साथ कार्य कर रहे है तो अपने हाथो को मुँह और आँखों से स्पर्श न करें।

Social Aspects:

जब कोई भी दुर्घटना होती है तो वह उस आदमी व उसके साथ कार्य करने वाले कामगारों, परिवार तथा अपने परिचितो के साथ लम्बे समय के लिए प्रभाव छोड़ता है।

- हमें कार्य करने से पहले हमेशा यह सुनिश्चित करना चाहिए की कहि हम किसी कार्य को गलत तो नहीं कर रहे है जिससे हमारे साथ हमारे परिवार पर संकट आ सकता है।
- हमारा कार्यस्थल एक तरह से हमारा दूसरा घर है जिसकी वजह से हमारा पहला घर चल रहा है इसलिए हमें हमारे कार्यस्थल की साफ सफाई उचित तरह से बनाये रखना चाहिए।

03. Suraksha Katha Sagar (Safety Audiobooks) – 25 Modules

Suraksha Katha Sagar is collection of safety audiobooks describing the case studies on safety
✓ It is simple and effective method of telling stories of safety that highlights the lessons learnt from different accidents involving unsafe behavior
✓ It is one of the best tools to make aware the workers for ensuring safety at workplace
✓ These simple short stories are played during mass pep talks & during job specific pep talks
✓ The workers are easily corelating these case studies with their personal lives & able to implement these learnings.
✓ They are prepared on various themes like height work, road safety, electrical safety, fire safety &

illustration 4

Suraksha Katha Sagar (Safety Audiobooks)

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SL. NO.	SUBJECT
01	Road Safety
02	Electrical Safety
03	Fall from Roof
04	Unauthorized working on Electrical Equipment
05	Fall from height while using mobile phone
06	Falling object from Height
07	Frame falling accident
08	Fan cover falling accident
09	Backstay falling accident
10	Drowning in water channel
11	Fall from Ladder
12	Fall from scaffold
13	Explosion in paint drum

SL. NO.	SUBJECT
14	Cylinder valve breaking accident
15	Gas leak explosion
16	Tree falling accident
17	MGR Accident
18	Crane overturning accident
19	BOT toppling
20	Fall of plate
21	Road Accident
22	Electrocution
23	Crane incident due to limit switch failure
24	Fall of Hanging Beam
25	Fire due to falling welding spatters

04. Playing of safety songs in lifts, through PA system & at Safety temple:

✓ Lifts / elevators are equipped with safety songs in plant & township premises to address behavior – based safety
✓ It is a positive approach to create safe work culture and ensure safe behavior of workers at site through playing of safety songs
✓ Safety songs at safety temple are played in each shift (Morning 8 AM to 10 AM, Afternoon 01 PM to 02 PM and Evening 05 PM to 06 PM)

05. SOP for Mass Pep Talk on weekly basis:

illustration 5

Date: _____& Time: _____

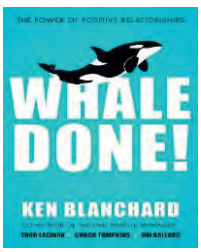
SOP FOR Mass Pep Talk

01. Location: Finalise
02. Welcoming all by Safety Department.
03. Playing of Suraksha Katha Sagar Audio clip
04. Safety Quiz for workers
05. Pep Talk Training: HOD (Safety)
    - Behavioral Aspect, wellbeing aspect
    - Personnel Hygiene
    - Sharing of incidents
06. Address by area executives – Job Safety Analysis
07. Safety speech by workers (Ensure two-way communication)
08. Safety Award distribution to workers for outstanding workers
09. Address by HOP / Head of O & M
10. Administering Safety pledge by HOP / Head of O & M
11. Refreshment

PRECAUTIONS/CONSIDERATIONS:

1. Audit team requires a shared sense of judgement regarding severity rating of an unsafe act.
2. Audit team members to be replaced preferably at an interval of six months so that more members can be brought onboard.
3. Safety Acts Audit is not to be used as a disciplinary tool.
4. **Focus on positive reinforcement. Catch people doing right things & reward them instantly. Readers are advised to go through this book "Whale Done" which describes the power of positive relationships. Negative reinforcement is to be avoided. Penalties, fines, gate pass impounding don't work in long term basis.**

illustration 6



Conclusion:

1. Innovative Tool Description: The explanation of SAI, its calculation, and its application is detailed and systematic.
2. The underlying factor for most of the incidents taking place worldwide is unsafe behavior of workers. Over 95% of all injuries & accidents were the results of the actions of the people.
3. Safety Act Index is a powerful tool to address unsafe behavior of workers in a non-threatening manner. It needs to be adopted as a leading safety parameter by the cross -section of industries of the country.
4. In most of the organizations, people look at equipment, facilities & procedures. They are ignorant of what the people are doing. It is high time; we need to be people centric to avoid injuries & have fool proof safety culture in our organizations. Behavioral safety mapping is the need of the hour.
5. Illustrations and Trend Analysis: The inclusion of quantitative data, tables, and graphs supports the argument that SAI is a remedy to control unsafe behavior prevailing in our workplaces.
6. Best way to improve safety culture is to pay attention & go to the workplace & look at what people are doing. This is also called Management By Walking Around (MBWA), observing people, talking to them, listening to their concerns, resolving their concerns, advocating good safety behaviors. This builds trust & interdependence.
7. SAI is not to be used as a disciplinary tool, however if someone refuses to live up to safety rules, then he/she has to go into progressive discipline system. Positive Reinforcement Focus: Emphasizing rewards and non-punitive measures shows a progressive approach to improving safety culture.
8. When consciousness of people is raised, people can pay better attention & avoid injuries & tragedies.
9. Example given of Station X in the Graphic -3 has improved safety behavior of workers by leaps & bounds & has featured in the top two power stations of the country for 2024 as announced by M/s National Safety Council on 31st Decemeber'24. This has been made possible by applying the sound principles of Behavior Based Safety. This station has injury free record of more than 7 years & 6 months. Case studies & results of station X demonstrate the effectiveness of SAI concept.
10. We need to embrace the concept of Safety Acts Index to ensure foolproof safety in our stations. The sooner we latch on to this bandwagon, the better it will be for our industries.

With our will & skill, we can make accidents nil

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