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WHITEPAPER

Crisis Response for Manufacturing Teams in the Process Industry

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by Andreas Eschbach

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1 Management Summary

"One of the reasons that humans can achieve so much is our ability to share ideas, information and instructions."

Dr. Andy Brazier, Human Factor and Process Safety Consultant, in "crisis communication" April-2020.

The strongest and richest form of human communication is face-to-face. Until the COVID-19 pandemic occurred, most people took this form of communication for granted.

Companies have contingency plans for a variety of circumstances and challenges – even calamities – that might occur. But very few, if any, contemplated a scenario like this pandemic with it hitting the entire world simultaneously and with great speed. As such, the resultant challenges along the entire value-chain also appeared simultaneously with some of the challenges interacting with one another and amplifying their seriousness and complexity.

In the process industry, we use face-to-face meetings for the shift handover, for morning meetings, for continuous improvement meetings, for Lean meetings on the shop floor, and for many more instances where communication between involved parties occur. With the pandemic and the requirements associated with social distancing, those meetings can no longer take place with people in close quarters for any extended period of time. As such, everybody must quickly determine and adapt to a new "normal".

This pandemic offers the opportunity to clearly demonstrate how much we can immediately benefit

from the digitization of communication processes; especially for those who haven't done it yet. And although the pandemic is an extreme case, there will always be the opportunity for some localized crisis which will require you to be agile, resilient, and engaging with great speed and clarity. However, by adapting to this new normal, your operations will be more efficient than before. In addition and considering the advent of artificial intelligence (AI) as it penetrates deeper into and across our businesses and its operations, AI will only reach its full potential if we incorporate human intelligence. This is especially true in the process industry where hazardous and complex processes are operated by highly skilled and experienced experts.

Customer Testimonial

"We have a lot of feedback from across the production site that Shiftconnector has become a powerful platform for providing information to all departments and to all shifts," said Mathias Gerchel, Manufacturing Technician, Roche Pharma.

"We have transitioned from multiple tools and applications to just the one solution from eschbach, making it much easier and allowing us to feel more confident and comfortable during this crisis."

See the full video testimonial:
https://www.youtube.com/watch?v=BhQrD5O1Umg&t=55s

Mathias Gerchel, Manufacturing Technician, Roche Pharma.

If data is the new oil, communication is the new jet fuel.

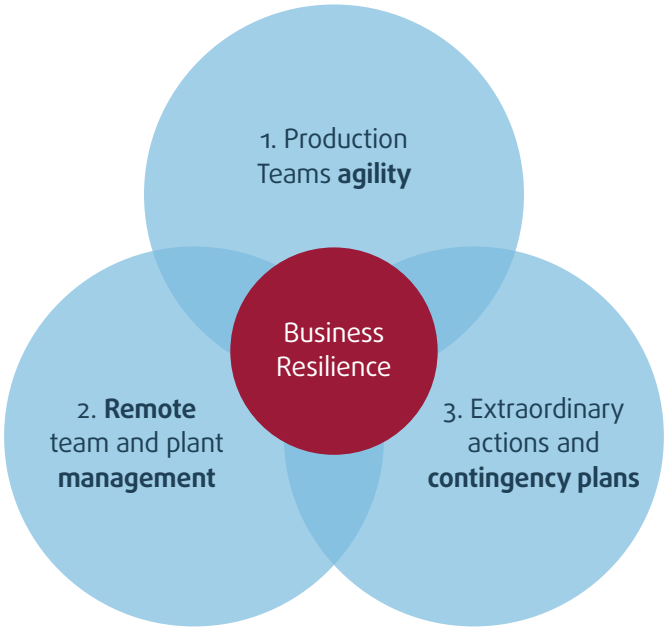
Customers who were already using Shiftconnector responded quickly after the lockdown and have been able to transition more easily. Their use of Shiftconnector lowered the shift-to-shift contamination and enabled their engineers to work remotely. The outgoing teams are connected virtually to the incoming teams and conduct digital handovers – and the engineers in the home offices can read the notations and observations and see the supporting photos or videos. Even as the shift is running, the outside operators are recording observations in real-time via mobile devices and sharing it with the board operators and their supervisors all in one contiguous communication platform. These capabilities that are required today will make your operation more agile and increase the overall business resilience.

2 Crisis Response Cycle

There are three main considerations, represented by the circles, which are important to the operation of your plant when responding to a crisis in manufacturing;

1. **Production team's agility:** To keep the availability of your shift teams, you need to reduce the shift-to-shift contamination.
2. **Remote team and plant management:** Enable plant managers and process engineers to work remotely and do this effectively and efficiently.
3. **Extraordinary actions and contingency plans:** Be prepared to downsize your production team and handle additional critical actions.

The actions which you take today are vital for the resolution of a crisis and will also be beneficial for the resilience over time. Addressing these three considerations correctly will result in your plants operating with greater agility establishing "Business Resilience".



3 Production Team's Agility

The first and most important circle represents your frontline people! We all learned about "Social Distancing" with the appearance of COVID-19. This is the first and most effective action that can be taken to reduce the contact between people and to reduce the shift-to-shift contamination.

Since the process industry consists of many hazardous processes, this is not as easy as it sounds. Many layers of protection depend on the cooperation between people. For example, the shift handover requires a conversation, many assessments depend on interdisciplinary collaboration, and most execution of work depends on a 4-eyes principle.

3.1 Reduce Shift-to-Shift Contamination – Replace Face-to-Face

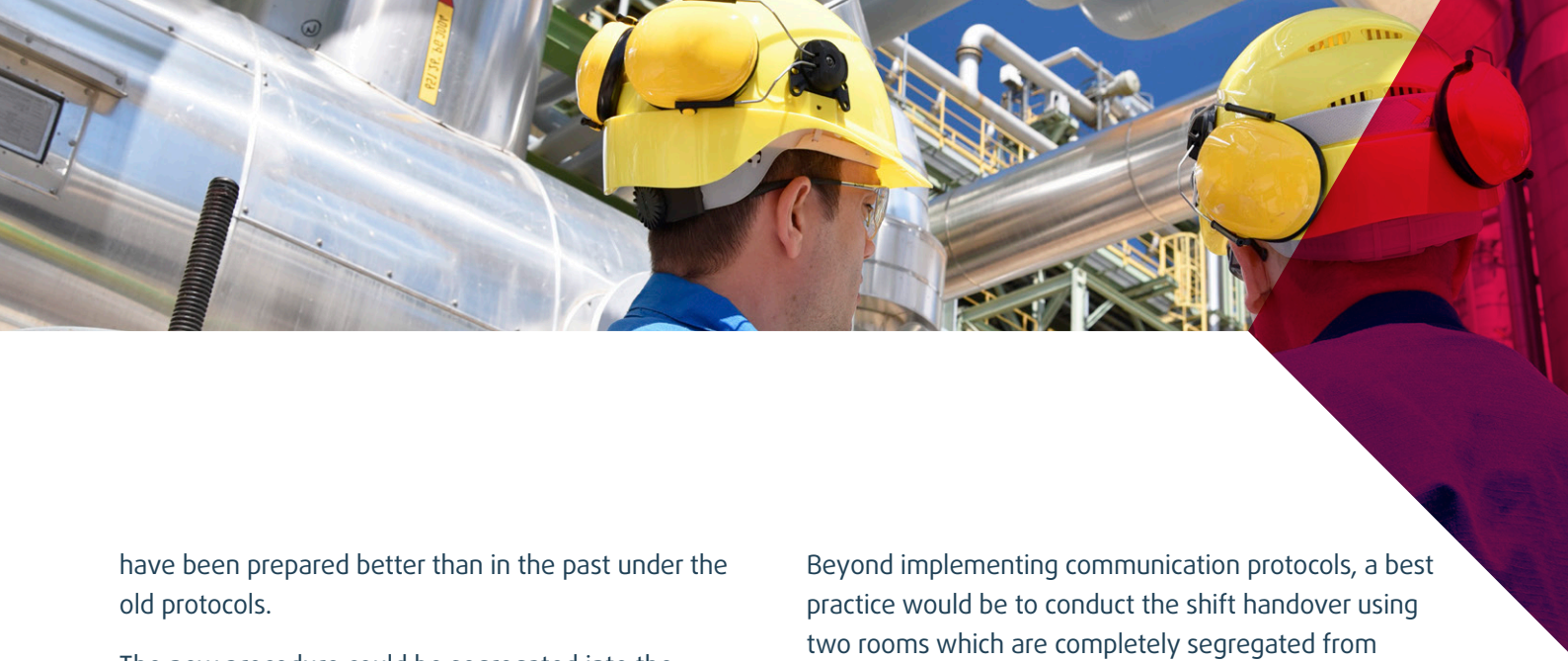
Obviously, a very vulnerable point in the operation of a plant is the shift handover, which relies on a combination of passing information in written and verbal form from one shift to the next – and is the combination of tasks that all experts in the industry recommend. Especially critical is the verbal exchange of information which would be best executed as a face-to-face meeting. Therefore, an overlap of shifts for 15 to 30 minutes is implemented in nearly all full-continuous plants to accommodate this need for verbal exchange.

With the pandemic and the contagion rate of the COVID-19 virus, this overlap time is more than enough for the virus to contaminate other colleagues who are in the shift hand-over meeting.

As the countermeasure to this risk, replace the face-to-face communication with a synchronous telephonic communication medium like a telephone or videoconference.

The best way to ensure there is a high-quality handover protocol in place is to use a handover management solution like Shiftconnector. Using Shiftconnector ensures that the outgoing team has collected and handed over to the incoming team all the necessary data and information before they leave the control room.

In normal times, where both shift supervisors meet at the same computer, the outgoing person more easily recognizes gaps in the data and information and can fill them instantly. Considering operating conditions under the pandemic, these people won't meet one another at the same computer. This means the outgoing shift must



have been prepared better than in the past under the old protocols.

The new procedure could be segregated into the following steps:

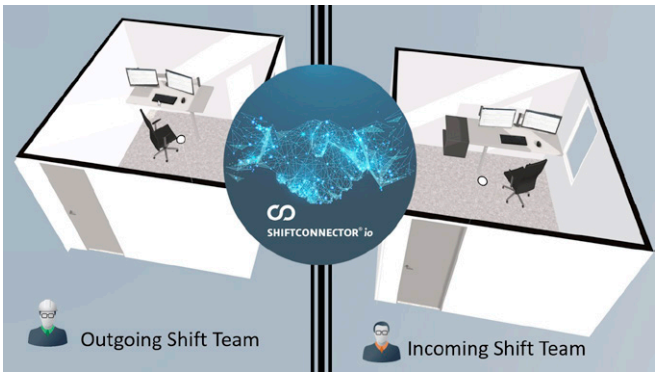
1. The outgoing team shares the data and details any necessary information in writing.
2. The outgoing team leaves the control room, performing any sanitization protocols that might exist before the incoming shift team enters the room. Both the outgoing and incoming shifts ensure they don't physically meet each other; not in the corridors, not in the dressing rooms, never.
3. The important addition is that there is a synchronous verbal exchange between the outgoing and incoming shifts by either telephone or video-conferencing solution as might be most appropriate.

It is important that during this verbal exchange, that both shift representatives have the same digital protocol in front of them – one source and version of the truth. This could be a tablet, or a notebook computer, or at the very least a printout.

3.2 Best practice setup

Technology differs from plant to plant and from company to company. Some technology depends on what your IT department offers and allows. Even during a crisis, the IT security is still important and needs to be considered before applying any changes.

Beyond implementing communication protocols, a best practice would be to conduct the shift handover using two rooms which are completely segregated from



one another – including segregated ventilation and environmental control systems.

Whether near to one another or not, the physical proximity to one another is only important to the extent the two shifts don't physically meet one another or share the same environment.

The proper outfitting of each room would include; desk and chairs, a whiteboard, and perhaps other visual management tools that might be appropriate. From a technology perspective, each room would also contain an office computer and two big screens as well as video conferencing software application and Shiftconnector.

One screen is used to share the handover protocol between the outgoing supervisor and incoming supervisor respectively so that both supervisors can see the same protocol. The second screen is used for two-way webcam telephony. If there is not enough

bandwidth for video conferencing, the second-best solution would be audio-only telephony where you can still share screens and speak with one another.

Please note, none of these options are as effective and efficient as a face-to-face meeting. But during this pandemic (and maybe for longer, even permanently), the shared screen video conferencing is the best.

Beyond the infrastructure you need an appropriate handover management solution with structured protocols and procedures which is outlined in the next three sections.

3.3 Prepare the Shift Protocol Continuously

The process industry is unique in the complexity and diversity of their plants. Even within a single company, each plant is likely to be different and it would be rare to find two equal production plants in the world for a variety of reasons.

Consequently, each shift organization looks slightly different. This means there are locally different roles with specific responsibilities and accountabilities for board operators and outside operators as well as shift supervisors. In addition, there are global unified responsibilities like immediate responds leader, HSE-, Quality- and GxP-responsible which are assigned to different managers.

A digital solution capable of structuring the information according to those roles is more likely to be accepted by your shift people; and is why an enterprise needs global standards and local adaptions.

The person executing a certain task or making a certain observation should have a specific digital form at their hands. These forms, such as an incident report, work permits, or loss accounting, can be standardized across the company.

Question to be answered:

- Who and When?
- What happened?
- What did they do?
- Which equipment?
- "Why" did they do it?
- Escalation required?

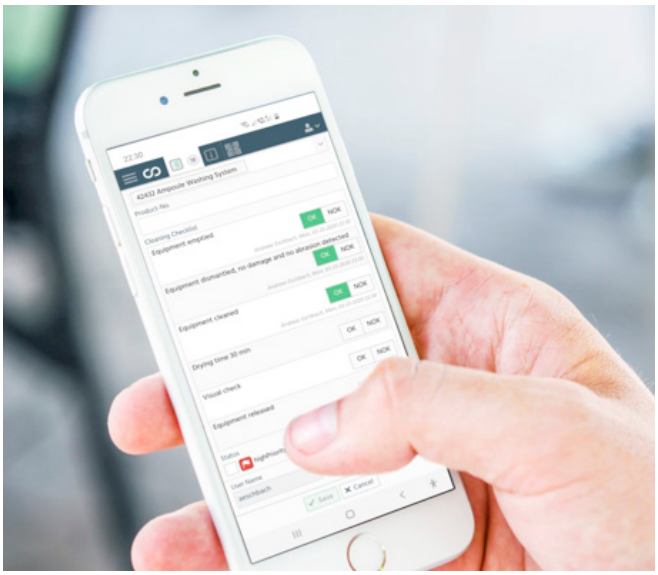
Digital solution simplifies the answers with audit-trail, auto filling and dropdowns.

Imported data reduces double work.

Imagine a person on the **night shift who is alerted to answer** the right questions, capture the right data, and executes the right actions; all the while thinking ahead. Beyond that, other people reading the information will be able to understand faster because everyone is **following a structured communication process**. Furthermore, senior staff who arrive in the plant after 6am are already equipped with the information instead of their having no opportunity to ask a question of someone who has already left for the next several days due to the shift pattern.

The solution enables **decentralized data acquisition**. Think about a shortage of personnel. Each person on shift documents their information and enters their data themselves. This brings the single individual out of the shadows of the team and ensures accountability to the single person.

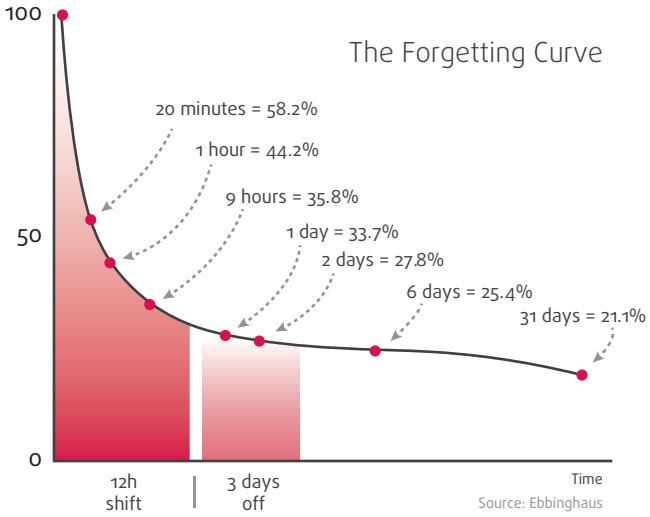
Because each record is available simultaneously on all devices, it helps to keep the shift supervisor on top of all documentation and allows the supervisors to engage and add further comments. The frontline people are the



eyes and the ears of the entire team. They can record videos and take photos and share with everyone – even the senior people at home.

Writing down immediately upon the experience is essential, because **forgetting is human nature**. After 20 minutes we can only repeat 58% of the information we read before (Refer. Ebbinghaus Forgetting Curve). But consider during these times of the COVID-19 pandemic; imagine an operator who is worrying about their health and what they are more likely to forget during an 8- or 12-hours shift. You want them to continuously write down what they are experiencing and that nothing falls between the cracks.

Record the decisions with the "why" in mind. In these unstable days during the pandemic, each person needs



to be prepared for not showing up to the next shift. You want for others get along without you and for you to be able to get along without others. This makes diarizing events, activities, observations, and decisions even more important.

Think especially about the "why" and put the reason why something is of note into your comments.

Your DCS and process historians are full of data. But you will not see the communication of others nor their thoughts and their decision-making process. Yet we all need to learn to share those thoughts. And there is nothing wrong with making an assumption; the only thing that would be wrong is not to communicate on which assumptions your decision has been based. This is especially true in those processes which are hazardous and where we need to be highly transparent.

3.4 Prepare the Shift Handover

A good shift handover needs preparation because the first 3 to 4 hours of operation are inherited from the

shift before. As the shift comes close to ending, the shift supervisor needs to get ready for the handover.

Depending on the size of the shift teams, we recommend the shift handovers across all the shift teams occur in parallel; from Board-Operator to Board-Operator and from Shift Supervisor to Shift Supervisor.

That also means the scope and protocols of those handovers needs to be specified in a documented Standard Operating Procedure and a solution like Shiftconnector will help you to manage this properly.

The following are examples of content for such handovers:

1. **Status of Safety critical systems:** Could be imported from your DCS and extended with human context. Due to social distancing, people can't walk together through the control room. So, it might be appropriate to attach a screenshot to be prepared for the handover call.
2. **Status of production:** Means where is your batch in the production process and what steps come next. Sharing KOP or trends of your high-volume plant among shifts is important. And think about white boards – perhaps sharing photographs may satisfy the need.
3. **Executed activities:** Such as an observation while executing a safety round, or a released maintenance notification, or a changed set-point – together with the "why".
4. **Ongoing work and priorities:** Anticipate what the next shift team needs to know and what it needs to do? For example: There is an active work permit for an ongoing maintenance activity. You are running out of raw material in 4 hours.

3.5 Execute an Excellent Shift Hand Over

Even in normal times the shift hand over is a **critical moment** since there are also a lot of human factors relevant: outgoing shifts might be exhausted, and incoming shifts might be coming back after four days off and need to build their mental models in their minds. This is even more difficult through any crisis, since additional pressures weigh on every single person.

Those of you who are new to Shiftconnector, reading these several statements about required structure and you might think: The structure of today could be the limitation of tomorrow.

That's why Shiftconnector has a WYSIWYG Form-Designer; to edit such overviews, protocols and forms. You can do that yourself without vendor or IT support. Given an 100% audit trail, this ensures version-controlled forms and tamper-proof records.

All experts recommend that a handover needs to be **both in writing and verbal**. Many investigation reports about fatal accidents recommend this combination. Given the circumstances, this means we need to digitize the written record and replace the face-to-face verbal with a telephonic solution.

Talking stays important during any crisis because synchronous communication allows time for asking questions and ensures the messages are received. So you need to make sure your teams take enough time to talk. During the pandemic and to meet the requirements of social distancing, allow for an increase in the handover time by 5 to 10 minutes because the updated shift changeover protocols may require more time to complete than before. Increasing the handover time gives everybody the opportunity to ensure all essential communications have occurred and could be a supportive management instruction to underline the importance of the conversation.

The handover conversation follows the **structure** of the handover protocol. Both the outgoing and the incoming shifts must see the same protocol on their devices. The outgoing lead the handover conversation. They should explain line item by line item.

The communication protocol is similar to how a pilot of an aircraft would communicate with ground control in a **three-step conversation**;

1st Sender states a **message**,
2nd receiver **repeats**,
3rd sender **acknowledges**.

Whenever there are **relevant discussion** points or events during a shift, they are captured and notated as additional "information". This helps to ensure the situation or event is captured for the next shift as well as for senior people working remotely. To ensure people have communicated, you can also **request digital signatures**. Furthermore, we recommend segregating the handover from the startup meeting. The shift **startup meeting** should be an additional activity after the outgoing team has left the call.

If you don't already have **procedures in place**, create them now in detail. Especially in cases where normal face-to-face is not possible **how they must replace the face-to-face** handover with remote communication.

4 Enable Remote Teams to Work Effectively

The second circle addresses remote teams. To reduce the contamination of the shift teams, the managers and process engineers will not be able to access the control rooms or plant buildings as often as they would in normal times. Sending the engineers and plant managers to their home office sounds easy, but since the process industry consists of hazardous environments, it is not as easy as it is for many other industries.

"We need to be careful how we do this", mentions Dr. Andy Brazier in a webinar conducted in early April 2020. He went on to share the background of an explosion that happened in 1998 in Australia several months after all engineers had been moved to a remote location.

With the appearance of the COVID-19 pandemic we experience for the first time how much we depend in business on face-to-face communication. There is a lot of informal and formal communication that occurs in normal times each day. Much of the informal communication ensures that everything operates as it should. Furthermore, while communicating there is non-verbal communication (such as a nod of the head) which ensures that the sender realize that the receiver understands. In a phone call or in a video conference it is hard to catch those non-verbal parts.

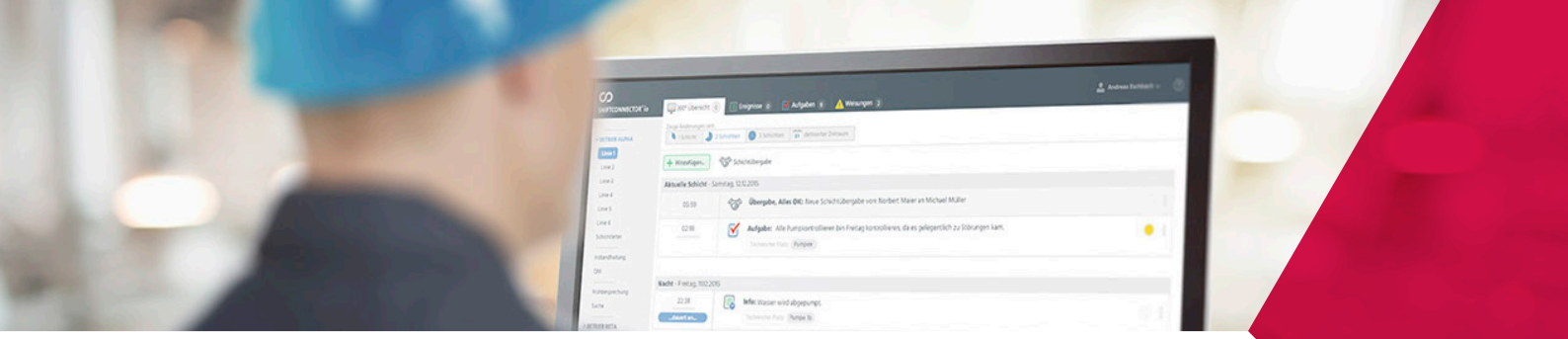
4.1 Work Anywhere

Implement Workplace Flexibility: Work which does not necessarily need to be done in the plant, needs to be executed remotely. That means the infrastructure for the senior team and remote access must be available. Instead of purely thinking about the home office, it's better to think about working anywhere to be ready for another crisis.

Access and share information: Frontline people need to share their observations. And the mangers and engineers in their home-offices need to be precise with the instructions so that even shift workers who did not participate can understand the tasks.

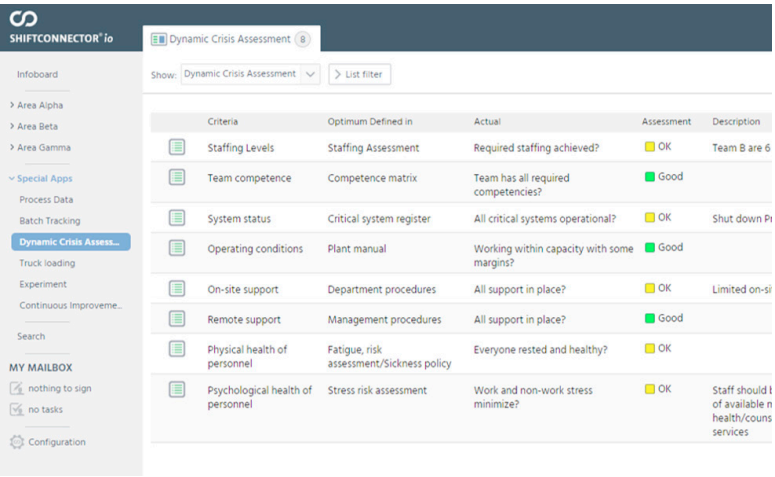
Efficient Remote Video Meetings: Working remotely with all the digital tools which we have available also has its downsides. The following could help to improve the efficiencies:

- Pre-announce and plan meetings. Don't call in randomly.
- Take the attendees out of the control room. Especially during a crisis, you should have rooms free in your production buildings so only the required people need to contribute, and others are not distracted.



- Share a screen like a “morning meeting” overview, to keep everyone focused.
- Taking notes of the meeting and share tasks.

During the pandemic a daily traffic light assessment could be easily added to Shiftconnector. It could be done each day new and shared with everybody in the control room and off-site. There is an example of those traffic lights.



The assessment results based on the criteria above can be used as follows:

Assessment	Outcome	Action
>4 OKs or >1 unacceptable	Red	Stop operations and put into a safe hold position until conditions improve.
<4 OKs or 1 unacceptable	Amber	Reduce workload. Increase vigilance and be prepared to stop operations.
All good	Green	Operations can continue as planned

4.2 Page vs. Records based Approach overcomes

Working remotely should not result in significantly more emails for your production teams.

We all struggle with a large amount of emails. Imagine a shift supervisor who returns after four days off and needs to find out which of the engineers’ instructions are still relevant. He will be sifting through dozens of emails and hopeful to find all of the facts. Some hours later he remembers there was something but doesn’t remember each detail and he starts searching through them again. Remember the forgetting curve mentioned before? After 20 mins we forget already 42% of the content.

This feels like sifting through a stack of folders and papers. The same with page-based documents as Emails, Excel-sheets and Word processors.

The solution is to switch from a page-based approach to a **record-based approach** and which is implemented in "Shiftconnector"; allowing for multi-dimensional views and connecting records across multiple shift reports. Furthermore red-flagging items will call to attention issues which require special attention and becomes part of the production team reporting.

It will also connect shift records with records in other mission critical systems like maintenance orders in SAP PM® or IBM Maximo® as well as losses from the historian like an OSIsoft PI®. This records-based reporting principle allows to sort and order key details at the push of a button, allows for a search in historical records, and helps you build a knowledge base of your production plant.

4.3 Establish a Communication Platform and Knowledge Organization

This pandemic shows us how much we immediately benefit from the digitization of communication processes. And here we find additional communication that is invaluable to be considered other than the shift changeover in a platform where every **operations communication** runs through it. For instance, you could digitize; the morning production meetings, the Lean and improvement meetings, organize night instructions, and gather the feedback in a **communication platform** which connects the people on- and off-site. Our customers are usually able to replace 5 to 10 different Tools and Excel-spreadsheets, and significantly reduce emails.

With a managed communication processes like in Shiftconnector, you ensure better communication which keeps everybody, everywhere, informed and aligned. Adapting to the new normal makes your operations more efficient than before and prepares you for the next crisis by increasing your agility and business resilience.

The Shiftconnector solution was developed over the last 15 years. It was designed to ensure **transparency and visibility** across the functions and roles on the left side of the figure above – helping them to become **high-performance teams**. And it contains an integration with other mission critical systems as shown on the right side. Having all communication in one platform **reduces the risk of miscommunication**. With the Shiftconnector solution you start the process of digitalization now and move towards becoming a **knowledge organization**.

Lastly, the information and human intelligence captured by the Shiftconnector solution will serve as the **wisdom repository** for our aspirations and journey **towards artificial intelligence**.

5 Extraordinary Actions and Contingency Plans

The 3rd circle in our crisis response helps to keep us up and running and acting spontaneously.

Remember the time before COVID-19, if somebody would have told you that a virus caused a major shut-down in your production, the first picture in your mind would have been corrupted **OT/IT systems**; as happened in several plants in the middle of 2010 where the Stuxnet computer virus hit the OT-systems.

Now a **virus that infects humans has interrupted the human communication** of your production teams and engineers. Even if certain guidelines for contingency plans – like in the pharmaceutical industry require plans for pandemics – most of us did not spend so much attention to this field.

5.1 Contingency Plans

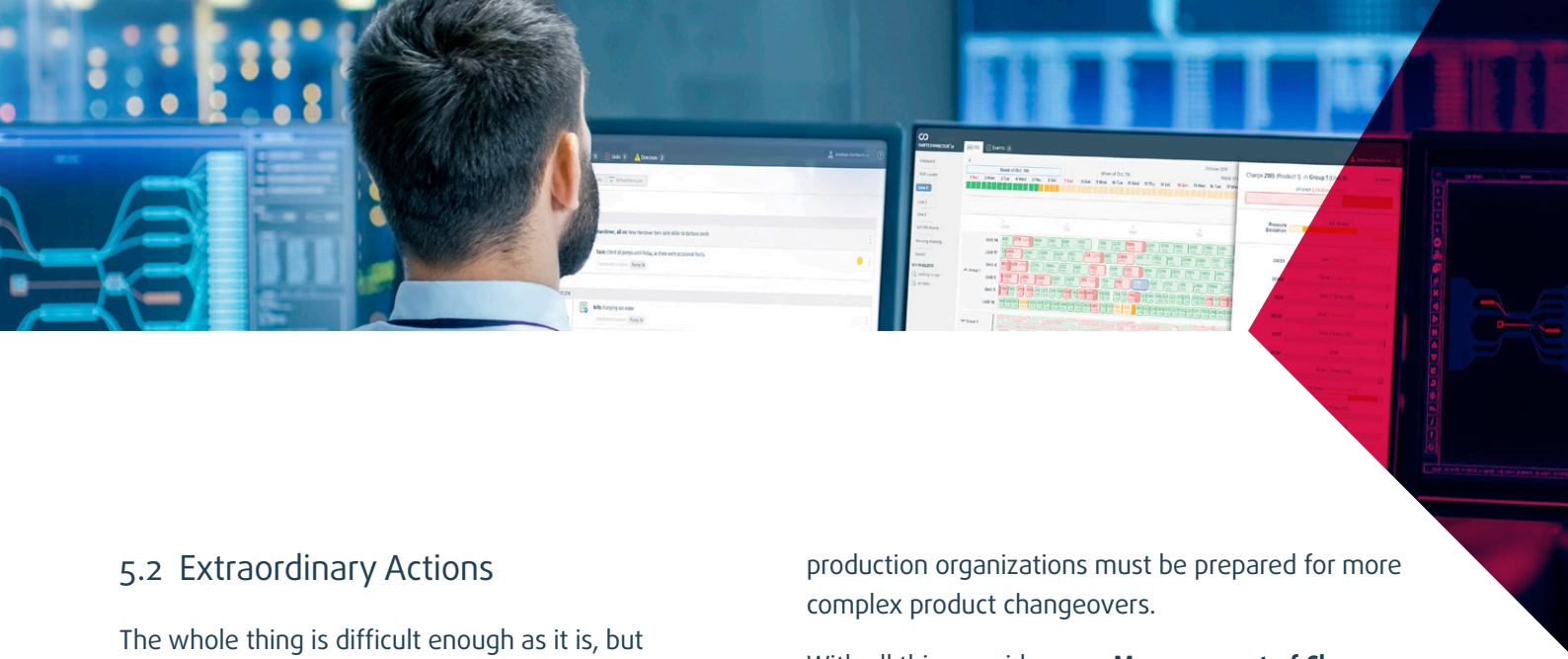
Be prepared for further **downsizing** of your personnel.

Customers reported that they have **changed their shift cycles** to 14 days on and 14 days off. This gives them some time, in case of one person is tested positive, to test the others. Consider options for conducting essential operations with a reduced workforce. Those new shift patterns requires the incoming shift team examine a longer period of absence and needs better search functionality.

You cannot rely on **physical access to documents**. One of the biggest limitations is paper. And the next is single page digital documents like spreadsheets. Even cloud-storage and real-time synchronization can't cope with the requirements. You need a 100% audit trail to have accountability and tamper proof records. Furthermore, digital access simplifies to handover tasks remotely, in case an engineer needs to handover.

Replaced Workers. Mitigation for gaps in the workforce could be to bring back former shift workers who have been promoted. Some others might have trained people across different jobs in order to continue operations. There are even users of Shiftconnector who are using the training functionality for "Micro-Learnings" with videos to retrain their personnel.

Be prepared for **Long term absence of key personnel**. As mentioned earlier, each of us needs to complete their shift or workday successfully, so that others can get along without us.



5.2 Extraordinary Actions

The whole thing is difficult enough as it is, but extraordinary actions must be considered.

First, you need **restrict the access** to your control rooms. You might already have a digital shift presence sheet for your crews in place. We suggest writing down all the other people who entered the control room. Like a manager or a maintenance contractor who fixes an urgent problem. This would help in tracing who else might have been exposed and infected in case a person tests positive.

Another issue is the interruption of supply chains. This can result in some manufacturers ordering raw material from secondary vendors and which results in more temporary and special instructions. These can be captured and shared in Shiftconnector with the shift teams with full digital signature tracing.

A similar issue occurs in case of delayed deliveries. Imagine a truck arriving late after the logistics department has already closed. Due to a shortage of supply, this delivery is urgently needed. The engineers and managers who expect the truck to be unloaded should have released a special instruction of what to do and which safety measures must be met before they start.

Product Changeovers. While several countries encountered a shortage of sanitizer, several of our customers – like BASF, Bayer, DSM and Lonza – started to produce sanitizer who did not produce them before. Although sanitizers change-overs are rather easy, many production organizations must be prepared for more complex product changeovers.

With all this, consider your **Management of Change process**. Always keep the big picture in mind. Good ideas in the short term might need to be reviewed and reversed in the near future.

We are sure challenges being faced by this pandemic requires much more agility from the management, the engineers, and shift teams. But remember that safety goes first. This means that a crisis is no excuse to allow uncoordinated and undocumented changes. Maintaining temporary instructions, such as those available in Shiftconnector, can help you be more agile while remaining crystal clear and safely organized.

By implementing a digital platform like Shiftconnector the right way, it will **increase the agility** and result in **higher business resilience** of your production organizations.

Photo: BASF SE

eschbach

We Can Help! Contact us!

www.shiftconnector.com
info@eschbach.com

Europe HQ: +49 (0)7761 55959-0
Bad Saeckingen, Germany

USA & Canada: +1 (617) 618-5261
Boston, MA

About eschbach and Shiftconnector

We help production teams stay safe and work smarter through better information sharing and collaboration. Eschbach provides solutions for effective shift handovers, transparent team communication and increased asset performance. For over 15 years, our award-winning Shiftconnector® solution has brought shift teams together to improve safety and performance. In that time, we have continuously developed Shiftconnector® in close cooperation with leading organizations in the chemical industry. Companies like BASF, Bayer, Roche and DuPont engage their workforce with our easy to use, yet powerful solution. Eschbach is a provider of manufacturing solutions and headquartered in southern Germany with offices in Boston, Mass.

Additional information

- Dr. Andy Brazier, Crisis Communication, 2020, https://www.eschbach.com/en/blog/posts/webinar-social-distancing-for-your-plant.php
- OSHA guideline COVID-19, https://www.osha.gov/Publications/OSHA3990.pdf
- Your local health and safety authorization as well as your organizations guidelines.