Note:

- Our responses

Safety Form

Due July 21 (Preliminary) / September 1 (Final)

This form is for you to tell us about your safety training, the organisms/parts you are using, the potential risks of your project, and what you have done (or will do) to minimize those risks.

- By **July 21**, you should submit a **Preliminary Version** of this safety form. Even if you are only just starting your project, please submit the form anyway. Answer as many questions as you can, and leave blank the questions you cannot answer yet. We encourage you to tell us about any (or all) of the project ideas you have, not only ideas on which you have made substantial progress.
- By **September 1**, you must submit a **Final Version** of this safety form. On the Final Version, you should answer all the questions.
- If you need **extra time** to complete the Safety Form, please email safety AT igem DOT org. You may request extra time for any reason.
- If you need **help**, start by asking your faculty advisor or lab manager. You can also read the Safety Hub, or email safety AT igem DOT org.
- We encourage students, rather than instructors, to complete the Safety Form. Once it is complete, an Instructor or Primary Contact should review the form, and press Submit from his or her own iGEM.org account.

You are completing this form for Team **UCL**, and your role on this team is **Student**.

This form will remember what you type, in case you need to leave this page and return later.

Team member who should be contacted about this form:

Name Behzad Karkaria

Email behzad.karkaria@kcl.ac.uk

1. Your Training

a) Have your team members received any safety training yet?

- Yes, we have already received safety training.

b) Please briefly describe the topics that you learned about (or will learn about) in your safety training.

In our safety training we covered the following: first aid; fire safety; building security; identification of potential (lab) hazards, filing risk assessments, and minimising risk; reporting faults; lab safety wear (conduct, clothing, safety glasses/goggles, gloves); use, storage, and safe disposal of biological and chemical materials and wastes; use of fumehoods and biosafety cabinets; transfer of material between labs.

c) Please give a link to the laboratory safety training requirements of your institution (college, university, community lab, etc). Or, if you cannot give a link, briefly describe the requirements.

All lab users must undertake a safety induction, and be taught lab techniques by experienced personnel.

2. Your Local Rules and Regulations

a) Who is responsible for biological safety at your institution? (You might have an Institutional Biosafety Committee, an Office of Environmental Health and Safety, a single Biosafety Officer, or some other arrangement.) Have you discussed your project with them? Describe any concerns they raised, and any changes you made in your project based on your discussion.

Within the Department of Biochemical Engineering, we have departmental safety officers, and a safety committee. The key safety personnel we'll interact with are:

Prof. Nigel Titchener-Hooker - Head of Department;

Dr. Brian O'Sullivan - Departmental Safety Officer & Chemical Safety;

Ms. Elaine Briggs - Departmental Safety Officer;

Prof. Eli K-Moore - Safety Committee & GM organism Safety

Dr. Darren Nesbeth - Safety Committee

b) What are the biosafety guidelines of your institution? Please give a link to these guidelines, or briefly describe them if you cannot give a link.

http://www.ucl.ac.uk/estates/safetynet/guidance/substances/acop.pdf

c) In your country, what are the regulations that govern biosafety in research laboratories? Please give a link to these regulations, or briefly describe them if you cannot give a link.

http://www.hse.gov.uk/aboutus/meetings/committees/acdp/080609/acdp-92-p13a-annex1.pdf

3. The Organisms and Parts that You Use

Please visit this page to download a blank copy of the spreadsheet for question 3. (If you need a CSV version instead of XLS, visit this page.)

Complete the spreadsheet. Include all whole organisms that you will handle in the lab, whether you are using them as a chassis or for some other reason. Include all **new** or **highly modified** protein coding parts that you are using. If you submitted a Check-In for an organism or part, you should still include it in this spreadsheet.

You may omit non-protein-coding parts, and you may omit parts that were already in the Registry if you are using them without significant modifications.

Upload Spreadsheet -- Please do not change the "Destination Filename"!

You may upload multiple versions of your spreadsheet. The wiki software will keep track of different versions and list them in chronological order.

http://2014.igem.org/File:UCL_Safety2014_Spreadsheet.xls

4. Risks of Your Project Now

Please describe risks of working with the biological materials (cells, organisms, DNA, etc.) that you are using in your project. If you are taking any safety precautions (even basic ones, like rubber gloves), that is because your work has some risks, however small. Therefore, please discuss possible risks and what you have done (or might do) to minimize them, instead of simply saying that there are no risks at all.

a) **Risks to the safety and health of team members, or other people working in the lab:**

Ethidium bromide (EtBr) is mutagenic and moderately toxic. To counter this, all work with EtBr takes place in a fumehood with protective gear (gloves, safety glasses and lab coats). All EtBr waste is disposed of separately.

All team members will be trained in standard microbiological handling safety techniques limiting the risks associated with handling E.coli.

Azo dyes are mildly toxic and may cause genetic mutations. Laboratory experiments have shown mutagenic and carcinogenic effects after ingestion. Their breakdown products are also known to be mutagenic and carcinogenic. Again, all work will be done using protective gear, and dyes will be disposed of separately.

b) Risks to the safety and health of the general public (if any biological materials escaped from your lab):

Our genetically modified organism (GMO; E.coli) may be capable of proliferating outside the lab. Azoreductase, the main enzyme being incorporated into our GMO, may degrade compounds with azo bonds potentially producing toxic aromatic amines.

c) Risks to the environment (from waste disposal, or from materials escaping from your lab):

Our GMO may be capable of proliferating outside the lab disturbing the ecosystem, despite E.coli already being present in the natural environment. Azoreductase can also be found naturally in some E.coli strains, and other micro-organisms.

d) Risks to security through malicious mis-use by individuals, groups, or countries:

As mentioned, the gene functions being incorporated into E.coli can also be found naturally in E.coli strains and other organisms (e.g. Bacillus subtilis and Pseudomonas sp.) so it should pose little risk.

e) What measures are you taking to reduce these risks? (For example: safe lab practices, choices of which organisms to use.)

Appropriate safe microbiological practice. Careful use of gloves, goggles, lab coats etc. Not to take substances/materials out of the building. All organisms being used are at security level 1.

5. Risks of Your Project in the Future

What would happen if all your dreams came true, and your project grew from a small lab study into a commercial/industrial/medical product that was used by many people? We invite you to speculate broadly and discuss possibilities, rather than providing definite answers. Even if the product is "safe", please discuss possible risks and how they could be addressed, rather than simply saying that there are no risks at all.

a) **What *new* risks might arise from your project's growth? (Consider the categories of risk listed in parts a-d of the previous question: lab workers, the general public, the environment, and malicious mis-uses.) Also, what risks might arise if the *knowledge* you generate or the *methods* you develop became widely available?**

The long term aim is to incorporate our method of azo dye detoxification and decolourisation system as an industrial-sized bioreactor, to be used to remove excess azo dye wastewater/effluent at the source.

Risks from the project's growth (up-scale) arise in the task of safely containing and maintaining a large quantity of our GMO in a large bioreactor and preventing its escape into the environment.

Lab workers will still require standard microbiological safety training and the use of protective gear, but they will also need to know how to safely maintain a large bioreactor of GMOs. Correct maintenance should theoretically pose low risk to the public and the environment. Similarly, as the functions are found naturally in the environment, it is unlikely it will/can be maliciously mis-used.

If our methods become widely available, it is possible some members of the public may attempt to recreate the same process, and potentially procure azo dyes to degrade. If they do so, and do not successfully process/dispose of the toxic azo dye breakdown intermediates, there is a chance they may be exposed to mutagenic reagents/release these products into the environment.

b) **Does your project currently include any design features to reduce risks? Or, if you did all the future work to make your project grow into a popular product, would you plan to design any new features to minimize risks? (For example: auxotrophic chassis, physical containment, etc.) Such features are not required for an iGEM project, but many teams choose to explore them.**

We plan to incorporate a few fail-safes to reduce risks from our bioreactor processor and GMOs. This includes the incorporation of our GMOs into a closed-system bioreactor at designated industrial factories that have undergone checks that allow the safe use, maintenance, and containment of the GMOs and bioreactor. This should prevent the release of the organisms into the natural environment.

However, we also plan to incorporate xenobiology into our GMOs, which would restrict its survival outside in the wild. We intend for our GMOs to exist as part of a symbiotic relationship in which each organism provides an essential (synthetic) vitamin to the other(s); such that if one is released into the wild, it will not have the appropriate nutrients to survive and proliferate.

If the project does reach large-scale proportions, we will also consider incorporating a kill switch into the GMOs as well.

6. Further Comments

If you are completing a Preliminary Version of your Safety Form, use this space to describe how far you have progressed in your project, and give some comments about any questions that you left blank.

You can also use this space for any other comments or additional material.

Submit

Only a team Instructor (or Primary Contact) may submit the Safety Form.

Instructors, please read the form you are submitting, and confirm that all its information is correct. By checking the "I Agree" box and clicking the "Submit" button, you are agreeing that the Safety Form accurately describes the activities of your team. We are using the "I Agree" box in lieu of a signature with paper and pen.

I Agree

Behzad Karkaria