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United Nations  
Interregional Crime and Justice  
Research Institute

OPCW

# Compendium of Best Practices

ON THE ENGAGEMENT AND  
ADVANCEMENT OF WOMEN IN  
CHEMICAL SAFETY AND SECURITY



Co-funded by  
the European Union





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# Foreword

In today's globally interconnected, technologically advanced society, "science" is rapidly gaining traction as a core field driving peace and prosperity as well as social and economic advancement. The knowledge provided by science, and "chemistry" as a sub-discipline, is fundamental to daily human life, spanning social, environmental, political, biological and technical realms that are experienced by all genders. Improving scientific literacy has, therefore, emerged as a priority for maintaining safety, stability and security in these realms.

As the ambition of the 2030 Agenda for Sustainable relies heavily on "innovation" and "equality", the international community is advocating and supporting efforts to increase the number of people working in the fields of science and technology.

Women and girls represent half of the world's population, half of its potential, and capacity to effectively spur productivity, technological and scientific advancement, and economic growth, while maintaining peace and stability within their communities.<sup>1</sup> Women's resilience and strength at times of crisis, displacement and chaos have held families and communities together and kept a measure of stability.

The United Nations recognized "Gender Equality" as a global priority and "necessary foundation for a peaceful, prosperous and sustainable world" in its Sustainable Development Goal 5. Additionally, in its Women, Peace, and Security (WPS) resolutions, the United Nations Security Council

1 World Economic Forum (2022). Global gender Gap Report 2022. Geneva, Switzerland: World Economic Forum: [https://www3.weforum.org/docs/WEF\\_CGGR\\_2022.pdf](https://www3.weforum.org/docs/WEF_CGGR_2022.pdf)

(UNSC) stressed the importance of the equal participation and full involvement of women in all efforts for the maintenance and promotion of international peace and security.

Notwithstanding the global progress made towards achieving gender parity for labour-force participation (62.9% in 2022) and the inclusion of women into paid jobs and leadership positions (36.9% in 2022),<sup>2</sup> a multitude of factors continue to play a major role in determining the traditional patterns for career selection, particularly in male-dominated sectors, such as the chemical safety and security field. Such factors include, among others, perceived gender roles, societal expectations, workplace policies, opportunities for career advancement, and the availability of equitable support.

While women continue to play an increasingly important role in the chemical sciences, including “heading multinational chemical companies, leading chemical societies, and steering cutting-edge research,”<sup>3</sup> they are still underrepresented in other important chemical safety and security functions. The increased engagement of women is particularly relevant, considering their designation as a vulnerable group disproportionately exposed to hazardous chemicals.

The Organization for the Prohibition of Chemical Weapons (OPCW) and the United Nations Interregional Crime and Justice Research Institute (UNICRI), in close cooperation with international partners, stakeholders and practitioners, recognized the asymmetric portrayal of women and men in chemical safety and security; both in global literature and policy debates. To this end, the above mentioned entities decided to address this gap by developing a compendium

2 World Bank (2019). *Population, female (% of total population)*: <https://data.worldbank.org/indicator/SP.POP.TOTL.FE.ZS>

3 Arias, Fernando (2019). Women Scientists Discuss Responsible Culture in Chemical Safety and Security for Future Generations. In: *Women in Chemistry Symposium*. The Hague, Netherlands: OPCW: <https://www.opcw.org/media-centre/news/2019/06/women-scientists-discuss-responsible-culture-chemical-safety-and-security>

of best practices that would amplify women's voices and promote opportunities to increase their engagement in this important field.

The Compendium on “Engagement and Advancement of Women in Chemical Safety and Security” aims to provide policymakers and practitioners in the field of chemistry with guidance to promote gender inclusivity in the chemical safety and security sector through the identification of best practices in recruiting, training and promoting gender-inclusive careers.

We are grateful to the European Commission for funding the research that led to the production of this Compendium as part of the Women in Chemistry project. The Compendium builds upon the achievements of the annual symposiums on Women in Chemistry implemented by OPCW since 2016, notably in illustrating the strength and depth of contributions women have made to the peaceful uses of chemistry.

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In addition, UNICRI would like to thank all Women in Chemistry (WIC) network members who participated in the focus group discussions and surveys conducted within the framework of this project.

# Introduction

In 2016, the Organization for the Prohibition of Chemical Weapons (OPCW) launched the Women in Chemistry (WIC) symposium with the aim of providing an annual platform to discuss “a broad range of challenges and opportunities for women pursuing careers in the chemical sciences, in academia, in research, or in industry.” Each year, the symposium provides “an interactive forum for sharing experiences and advice that not only advance careers, but also build skills and opportunities.”<sup>4</sup>

The theme addressed during the 2022 WIC symposium is “Identifying Opportunities for Gender Diversity in Chemical Safety and Security” which includes opportunities for career advancement and training, as well as the value added by gender diversity in various roles and functions related to chemical safety and security.

To analyse the accessibility of chemical safety and security careers for women, UNICRI carried out quantitative and qualitative research. This started with the publication of a call for “Women in Chemistry”, an effort to develop an expert network in which women, active at varying stages of academic and professional careers in chemical safety and security, could share their knowledge and expertise with each other. Over 150 women from 60 countries have joined the network and were the primary contributors of this research.

4 Üzümcü, A. (2016). *Opening Remarks by Director-General Ahmet Üzümcü*: [https://www.opcw.org/sites/default/files/documents/ODG/uzumcu/DG\\_Remarks\\_to\\_Symposium\\_on\\_Women\\_in\\_Chemistry.pdf](https://www.opcw.org/sites/default/files/documents/ODG/uzumcu/DG_Remarks_to_Symposium_on_Women_in_Chemistry.pdf)

Women from the WIC network were invited to share their experiences, recommendations and best practices during three focus group discussions. The feedback received during the discussions, supported by desk research, formed the basis of a close-ended survey.

Quantitative and qualitative data gathered from 156 responses to close-ended surveys and the focus group discussions, as well as data from publicly available sources, were examined and elaborated to guide the drafting of this Compendium.

The gathering and analysis of such data is imperative for identifying and understanding persisting gender-based barriers impeding women's access to this sector, as well as opportunities for overcoming these barriers at a young age. This will not only encourage more females to pursue a chemistry education, but it will also boost their prospects of pursuing a career in chemical safety and security, a traditionally male-dominated field.

According to the research results, 96% of women survey respondents agreed that women can bring an added value to the chemical safety and security field, citing three key reasons:

**1 DIVERSITY AND BRINGING A WIDER RANGE OF PERSPECTIVES, TALENT, SKILLS AND EXPERIENCE;**

*I believe that women pay close attention to detail in the majority of technical work they perform, and in chemical safety and security, women would thrive far better because we are observant and notice things more quickly, hence identifying potential dangers before incidents/accidents occur.*  
(Survey respondent)

2

**PROBLEM SOLVING, WHICH IS ENHANCED BY DIVERSE KNOWLEDGE AND EXPERIENCE;**

*Since many women work in chemical industries, particularly at lower levels, women who participate in chemical safety and security have a significant advantage in assessing risk and danger. It is also essential to establish hazard and risk management mechanisms in advance. (Survey respondent)*

3

**MORE EQUAL REPRESENTATION OF WOMEN, A POPULATION UNIQUELY IMPACTED BY CHEMICAL RISKS.**

*There is no gender restriction on introducing and implementing chemical safety and security because accidents and incidents can occur to anyone, regardless of gender or other factors. Therefore, chemical safety and security is the responsibility of all of us with expertise in this subject. (Survey respondent)*

Emphasizing the need to enhance gender inclusion in chemical safety and security, survey respondents and focus group participants selected a variety of enabling factors that, in their view, would facilitate women's career access and advancement. Identifying and analysing these factors is necessary to achieve gender parity in the sector by establishing and sustaining healthy, impartial pathways for

entering and advancing a career, as well as establishing a diverse workforce comprising talents from both genders. It is essential to recognize that such diversity is instrumental for facilitating the development of more innovative and effective sustainable solutions for anticipated risks associated with chemical exposure and hazards.<sup>5</sup>

The following chapters will investigate some of the identified key enabling factors for engaging and advancing women in chemical safety and security, as well as recommending and showcasing best practices for addressing challenges related to the applicability of these factors. In essence, all efforts aiming at attaining gender equality in the workplace commence with addressing gender prejudices stemming from deep-embedded, widely accepted cultural and societal norms, perceived gender roles, and implicit bias. Without addressing these issues, there is a risk that gender discriminatory workplace practices and regulations would proliferate unchecked, perpetuating inflexible, exclusive, and male-dominated cultures.

5 UNIDIR (2008). *The Value of Diversity in Multilateral Disarmament Work*. New York and Geneva: United Nations Publications







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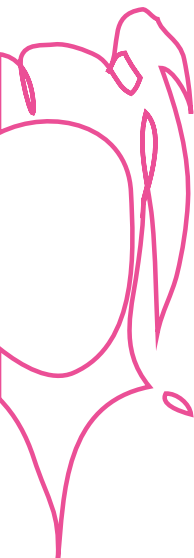
# 1

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## Engaging girls at an early age

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Families and teachers' play a significant role in fostering a passion for studying chemistry, especially at a young age. Most of the female chemist respondents received family support for their decision to study chemistry (89%) while teachers and professors had an inspirational influence for 60% of the respondents. This confirms the crucial role that both families and educators play in encouraging girls to pursue an education in a specific field. One respondent reported: *When I was 14 years old, my high school science teacher took my class to a science outreach event at the university (week of science) where we could visit the department of chemistry for a "chemical show" that had a profound impact on me.* Research has also found that parents who speak positively about science inspire their children to study and seek a career in science.<sup>6</sup>



<sup>6</sup> N.M. Makwinya, R. H. (2015). Gender Disparities in Sciences: the Question of Parental Influence on Children's Self-Concept and Utility-Value. *Journal of Education and Practice*, 6(13), pp. 70-75.

The majority of respondents (67%) reported being confident in their ability to pursue a career in chemical safety and security, of whom 62% indicated that their families supported them and 51% indicated that their teachers, mentors and professors did. This again demonstrates the vital role of families, partners, mentors and educators in boosting the confidence of women seeking careers in chemical safety and security. Although the recorded influence of teacher and family support on career access was slightly less than that of starting education in chemistry, both were still the most frequently cited as enabling factors for career access (56%), followed by inspiring role models (42%). This observation is consistent with the existence of other fundamental work and gender-related factors that may have a substantial impact on career access and advancement.

The majority of respondents (93%) did not develop an interest in studying chemistry before high school, with 55% indicating that they had no prior knowledge about the subject beforehand. Only 11 respondents reported that they initially became interested in chemistry in elementary and middle school, while six others became interested in the subject after graduation, mostly for work-related reasons.

Traditionally, women and young girls highly value and trust the perspectives and judgements of their families, teachers, and instructors, particularly when taking major decisions regarding their education and professional careers. This makes them the ideal candidates to combat both socially constructed gender-biased perceptions of typical female and male jobs and interests at a young age, as well as expected performance in chemical safety and security positions.<sup>7</sup> In a study conducted in 2016, when children were

7 Dasgupta, N. and Stout, J.C. (2014). Girls and Women in Science, Technology, Engineering, and Mathematics. *Policy Insights from the Behavioral and Brain Sciences*, 1(1), pp. 21–29. doi:10.1177/2372732214549471.



asked to sketch a scientist, more than 85% of girls and nearly all boys drew men due to a perception that science is a male-dominated area.<sup>8</sup> Failing to counteract these perceptions may induce self-doubt in girls and lead to diminished self-perception and low self-efficacy, and thus suppressing their career ambitions.<sup>9</sup>

As stated by the Secretary-General of the United Nations, António Guterres: *Negative gender stereotypes related to girls' education in science, technology, engineering, and mathematics begin as early as primary school and have the devastating effect of making them doubt their own potential.*<sup>10</sup>

Out of the female respondents that developed an interest in studying chemistry after entering high school, 33% perceived that the subject was too complex; less than 20% of those that developed an interest before high school had the same perception. Research shows that when teachers and parents acknowledge girls' skills and predispositions, encouraging them to continue their study and expand their experience and learning, they perform better, especially in Science, Technology, Engineering and Mathematics (STEM) courses, and are more likely to pursue STEM careers in the future.<sup>11</sup>

According to one focus group participant, the opposite of this happened when her chemistry instructor discouraged her from pursuing a career in chemical safety and security due to its complexity. This significantly affected her interest

8 Christidou, V., Bonoti, F. and Kontopoulou, A. (2016). American and Greek Children's Visual Images of Scientists. *Science & Education*, 25(5-6), pp. 497-522.

9 CRDF Global (2019). *Breaking Barriers: Best Practices for the Advancement and Inclusion of Women in STEMM and National Security*: [https://9011449.fs1.hubspotusercontent-na1.net/hubs/9011449/W-ScienceAndSecurity\\_Website/Women%20in%20Science\\_Best%20Practices\\_Final\\_Pgs.pdf](https://9011449.fs1.hubspotusercontent-na1.net/hubs/9011449/W-ScienceAndSecurity_Website/Women%20in%20Science_Best%20Practices_Final_Pgs.pdf)

10 11 October 2018: Secretary-General - Message on the International Day of the Girl Child: [The Secretary-General - Message on the International Day of the Girl Child | MINUJUSTH \(unmis-sions.org\)](https://www.un.org/News/Press/docs/2018/10/sgsm10449.html)

11 Hill, C., Corbett, C. and St. Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics*. Washington, DC: AAUW.

in chemistry at the time, as she stated, *I would fear it, yet I would not have seen it*. A considerable number of female respondents (36%) were told that studying chemistry is too difficult for women.

During their school years, 29% of the female respondents felt that chemistry was too complex for them to study. The self-perception of competency to perform effectively in chemistry is an attitudinal factor that may have consistently impacted women's interest and decision to pursue education and careers in this field.<sup>12</sup> *The word chemistry is scary for some people because they only think of organic chemistry, but there is so much more to chemistry. I think this should be explained to girls at an early age. I hear so many young girls tell me they can't imagine being a chemist because it is so hard. When I explain to them what I do, they seem to think it is much more attainable for them.* (Survey respondent)

*“Often times, ladies do not comprehend the breadth of chemistry and its numerous applications. Before I began studying Chemistry, I was unaware of all of its potential applications. There is so much more to chemistry than organic chemistry, which some people associate with the term chemistry. I believe this should be explained to young girls. So many young women tell me they cannot fathom becoming chemists because of the difficulty of the profession. When I describe what I do, they appear to believe that it is much more reachable for them.* (Survey respondent)

According to a recent study conducted by the *Civilian Research and Development Foundation* (CRDF) Jordan, “in the case of STEMM,<sup>13</sup> women report feeling that they do not fit in due to the continuing stereotype — conscious or unconscious — that males are inherently “better” at STEMM.”<sup>14</sup>

12 Paulette Vincent-Ruz, K. B. (2018). The effect of math SAT on women's chemistry competency beliefs. *Chemistry Education Research and Practice*, 342-351: <https://pubs.rsc.org/en/content/articlelanding/2018/rp/c7rp00137a>

13 STEMM stands for Science, Technology, Engineering, Mathematics and Medicine.

14 CRDF *ibid* p.11.



This phenomenon of regressive-to-diminished self-perception among women has been linked to an increase in “imposter syndrome” conditions,<sup>15</sup> which have strongly affected girls’ and women’s education and career choices.

In addition, based on interviews conducted within the framework of University College London’s long-term “ASPIRES” project<sup>16</sup> to study young people’s science and career aspirations, the research group reached a conclusion that girls generally do not believe that science is a discipline they are fully capable of pursuing. This attitude has been observed most frequently among girls from working-class or ethnic minority backgrounds. Fundamentally, girls’ lack of confidence in their ability to perform well in science has been associated with stereotypes and prejudices within the classroom. More studies have come to the same conclusion about competency beliefs in chemistry, with one study pointing out that boys attribute their competence to internal factors, such as ability, while girls attribute successes to external factors, such as luck.<sup>17</sup>

Individual and group support provided at home and in educational institutions is a highly powerful parameter in generating motivation to pursue a career in male-dominated industries, especially in societies where social and cultural barriers coexist with implicit gender biases.<sup>18</sup> Addressing these misconceptions will not only contribute to altering individuals’ attitudes toward one another but will also influence girls’ and women’s likelihood of developing an interest in working in a specific field.<sup>19</sup>

15 Imposter syndrome is a chronic feeling of inadequacy or self-doubt that persists despite evident success and competence.

16 UCL (2022). *ASPIRES research*. IOE - Faculty of Education and Society: <https://www.ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/aspires-research>

17 Paulette Vincent-Ruz, K. B. Ibid.

18 Implicit bias is a form of bias that occurs automatically and unintentionally, that nevertheless affects judgments, decisions, and behaviours.

19 Hill, C., Corbett, C. and St. Rose, A. Ibid.



**Recommendation: Improving families' and communities understanding of the value of girls' education and career progression;** given that, as the survey showed, parental perspectives and attitudes, as well as the entire household environment, are crucial to boost young girls' confidence and ability to make well-informed decisions regarding their fields of study.



**Best practice:** UNICEF works together with families and communities to implement the “UNICEF Gender Policy 2021-2030” and the “UNICEF Gender Action 2022-2025 through concrete steps empower girls to access education, build skills and enter career paths.”<sup>20,21</sup>



**Best practice:** In Kenya, a group of postgraduate students conducted school visits to encourage girls to pursue professions in science. They discussed the specifics of working in the area, to support making informed judgments about the possibility of pursuing a career in chemistry.<sup>22</sup>

20 <https://www.unicef.org/media/117706/file/Gender%20Policy%202030.pdf>

21 [https://www.unicef.org/executiveboard/media/7046/file/2021-31-Gender\\_Action\\_Plan\\_2022-2025-EN-ODS.pdf](https://www.unicef.org/executiveboard/media/7046/file/2021-31-Gender_Action_Plan_2022-2025-EN-ODS.pdf)

22 Focus Group Discussions.



**Recommendation:** Instructors and academic institutions should **encourage the redesigning of chemistry courses and teaching methods** to make them more interactive and easier for students to comprehend fundamental concepts while simultaneously stimulating their intellectual curiosity.<sup>23</sup> This will enhance academic performance in the discipline and inspire a greater number of students to pursue postgraduate degrees. Also, **delivering simplified interactive knowledge about chemistry at a younger age**, within and outside the school setting, through more child-friendly materials, such as art and novels, can create an earlier interest in the subject.

*When I was in elementary school (4<sup>th</sup> grade-age 7), I had a female teacher who created an after-school science programme. This was not a chemistry-specific activity, but it reignited children's interest in the concept of science. This does not occur in the same way all over the world. Science is often introduced at a later age, and by then, it appears too complex for many girls to feel confident enough to try. I believe that engaging girls in science and scientific thinking at a young age makes chemistry less intimidating later in life. (Survey respondent)*

23 Institute of Chemical Technology (n.d.). *Successful Experience in Chemistry Teaching in the Czech Republic*. Prague: Institute of Chemical Technology.



**Best practice:** In Italy, the first interactive chemistry museum in Europe, “MU-CH”, recently opened in the Siva paint factory in Settimo Torinese. The museum provides children, teenagers and their families with an immersive experience in the world of science, allowing them to learn complex scientific concepts while also stimulating creativity and awareness that science is all around them.<sup>24</sup> A chemistry lab in Florence provides the same experience for young children through a project of the CR Firenze Foundation for young people and new technologies. Scientific paths designed by OpenLab have been selected to stimulate the interest of children and young people in science, through fun and interesting activities. They organize free laboratories in the subjects of Biology, Biotechnology, Physics and Chemistry for primary and secondary school classes.<sup>25</sup>



**Best practice:** The Marie Curie Alumni Association, in collaboration with the Poland Chapter, initiated activities to engage children in science. Using the power of storytelling, they introduced a webinar series titled “My Super Science Heroes” in which superheroes were actually renowned scientists, and their “superpowers” were their drive to improve their knowledge through characteristics such as curiosity and perseverance.<sup>26</sup>

24 Turismo Torino e Provincia (n.d.). *MU-CH. Museo della Chimica*: <https://www.turismotorino.org/en/mu-ch-museo-della-chimica>

25 OpenLab (2022). *Attività per le scuole*: <https://www.openlab.unifi.it/vp-90-attivita-per-le-scuole.html>

26 My Super Science Heroes (n.d.): <https://mysuperscienceheroes.com/>





**Recommendation:** To further improve women and girls' education in Chemistry, promote quality education and gender-responsive teaching methods. These approaches can transform unequal gender expectations and harmful gender norms in primary, secondary and tertiary schooling. **Teachers are recommended to develop curricula and classroom activities that are inclusive and supportive of students of both sexes.** To achieve this, teachers must also receive adequate training and support to advance girls' education.<sup>27</sup>



**Best practice:** UNESCO developed the approach for “Gender-responsive STEM education”, which aims to transform gender stereotypes in the classroom. Education in STEM provides girls and women with the confidence, agency, and tools to challenge traditional gender roles, and views of men and women about what girls can do. UNESCO's Capacity Development for Education (CapED) Programme supports countries to design and implement education reforms that foster gender-responsive pedagogy. In 2016, the CapED Programme launched a pilot initiative in 15 secondary schools in Niger, training teachers and principals in gender-responsive pedagogy in STEM subjects.<sup>28</sup>

27 Chun Wu, J. F. (2010). Making Chemistry Fun to Learn. *Literacy Information and Computer Education Journal (LICEJ)*, 1(1), pp. 3-7.

28 United Nations Children's Fund (2020). *Towards an equal future: Reimagining girls' education through STEM*. New York: ITU.



**Best practice:** The International Coalition of Girls' Schools (ICGS) offers symposiums and an action research programme that enables instructors interested in learning more about girls' education to participate in a worldwide network where they have access to an abundance of useful information on girls' education.<sup>29</sup>



**Best practice:** The Royal Society of Chemistry (RSC) in the United Kingdom, in partnership with Education Scotland, implemented a project designed to equip educational practitioners in Chemistry with the necessary knowledge, skills and confidence to develop and deliver inspiring, high-quality interdisciplinary teaching for all learners, across all ages and stages.<sup>30</sup>

29 International Coalition of Girls' Schools (ICGS) (n.d.). *Research Collaborative on Girls' Education (GARC)*: <https://girlsschools.org/garc-2/>

30 Royal Society of Chemistry (2020). *Supporting Excellence in the Teaching of Chemistry in Scotland*: <https://edu.rsc.org/download?ac=520681>





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## 2 Enhancing access to education opportunities for female students

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In order to enable girls and women to pursue an interest in studying chemistry, they need to have access to education opportunities. The proximity of educational facilities where Chemistry is taught to residential areas was identified by 21% of respondents as an important enabling factor. In certain conservative contexts, this gender-specific factor can be a prerequisite for receiving families' endorsement and support to pursue an education in Chemistry and beyond.

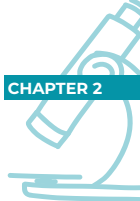
Focus group responses further revealed that this trend is associated with cultural, religious and social norms. For instance, one participant noted that the availability of distinct female-only educational facilities can increase women's opportunities to pursue undergraduate and postgraduate studies in the field. In Pakistan, "Fatima Jinnah Women" is one example of a university that offers undergraduate chemistry courses for women.

Even when there are opportunities to study Chemistry within reach, it is important that female students have access to financial means to support their studies. About 49% of respondents stated that studying Chemistry requires additional financial resources, an issue that was also highlighted in focus groups as a determining factor for access to education, especially among low-to-middle income households. However, only 8% of respondents selected *the availability of additional resources* as an enabling factor, whereas 49% highlighted *the availability of scholarships* as a more important enabling factor.

Notably, receiving family support for an education in Chemistry, as indicated by multiple focus group responses, is highly influenced by various social and cultural aspects as well as perceived gender roles in the society. For instance, in societies where women are socialised to marry and start families at a young age, they may be discouraged from pursuing education in Chemistry, which is widely perceived as a highly technical and demanding field for women, posing difficulties to balance work and caregiving responsibilities.

The majority of survey respondents (73%) agreed that women with parenting and/or caregiving responsibilities face additional barriers to studying Chemistry compared to men. According to some focus group testimonies, this is largely related to marriage, including early marriage, and early pregnancy, as well as family caregiving roles.

Role model also play and important role in encouraging females to enter chemistry education. A positive indicator that was observed is the gender balance of the individuals who served as role models for respondents, with 45% and 42% of the respondents identifying their role models as female and male, respectively. One respondent cited her male boss as a primary source of motivation for pursuing



further studies in Chemistry. Some focus group participants confirmed being inspired and encouraged to pursue post-graduate studies in Chemistry by male supervisors, while the rest preferred to be mentored by females.



**Recommendation: Promote more hybrid and part-time study opportunities.**

These measures support students who have caregiving roles to make it more feasible for them to balance their studies with other duties. They are also useful for students that are interested in educational opportunities available in institutes in countries or cities that are distant from where they live. These opportunities should also be extended to women and girls who are unable to travel for cultural or personal reasons. Providing day-care facilities for maternal caregivers at universities is also advantageous for the same purpose.



**Best practice:** The Open University (OU) in the UK offers a BSc (Honours) in Chemistry through distance learning, to enable studying from home or work and provide the flexibility to study at times that are suitable for the learner. The OU organizes yearly in-person laboratory schools in Milton Keynes, to allow their students to gain laboratory skills.<sup>31</sup>

31 The Open University (2022). *BSc (Honours) Chemistry*. <https://www.open.ac.uk/courses/chemistry/degrees/bsc-chemistry-r59>



**Best practice:** One of the programmes provided at the Universidad Nacional de Costa Rica offers day-care grants for student-mothers to make it more affordable for them to bring their children to campus.<sup>32</sup> The Universidad de El Salvador has also constructed day-care areas for student-mothers<sup>33</sup>.



**Recommendation:** For women who lack the financial resources to study Chemistry, it is pivotal to **provide more scholarship opportunities, with inclusive admission standards for students of varying ages and grade levels.** Specifically, it is recommended, as proposed in focus groups, to perform practice-based assessments of applicants' knowledge and abilities instead of an assessment of past experience, as past opportunities might differ based on gender. *Structuring scholarships differently may accommodate and attract a lot more candidates, males and females, with the hope of attracting more female candidates.* (Focus group participant)

A practical suggestion that was made within the focus group was to ask for applicants to be assessed on developed project proposals, to verify their knowledge and ability, instead of past experiences, to break the cycle of missed opportunities. *Universities should give women with limited educational backgrounds in Chemistry the opportunity to pursue higher education in the subject if they believe they can do it. They should not be excluded.* (Survey respondent)

32 Universidad Nacional Costa Rica (2022). *Vicerrectoría de Vida Estudiantil*: <https://www.vidaestudiantil.una.ac.cr/pasos#beneficio-para-pago-de-cuido-de-hijos-e-hijas-de-personas-estudiantes>

33 Focus Group Discussions.





**Best practice:** The Future of STEM Scholars Initiative (FOSSI) awards scholarships to underrepresented students pursuing STEM degrees, including Chemistry, and connects them to internships, leadership development, and mentorship opportunities through partner organizations.<sup>34</sup>



**Recommendation:** To further enhance the engagement of women in chemical safety and security, it is essential to **incorporate chemical safety and security modules and classes into all chemistry school courses**, undergraduate and graduate degrees. This can impact future decisions to pursue a career in chemical safety and security. *To broaden the chemistry field, universities should develop more chemical response courses, such as threat response or detection of chemical malicious acts that can lead to WMDs.* (Survey respondent)

34 AIChE: The Global Home of Chemical Engineers (2022). *The future of STEM scholars initiative: Fossi*. <https://www.aiche.org/giving/impact/funds/future-stem-scholars-initiative-fossi>



**Best practice:** The School of Chemical Sciences at the Universiti Sains in Malaysia has incorporated the first ever undergraduate course on “Chemical Safety and Security for Sustainable Chemistry,”<sup>35</sup> effectively creating awareness of this subject area much earlier in students’ careers.



**Recommendation:** More managers and decision makers from both genders can encourage and promote the inclusive practice of **sensitizing adults to the study of Chemistry at later ages** and different professional levels, particularly women.



**Best practice:** Several universities have established mentorship programmes to provide support, encouragement, and mentorship for students on areas of study and potential career paths in Chemistry.<sup>36 37 38 39 40</sup>

35 Focus Group Discussions.

36 University of Toronto, Faculty of Arts and Science, Department of Chemistry (2021). *Chemistry graduate mentorship program*: <https://www.chemistry.utoronto.ca/graduate/current-students/professional-development/chemistry-graduate-mentorship-program>

37 University of Minnesota (n.d.). *Mentorship Program for Aspiring Chemistry Teachers (MPACT) Program*: <https://mpact.chem.umn.edu/>

38 UC Davis, Department of Chemistry (2022). *Chemistry Peer Mentoring Program*: <https://chemistry.ucdavis.edu/chemistry-peer-mentoring-program>

39 American Chemical Society (n.d.). *Chemistry for life, Finding a mentor*: <https://www.acs.org/content/acs/en/education/students/college/findingamentor.html>

40 Bryn Mawr College (n.d.). *Chemistry mentorship program*: <https://www.brynmawr.edu/inside/academic-information/departments-programs/chemistry/chemistry-mentorship-program>



**Best practice:** The University of York in the UK has a Research Student Mentoring Scheme, where “all new Chemistry postgraduate research students are assigned a Graduate Student Mentor.” The scheme aims to welcome and support new research students, “promote links across the Department” and “provide skills development for both mentor and mentee.”<sup>41</sup>



**Best practice:** University College London provides a Chemistry Mentoring scheme that “aims at supporting and encouraging a professional relationship in which an experienced professional (the mentor) assists another, less experienced professional (the mentee) in appraising, reflecting upon and steering the mentee’s career and personal growth within the complicated and increasingly large academic world.”<sup>42</sup>

41 University of York (n.d.). *Research student mentoring scheme*: <https://www.york.ac.uk/chemistry/postgraduate/mentors/>

42 UCL (2021). *Mentoring scheme*: <https://www.ucl.ac.uk/chemistry/equality/mentoring-scheme>




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# 3

## Promoting gender inclusive working policies and culture

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### 3.1 Workplace policies



One-third of the survey respondents and focus group participants reported encountering gender discrimination in the workplace. In particular, 31% of respondents reported unequal workplace opportunities compared to men; 28% reported unfair and non-transparent recruitment processes; 29% did not have access to work-life balance opportunities; and 33% believed that women have less job security in chemical safety and security. These practices were documented even though women hold leadership positions in over 70% of the organizations where respondents work. This shows that, despite the increasing number of women in leadership roles, it is difficult to eliminate the structural and gender-specific hurdles that have been ingrained in the work environments and cultures of these workplaces.

The majority of the barriers that women face, were encountered when accessing their career and progressing in it. Workplace policies on transparent and fair practices, promotion, equal pay for equal work, and work-life bal-

ance, among others, should be promoted, adopted and implemented. *I don't know where it falls, but I think what I found most challenging was the gaslighting. For example, if you object, everyone thinks you are crazy and you start doubting yourself.* (Focus group participant)

Institutional and organizational policies addressing gender equality are critical building blocks for fostering an inclusive environment anchored in equality, as they enable institutions to set and measure progress towards goals, and support organizations in developing a business case for gender equality. Effective policies regarding gender diversity and inclusion set the tone of an organization, reflect leadership commitment, and assist organizations to achieve gender equality.<sup>43</sup>



**Recommendation: Anti-discrimination regulations should be enacted to prevent discrimination** based on gender, sexual orientation, marital status, or pregnancy. Organizations should recognize that men and women are both important agents of change in chemical safety and security, with varied needs, vulnerabilities, and capacities that must be addressed.<sup>44</sup>



**Recommendation: Using gender-neutral language in the workplace** has been associated with a greater sense of belonging, satisfaction, and improved job performance. In addition, the use of gender-neutral terms in job advertising creates

43 USAID (2022). *Integrating Gender into Workplace Policies*: <https://www.usaid.gov/engendering-industries/gender-equality-guides/policies>

44 Ibid.

an environment that encourages more women to apply for professional opportunities in the field.<sup>45 46</sup>



**Best practice:** In an effort to be more gender neutral, the Queensland government of Australia adopts an innovative approach to maternity by replacing the term “maternity leave” with “birth-related leave.”<sup>47</sup>



**Recommendation: Encouraging male employees to support their female co-workers** in fostering a positive and diverse work environment through inclusive language and actions. *I would say that having a female role model, as well as support from my colleagues in the organization, has aided me. My workplace promotes work-life balance, and the supervisors set a good example of leadership, so I don't feel pressured.* (Survey respondent)



**Recommendation: Sign and ratify International Labour Organization (ILO) Instruments** on Chemical Safety; the ILO Maternity Protection Convention (No. 183) and the accompanying Recommendation (No. 191); ILO Convention (No. 190) on the elimination of violence and harassment in the world of work.

45 Carr, E.W., Reece, A., Kellerman, G.R. and Robichaux, A. (2019). The Value of Belonging at Work. *Harvard Business Review*. <https://hbr.org/2019/12/the-value-of-belonging-at-work>

46 InHerSight.com (n.d.). *Gender-Neutral Terms for the Workplace & Beyond* | InHerSight: <https://www.inhersight.com/blog/diversity/gender-neutral-terms>

47 Doucet, A., Mathieu, S., McKay, L. (2020). Redesign parental leave system to enhance gender equality. *Policy Options*: <https://policyoptions.irpp.org/magazines/october-2020/redesign-parental-leave-system-to-enhance-gender-equality>

### 3.1.1 Recruitment and promotion policies

During the last two decades, along with intensifying social and economic changes, women's participation in economic, social and decision-making spheres has increased. International and often national agendas have pushed for the elimination of barriers and discrimination, asking for equal representation and equal treatment.<sup>48</sup>

However, hiring managers' decisions to select female candidates are sometimes still influenced by prevalent perception of gender roles and other implicit biases related to the expected performance of female candidates in technical and male-dominated jobs, leading to the selection of more male candidates with the same or fewer competences.<sup>49 50</sup>

Studies conducted by ILO have found that women are more likely than men to be asked about marriage and childcare responsibilities during job interviews, in anticipation of whether they would become pregnant and request maternity leave at a given point.<sup>51</sup> Moreover, as shown in focus groups, there is lack of trust in women's capabilities and competences to perform high-risk functions like those associated with chemical safety and security in some workplaces, consequently influencing the hiring manager's selection decision.

48 Diekmann, A. B., Johnston, A. M., and Loescher, A. L. (2013). Something old, something new: evidence of self-accommodation to gendered social change. *Sex Roles*, 68, pp. 550–561: <https://psycnet.apa.org/record/2013-05363-001>

49 Thébaud, S. and Charles, M. (2018). Segregation, Stereotypes, and STEM. *Social Sciences*, 7(7): <https://ideas.repec.org/a/gam/jscscx/v7y2018i7p111-d156990.html#download>

50 European Institute for Gender Equality (2018). *Gender equality in recruitment and career progression*: <https://eige.europa.eu/gender-mainstreaming/toolkits/gear/gender-equality-recruitment-and-career-progression>

51 Addati, L., Cassirer, N. & Gilchrist, K. (2014). *Maternity and paternity at work: Law and practice across the world*. Geneva: International Labour Office.



There have been instances of organizations paying men more than their female counterparts who fulfil the same duties and responsibilities. Participants reported that in some countries, chemical professionals from both genders are often underpaid and their promotion prospects are very low.

In addition, parents and partners play a paramount role in countering stereotypes associated with societal role expectations for women. One focus group participant noted that while women are well-represented in chemistry education in her country, they are underrepresented in chemistry jobs. Given the perception in some communities that women's primary role in society is marriage and child raising, it is challenging for many young women to persuade their families that they can pursue a career in technical and high-risk sectors. In certain instances, societal pressure has forced qualified women to abandon their chemistry career objectives and aspirations.



**Best practice:** The Civil Rights Act of 1964 in the USA “prohibits employers from explicitly soliciting a certain gender in job listings.” The Act’s passing allowed individuals to litigate against employers in defence of their rights, and “changed the legal norm from one of exclusivity to one of inclusivity, which can be seen in the abundance of anti-discrimination acts that have been passed since 1964.”<sup>52</sup>

52 Hersch, J. and Bennet Shinall, J. (2015). Fifty Years Later: The Legacy of the Civil Rights Act of 1964. *Journal of Policy Analysis and Management*, 34(2), pp. 424–456. doi: 10.1002/pam.21824.



**Recommendation: Adopting a performance management system based on competencies that emphasize skills and behaviours.**

The objectives for performance reviews must be realistic, attainable, gender-neutral, aligned with the competencies outlined in job descriptions, and linked to the company's key performance indicators (KPIs). Every manager and leader's succession plan should align with the company's diversity and gender equality strategies.<sup>53</sup> *Equal opportunities should be provided for women and men in chemical safety and security. Let the individual assess his/her capabilities and decide whether he/she is fit for a certain job.* (Focus group participant)



**Recommendation: Enacting national legislation that requires all national and private entities to make pay data public**

is a crucial step towards closing gender pay gaps, promoting transparency and equal pay for equal work.

53 USAID (2022). *Integrating Gender into Workplace Policies*: <https://www.usaid.gov/engendering-industries/gender-equality-guides/policies>



**Best practice:** Since 2017, all large UK companies are required to publish hourly wages and bonuses.<sup>54</sup> In addition, German companies with more than 500 employees must publish regular reports on gender parity<sup>55</sup> and companies in Iceland must prove that they provide equal pay to their employees.<sup>56</sup>



**Recommendation:** To ensure transparency and accountability at all levels, governments are encouraged to **commission independent research to analyse progress in the implementation of national gender pay policies.** Equally, organizations are encouraged to hire external firms to evaluate salaries and compensations packages to prevent unconscious bias from entering the hiring, promotion, or bonus-granting processes.



**Best practice:** The provision of transparent information on salaries, remuneration, and compensation packages for all positions was one of the factors that motivated some focus group participants to pursue a career in the field.

- 54 Kong, S., Carroll, K., Lundberg, D., Omura, P. and Lepe, B. (2020). Reducing gender bias in STEM. *MIT Science Policy Review*, 1, pp.55-63.
- 55 Oltermann, P. (2016). Germany to require firms to publish data on gender pay parity. *The Guardian*: <https://www.theguardian.com/world/2016/oct/07/germany-to-require-firms-to-publish-data-on-gender-pay-parity>
- 56 Domomoske, C. (2018). Companies In Iceland Now Required To Demonstrate They Pay Men, Women Fairly. *Npr.org*: <https://www.npr.org/sections/thetwo-way/2018/01/03/575403863/companies-in-iceland-now-required-to-demonstrate-they-pay-men-women-fairly>

### 3.1.2 Work-life balance policies

Almost one-third of the survey respondents and focus group participants identified work-life balance as a common challenge, particularly as a result of it being intricately connected with other factors, including prevalent attitudes and entrenched gender stereotypes regarding the societal roles of women and men.

In the context of a traditionally male-dominated industry like chemical safety and security, the availability of flexible work-life balance policies is necessary for achieving both personal and professional goals, as well as for promoting better career access, recruitment and retention of women in this sector, thereby enhancing workplace inclusivity.



**Recommendation: Facilitating hybrid or remote work arrangements**, including for caregiving employees, **as well as flexible work hours and schedule**. This has a positive impact on their mental health and job performance, allowing them to balance their professional and personal commitments with greater ease.



**Best practice:** The Slovenian National Institute of Chemistry extended the option to work from home for a higher number of days. This helps researchers to balance work and family life and organize their own time. These measures targeted employees of all genders but may be more beneficial to those with caring duties.<sup>57</sup>

57 National Institute of Chemistry (n.d.). *Gender Equality Plan*: <https://www.ki.si/en/about-the-institute/gender-equality-plan/>



**Recommendation: Establishing family-friendly and childcare facilities at the workplace**, such as nursing rooms and on-site day-care facilities (e.g., crèche or nursery), will facilitate and enhance the productivity of working mothers. **In lieu, providing financial assistance** can assist mothers when placing their child dependents in external nurseries. *Women should be given more opportunities to expand their knowledge and equip their skills as opposed to having to put back since they are considered the primary caregivers.* (Survey respondent)



**Recommendation: Developing gender-inclusive policies and/or laws that provide paid maternity and paternity leave** in an effort to reduce the cultural stigma associated with employing women.<sup>58</sup>

58 Doucet, A., Mathieu, S., McKay, L. Ibid.

### 3.1.3 Policies prohibiting sexual harassment and abuse

Sixty-four per cent of respondents' workplaces have policies in place against harassment. For 83% of the respondents, their institutions must have policies in place for equal opportunities (e.g., a gender policy), a code of conduct against harassment in the workplace and gender equality positions such as gender focal persons.

The absence of gender policies can be a major barrier to creating inclusive organizations and institutions. *As a victim of sexual harassment throughout my career (university, part-time jobs, first job), I would recommend providing trainings on this critical subject to explain what victims should do when they are subjected to sexual harassment and what their legal rights are.* (Survey respondent).



**Recommendation:** Adopt sexual harassment policy that states the organization's position of intolerance for harassment or inappropriate behaviour and that applies to all persons involved in the operations of the organization. The policy should have an accountability and reporting mechanism for investigating and protecting complainants.



**Best practice:** ILO has prepared a sample policy<sup>59</sup> for organizations and companies that have still to adopt a policy on sexual harassment. The policy is available free of charge and includes explanatory notes for better understanding of the policy and what constitutes sexual harassment.

59 International Labour Organization (2015). *Sample sexual harassment policy*: [https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-suva/documents/policy/wcms\\_407364.pdf](https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-suva/documents/policy/wcms_407364.pdf)

## 3.2 Organizational/institutional culture for gender equality

Eighty-three percent of the respondents believe that their institutions should have policies in place for equal opportunities (e.g., gender policy). Yet, 30% of the respondents reported that there are no specific gender policies at the institutional level, and 40% reported that there are no gender equality positions, such as gender focal persons, assigned to mainstream gender inside their departments.

To support the systematic mainstreaming of gender within all activities and at all levels, organizations would need processes that reflect their commitments to gender equality. These include:

- 1. Formal legal commitment:** internal gender policy affirming the principle of gender equality, non-discrimination and equal opportunities.
- 2. Plans and strategies:** a gender equality strategy and/or gender action plan setting long- and mid-term objectives, expected results, actions and monitoring indicators.
- 3. Supporting structure and tools:**
  - **Establish a gender equality structure,** department, office, team or person (**gender focal person**) tasked with implementing and monitoring gender commitments and strategies/action plans.
  - **Conduct gender analysis** to integrate a gender perspective into policies, programmes and projects. In Chemistry, *gender analysis enables us to understand and unpack the root causes of unsustainable*

*behaviour, and helps to find new solutions for sustainable chemical policies by thinking outside the “masculine” box with a gender perspective. (MSP Institute, 2021)*

- **Collect gender-disaggregated data.** The collection of data can range from women’s representation at all levels to data on work-related risks and health impacts on women and men, due to exposure to chemicals.



**Best practice:** The Basel, Rotterdam and Stockholm (BRS) Conventions Secretariat has a strong institutional setting in place for gender mainstreaming:

1. Adopted the BRS Gender Action Plan (GAP).
2. Developed tools to support the GAP’s implementation, including a guiding document on mainstreaming gender in the Secretariat as well as a collection of stories featuring gender perspectives on the management of hazardous chemicals and wastes.
3. Formed a Gender Task Team within the Secretariat.
4. Nominated Gender Champions to showcase the leadership of women and men in contributing to advancing gender equality and mainstreaming gender in the area of chemicals and waste.





**Recommendation: Assigning a gender focal person** to monitor the implementation of the institution's gender mainstreaming policies and code of conducts and to offer support and counselling to employees, if needed.



**Recommendation: Providing compulsory training on gender equality and the institution's policies in this regard for all staff** to promote a more inclusive organizational culture.<sup>60</sup>



**Best practice:** There is a variety of gender equality training programmes and tool kits provided by international organizations including UN Women, the European Union, USAID and others. Key examples include: The "I Know Gender (1-17)" series of free online courses provided by UN Women; the Gender 101 training provided by USAID;<sup>61</sup> and the Gender Equality training tool kit provided by the European Union.<sup>62</sup>

- 60 Salama, Hana and Bjertén-Günther, Emma (2021). *Women Managing Weapons: Perspectives for Increasing Women's Meaningful Participation in Weapons and Ammunition Management*. Geneva: United Nations Institute for Disarmament Research: <https://unidir.org/publication/women-managing-weapons>
- 61 USAID (2021). *Gender 101 Training*: <https://www.usaid.gov/engendering-industries/gender-101-training>
- 62 European Institute for Gender Equality (2016). *Gender Equality Training Gender Mainstreaming Toolkit*: <https://eige.europa.eu/sites/default/files/documents/mh0716093enn.pdf>



**Recommendation: Conduct gender analysis to identify the differentiated use of chemicals** among women and men, **and how they are differently affected by chemicals**, as well as the structural barriers that may constrain women's participation, and access to opportunities in chemical safety and security.



**Best practice:** As part of the implementation of the Gender and Chemicals Road Map in Germany (April 2021–March 2022), a gender analysis was carried out on the topic of chemicals in building materials. The gender analysis identified some gaps in terms of availability of gender-specific data, slower advancement of women in chemicals management, and the lack of a strategic overview to improve gender mainstreaming in chemicals management.





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# 4

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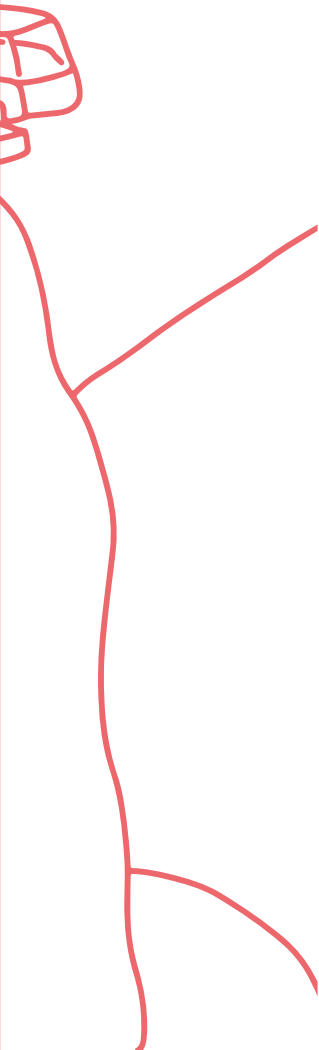
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## Ensuring safe work conditions and environment

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Both sexes experience varying levels of exposure to chemicals and their associated risks across different contexts. Factors such as occupational roles, gender<sup>63</sup> roles, household responsibilities, geographical location and biological susceptibility determine the exposure to toxic chemicals and the resulting health impact. For instance, in agricultural communities in developing countries, men may be at higher risk of direct exposure to chemical pesticides during application, while women and sometimes children may be more likely to be indirectly exposed during planting and harvesting, in addition to their exposure to chemicals contained in cleaning agents,

<sup>63</sup> Gender as defined by UN women “refers to the social attributes and opportunities associated with being male and female and the relationships between women and men and girls and boys, as well as the relations between women and those between men. These attributes, opportunities and relationships are socially constructed and are learned through socialization processes. They are context/ time-specific and changeable. Gender determines what is expected, allowed and valued in a woman or a man in a given context. In most societies there are differences and inequalities between women and men in responsibilities assigned, activities undertaken, access to and control over resources, as well as decision-making opportunities.”



professional cosmetic and personal care products.<sup>64</sup> Many of those women and others working in the informal sector rarely receive basic training related to the chemicals they use hence increasing their vulnerability to health hazards.

Susceptibility to health damage from exposure to toxic chemicals can also be influenced by biological factors – particularly size, physiological, hormonal, and enzyme differences between women and men, and between adults and children.<sup>65</sup> Chemical exposure<sup>66</sup> can cause either bioaccumulation or immediate effects. Bioaccumulation<sup>67</sup> may lead to health complications like kidney failure, various forms of cancers and nephrotic syndrome long after exposure. Some of the immediate effects that may be experienced after exposure to chemicals include skin rashes and burns, chloracne, nervous system damage, dizziness and fatigue. Other effects may include impaired foetal development, diabetes, cardiovascular disease and endocrine activation just to mention a few. Moreover, the reproductive health of both men and women and their offspring can be affected by exposure to toxic chemicals. In women, exposure to toxic chemicals can lead to miscarriages, difficult pregnancies, breast and ovarian cancers and many gynaecological disorders.<sup>68</sup>

64 UNDP Environment and Energy Group (2015). *Chemicals and gender*. UNDP Environment and Energy Group: <https://www.undp.org/sites/g/files/zskgke326/files/publications/2011%20Chemical&Gender.pdf>

65 Ibid.

66 In 2021, the International Labour Organization (ILO) conducted a global review of chemical exposures and health impacts in the world of work. The report identified that certain groups of workers, such as young workers, aging populations, migrant workers, women and workers in the informal sector, may face increased exposures to hazardous chemicals and suffer disproportionately from their health effects.

67 Bioaccumulation is when the toxins are consumed or absorbed and the body cannot excrete or catabolize it fast enough leading to a build-up in the body.

68 Amnesty International (n.d.). *India: Summary of Clouds of Injustice - Bhopal Disaster 20 years on*: <https://www.amnesty.org/en/documents/ASA20/104/2004/en/>



Recognizing that women and men are exposed to different risks and may react differently to the same risks makes it easier to understand the root causes of unsustainable practices and has the potential to support sustainable solutions for mainstreaming gender in the sound management of chemicals.

The majority of respondents (88%) reported an equal safe work environment for both genders, however it was also reported that, *there is no periodic assessment of safety needs of men and women before establishing safety measures in the working environment*, in one case it was reported that, *the safety and security elements are not well-communicated and practiced at the workplace* and that, *women are more exposed to health risk factors when working in certain environments and this poses a natural threat thus causing the environment to appear less safe for women than men*. It was explained that for this reason the field is male dominated: *my field is male dominated because of the health risk exposure and the type of strenuous work required*. (Survey respondent)

At the same time, because it is a male-dominated environment, the environment and personal protective equipment (PPE) is not designed to sufficiently consider women's needs. While 82% of the respondents were provided adequate personal protective equipment (PPE), testimonies reveal that improvements need to be made, both in the provision of PPE – *Breastfeeding mothers are exposed to highly toxic substances. Lack of personal protective equipment* – and its design – *Equipment is not designed for women; does not fit the female body, "PPE in CBRN work do not take into consideration the anatomy of women*.

In several cases, assumptions regarding the equal application of established safety systems, procedures and equipment to men and women produced unequal and frequent-

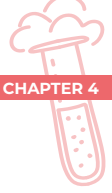
ly unsafe outcomes for women. In addition, one focus group participant noted that the available PPE suits in her country are neither built to fit both male and female bodies, nor the special cultural and religious needs, such as head coverings for Muslims.

In taking a gender-sensitive approach, it is important to recognize that different societal and gender roles, expectations and responsibilities may dictate the different jobs women and men assume in the field of chemistry, resulting in different exposure to toxic agents, and gender-specific patterns of home and occupational hazards and risks. For example, a study conducted on the impact of firefighting on women revealed mounting concern at the high incidence of pre-menopausal breast cancer among women in the fire department.<sup>69</sup>

The distinct health risks associated with women's exposure to chemicals should be considered when developing safety regulations and PPE. This is of particular concern to pregnant and breastfeeding women, who would normally avoid exposure to toxic chemicals in risky work conditions. Women who are aware of the gender-specific effects of chemical exposure will recognize their entitlement to safe working conditions as a prerequisite for working in chemical safety and security. Therefore, it is crucial that all women considering careers in this field receive the necessary training on chemicals, their associated hazards, and protection measures.

69 Westervelt, A. (2015). Research lags on the health risks of women's exposure to chemicals. *The Guardian*: <https://www.theguardian.com/lifeandstyle/2015/may/05/osh-health-women-breast-cancer-chemicals-work-safety>





**Recommendation:** Men and women workers are treated equally in all decisions affecting their safety and health, from national safety councils to occupational health services and safety committees at the workplace level.<sup>70</sup>



**Recommendation:** Integrate a gender perspective in **occupational safety and health (OSH) policies**, recognizing gender differences in the workforce to ensure the safety and health of both men and women workers.



**Best practice:** Finland has introduced OSH legislation covering reproductive hazards for both men and women. The OSH Act (738/2002) requires a risk assessment to take account of “the potential risks to reproductive health” and to reduce exposure to hazardous chemicals, physical agents and biological agents so that “no risk is caused to the employees’ safety or health or reproductive health.” The risk assessment must also take account of “age, gender, occupational skills and other personal capacities.”<sup>71</sup>

70 International Labour Office (2013). *10 Keys for Gender Sensitive OSH Practice: Guidelines for Gender Mainstreaming in Occupational Safety and Health*. Geneva: International Labour Office: [https://www.ilo.org/wcmsp5/groups/public/---ed\\_protect/---protrav/---safework/documents/publication/wcms\\_324653.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_324653.pdf)

71 Ibid.



**Best practice:** The ILO convention on maternity protection “sets out that pregnant women should not be obliged to carry out work that is a significant risk to her health and safety or that of her child and it provides for the elimination of the risks, including caused by chemical agents.”<sup>72 73</sup> Furthermore, the ILO has developed Guidelines for Gender Mainstreaming in Occupational Safety and Health to assist policymakers and practitioners in taking a gender-sensitive approach for the development and implementation of OSH policy and practice.



**Recommendation:** As advised by ILO, “**safety and health authorities should ensure that the design of work equipment, tools and PPE developed are suitable for both genders.** In addition, the use of anthropometric data that reflect the characteristics of the actual working population will be useful in ensuring equipment, tools and PPE are suitable for both sexes.”<sup>74</sup>



**Recommendation: Providing access to separate toilets, showers, and dormitories in areas where remote fieldwork** is conducted is crucial for providing a gender-sensitive safety environment.

72 Ibid.

73 Addati, L., Cassirer, N. & Gilchrist, K. (2014). *Maternity and paternity at work: Law and practice across the world*. Geneva: International Labour Office.

74 ILO (2013). Ibid.





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# 5

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## Creating career progression opportunities

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In Chemistry, numerous career options are available, ranging from chemical safety and security in the laboratory to environmental health and safety employment in a variety of industries, as well as in research, academia, hospitals, and the military. The list is extensive, and there are numerous opportunities for women and men to begin a career in this field. However, women's career advancement in the chemical safety and security professions is relatively slow and not particularly inclusive, as opposed to their career advancement in academia and chemistry teaching.

The provision of gender-inclusive career progression opportunities is vital to achieve gender parity in chemical safety and security and overcome many barriers that impede equal career advancement for both genders as indicated by 62% of respondents. The majority of respondents (72%) participated in learning initiatives to enhance their professional knowledge and skills including capacity building and training programmes (in-person and virtual). Other opportunities, selected by around 20-35% of respondents, included participation in expert network panels and/or conferences;

participation in mentoring and coaching programmes; conducting research and publishing papers in internationally recognized scientific journals and participating in experience-sharing activities with other female role models working in the field of chemical safety and security.



**Best practice:** The Government Chemist's office in Kenya is attempting to achieve a 50-50 ratio of male and female employees by hiring more female analysts. This approach is part of a broader strategic shift the Kenyan government is implementing to advance gender equality in its institutions.<sup>75</sup>



**Best practice:** The government of Philippines has established the "Gender and Development" (GAD) programme which aims to mainstream gender and provide equitable employment opportunities for women and men in all government sectors.<sup>76</sup>



**Best practice:** The UN Inter-Agency Network on Women and Gender Equality (IANWGE) published a repository of resources and tools for capacity development of gender mainstreaming within the UN system. The repository aims to provide a comprehensive system-wide resource on capacity de-

75 Focus Group Discussions.

76 Focus Group Discussions.



velopment related to gender mainstreaming for experts and practitioners.<sup>77 78 79</sup>

Notwithstanding the fact that 62% of the respondents are aware that academic and career opportunities exist in the chemical safety and security sector, the majority of respondents (57%) have predominantly experienced challenges and gender-based barriers in their career advancement. According to the testimonies of 72 respondents, the following barriers were identified:

- ➔ Men in leadership/management roles do not provide women with equal opportunities for advancement to senior and leadership positions.
- ➔ *Male-dominated leadership in the chemical field makes career progression more difficult for women.* (Survey respondent)
- ➔ Some focus group responses indicated that female practitioners are excluded from specific chemical security responsibilities, notably waste management and the sampling of potentially hazardous material, while possessing the same or more knowledge and expertise than their male counterparts. Since the sampling activities are conducted in remote places, the management team prefers to send male-only chemist teams to the field, so they can all be lodged

77 UN Inter-Agency Network on Women and Gender Equality (IANWGE) (2021). *Repository on Resources and Tools for Capacity Development on Gender Mainstreaming within the United Nations System*: <https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/How%20We%20Work/UNSystemCoordination/IANWGE/IANWGE-Resources-and-tools-for-capacity-development-in-gender-mainstreaming-en.pdf>

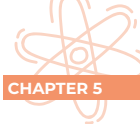
78 USAID (2021). *Ibid.*

79 UN Women Training Centre (2017). *Trainings*: <https://portal.trainingcentre.unwomen.org/unw-catalog-mobile/>

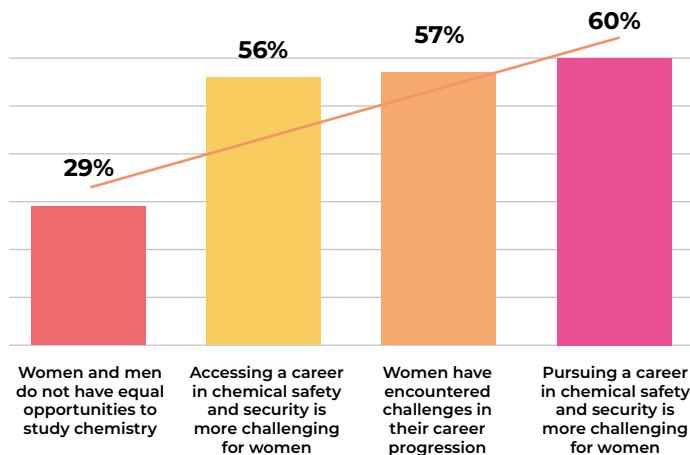
in a single room, avoiding the cost of providing an additional room for females.

- ➔ Competency-based promotion is replaced by gender-biased promotion, discounting women's skills and qualifications in comparison to men.
- ➔ In certain instances, female respondents were excluded from capacity building and learning opportunities as well as opportunities for international representation compared to men. *Most times when we apply for OPCW trainings, the head of national authority does not endorse our forms we end up missing training chances. They also limit the endorsement to fewer numbers. In addition, my male counterparts are more often chosen over me for an assignment or training course just because I am a woman.* (Survey respondent)
- ➔ Pregnancy and maternity leave are used as an excuse to exclude women from available job advancement opportunities. *Due to my maternity leave I was not treated equally with my male colleagues whose performance was not as good as mine.* (Survey respondent)
- ➔ In certain instances, sexual harassment was pointed out as a means of exploitation for women's career progress, underlining that in some countries, women's success is believed to be fundamentally associated with sexually inappropriate behaviour with male managers. *If a woman achieves something at work, most of her co-workers will ascribe it to an affair she is having with a higher-up rather than her own hard work.* (Survey respondent)





## Challenges faced by women from education to career



Recommendations collected through surveys as well as focus groups highlighted that mentoring represents a powerful tool for women's empowerment in chemical safety and security. Yet, 64% of the respondents have never participated in a mentorship programme. Further literature and research studies have confirmed "a positive correlation between women's attitudes and improved performance when provided early mentorships."<sup>80</sup>

Mentorship programmes provided by chemist role models, practitioners and experts can have a significant impact on women's perception of different chemical safety and security career trajectories and their own capabilities as impor-

80 CRDF Global (2019). *Breaking Barriers: Best Practices for the Advancement and Inclusion of Women in STEMM and National Security*. [https://9011449.fs1.hubspotusercontent-na1.net/hubfs/9011449/WomenInScienceAndSecurity\\_Website/Women%20in%20Science\\_Best%20Practices\\_Final\\_Pgs.pdf](https://9011449.fs1.hubspotusercontent-na1.net/hubfs/9011449/WomenInScienceAndSecurity_Website/Women%20in%20Science_Best%20Practices_Final_Pgs.pdf)

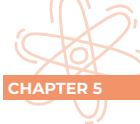
tant active agents in this sector. Such programmes can also provide important guidance at different career stages including career choices and expectations, opportunities for career progression, and the necessary skills, capabilities and qualifications required for assuming different research, industry and field roles in chemical safety and security. *When I studied at university, professional female chemists were frequently invited to lead seminars and provide trainings. This has helped me and my female group mates to keep ourselves motivated about the presence of opportunities to pursue our career successfully as chemists. I strongly believe that organizing trainings and involving successful female chemists as mentors and coaches can have an important role in promoting the engagement of females in Chemistry.* (Survey respondent)



**Recommendation:** Providing **mentorship and coaching opportunities** for women in the field with the aim of maximizing opportunities for networking and exchange of experiences that would guide them in their career advancing journeys. *Mentoring and networking are two of the most critical aspects of career success. These strategies can help women in chemical safety and security exchange information, build valuable job contacts and gain visibility, learn the culture and politics of an organization, and develop communication and leadership skills.* (Survey respondent)



**Best practice:** CRDF Global implemented a programme to advance women's leadership in chemical security (WomenAdvance: Chemical Security). The primary goal of the programme was to pro-



vide professional enhancement opportunities for Iraqi women whose current working roles entail some form of responsibility for chemical security or management in chemical industry, government or academia, in order to advance their leadership and expertise in chemical security topics. Through programme options including regional fellowships, professional development, and mentorship, selected women will receive the opportunity to work with and learn from influential global experts in their sector who have contributed to advancing chemical security.<sup>81</sup>



**Recommendation: Providing capacity building opportunities** and advanced training courses in the field of chemical safety and security including on cross-cutting topics related to gender diversity, gender-responsive leadership, entrepreneurship, and digitalization.



**Recommendation: The inclusion of women in decision-making positions** is essential for managing the complexity of chemical risks for both sexes and ensuring that gender perspectives are incorporated into national legislation and organizational policies.

81 CRDF Global (n.d.). *Advancing Knowledge, Fostering Connections: A Q&A with the 2020 WomenAdvance: Chemical Security Fellows*: <https://www.crdglobal.org/news/advancing-knowledge-fostering-connections-qa-2020-womenadvance-chemical-security-fellows/>



**Best practice:** The Stockholm Convention on Persistent Organic Pollutants obligates governments to “consult their national stakeholders, including women’s groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.”<sup>82</sup>

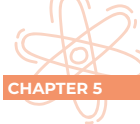


**Best practice:** In December 2017, UN Environment Program (UNEP) and the International Pollutants Elimination Network (IPEN) signed a Memorandum of Understanding to collaborate on Gender and Chemicals with a particular focus on:

- ➔ Raising awareness of the impact of women and children’s exposure to chemicals, including the creation of training and experience-sharing opportunities and the collection of gender-specific statistics.
- ➔ Promoting women’s engagement and leadership in decision-making processes at national and international levels.<sup>83</sup>

82 Stockholm Convention Article 7: <http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>

83 Brosché, S. (n.d.). *Women, Chemicals and the SDGs Gender Review Mapping with a Focus on Women and Chemicals: Impact of Emerging Policy Issues and the Relevance for the Sustainable Development Goal*. Stockholm: International Pollutants Elimination Network (IPEN): [https://ipen.org/sites/default/files/documents/ipen-gender-chemicals-report-v1\\_6dw-en.pdf](https://ipen.org/sites/default/files/documents/ipen-gender-chemicals-report-v1_6dw-en.pdf)



**Recommendation: Establishing gender-inclusive networks that promote women in chemical safety and security**

for the purpose of exchanging experiences and discussing challenges and opportunities experienced by women in the field.



**Best practice:** Within the framework of OPCW's Women in Chemistry (WIC) project, UNICRI has established a WIC network of more than 150 women actively working in the field of chemical safety and security from over 60 countries worldwide. The network will provide a platform for the exchange of information on best practices and career opportunities in the field. Additionally, the network will continue to expand by inviting more interested women to join.



**Best practice:** The Women in Supramolecular Chemistry (WISC) is an international network created to support the retention and career progression of women of all career stages within the supramolecular chemist community.<sup>84</sup>

84 WISC (n.d.). *Home | Women in Supramolecular Chemistry*: <https://www.womeninsuprachem.com>



**Recommendation: Encouraging the participation of women on an equal basis in national, regional and international symposiums** that serve as platforms for promoting cooperation and exchange of best practices in chemical safety and security.



**Recommendation: Increasing women's participation as panellists at international events** is encouraged as a means of boosting exposure and visibility.



**Best practice:** To increase diversity and inclusiveness in the chemical sciences, since 2020, the Royal Society of Chemistry (RSC) has put in place new requirements for the events it supports. One of the requirements was that at least one-third of speakers and chairs at RSC-sponsored events must be women.<sup>85</sup>



**Recommendation: Designing reward-based systems and awards to recognize the accomplishments** of women who have actively pursued and advanced their careers can be crucial for enhancing their visibility and recognition.

85 Royal Society of Chemistry (2022). *Inclusion & diversity*: <https://www.rsc.org/new-perspectives/talent/inclusion-and-diversity/>



**Recommendation: Nominate Gender Champions** who take bold steps to build a gender equal world.



**Best practice:** The International Gender Champions is a leadership network that brings together female and male decision-makers determined to break down gender barriers and make gender equality a working reality in their spheres of influence. The network numbers over 250 active Champions and 160 Alumni who are the heads of international organizations, permanent missions, and civil society organizations. The core of the International Gender Champions' work begins with the Panel Parity Pledge, the Gender-based Violence Pledge and two personal commitments that each Champion makes every year.

OPCW Director-General, Fernando Arias, became an International Gender Champion in November 2018.<sup>86</sup> Irakli Beridze, Head of UNICRI Centre for Artificial Intelligence and Robotics is also a Gender Champion.<sup>87</sup>

86 International Gender Champions (2022). *Fernando Arias*: <https://genderchampions.com/champions/fernando-arias>

87 International Gender Champions (2022). *Irakli Beridze*: <https://genderchampions.com/champions/irakli-beridze>

## Conclusion

Incorporating gender into chemical safety and security is a challenging endeavour requiring a multidimensional effort to advocate for the required behavioural and regulatory changes at all levels. Families, educational institutions, mandated government agencies, public and private chemical safety and security entities should all be involved to accomplish this strategic goal. The main driver for effectively planning, designing and implementing these interventions is a genuine belief in the value of women's inclusion in this sector.

The best practices and recommendations presented in this Compendium were voiced and chosen by women working in chemistry to support the creation and implementation of gender-inclusive policies that empower women and promote gender equality in chemical safety and security. While the listed practices here presented are not exhaustive of all best practices, whose applicability can vary across country contexts, they aim to provide direction on how governmental, private and social actors can advance gender parity in this sector.

In addition, it is crucial to note that the lack of gender-specific data on women in chemical safety and security has posed a significant research limitation to develop more inclusive and comprehensive gender analysis of the issue. In the future, the newly established "Women In Chemistry" network could promote data collection initiatives in order to tackle this limitation.

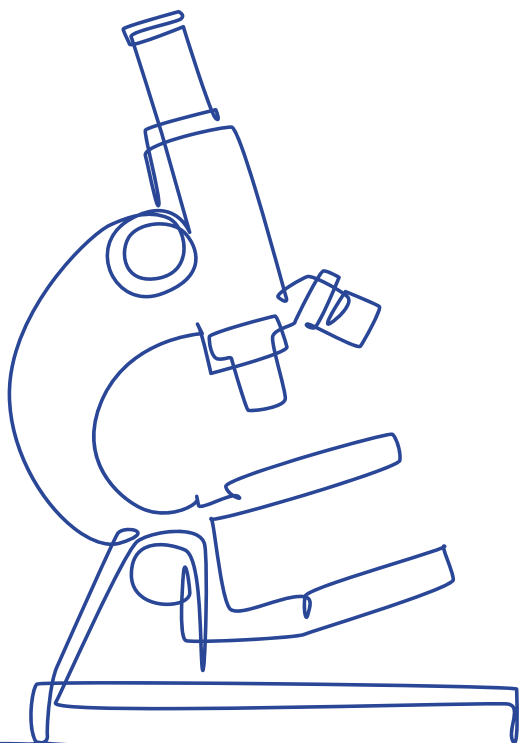




Based on the findings from the survey, focus groups and desk research, the following five aspects have emerged as some of the most prudent next steps towards achieving greater gender parity in the field of chemical safety and security:

- 1. Gathering gender-disaggregated data on accessing education and careers in chemical safety and security at the national level.** This information would inform the formulation, implementation and review of gender-specific national policies that could assist in addressing barriers to chemical safety and security for both genders.
- 2. Conducting broader cross-country research and analysis of women in the chemical safety and security sector** to address gaps in gender-inclusive policies and opportunities.
- 3. Developing and implementing a national gender mainstreaming strategy and action plan** to improve the quality of policies, programmes, and projects, ensuring a more efficient allocation of talents and resources while ensuring that both men and women can influence and participate in advancing efforts that promote chemical safety and security.
- 4. Providing capability building programmes on “gender mainstreaming in chemical safety and security”** to practitioners in the field.
- 5. Empowering communities through awareness creation about the risks associated with the exposure to chemicals for both genders,** and the importance of the inclusion of women in decision-making roles to manage the complexities of chemical risks for both genders and to ensure that gender perspectives are present in policies.

UNICRI and the OPCW will continue to leverage on the newly established “Women in Chemistry” network by connecting members with career progression opportunities and by providing a regular platform for discussions and exchange of knowledge and expertise on chemical safety and security.





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